GW - 28

ABATEMENT PLAN FARM FIELDS

2019

Chavez, Carl J, EMNRD

From:	Chavez, Carl J, EMNRD
Sent:	Friday, June 7, 2019 1:50 PM
To:	'Combs, Robert'
Cc:	Griswold, Jim, EMNRD; Tsinnajinnie, Leona, NMENV; Denton, Scott; Sahba, Arsin M.; Holder, Mike
Subject:	RE: {EXTERNAL} HollyFrontier Navajo Refining, LLC Artesia Refinery (GW-28) Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields (March 2019)

Robert, et al.:

Approved. Please proceed in accordance with the revised Figure 7.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

"Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?" (To see how, go to: http://www.emnrd.state.nm.us/OCD and see "Publications")

From: Combs, Robert <Robert.Combs@HollyFrontier.com>
Sent: Friday, May 24, 2019 12:29 PM
To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>
Cc: Griswold, Jim, EMNRD <Jim.Griswold@state.nm.us>; Tsinnajinnie, Leona, NMENV <Leona.Tsinnajinnie@state.nm.us>; Denton, Scott <Scott.Denton@HollyFrontier.com>; Sahba, Arsin M. <Arsin.Sahba@HollyFrontier.com>; Holder, Mike <Michael.Holder@hollyfrontier.com>
Subject: [EXT] FW: {EXTERNAL} HollyFrontier Navajo Refining, LLC Artesia Refinery (GW-28) Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields (March 2019)

Carl,

Thanks for your time to visit on May 16, 2016 regarding your comments on the Stage 1 Abatement Plan of the Reverse Osmosis Discharge Fields at the Artesia refinery. As agreed on that call, we have reduced the monitoring period initially proposed from 8 quarters to 4 quarters. We are submitting the attached amendment to that plan by FedEx today for delivery on May 28, 2019.

If you have any further questions, please let us know.

Thanks,
Robert

Robert Combs
Environmental Specialist
The HollyFrontier Companies
P.O. Box 159
Artesia, NM 88211-0159
office: 575-746-5382
cell: 575-308-2718
fax: 575-746-5451
Robert.Combs@hollyfrontier.com

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Wednesday, May 08, 2019 1:46 PM
To: Combs, Robert
Cc: Griswold, Jim, EMNRD; Tsinnajinnie, Leona, NMENV; Denton, Scott
Subject: RE: {EXTERNAL} HollyFrontier Navajo Refining, LLC Artesia Refinery (GW-28) Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields (March 2019)

Robert, et al.:

Good afternoon. There were MWs installed into the RO Fields and monitoring did occur in the fields under the prior permit. OCD met with Geolex on the feasibility of Phyto-remediation in the fields, and OCD regarded it favorably. OCD was aware “constituents of concern” were identified.

The language in the modification paragraph below of 6/29/17, states, “shall submit a plan for characterization and abatement of the vadose zone.”

We can discuss during the meeting of 5/16, since it is fast approaching.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us
“Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?” (To see how, go to: http://www.emnrd.state.nm.us/OCD and see “Publications”)

From: Combs, Robert <Robert.Combs@HollyFrontier.com>
Sent: Wednesday, May 8, 2019 9:42 AM
To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>
Cc: Griswold, Jim, EMNRD <Jim.Griswold@state.nm.us>; Tsinnajinnie, Leona, NMENV <Leona.Tsinnajinnie@state.nm.us>; Denton, Scott <Scott.Denton@HollyFrontier.com>
Subject: [EXT] RE: {EXTERNAL} HollyFrontier Navajo Refining, LLC Artesia Refinery (GW-28) Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields (March 2019)

Carl,

Thanks for your response, we would like to schedule a call or meeting in the near future to discuss the path forward for the RO fields.

Our approach for preparing the Stage 1 Abatement Plan was based on the following permit requirements (GW-028; May 25, 2017 and June 29, 2017 modified):

- Section 1.B. Scope of Permit: "This Permit renewal includes requirements for facility-wide groundwater monitoring and for the abatement of vadose zone and groundwater contamination resulting from the discharge of reverse osmosis reject fluids along with any other releases of potential groundwater contaminants."

- Section 1.I. Closure Plan and Financial Assurance: "The plan shall provide, at minimum, for the removal or plugging of all lines leading to the discharge locations so that a discharge could no longer occur. As abatement of vadose zone and groundwater contamination resulting from the discharge progresses, modification of the closure plan and financial assurance will be required to incorporate the abatement effort including possibly post-closure monitoring."

- Section 6. Abatement: "The permittee shall submit a plan for characterization and abatement of vadose zone and groundwater contamination associated with the discharge of reverse osmosis reject fluids within [60 days of the cessation of discharge of reverse osmosis reject fluids to the ground surface at the facility. – June 29, 2017 modification]. The OCD will review that plan and upon its approval, the Permittee shall proceed with the characterization and abatement effort including regular reporting to the OCD of the results. Failure to submit such a plan, or to fulfill the OCD requirements associated with the characterization and/or abatement, will be deemed by the OCD as noncompliance…"

During preparation of the submitted plan, we reviewed the requirements of 20.6.2.4103-4115 NMAC as well as the above-referenced sections of the GW-028 Discharge Permit. The Permit requirements for 'characterization' indicate that a Stage 1 Plan (20.6.2.4106 C NMAC) should logically be prepared and submitted within 60 days following the discharge cessation. 20.6.2.4106 NMAC states "The purpose of Stage 1 of the abatement plan shall be to design and conduct a site investigation that will adequately define site conditions, and provide the data necessary to select and design an effective abatement option."

Given the change in conditions at the site (i.e., discharge is no longer occurring), we felt it was appropriate to conduct site characterization prior to proposing an abatement approach in order for HFNR to characterize potential vadose zone and groundwater impacts, post discharge. The following parameters will be determined during the characterization phase and are critical to develop an effective Stage 2 Abatement Plan: (1) define the chemicals that require abatement and (2) determine the degree to which this abatement is needed (i.e., how much concentrations need to be decreased through abatement). 20.6.2.4016.D NMAC states that the Stage 2 Abatement Plan should then be prepared pursuant to Stage 1 of the abatement plan. Performance of the activities described in the Stage 1 Abatement Plan will allow for an appropriate and effective Stage 2 abatement program to be developed that best addresses conditions at the site.

As mentioned above, we would like an opportunity to discuss this matter with you. We can be available by phone during the next week or we can meet at OCD office on May 16.

Thanks,
Robert

Robert Combs
Environmental Specialist
The HollyFrontier Companies
P.O. Box 159
Artesia, NM 88211-0159
office: 575-746-5382
cell: 575-308-2718

fax: 575-746-5451
Robert.Combs@hollyfrontier.com

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Thursday, April 18, 2019 4:25 PM
To: Denton, Scott; Combs, Robert
Cc: Griswold, Jim, EMNRD; Tsinnajinnie, Leona, NMENV
Subject: {EXTERNAL} HollyFrontier Navajo Refining, LLC Artesia Refinery (GW-28) Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields (March 2019)

The New Mexico Oil Conservation Division (OCD) has completed its review of the above subject plan.

OCD believes that while the plan is well constructed and professional with an acceptable monitoring approach , the plan is fundamentally deficient in that it lacks actual abatement (Stage 2) going forward, which is what OCD was expecting. There appears to be an option for phytoremediation, but it is not put forth as the stage 2 remediation plan.

OCD requires Navajo Refining, LLC (Navajo) to review the WQCC Regulations, i.e., 20.6.2 NMAC (Abatement Provisions) and amend or resubmit a stage 2 plan to OCD for approval. Navajo may want to propose or consider other remedial options for feasibility based on this message.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us
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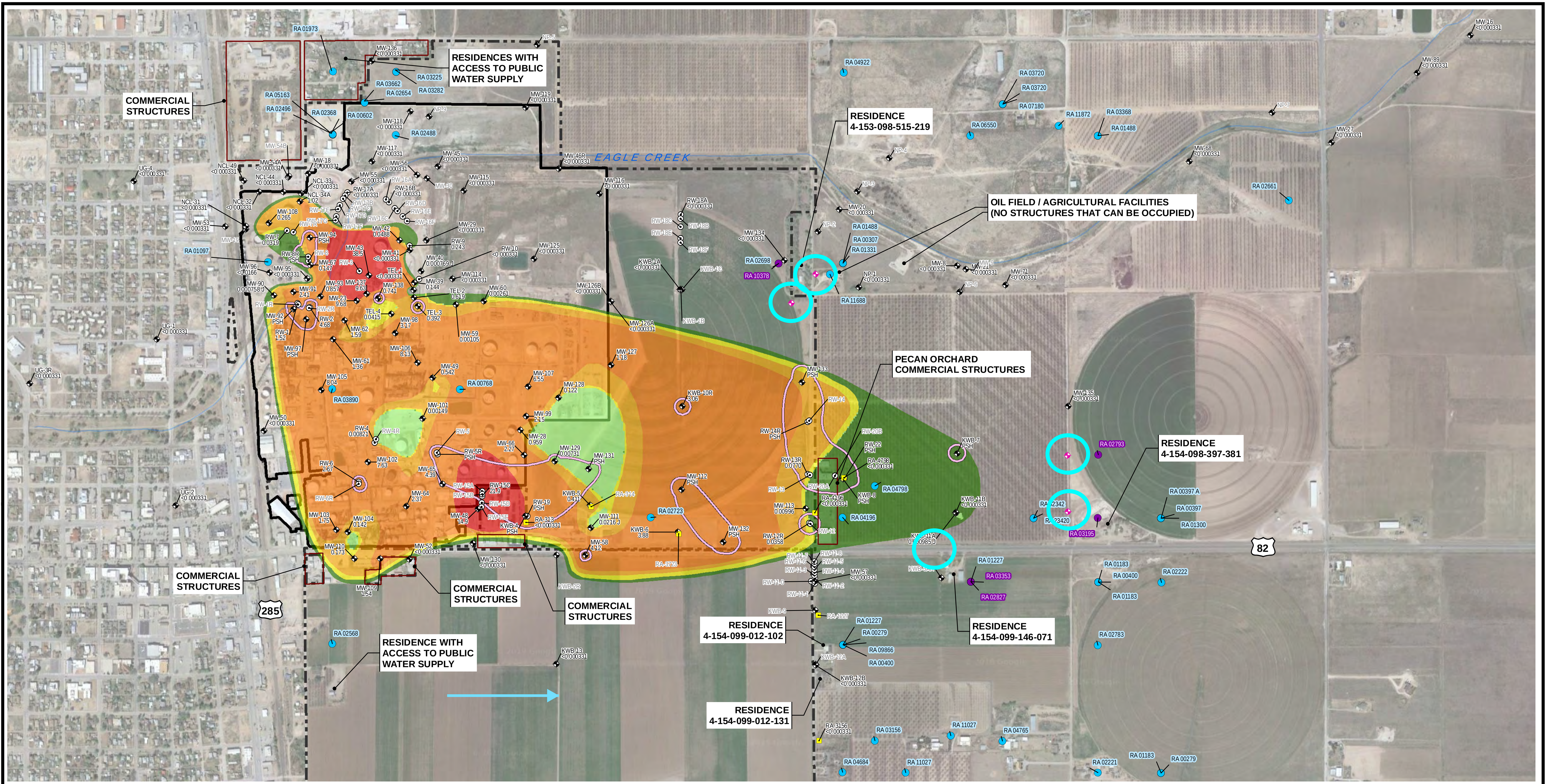


LEGEND

◈	MONITORING WELL
⊙	RECOVERY WELL
▣	IRRIGATION WELL IN MONITORING PROGRAM
◈	PROPOSED MONITORING WELL
1.75	BENZENE CONCENTRATION
<0.000331	BENZENE NOT DETECTED ABOVE METHOD DETECTION LIMIT
PSH	PHASE-SEPARATED HYDROCARBON PRESENT IN WELL (≥ 0.03 FEET THICK)
KWB-9	WELL NOT SAMPLED
●	POTENTIAL SHALLOW WATER WELL
●	POTENTIAL DOMESTIC WATER WELL, FURTHER ASSESSMENT RECOMMENDED
▢	REFINERY FENCELINE
⬚	FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
→	GROUNDWATER FLOW DIRECTION
⬭	PSH PRESENCE 2016-2018

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

AERIAL IMAGERY SOURCE: GOOGLE EARTH PRO AND THEIR DATA PARTNERS, 3/12/2016.

BENZENE CONCENTRATION FROM 2018 FIRST SEMIANNUAL EVENT (mg/L)

🟩	0 - 0.0001
🟩	0.0001 - 0.001
🟩	0.001 - 0.01
🟨	0.01 - 0.1
🟧	0.1 - 1.0
🟧	1.0 - 10
🟥	10 - 100

0 500 1,000 Feet
1 " = 1,000 '
1:12,000

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

TITLE:
POTENTIAL GROUNDWATER RECEPTORS
AND BENZENE ISOCONCENTRATION MAP
(FIRST 2018 SEMIANNUAL EVENT)

DRAWN BY:	MHORN	PROJ. NO.:	326778
CHECKED BY:	AELJURI		
APPROVED BY:	JSPEER		
DATE:	APRIL 2019		

FIGURE 2

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

FILE NO.: 326778_2_BenzSpring.mxd

Plot Date: 4/10/2019, 14:26:15 PM by MHORN -- LAYOUT: ANSI B(11"x17")
Path: \\appenvfile01\GIS\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\326778_GW_Rec_Survey\326778_2_BenzSpring.mxd

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

TRC - GIS

HOLLYFRONTIER.

May 24, 2019

Mr. Carl Chavez
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Amendment of the March 2019 Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields
HollyFrontier Navajo Refining LLC
Discharge Permit GW-028

Dear Mr. Chavez:

This letter provides an amendment to the Stage 1 Abatement Plan for the Reverse Osmosis (RO) Reject Discharge Fields that was submitted for the HollyFrontier Navajo Refining LLC (HFNR) Artesia, New Mexico Refinery on March 20, 2019. Based on our meeting with you on May 16, 2019, the plan has been revised to reflect a shorter characterization period for collection of samples to support development of the Stage 2 Abatement Plan. As agreed, the proposed additional monitoring wells required to provide adequate monitoring coverage both upgradient and downgradient of the two fields will be installed as soon as possible following approval of the Stage 1 Abatement Plan, as well as this amendment to the Stage 1 Abatement Plan. The soil moisture and groundwater monitoring will be performed on a quarterly basis for 4 quarters rather than 8 quarters as proposed in the Stage 1 Abatement Plan. Groundwater sampling will begin during the initial quarter rather than being triggered based on moisture probe data as proposed in the Stage 1 Abatement Plan. Quarterly reports will be submitted following each of the first 3 quarterly events, and a final report will be submitted following the fourth quarterly event. If the data from monitoring through this period suggests that additional characterization (e.g., quarterly monitoring) is recommended, HFNR will discuss with the Oil Conservation District (OCD) prior to submittal of the report. A revised Figure 7 showing the amended schedule is attached. This modification to the duration of the test will result in the following changes to sections of the Stage 1 Abatement Plan:

- **Executive Summary**, page ii, 2nd full paragraph, modify the last sentence to read: A proposed schedule of one year for implementation of the investigation and monitoring is also provided in this Stage 1 AP.
- **Section 3.1,** page 13, 1st full paragraph, replace 1st sentence with: Soil moisture will be monitored throughout the Stage 1 AP.
- **Section 3.1,** page 13, delete 2nd full paragraph.
- **Section 3.2,** page 13, 1st full paragraph, replace 1st sentence with: Soil samples will be collected during installation of the eight soil moisture probes that will be installed within the two discharge fields, as described in the following subsections.

- **Section 5,** page 21, 2nd full paragraph, replace 3rd and 4th sentences with: The proposed schedule is based on a 1-year groundwater monitoring period. The moisture profile and groundwater analytical data will be reviewed and evaluated throughout the 1-year period and reported as required.
- **Figure 7**, replace with attached revised figure.

HFNR has reviewed the downgradient monitoring network and believes existing wells MW-18A and KWB-1A and the one proposed well north of MW-18A provide sufficient coverage to monitor groundwater between the RO fields and the Pemberton property located to the east (downgradient). Figures 2 and 3 in the *Artesia Refinery, Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation of Off-Site Receptors* memorandum submitted to the OCD on April 12, 2019 show historical non-detect concentrations for benzene and methyl tert-butyl ether (MTBE).

HFNR has reviewed the upgradient monitoring network and believes that the three existing wells along the western boundary of the South RO Field and existing well MW-55 along with the two proposed wells along the western boundary of the North RO Field provide adequate coverage to monitor the water quality flowing into the former discharge areas.

If you have any questions or comments regarding this request, please feel free to contact me at 575-746-5487 or Robert Combs at 575-746-5382.

Sincerely,

Scott M. Denton
Environmental Manager
HollyFrontier Navajo Refining LLC

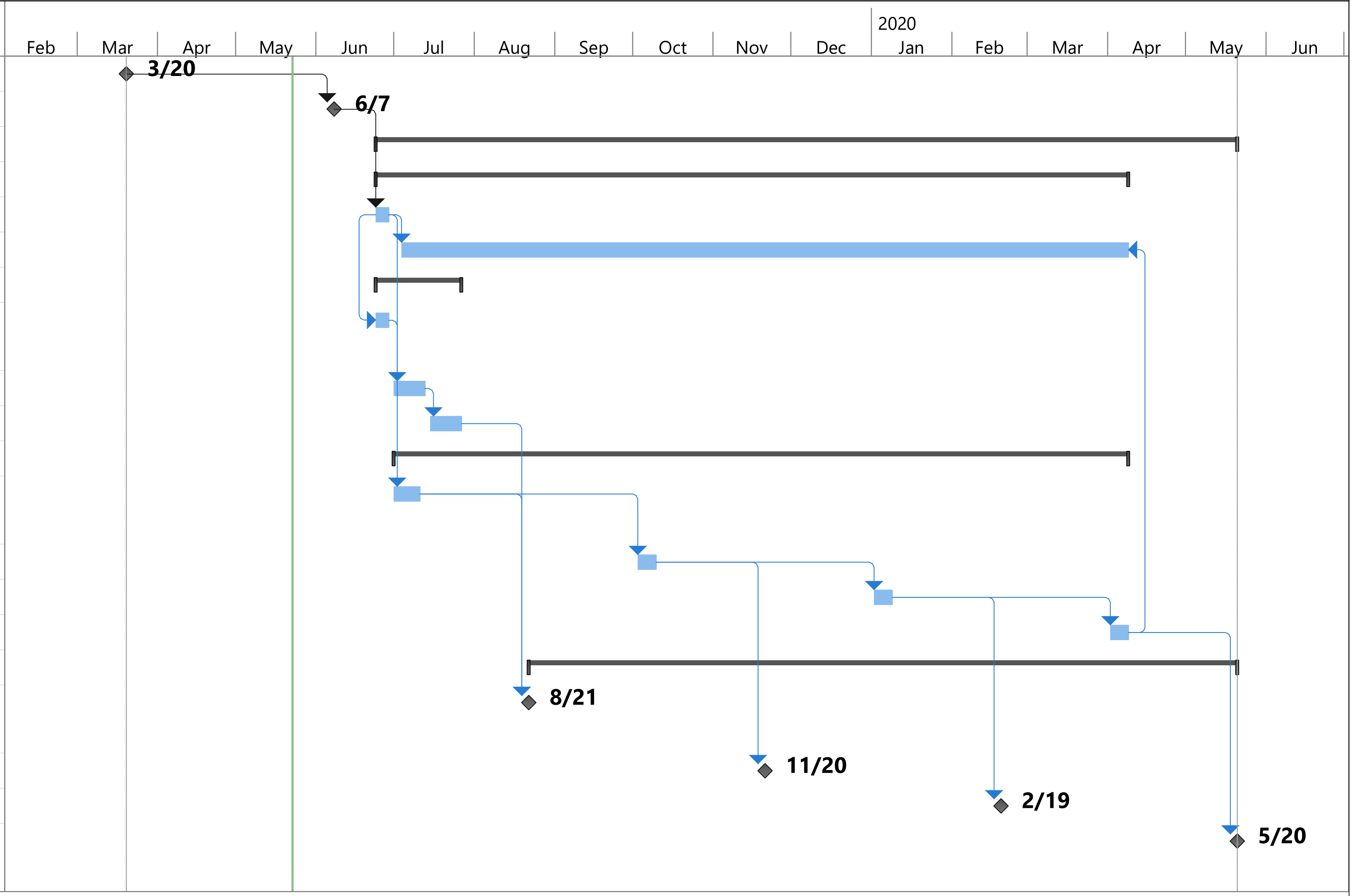
c: HollyFrontier: R. Combs, A. Sahba

File Location: Env\OCD\RO Fields Stage 1 AP

Figure 7 - Implementation Schedule (Amended)

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields Stage 1 Abatement Plan

ID	Task Name	Duration	Start	Finish
1	Stage 1 AP Submitted to OCD	0 days	Wed 3/20/19	Wed 3/20/19
2	OCD Approval of Stage 1 AP (projected)	0 days	Fri 6/7/19	Fri 6/7/19
3	**Implement Stage 1 AP**	**238 days**	**Mon 6/24/19**	**Wed 5/20/20**
4	**Soil Moisture Evaluation**	**208 days**	**Mon 6/24/19**	**Wed 4/8/20**
5	Install Soil Moisture Probes	5 days	Mon 6/24/19	Fri 6/28/19
6	Monitor Soil Moisture Throughout Stage 1 AP	10 mons	Thu 7/4/19	Wed 4/8/20
7	**Soil Evaluation**	**25 days**	**Mon 6/24/19**	**Fri 7/26/19**
8	Collect Soil Samples (during moisture probe installation)	5 days	Mon 6/24/19	Fri 6/28/19
9	Laboratory Analyses of Soil Samples	10 days	Mon 7/1/19	Fri 7/12/19
10	Summarize Soil Data for Progress Report	10 days	Mon 7/15/19	Fri 7/26/19
11	**Groundwater Monitoring**	**203 days**	**Mon 7/1/19**	**Wed 4/8/20**
12	Install Additional Monitoring Wells, Collect Initial GW Samples for Stage 1 AP Parameters (Q1)	8 days	Mon 7/1/19	Wed 7/10/19
13	Collect GW Samples (Q2)	5 days	Thu 10/3/19	Wed 10/9/19
14	Collect GW Samples (Q3)	5 days	Thu 1/2/20	Wed 1/8/20
15	Collect GW Samples (Q4)	5 days	Thu 4/2/20	Wed 4/8/20
16	**Report Submittal Dates**	**195 days**	**Wed 8/21/19**	**Wed 5/20/20**
17	Progress Report 1 (soil moisture, boring and well installation summary, soil and Q1 groundwater results)	0 days	Wed 8/21/19	Wed 8/21/19
18	Progress Report 2 (Q2 GW and moisture data)	0 days	Wed 11/20/19	Wed 11/20/19
19	Progress Report 3 (Q3 GW and moisture data)	0 days	Wed 2/19/20	Wed 2/19/20
20	Final Report (Q4 GW, overall summary and recommendations)	0 days	Wed 5/20/20	Wed 5/20/20



Schedule assumes additional mointoring wells installed immediately following moisture probe installation.

Task ▬	Milestone ◆	Summary ⊓

HOLLYFRONTIER

March 21, 2019

Mr. Carl Chavez
New Mexico Energy, Minerals and Natural Resources Department
Environmental Bureau
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields
HollyFrontier Navajo Refining LLC
Discharge Permit GW-028

Dear Mr. Chavez:

Enclosed is one paper copy and one electronic copy of the Stage 1 Abatement Plan (AP) for the Reverse Osmosis Reject Discharge Fields. The Discharge Permit, GW-028, for the Artesia, New Mexico refinery required that a Stage 1 AP be developed and submitted within 60 days after discharge to the fields ceased. The discharge to the fields was discontinued on January 24, 2019; therefore, this Stage 1 AP is being submitted prior to March 25, 2019.

If you have any questions or comments regarding this request, please feel free to contact me at 575-746-5487 or Robert Combs at 575-746-5382.

Sincerely,

Scott M. Denton
Environmental Manager
HollyFrontier Navajo Refining LLC

c: HollyFrontier: R. Combs, A. Sahba

File location: \Env\OCD\RO Fields Stage 1 AP

HollyFrontier Navajo Refining LLC
501 East Main • Artesia, NM 88210
(575) 748-3311 • http://www.hollyfrontier.com

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields Discharge Permit GW-028

HollyFrontier Navajo Refining LLC
501 East Main Street
Artesia, New Mexico 88210

March 2019
Project 6703180022

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields
Discharge Permit GW-028

HollyFrontier Navajo Refining LLC
Artesia, New Mexico

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields
Discharge Permit GW-028

HollyFrontier Navajo Refining LLC
Artesia, New Mexico
Project 6703180022

Prepared for:

HollyFrontier Navajo Refining LLC
801 East Main Street, Artesia, New Mexico 88210

Prepared by:

Wood Environment & Infrastructure Solutions
17320 Katy Freeway, Houston, Texas 77094

March 21, 2019

Executive Summary

HollyFrontier Navajo Refining LLC (HFNR) owns and operates the Navajo Refinery (Refinery), which is located in Artesia, New Mexico, and can process heavy, sour and light, sweet crude oils. The facility has been in operation since the 1920s, runs a predominant slate of Permian Basin crudes that are gathered in west Texas and southeast New Mexico, and can also source a variety of crude oils from Cushing, Oklahoma including Canadian crudes. The Refinery serves markets in the southwestern United States and northern Mexico.

HFNR utilizes reverse osmosis (RO) to remove minerals and salts from fresh water prior to use in the refining process. The fresh water is supplied from a blend of publicly supplied water from the City of Artesia and fresh groundwater obtained from the Refinery's water supply wells. The treated water (permeate stream) is used in the Refinery process while the RO reject stream cannot be used in the Refinery process as it contains concentrated salts and minerals that do not pass through the RO membranes. Prior to January 24, 2019, this concentrated rejected stream was discharged to the surface of two fields located northeast of the Refinery operations area. The fields are covered with native grass, and discharged water was allowed to percolate or evaporate in those permitted areas. The discharge is performed under the jurisdiction of the State of New Mexico Energy, Minerals and Natural Resource Department Oil Conservation Division (OCD) in accordance with Discharge Permit GW-028 (Permit), which was initially issued in October 1991 and modified in April 1993. The Permit has subsequently been modified and renewed several times with the most recent renewal issued in May 2017 (OCD 2017a) and the most recent modification issued in June 2017 (OCD 2017b).

An investigation of the RO reject water discharge fields was conducted throughout 2013 in accordance with an approved investigation work plan (Arcadis 2012). The results of that investigation indicated that groundwater beneath the two RO reject discharge fields reflects mounding due to infiltration of the discharge water. Furthermore, the investigation concluded that no hydrocarbon impacts are present in the fields but that some inorganic constituent impacts are present in the groundwater beneath the fields. The recommendations of the investigation were to continue to monitor the groundwater in the vicinity of the RO reject discharge fields as part of the on-going facility-wide monitoring program and to continue to evaluate the trends in constituent concentrations.

In 2017, OCD renewed the Permit, which included a stipulation that discharge of RO reject water to the surface cease upon operational completion of a Class I disposal well, but not later than October 31, 2018. An extension to the October 31, 2018, deadline was requested and approved by OCD due to delays in operational completion of the Class I disposal well (OCD 2018a and 2018b). The renewed Permit requires characterization and abatement of vadose zone and groundwater contamination due to the historical discharge of RO reject fluid. The Permit stipulated that a plan for characterization and abatement of such contamination should be submitted within 60 days after cessation of discharge of RO reject fluid. In order to comply with the Permit requirements, this Stage 1 Abatement Plan (AP) has been developed. The disposal well became operational on January 16, 2019, and the discharge was discontinued on January 24, 2019; therefore, this Stage 1 AP is required to be submitted by March 25, 2019.

The purpose of the Stage 1 AP is to present an evaluation of the vadose zone and underlying shallow groundwater conditions following cessation of discharge of the RO reject fluids to the surface in order to determine whether there is potential for impacts to shallow groundwater. This document describes the activities proposed to be undertaken to determine the concentrations of constituents of concern within the vadose zone and shallow groundwater in order to assess the site conditions and determine if a Stage 2 AP or on-going groundwater monitoring is appropriate.

This Stage 1 AP provides a summary of previous investigations and the information obtained during those investigations that has been used to develop the recommended investigation and monitoring required to perform the evaluation of the RO reject discharge fields. The proposed investigation and monitoring to be performed for the Stage 1 AP includes:

- Active monitoring of soil moisture throughout the vadose zone within each of the two RO reject discharge fields to determine when the elevated moisture within the soil column has drained to field capacity conditions
- Active monitoring of soil and groundwater conditions within each of the two RO discharge reject fields
- Active monitoring of groundwater conditions in nearby upgradient and downgradient wells
- Assessment of field and analytical data
- Reporting to recommend future actions

This Stage 1 AP describes the proposed locations and methods for installation of soil moisture probes, collection of soil samples, installation of additional groundwater monitoring wells, and collection of groundwater samples, as well as the laboratory analyses for both soil and groundwater samples and the reporting frequency. A proposed schedule of two years for implementation of the investigation and monitoring is also provided in this Stage 1 AP.

If the data collected according to the approved Stage 1 AP indicates that there is potential for impacts to shallow groundwater from previous discharge of RO water (including from the vadose zone soils), a Stage 2 AP will be developed. However, if the evaluation does not indicate that there is potential for impacts to shallow groundwater from previous discharge of RO water, then a recommendation of no further action will be made with respect to the RO field operation and the Permit.

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Appendix

List of Acronyms

AOC	Area of Concern
AP	Abatement Plan
bgs	below ground surface
CGWSL	Critical Groundwater Screening Level
COC	Constituent of Concern
EC	Electrical Conductivity
HFNR	HollyFrontier Navajo Refining LLC
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OCD	Oil Conservation Division
PCC	Post-Closure Care
PID	Photoionization Detector
PSH	Phase-Separated Hydrocarbon
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RO	Reverse Osmosis
SPLP	Synthetic Precipitation Leaching Procedure
SSL	Soil Screening Level
SWMU	Solid Waste Management Unit
TDS	Total Dissolved Solids
UTL	Upper Tolerance Limit
WQCC	Water Quality Control Commission

1.0 Introduction

HollyFrontier Navajo Refining LLC (HFNR) owns and operates the Navajo Refinery (Refinery), which is located in Artesia, New Mexico (**Figure 1**) and can process heavy, sour and light, sweet crude oils. The facility has been in operation since the 1920s, runs a predominant slate of Permian Basin crudes that are gathered in west Texas and southeast New Mexico, and can also source a variety of crude oils from Cushing, Oklahoma including Canadian crudes. The Refinery serves markets in the southwestern United States and northern Mexico.

HFNR utilizes reverse osmosis (RO) to remove minerals and salts from fresh water prior to use in the refining process. The fresh water is supplied from a blend of publicly supplied water from the City of Artesia and fresh groundwater obtained from the Refinery's water supply wells. The treated water (permeate stream) is used in the Refinery process while the RO reject stream cannot be used in the Refinery process as it contains concentrated salts and minerals that do not pass through the RO membranes. Prior to January 24, 2019, this concentrated rejected stream was discharged to the surface of two fields located northeast of the Refinery operations area. The fields are covered with native grass, and discharged water was allowed to percolate or evaporate in those permitted areas. The discharge is performed under the jurisdiction of the State of New Mexico Energy, Minerals and Natural Resource Department Oil Conservation Division (OCD) in accordance with Discharge Permit GW-028 (Permit), which was initially issued in October 1991 and modified in April 1993. The Permit has subsequently been modified and renewed several times with the most recent renewal issued in May 2017 (OCD 2017a) and the most recent modification issued in June 2017 (OCD 2017b).

In 2017, OCD renewed the Permit, which included a stipulation that discharge of RO reject water to the surface cease upon operational completion of a Class I disposal well, but not later than October 31, 2018. An extension to the October 31, 2018, deadline was requested and approved by OCD due to delays in operational completion of the Class I disposal well (OCD 2018a and 2018b). The renewed Permit requires characterization and abatement of vadose zone and groundwater contamination due to the historical discharge of RO reject fluid. The Permit stipulated that a plan for characterization and abatement of such contamination should be submitted within 60 days after cessation of discharge of RO reject fluid. In order to comply with the Permit requirements, this Stage 1 Abatement Plan (AP) has been developed. The disposal well became operational on January 16, 2019, and the discharge was discontinued on January 24, 2019; therefore, this Stage 1 AP is required to be submitted by March 25, 2019.

The purpose of the Stage 1 AP is to present an evaluation of the vadose zone and underlying shallow groundwater conditions following cessation of discharge of the RO reject fluids to the surface in order to determine whether there is potential for impacts to shallow groundwater. This document describes the activities proposed to be undertaken to determine the concentrations of constituents of concern (COCs) within the vadose zone and shallow groundwater in order to assess the site conditions and determine if a Stage 2 AP or on-going groundwater monitoring is appropriate.

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2.0 Site Description

2.1 Facility Description

As described in Section 1.0, HFNR discharges the RO reject stream, which contains concentrated salts and minerals that cannot pass through the RO membranes, to the surface of two fields located northeast of the Refinery operations. **Figure 2** depicts the boundaries of both the North RO reject discharge field (North RO field) and the South RO reject discharge field (South RO field). Due to the nature of the RO reject stream, the potential COCs in soil and groundwater within the fields are inorganic compounds.

An investigation of the RO reject water discharge fields was conducted throughout 2013 in accordance with an approved investigation work plan (Arcadis 2012). The results of that investigation indicated that groundwater beneath the two RO reject discharge fields reflects mounding due to infiltration of the discharge water. The investigation confirmed that no hydrocarbon impacts are present in the fields, but concluded that some inorganic constituent impacts are present in the groundwater beneath the fields at concentrations above the Water Quality Control Commission (WQCC) standards. The recommendations of the investigation were to continue to monitor the groundwater in the vicinity of the RO reject discharge fields as part of the on-going facility-wide monitoring program and to continue to evaluate the trends in constituent concentrations. The report also included a recommendation to perform an evaluation of upgradient concentrations of inorganic compounds in groundwater to determine if any of the observed concentrations may be naturally occurring.

2.1.1 Subsurface Conditions

In addition to Discharge Permit GW-028, the Refinery operates under a Resource Conservation and Recovery Act (RCRA) Post-Closure Care (PCC) Permit, which has United States Environmental Protection Agency ID Number NMD048918817, issued by the Secretary of the New Mexico Environment Department (NMED; NMED 2003). Among other action items, the PCC Permit authorizes and requires HFNR (the Permittee) to conduct site investigations at Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) listed in the Permit. The purpose of each investigation is to evaluate the presence, nature, and extent of hazardous and regulated constituents pursuant to New Mexico Administrative Code (NMAC) 20.4.1.500. In 2010, the Permit was modified to address changes at the North Colony Landfarm, and additional SWMUs and AOCs were added to the Permit.

Soil and groundwater investigations have been completed at all of the SWMUs and AOCs included in the 2003 PCC Permit (NMED 2003) and at two of the AOCs added in the 2010 modification (NMED 2010). Sitewide groundwater monitoring is performed semiannually and the results of the monitoring program are reported to OCD and NMED annually. The most recent groundwater monitoring report was submitted in February 2019 (TRC 2019) and contains figures that depict the extent of dissolved phase groundwater impacts along with the extent of identified phase-separated hydrocarbon (PSH) on groundwater.

Information obtained during the investigations of AOCs and SWMUs required by the PCC Permit, as well as information obtained during the previous investigation of the RO reject discharge fields, was compiled to provide information required in a Stage 1 AP in the following subsections.

2.1.1.1 Soils

Soils at the Refinery are primarily of the Pima and Karro series. Soils characterized for permitting the North Colony Landfarm were about 60 percent (%) Pima and 40% Karro soils. The Pima and Karro soils have similar properties. Pima soils are deep, well drained, dark colored, calcareous soils, which occur on floodplains of narrow drainage ways (e.g., Eagle Creek). These soils have moderate shrink-swell potential and were subject to periodic flooding. Runoff from Pima soils is slow, permeability is moderately low and the water-holding capacity is high. The effective rooting depth is greater than 5 feet and the water table is deeper than 5 feet.

The Karro soils are highly calcareous. Calcium carbonate typically accumulates as caliche at a depth of about 45 inches. These soils are found on level to gently sloping terrains and are susceptible to wind erosion. Runoff is slow and water-holding capacity is high. Permeability is moderate and the effective rooting depth and depth to groundwater are both over 5 feet.

Lithologic observations from borings installed in the North RO field (RO-SB-1, MW-117, MW-118, and MW-119) indicate that shallow subsurface soils are predominantly silty clay with deeper discontinuous units of silty/clayey sands and gravels observed at depth intervals ranging from 16 to 18 feet below ground surface (bgs) and 24 to 25 feet bgs in RO-SB-1, from 20 to 20.5 feet bgs in MW-117, and from 23 to 25 feet bgs in MW-118. Subsurface soils were similar in the South RO field (MW-114, MW-115, and MW-116) with upper silty clay soils underlain by units of silty/clayey sands and gravels observed at depth intervals ranging from approximately 21 to 24 feet bgs in MW-114 and from 7 to 24 feet bgs in MW-116.

2.1.1.2 Regional Geology

The Refinery is located on the northwest shelf of the Permian Basin. In this region, the deposits are comprised of approximately 250 to 300 feet of Quaternary alluvium uncomformably overlying approximately 2,000 feet of Permian clastic and carbonate rocks. These Permian deposits uncomformably overlie Precambrian syenite, gneiss and diabase crystalline rocks. The relationships between the sedimentary deposits are discussed below.

Quaternary Alluvium

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

The carbonate gravel unit blankets the other valley fill units and forms a fairly uniform slope from the Permian rock outcrop areas on the west side of the Permian Valley eastward to the Pecos River floodplain. The unit consists of coarse-grained carbonate gravel deposits along major drainage ways to the Pecos River, which grade into brown calcareous silts and thin masses of caliche in the interstream regions. The carbonate gravel unit includes the Orchard Park, Blackdom and Lakewood terrace deposits of Fielder and Nye as well as Holocene and Pleistocene Pecos River alluvial deposits.

The agricultural land around Artesia is part of the Orchard Park terrace deposit, which forms a thin veneer overlying older valley fill alluvium. The Orchard Park terrace surface gently rises in elevation to between 5 and 25 feet above the Lakewood terrace. The Orchard Park is generally less than 20 feet in thickness in the Refinery area and is comprised of silt interbedded with poorly sorted lenses of mixed size pebbles in a silt and sand matrix. Chalky caliche commonly occurs in the upper layers.

The Blackdom terrace is about 40 to 50 feet in elevation above the Orchard Park terrace west of Artesia. However, the deposits associated with the Blackdom terrace are generally less than 20 feet in thickness.

The Blackdom terrace deposits are coarser grained than the deposits associated with the Orchard Park and Lakewood terraces. In addition, the caliche soils have a higher density than those developed on the Orchard Park terrace.

The Lakewood deposits, the lowest of the three terrace units, are essentially the current alluvial sediments in the floodplain along the river. They consist of brown sandy silt interbedded with lenses of gravel and sand and some localized caliche in higher parts. The Lakewood terrace is confined to the area immediately adjacent to the river and is underlain by Pleistocene alluvium deposited by the Pecos River and its tributaries.

The clay unit is not laterally continuous throughout the valley fill deposits, but occurs in isolated lenses generally overlying the quartzose unit. The clay unit is comprised of light-to-medium-gray clays and silts deposited in localized ponds and lakes. These ponds and lakes may have formed in conjunction with dissolution and collapse of the underlying Permian rocks.

The quartzose unit consists primarily of fragments of quartz and igneous rocks cemented by calcium carbonate. This unit is laterally contiguous throughout the Pecos River Valley and is generally less than 250 feet thick. The quartzose unit unconformably overlies Permian Rocks and lower quartzose gravels are commonly used for groundwater production.

Permian Artesian Group

The Permian Artesian Group is comprised of five formations (from shallowest to deepest): the Tansill, Yates, Seven Rivers, Queen and Grayburg Formations. The Tansill and Yates Formations outcrop at the surface east of the Pecos River and are not present in the vicinity of the Refinery.

The uppermost Permian formation in the Artesia area is the Seven Rivers Formation, which outcrops east of the Pecos River. This eastward-dipping formation is eroded and buried by the valley fill alluvium at a depth of 300 feet in the area between the river and the Refinery. Nearer the Refinery, the formation thins and disappears farther west. Where the formation is present, it consists of a sequence of evaporites, carbonates, gypsum and shale with isolated sand and fractured anhydrite/gypsum lenses.

An examination of available borehole logs by IT Corporation in the mid-80s provided no indication that the Seven Rivers formation has been encountered beneath the Refinery. However, the lithologic logs of wells completed in the Refinery area describe unconsolidated alluvial deposits from depths of about 20 feet to more than 250 feet.

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

San Andres Formation

The San Andres Formation lies beneath the Grayburg and Queen Formations and immediately above the Precambrian crystalline basement rocks. The San Andres Formation is composed mainly of limestone and dolomite containing irregularly and erratic solution cavities, which range up to several feet in diameter. Its thickness is greater than 700 feet.

2.1.1.3 Regional Groundwater

The principal aquifers in the Artesia area are within the San Andres Formation and the valley fill alluvium. The deeper carbonate aquifer is referred to as the deep artesian aquifer, whereas the water-bearing zones of the shallower alluvial fill aquifer are referred to as the valley fill aquifer. Adjacent to the Refinery, the uppermost water-bearing zone in the valley fill aquifer is referred to as the near-surface saturated zone. **Figure 3** shows the locations of monitoring wells associated with the Refinery.

Near-Surface Saturated Zone

Lithologic logs from monitor wells installed near the Refinery process area document a near-surface saturated zone overlying the main valley fill alluvium aquifer and containing groundwater of variable quality in fractured caliche and sand and gravel lenses at depths of 10 to 30 feet bgs. This near-surface saturated zone is under confined conditions for at least some or most of the year with static water levels 3 to 5 feet above the saturated zones.

Locally, the near-surface saturated zone is partially recharged from infiltration from Eagle Creek and from lawn watering runoff from the grass-covered urban park immediately upstream of the Refinery, and partially recharged from upwelling from the Valley Fill Aquifer. The near-surface saturated zone most likely discharges to marshes and shallow alluvium along the west side of the Pecos River.

The groundwater in the near-surface saturated zone is highly variable in quality, volume, areal extent and saturated thickness. Concentrations of Total Dissolved Solids (TDS) exceeding 2,000 milligrams per liter (mg/L) and sulfate exceeding 1,000 mg/L have been recorded in monitoring wells installed upgradient (west) of the Refinery.

The monitoring wells installed in the two RO fields are completed in the near-surface saturated zone. Water level measurements indicate confined groundwater conditions in both RO fields based on depth to water measurements that are consistently above the more permeable sand and gravel units observed during RO field well installations. Groundwater flow is generally to the east, which is consistent with potentiometric surface data obtained as part of the facility-wide groundwater monitoring program. Potentiometric data from the wells in the vicinity of the RO fields indicate that mounding occurs beneath the fields, which is attributed to the discharge of the RO reject stream.

Valley Fill Aquifer

Quaternary alluvial deposits of sand, silt, clay and gravel are the main components of the valley fill aquifer. These sediments are about 300 feet thick in the area between the City of Artesia near the Refinery and the Pecos River. The three principal units in the valley fill are the carbonate gravel, clay, and quartzose.

The carbonate gravel unit, described in an earlier section, is the uppermost alluvial unit in the valley fill. Coarse-grained gravels deposited in the major tributaries to the Pecos River grade to calcareous silts and thin zones of caliche in the interstream areas. Near the surface, groundwater is found in thin discontinuous gravel beds typical of braided channel material deposited during flood events.

Supply wells completed in the valley fill aquifer typically are screened across from one to five water-producing zones. Water-producing zones have thicknesses of up to 170 feet, but most are less than 20 feet. Producing zones are principally sand and gravel separated by less permeable lenses of silt and clay. The depth of supply wells in the valley fill range from 40 to 60 feet below ground level and water quality ranges from 500 to 1,500 mg/L TDS. The average transmissivity of the alluvium has been estimated at 100,000 to 150,000 gallons per day per foot.

Recharge of the shallow valley fill aquifer is generally attributed to irrigation return flow from pumpage of the aquifers and from infiltration from the Pecos River. In areas of the valley where the San Andres and valley fill aquifers are hydraulically connected in the subsurface, water tends to flow up from the deep to the shallow aquifer except in areas of heavy San Andres pumpage. The general direction of groundwater flow in the valley fill aquifer follows the regional stratigraphic dip eastward toward the Pecos River, then southward subparallel to the river.

Monitoring wells completed in the Valley Fill Aquifer in the vicinity of the Refinery typically have a higher potentiometric surface than monitoring wells completed in the near-surface saturated zone, indicating that upwelling occurs from the Valley Fill Aquifer into the overlying strata.

Deep Artesian Aquifer

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

The deep artesian aquifer has been developed for industrial, municipal, and agricultural use. The quality of water from this aquifer ranges from 500 to 5,000 mg/L TDS depending on location. In the Artesia area, deep artesian aquifer wells are generally completed at depths ranging from 850 to 1,250 feet bgs. The aquifer recharge is in the Sacramento Mountains to the west of Artesia. Extensive use of this aquifer in recent decades has lowered the potentiometric head in the aquifer in some locations from 50 to 80 feet below ground level, although rainfall in some years may bring the water levels in some wells close to the surface.

2.1.2 Surface Conditions

2.1.2.1 Area Land Uses

The area north, south, and east of the Refinery is sparsely populated and used primarily for agricultural and ranching purposes. The primary business and residential areas of the City of Artesia are located to west, southwest, and northwest of the Refinery. There are a few commercial businesses south of the Refinery along Highway 82, including an oil field pipe company located at the southeast corner of the plant. Much of the property for a half mile north to East Richey Avenue and east toward Bolton Road is owned by HFNR. Much of the area east and northeast to Haldeman Road is a cultivated pecan orchard or used for other agricultural and ranching purposes.

The RO fields are located within the property boundary of the Refinery, north and northeast of the active process units, as shown on **Figure 2**.

2.1.2.2 Topography

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

The two RO fields are relatively flat with mild slopes toward the east. Shallow trenches exist in each field to assist in the even distribution of the discharge water throughout each field.

2.1.2.3 Surface Water Drainage Features

Surface drainage in the area is dominated by small ephemeral creeks and arroyos that flow eastward to the Pecos River, located 3 miles east of the city.

Natural surface drainage at the facility is to the north and east. The major drainage in the immediate area of the site is Eagle Creek (or Eagle Draw), an ephemeral watercourse normally flowing only following rain events, that runs southwest to northeast through the process area of the Refinery and then eastward to the Pecos River. Upstream of the Refinery, Eagle Draw functions as a major storm water conveyance for the community. It also drains outlying areas west of the city and is periodically scoured by storm water during and following intense rainfall events.

The elevation of Eagle Draw is 3,360 feet at its entrance to the Refinery and decreases to approximately 3,305 feet at its confluence with the Pecos River. A large portion of the Refinery is within the 100-year floodplain of Eagle Draw. However, Eagle Draw has been channelized from west of Artesia to the Pecos River to help control and minimize flood events. In the vicinity of the Refinery, the Eagle Draw channel has been cemented to provide erosion protection during flood events. A check dam was also constructed west of Artesia along Eagle Draw.

Surface water flow within the Refinery is controlled by containment berms. Stormwater that falls within process areas is directed to the Refinery wastewater treatment system through a series of sumps and underground piping. Stormwater that falls within the Refinery but outside of process areas is directed to stormwater retention areas and is not allowed to enter Eagle Draw or any of the surface water drainage ditches that drain stormwater from the city.

The two RO fields are surrounded by containment berms to prevent runoff of the RO reject discharge and to control stormwater that falls on the RO fields. The berms prevent runoff from the fields and thus, the RO reject stream discharged to the RO fields either evaporates or infiltrates.

2.2 Previous Investigations

2.2.1 RO Reject Discharge Fields Investigation

Investigation of the two RO reject discharge fields was performed in 2013, following GW-028 requirements in the 2012 permit condition 6.D. The final report of the investigation (Arcadis 2015) describes the activities in detail. The following is a summary of the conclusions made in the revised RO fields investigation report (Arcadis 2015):

- Discharge to the fields results in mounding of groundwater beneath both of the RO reject discharge fields. The mounding is more pronounced beneath the South RO field due to the fact that the majority of the discharge is directed to that field.
- Organic COCs were below their respective screening levels in all of the soil and groundwater samples collected as part of the investigation, confirming that no impacts from organic compounds have occurred as a result of the discharge of the RO reject stream to the two fields.
- Although arsenic concentrations in groundwater samples were slightly above the screening level, the concentrations of arsenic in the RO reject discharge stream were below the screening level,

indicating that the RO reject discharge stream is not a source of dissolved arsenic above the screening level in groundwater.

- The reported concentrations of boron, manganese, uranium, chloride, fluoride, nitrates, and sulfate from some of the groundwater samples exceeded the screening levels for groundwater; however, none of these compounds contained reported concentrations above the screening levels in the soil samples collected during this investigation.
- The recommendations of the investigation were to continue to monitor the groundwater in the vicinity of the RO reject discharge fields as part of the on-going facility-wide monitoring program and to continue to evaluate the trends in concentrations. The report also included a recommendation to perform an evaluation of upgradient concentrations of inorganic compounds in groundwater to determine if any of the observed concentrations may be naturally occurring.

2.2.2 Background Groundwater Evaluation

Following review of the RO reject discharge fields investigation report, OCD requested that a formal background evaluation be performed to assist in determining if concentrations of specific COCs in the groundwater beneath the fields are a result of the discharge activities or are within expected background concentration ranges. In 2014, a work plan to perform an evaluation of background groundwater was submitted to OCD and NMED (Arcadis 2014). Both agencies approved the work plan, with modifications (OCD 2014, NMED 2014a). The evaluation included collection of groundwater samples from a total of 11 monitoring wells (9 existing and 2 newly installed wells) over a 12-month period, and laboratory analysis of the samples for both organic and inorganic compounds. The 11 monitoring wells included in the evaluation were located either hydraulically upgradient or cross-gradient to the Refinery operations in areas where impacts from the Refinery were not expected.

A statistical evaluation of the analytical data was performed following completion of the 12 monthly monitoring events and was submitted in a final summary report (Arcadis 2015). The statistical evaluation was performed using all of the data from 10 of the 11 monitoring wells. The data from well UG-3R was removed from the statistical evaluation as an outlier. Upper tolerance limits (UTLs) were then calculated for each COC and were compared to the Critical Groundwater Screening Level (CGWSLs). The calculated UTLs for the following constituents were determined to be above the respective WQCC standards:

- Boron
- Chloride
- Fluoride
- Manganese
- Mercury
- Nitrate/Nitrite
- Sulfate
- TDS
- Uranium

As noted in the 2018 Annual Groundwater Report (TRC 2019), concentrations for many of the inorganic COCs depicted as “exceedances” may actually be reflective of background groundwater concentrations.

The recommendation of the background groundwater evaluation report was to use the calculated UTLs for these COCs in lieu of the CGWSLs; however, after reviewing this report, OCD and NMED rejected the calculated UTLs. The use of background UTLs in lieu of CGWSLs is not being used at this time.

2.2.3 Phytoremediation Study

A phytoremediation study was performed beginning in 2017 to evaluate the potential for specific plants to adequately uptake and/or sequester the COCs contained in the RO reject stream with the following objectives: (1) determine whether plants would uptake all the constituent loading for RO-reject water, allowing for some ongoing RO-reject water irrigation, and (2) determine if it would be viable to use phytoremediation as an approach to reduce accumulated constituents in soils/vadose zone and groundwater after ceasing land application of RO-reject water.

As part of this study, soil and groundwater samples were collected and shallow lysimeters were installed to collect samples of vadose zone water. The study concluded that "…phytoremediation appears to be a viable method to prevent accumulation of most constituents in groundwater and soil over time. However, chemical uptake by phytoremediation is not occurring at a significantly faster rate than the loading of constituents in shallow soil and groundwater via RO-reject water." The data from the phytoremediation study suggest that objective 1 may not be feasible (plant uptake does not exceed loading from RO-reject water, thus ongoing RO-reject water irrigation is not feasible) but objective 2 may be feasible whereby phytoremediation may be a viable option for abatement of soil and groundwater after ceasing land application of RO-reject water. Some of the data obtained from that study are included in the data summary presented in Section 2.2.4. A copy of the phytoremediation study report is provided in **Appendix A**.

2.2.4 Summary of Analytical Data from Previous Investigations

2.2.4.1 Soil Data

Table 1 provides a summary of the inorganic soil analytical data collected from the two RO reject discharge fields from 2013 through 2018. The organic soil analytical data were not included in **Table 1** as the previous evaluation confirmed that the RO reject stream is not a source of organic COCs. **Figure 4** shows the locations where previous soil samples have been collected within the two RO reject discharge fields.

The soil data in **Table 1** are compared to the most recent Soil Screening Levels (SSLs) published by NMED in 2017 (NMED 2017). The following COCs exceed the lowest of the soil-leaching-to-groundwater pathway SSLs in more than one sample:

- Arsenic
- Cobalt
- Iron
- Lead
- Manganese
- Cyanide

As seen in **Table 1**, none of the inorganic COCs exceeded the Industrial/Occupational SSLs and the only inorganic COC that exceeded the Construction Worker SSL was manganese. The manganese exceedances were observed in two of the initial shallow soil samples collected in 2017 as part of the phytoremediation study, but manganese concentrations were below all of the SSLs in the final shallow soil samples collected in 2018 as part of that same study.

2.2.4.2 Groundwater Data

Table 2 provides a summary of the inorganic groundwater analytical data collected from the monitoring wells located within the two RO reject discharge fields from 2013 through 2018. The organic groundwater analytical data were not included in **Table 2** as the previous evaluation confirmed that the RO reject stream is not a source of organic COCs and thus any organic COCs present in groundwater would be from an upgradient source and not from infiltration through the RO reject discharge fields.

The groundwater data in **Table 2** are compared to the CGWSLs, including the most recent maximum contaminant levels (MCLs), WQCC standards, and Tap Water screening levels from the NMED 2017 risk assessment guidance document (NMED 2017). The COCs that exceed the CGWSL in more than one sample include:

- Arsenic
- Boron
- Chloride
- Fluoride
- Iron
- Manganese
- Nitrate/Nitrite (screened as Nitrite)
- Sulfate
- TDS
- Uranium

2.2.4.3 Vadose Zone Water Data

Table 3 contains a summary table of the analytical results from vadose zone water samples collected from lysimeters installed as part of the phytoremediation study. **Figure 4** shows the locations of the lysimeters that were installed as part of the phytoremediation study.

For evaluation purposes, the vadose zone water sample results presented in **Table 3** were compared to the CGWSLs used for evaluation of groundwater concentrations. The COCs that exceed the CGWSL in more than one vadose zone water sample include:

- Boron
- Chloride
- Fluoride
- Iron
- Manganese
- Nitrate/Nitrite

- Sulfate
- TDS

Selenium was detected above the screening level in one vadose zone water sample, but was not reported above the screening level in any of the other vadose zone samples, or in the soil and groundwater samples collected as part of these investigations.

3.0 Assessment Monitoring Plan

The Permit requires the Refinery to cease discharging RO reject water to the two RO reject discharge fields and begin discharging RO reject water to an injection well. The purpose of this Stage 1 AP is to evaluate the potential for impacts to shallow groundwater as a result of the discharge of the RO reject stream to the two discharge fields. Specifically, the investigation proposed in this Stage 1 AP will evaluate the potential for leaching of inorganic constituents that may have accumulated as precipitates in soil within the vadose zone as a result of RO reject stream discharge operations. Previous investigations of the discharge fields have occurred during ongoing discharge, and so it is necessary to evaluate site conditions after the discharge has discontinued to determine the appropriate ongoing action or monitoring program, if any.

Discharge to the RO fields ceased on January 24, 2019, so the discharge fields are currently draining to field capacity, which is the soil moisture condition where excess water has drained from the soil and downward movement of pore water has ceased or greatly reduced. After the RO fields have reached field capacity, monitoring will be conducted to evaluate soil and groundwater conditions and changes.

The following sections describe the activities that are recommended, including:

- Active monitoring of soil moisture throughout the vadose zone within each of the two RO reject discharge fields to determine when the elevated moisture within the soil column has drained to near field capacity conditions
- Active monitoring of soil and groundwater conditions within each of the two RO discharge reject fields
- Active monitoring of groundwater conditions in nearby upgradient and downgradient wells

It is proposed that the fields be graded to promote drainage and more uniform infiltration, as well as reduce ponding of rainfall or snowmelt. The existing ditches used to distribute the discharged RO reject stream throughout the fields will be filled with clean soil or graded to match the surrounding areas. The following subsections provide details of the proposed Stage 1 AP monitoring program.

3.1 Soil Moisture Monitoring

A soil moisture monitoring program will be implemented once discharge to the fields has ceased and the Stage 1 AP is approved. Soil moisture probes will be installed in a total of eight locations to monitor soil moisture and electrical conductivity (EC) at multiple depths in the soil profile within the two fields and outside the fields.

Soil moisture probes will be placed at depths of 2, 5, and 10 feet bgs in three locations within each of the two fields at the locations shown on **Figure 5**. One probe will be placed near the discharge location for each field and the remaining two locations will be located across the field in such a manner as to provide information across each of the fields. One probe will be installed in a location outside, but near, each of the two fields to provide a measure of “background” soil moisture. An estimate of field capacity will be made when the soil moisture content shows no or very small (asymptotic) changes over time. Alternatively, soil moisture readings can be compared to soil moisture retention curves for similar textured soils.

A hand auger or a direct-push rig will be used to advance a boring to a depth of 10 feet bgs at each location. The probes will be placed at the desired depth according to the manufacturer’s installation instructions. Each probe will be attached to a solar-powered data logger, and data will be automatically downloaded at regular intervals.

Soil moisture will be initially monitored for three months (one quarter) to assess whether the fields have drained to field capacity or if additional drainage is necessary prior to proceeding with the soil and groundwater monitoring effort. The soil moisture data will be used to evaluate any wetting fronts that may move through the soil profile, as well as provide data for assessing drainage of the soil profile to reach or approach field capacity.

A progress summary report will be prepared and submitted after collection of soil moisture data for one quarter and recommendations will be made whether to proceed with the soil and groundwater monitoring data collection (described below) or to continue to allow the fields to drain. If the recommendation is to allow continued drainage, a revised schedule for initiating the soil and groundwater monitoring program will be proposed.

Soil moisture probes will remain in place throughout implementation of the Stage 1 AP, and data will continue to be collected to evaluate the vadose zone moisture.

3.2 Soil Sampling

One soil boring will be completed within 10 feet of each of the eight soil moisture probes for a total of eight soil borings. Soil samples for field observation and laboratory analysis will be collected from borings completed within the two discharge fields, as described in the following subsections. The purpose of the soil sampling from within the discharge fields is to evaluate the concentrations of total and potentially leachable inorganic COCs within the vadose zone as pertains to potential leaching of inorganic COCs to groundwater. Analytical samples will not be collected from the soil borings completed adjacent to the background soil moisture probes; however, the soil strata will be observed and recorded for comparison to the soil strata of the borings installed within the discharge fields.

3.2.1 Soil Sample Collection Procedures

Continuous soil cores will be collected using a direct-push rig. Soil cores will be observed and screened using a photoionization detector (PID), such as a MiniRAE or similar device. Aliquots of soil will be placed into a plastic zip-top bag and allowed to equilibrate for a minimum of 10 minutes. The bag will then be punctured with the tip of the PID and the highest reading on the PID will be recorded on the boring log. The PID will be calibrated following the manufacturer’s specifications and the calibration results will be recorded in the field logbook. The actual model name and number of the PID used will also be recorded in the field logbook.

Soil characteristics and visual observations will be recorded on the soil boring log. Soil characteristics will be described by the field geologist and will include the soil or rock type, classified in general accordance with ASTM International specifications D2487 and D2488. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling, will be recorded on the log.

Discrete soil samples will be selected from the boring for laboratory analysis from the 1 to 2 feet bgs interval, the 4 to 5 feet bgs interval, and the 9 to 10 feet bgs interval, which correspond to the depths at which the soil moisture probes will be installed. The sample depths may be adjusted based on field conditions. Additional samples may be collected if soil strata are encountered that warrant sample collection. Each soil sample will be a discrete sample without compositing.

Soil samples submitted for laboratory analyses will be placed into appropriate containers (typically 4-ounce glass jars), labeled, and then placed in a cooler with ice. New nitrile gloves will be used each time samples are handled to prevent cross contamination. PID readings and field screening observations will be recorded on the boring log and will be included in the quarterly progress summary report.

3.2.2 Soil Analytical Methods

The soil samples will be analyzed for COCs that have been present in previous soil, vadose zone, and groundwater samples at concentrations above the screening standards as well as for cations. Soil samples, as well as groundwater samples, will not be analyzed for cyanide because cyanide was either not detected or was detected below the MCL in all quarterly groundwater samples collected during the previous investigation of the discharge fields. Therefore, cyanide is not considered a COC for the fields.

Both the total COC concentrations and the leachable concentrations, using the synthetic precipitation leaching procedure (SPLP) method, will be measured to evaluate the potential for mobilization of these compounds from the soils to groundwater. The leachable cation and anion data will help support any changes that may be observed in groundwater types beneath the RO fields.

These soil analyses will include:

- Total Metals (arsenic, boron, cobalt, iron, lead, manganese, and uranium) by Methods 6010 or 6020
- Leachable Metals (arsenic, boron, cobalt, iron, lead, manganese, and uranium) by Methods 6010 or 6020 using the SPLP method
- Total Cations and Anions by Methods 6010 or 6020 for Calcium, Magnesium, Potassium, and Sodium and Method 300 for Sulfate, Chloride, Nitrate/Nitrite (as N), and Fluoride
- Leachable Cations and Anions by Methods 6010 or 6020 for Calcium, Magnesium, Potassium, and Sodium and Method 300 for Sulfate, Chloride, Nitrate/Nitrite (as N), and Fluoride using the SPLP method

The laboratory will be provided the screening standards, where available, for soil samples and will make every possible attempt to maintain method detection limits that are less than or equal to the screening standards. Screening standards for the soil to groundwater leaching pathway are not available for Calcium, Chloride, Potassium, Sodium, and Sulfate; thus the lowest of the applicable direct contact screening standards will be used for these COCs. There is no direct contact screening standard for Sulfate so the laboratory will be requested to maintain the lowest detection limits. It should be noted that the laboratory may not be able to maintain method detection limits below the screening standards for a specific sample if that sample requires dilution.

3.2.3 Soil Quality Assurance/Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be collected to monitor the validity of the soil sample collection procedures. The following samples will be collected for QA/QC purposes:

- Field duplicates will be collected at a rate of 10%, or 1 field duplicate for every 10 soil samples. Field duplicates will be analyzed for the same constituents as the parent sample.
- Equipment blanks will be collected from sampling apparatus at a frequency of 5%, or 1 equipment blank for every 20 soil samples collected, with a minimum of 1 equipment blank per day. Equipment blank samples will be analyzed for the same constituents as the sample

associated with the equipment blank (sample collected immediately prior to the equipment blank).

3.2.4 Boring Permitting and Abandonment

Each soil boring will be used to install soil moisture probes, as described in Section 3.1, and will be grouted to the surface. The boring and grouting plan will be permitted through the Office of the State Engineer, as appropriate.

3.2.5 Survey

The soil boring and moisture probe locations and elevations will be located by a registered surveyor. The location will be determined to the nearest 0.1 foot and converted to state plane coordinates. The ground surface elevation will be determined to the nearest 0.01 foot relative to the known benchmark for the Refinery. A copy of the survey data will be included in the quarterly progress summary report.

3.3 Groundwater Monitoring

Groundwater monitoring will focus on a subset of monitoring wells including wells located within each of the RO reject discharge fields, as well as existing and proposed wells located upgradient and downgradient of the two fields. The purpose of the groundwater monitoring is to evaluate the current and temporal conditions immediately upgradient and downgradient of the fields, and within the fields, to determine the potential impact to groundwater from infiltration through the vadose zone beneath the RO fields.

Analytical results will be used to compare the water quality and COC concentrations of the upgradient locations, beneath the field locations, and downgradient locations. These comparisons will be used to determine if there have been impacts from the historical discharge of the RO reject stream, whether potential impacts are increasing or declining, and whether additional abatement (Stage 2) is appropriate. If the concentrations of COCs beneath the fields and/or downgradient of the fields are similar to or less than the concentrations of the same COCs in upgradient wells, then the historical discharge of RO reject water to the fields has not had an impact on the groundwater quality. However, if the inverse is true, then the historical discharge has potentially had an impact on groundwater quality.

Figure 6 shows the wells that will be included in this Stage 1 AP, including existing wells and proposed monitoring wells. The wells proposed to be included in the groundwater monitoring program for the Stage 1 AP are:

- South RO Reject Discharge Field:
  - Upgradient: MW-29, MW-40, MW-56
  - Within Field: MW-114, MW-115, MW-116
  - Downgradient: MW-125, RW-18A, one proposed new well
- North RO Reject Discharge Field:
  - Upgradient: MW-55, two proposed new wells
  - Within Field: MW-117, MW-118, MW-119
  - Downgradient: two proposed new wells

The proposed new wells have been sited based on the current groundwater gradient; however, the locations may be altered if the gradient changes significantly after field capacity is reached. The well installation and sampling procedures are described in the following subsections.

3.3.1 Groundwater Well Installation

The installation of the new monitoring wells will be performed by a driller licensed in New Mexico, using hollow-stem drilling methods, and directed by an experienced geologist or environmental scientist. Each well will be permitted under the New Mexico Office of the State Engineer.

3.3.2 Well Construction Methods

The monitoring wells will be drilled to the bottom of the shallow water-bearing zone, or to a depth of at least 10 feet below the capillary fringe of the shallow water-bearing zone. The depth of each monitoring well is anticipated to be approximately 30 feet bgs, but will be adjusted based on observed conditions in the field. The minimum diameter of the borings will be approximately 8 inches to allow for the installation of 2-inch diameter polyvinyl chloride well casings. Each monitoring well casing will consist of a bottom cap, a section of 0.010-inch slotted well screen, and solid casing extending to the surface. The well screens will extend to approximately 5 feet above the capillary zone. It is anticipated that the screen intervals will be between 15 to 20 feet in length; however, additional screen will be installed, as necessary, to extend from the bottom of the well to 5 feet above the capillary fringe. Well materials, including end caps, casings, and screens, will be pre-cleaned and will have threaded connections. Well construction materials will be kept wrapped in original packaging or plastic sheeting until used.

Each monitoring well casing will be extended approximately 3 feet above the ground surface. An 8/16-grade sand pack will be placed in the annular space to 3 feet above the screened interval, and a 2-foot bentonite seal placed on top of the sand pack. A grout seal will be placed from the bentonite seal to the surface. A locking, steel outer casing will be placed around each casing and a 4-foot by 4-foot by 4-inch thick concrete pad will be poured around each outer casing. Protective bollards will be placed around the concrete pad at the discretion of facility personnel. In the event that a well location is not suitable for installation of an outer casing above ground, a flush-mounted vault will be installed within a 4-foot by 4-foot by 4-inch thick concrete pad and a locking cap will be placed on the well casing.

An experienced geoscientist or environmental scientist will observe the installation and construction of the monitoring wells and will record measurements of various well dimensions, including distance from the top of ground or well casing to the:

- Bottom of the well
- Top of the sand pack
- Top of the bentonite seal
- Top of the screen
- Land surface

The field measurements will be included in the field logbook and on the final well completion logs.

Each monitoring well location will be located by a registered surveyor. The location will be determined to the nearest 0.1 foot and converted to state plane coordinates. The ground surface elevation and top of casing elevation will be determined to the nearest 0.01 foot relative to the known benchmark for the Refinery. Survey information from well completion logs will be included in the quarterly progress summary report following the well installation.

3.3.3 Well Development

Each monitoring well will be developed through bailing and/or pumping to remove fine-grained materials accumulated in the well casing until the bottom of the well casing can be reached. Conductivity, pH, and temperature of the purged groundwater will be monitored throughout the development process. The development process will be considered complete after the parameters stabilize (i.e., less than 10% variability between readings) and/or at least three well casing volumes have been removed. The measurements and equipment used to make the measurements will be recorded in the field logbook. Equipment will be calibrated following the manufacturer’s recommendations, and the calibration results will be recorded in the field logbook.

The volume of purged fluids will be observed and recorded in the field logbook. Fluids produced during development will be collected and disposed of in the Refinery wastewater treatment system, upstream of the oil-water separator.

3.3.4 Groundwater Sample Collection Procedures

Following well development, the depth to PSH (if present), depth to water, and total depth of the well will be measured from the top of casing and will be recorded in the field logbook. Depth to water will be measured using a battery-operated water level meter. If the presence of PSH is suspected, depth to water and PSH will be measured using a battery-operated oil/water interface probe. The model of meter(s) used will be recorded in the field logbook.

PSH is not expected to be present at the location of these monitoring wells. However, in the event that greater than 0.03 feet of PSH is present in any of these monitoring wells, a PSH sample will be collected for characterization. If no PSH or less than 0.03 feet of PSH is present, a groundwater sample will be collected following well development using low-flow sampling techniques. Dedicated tubing will be used to prevent the potential for cross-contamination.

Field measurements and equipment used to make the measurements will be recorded in the field logbook. Equipment will be calibrated following the manufacturer’s recommendations and the calibration results will be recorded in the field logbook.

Low-flow sampling procedures, as described in the NMED Position Paper “Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring” (NMED 2001), will be used to collect the groundwater sample. Low-flow purging will be continued until the field measurements of at least three of the five water quality parameters, including pH, temperature, specific conductance, oxidation-reduction potential, and dissolved oxygen, stabilize within 10% for three consecutive readings. Purge parameter readings will be documented in the field sampling logbook and will be included in the quarterly progress summary report.

Following completion of purging, groundwater samples will be collected directly into the laboratory-provided sample containers. Containers will be labeled and placed into appropriate containers (coolers) with ice for shipment to the analytical laboratory under proper chain of custody.

3.3.5 Groundwater Analytical Methods

Groundwater samples will be analyzed for the same COCs as the soil samples, which include COCs that have been present in previous soil, vadose zone, and groundwater samples at concentrations above the screening standards. In addition, groundwater samples will be analyzed for cations, carbonate, bicarbonate, and TDS to allow for evaluation of the ionic composition of the groundwater.

Groundwater samples will be collected semiannually from the specific wells listed in Section 3.3 and analyzed for:

- Total Metals (arsenic, boron, cobalt, iron, lead, manganese, and uranium) by Methods 6010 or 6020
- Dissolved (field-filtered) Metals (arsenic, boron, cobalt, iron, lead, manganese, and uranium) by Methods 6010 or 6020
- Total Cations and Anions by Methods 6010 or 6020 for Calcium, Magnesium, Potassium, and Sodium and Method 300 for Sulfate, Chloride, Nitrate/Nitrite (as N), and Fluoride
- TDS

The analytical results for the total metals will be compared to the MCLs (Arsenic, Lead, and Uranium), the secondary drinking water standards (Iron and Manganese), or the New Mexico tap water screening standard (Boron and Cobalt). The analytical results for the dissolved phase metals will be compared to the WQCC standards (all 7 metals). The analytical results for Chloride, Fluoride, Sulfate, and TDS will also be compared to the WQCC standards. In addition, the results from upgradient wells will be compared to the results from wells within the discharge fields and to the results from downgradient wells. Concentration trends will be evaluated to determine whether the historical discharge to the fields is having an impact on groundwater and, if so, whether that impact is increasing or decreasing.

The wells listed in Section 3.3 will also be sampled quarterly for the following parameters:

- Total Cations (Calcium, Magnesium, Potassium, and Sodium) by Methods 6010 or 6020
- Total Anions (Chloride, Fluoride, Sulfate, Carbonate, Bicarbonate, and Nitrate/Nitrite as N) by Method 300
- TDS

The quarterly analytical results for Chloride, Fluoride, Sulfate, and TDS will be compared to the WQCC standards. The entire suite of quarterly analytical data will be used to construct Piper and/or Stiff diagrams to evaluate changes in groundwater ionic composition following cessation of discharge to the fields.

Table 4 lists the proposed groundwater monitoring program for the Stage 1 AP, including monitoring wells, monitoring parameters, and frequency of sampling.

3.3.6 Groundwater Quality Assurance/Quality Control Samples

QA/QC samples will be collected to monitor the validity of the groundwater sample collection procedures. The following samples will be collected for QA/QC purposes:

- Field duplicates will be collected at a rate of 10%, or 1 field duplicate for every 10 groundwater samples. Field duplicates will be analyzed for the same constituents as the parent sample.
- Equipment blanks will be collected from non-dedicated sampling apparatus at a frequency of 5%, or one for every 20 groundwater samples collected, with a minimum of 1 equipment blank per day. Equipment blank samples will be analyzed for the same constituents as the sample associated with the equipment blank (sample collected immediately prior to the equipment blank). When dedicated sampling materials are used, such as dedicated tubing, no equipment blank samples are required.

3.4 Decontamination Procedures and Investigation Derived Wastes

3.4.1 Liquid Wastes

The hollow-stem augers will be decontaminated prior to initiation of drilling and between each well. The auger flights will be power washed in soap and water, then rinsed with distilled water.

All reusable groundwater sampling equipment will be decontaminated prior to coming in contact with the sample media to minimize the potential for cross-contamination of samples. This equipment includes all downhole well gauging devices. The equipment will be washed in soap and water then rinsed with distilled water.

Decontamination fluids will be contained and placed in a 55-gallon drum (or similar container) for later disposal in the Refinery process wastewater treatment system, upstream of the oil/water separator. The volume of decontamination fluids will be observed and recorded.

Groundwater removed from the wells during development and/or sampling will be contained and placed in a 55-gallon drum (or similar container) then disposed of within the Refinery process wastewater treatment system, upstream of the oil-water separator. The volume of liquid generated during development and sampling will be observed and recorded.

3.4.2 Solid Wastes

Sampling personnel will wear disposable gloves while collecting and handling samples. Gloves will be replaced prior to collection of each sample to prevent cross-contamination. Used gloves and disposable sampling equipment will be collected and placed into the Refinery trash.

Soil cuttings from collection of soil samples and installation of monitoring wells will be placed into 55-gallon drums for temporary staging and labeled appropriately. The volume of containerized solid wastes will be observed and recorded. Based on the results of the soil samples, the material will be disposed of appropriately.

Dedicated disposal sampling equipment, including tubing and bailers, will be disposed of in the plant non-hazardous waste bins.

Waste disposal records will be maintained at the Refinery and will be included in the quarterly progress summary report.

4.0 Health and Safety Plan

HFNR has a rigorous health and safety evaluation program and requires all subcontractors to adhere to that program. Each subcontractor must develop and implement their own task-specific health and safety plan. The health and safety plans must include the following items, at a minimum:

- Scope of work to be performed
- Hazard analyses and mitigation steps for each task
- Personal protective equipment required for each task
- Monitoring equipment required
- Emergency response and incident reporting procedures

A copy of each subcontractors' health and safety plan will be maintained on site during every field event and will be made available to OCD for review upon request.

5.0 Schedule

This Stage 1 AP will be implemented within 60 days of approval from OCD.

The requirements of NMAC 20.6.2.4106.C state that a Stage 1 AP must include submission of quarterly progress summary reports along with a detailed final site investigation report. The proposed schedule for implementation is shown on **Figure 7**. The proposed schedule is based on an initial 2-year groundwater monitoring period once soil moisture data indicate the fields have drained to field capacity. The moisture profile and groundwater analytical data will be reviewed and evaluated throughout the 2-year period and reported as required. The final report will utilize the monitoring and investigation evaluation to determine/recommend:

- If adequate data have been collected to properly evaluate whether there is potential for impacts to shallow groundwater from the RO fields
- If additional monitoring is appropriate
- If no further action is appropriate
- If corrective action (Stage 2 AP) is appropriate

6.0 References

Arcadis 2012. Reverse Osmosis Reject Water Discharge Fields Site Investigation Work Plan. November 20, 2012.

Arcadis 2014. Background Groundwater Evaluation Work Plan. July 25, 2014.

Arcadis 2015. Reverse Osmosis Reject Water Discharge Fields Investigation Final Report – Revised. December 30, 2015.

NMED 2001. Use of Low-Flow and Other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring, Position Paper, October 30, 2001.

NMED 2003. Navajo Refining Company Artesia Refinery Post-Closure Care Permit, September 2003.

NMED 2010. Navajo Refining Company Artesia Refinery Post-Closure Care Permit, December 2010.

NMED 2012. Risk Assessment Guidance for Site Investigations and Remediation. February 2012.

NMED 2014a. Approval with Modifications, Background Groundwater Evaluation Work Plan. July 25, 2014.

NMED 2014b. Risk Assessment Guidance for Site Investigations and Remediation. December 2014.

NMED 2017. Risk Assessment Guidance for Investigations and Remediation, March 2017.

OCD 2014. ARCADIS Letter: "Submittal of the Background Groundwater Evaluation Work Plan for the Navajo Refining Company, Artesia Refinery" dated July 8, 2014 with Work Plan dated July 2014. July 25, 2014.

OCD 2017a. Discharge Permit GW-028. May 25, 2017.

OCD 2017b. Discharge Permit Modification. June 27, 2017.

OCD 2018a. Discharge Permit (GW-28) Modification. October 25, 2018.

OCD 2018b. Discharge Permit (GW-28) Modification. December 14, 2018.

TRC 2019. 2018 Annual Groundwater Monitoring Report. February 28, 2019.

TABLES

Table 1 - Summary of Soil Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc
Units:			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ind/Occ SSL - Cancer:			--	3.59E+01	--	--	4.17E+05	5.05E+02	8.34E+04	--	--	--	--	--	--	2.89E+06	--	--	--	--
Ind/Occ SSL - Noncancer:			1.29E+06	2.08E+02	2.55E+05	2.59E+05	1.11E+03	3.14E+05	3.88E+02	5.19E+04	9.08E+05	8.00E+02	1.60E+05	1.11E+02	6.49E+03	2.57E+04	6.49E+03	6.49E+03	3.88E+03	3.89E+05
CW SSL - Cancer:			--	2.16E+02	--	--	3.61E+03	4.68E+02	7.22E+02	--	--	--	--	--	--	2.50E+04	--	--	--	--
CW SSL - Noncancer:			4.14E+04	4.12E+01	4.39E+03	5.14E+04	7.21E+01	1.34E+02	3.67E+01	1.42E+04	2.48E+05	8.00E+02	4.64E+02	2.05E+01	1.77E+03	7.53E+02	1.75E+03	1.77E+03	2.77E+02	1.06E+05
DAF 20 SSL - Risk-based:			5.97E+05	4.99E-01	2.70E+03	2.51E+02	9.39E+00	2.05E+05	5.40E+00	5.56E+02	6.96E+03	--	2.63E+03	6.54E-01	3.98E+01	4.85E+02	1.02E+01	1.38E+01	5.33E+02	7.41E+03
DAF 20 SSL - NMGW/MCL-based:			--	5.83E+00	1.65E+03	--	7.52E+00	3.60E+03	--	9.15E+02	--	5.20E-02	--	2.09E+00	--	--	5.17E+00	--	2.70E+02	--
Boring	**Date**	**Depth**																		
MW-114	1/28/2013	1	13,900	**4.67**	115	5.29	0.403	14.3	4.91	26.4	**9,110**	**37.3**	192	0.0199	0.58	10.7	1.12	< 0.584	< 0.584	40
	1/28/2013	5	5,490	**2.19**	99.2	5.78	0.0884	5.44	1.3	1.67	3,330	**2.59**	45.8	< 0.00471	0.273	3.16	0.307	< 0.584	< 0.584	9.61
	1/28/2013	10	8,230	**3.1**	131	6.34	0.126	7.76	2.14	2.82	4,890	**3.86**	78	0.00371	0.406	4.48	0.64	< 0.564	< 0.564	14.9
	1/28/2013	15	8,150	**3.48**	50.7	7.64	0.149	9.03	2.92	3.34	5,630	**4.96**	129	0.00127	0.808	6.38	0.537	< 0.499	< 0.499	16.1
	1/28/2013	20	8,460	**2.97**	191	3.21	0.186	3.77	2.65	3.97	5,630	**4.37**	137	< 0.00458	0.594	5.71	0.453	< 0.6	< 0.6	18.2
	1/28/2013	25	10,100	**3.14**	27	5.2	0.279	11.2	4.08	3.57	**9,390**	**6.42**	125	0.00738	0.592	5.62	< 1.24	< 0.618	< 0.618	23
	1/28/2013	30	11,100	**1.13**	111	3.95	0.183	11.4	3.6	5.59	**8,870**	**5.54**	217	< 0.00479	0.289	6.9	< 1.18	< 0.592	< 0.592	23.4
	1/28/2013	35	8,660	**1.09**	75.2	2.39	0.129	7.82	2.38	2.71	5,410	**4.82**	88.1	< 0.00412	0.187	5.19	0.258	< 0.442	< 0.442	14.4
MW -115	1/29/2013	1	13,800	**3.6**	147	6.45	0.39	12.8	4.78	11.4	**9,060**	**23.7**	357	0.0182	0.742	9.67	0.949	< 0.591	< 0.591	33.8
	1/29/2013	5	13,200	**2.42**	79.7	9.03	0.257	13	4.55	7.86	**8,880**	**8.22**	211	0.00569	0.68	8.77	0.843	< 0.599	0.856	31.4
	1/29/2013	10	12,100	**2.9**	120	6.04	0.449	14.3	4.7	15.5	**8,210**	**44.9**	175	0.0146	0.614	9.68	1.2	0.11	< 0.587	37.9
	1/29/2013	15	4,980	**0.893**	458	3.78	0.117	5.84	1.62	1.31	3,200	**3.28**	62.9	< 0.00415	< 0.549	3.12	0.348	< 0.549	< 0.549	8.52
	1/29/2013	20	10,300	**2.53**	179	4.85	0.251	9.21	3.7	3.3	**7,710**	**7.03**	132	< 0.00435	0.228	6.69	0.699	< 0.573	< 0.573	20.5
	1/29/2013	25	5,210	**1.05**	68	< 13.9	0.173	5.52	1.33	1.19	2,980	**3.73**	48	< 0.00449	< 0.558	2.74	0.428	< 0.558	< 0.558	8.99
MW-116	1/29/2013	1	14,600	**4.38**	130	7.77	0.407	14	**5.52**	11.1	**10,100**	**14.7**	375	0.0081	0.585	11.6	0.95	< 0.413	< 0.413	37.3
	1/29/2013	5	9,770	**3.65**	155	7.48	0.156	8.46	2.94	4.05	6,240	**4.47**	163	0.00677	0.485	6.19	0.485	< 0.382	0.523	19
	1/30/2013	10	7,550	**2.48**	43.5	9.23	0.114	6.73	2.58	2.97	4,720	**3.63**	139	0.00774	0.331	4.51	0.353	< 0.432	0.45	14.2
	1/30/2013	15	3,970	**2.83**	19	6.99	0.102	3.86	2.7	2.53	2,880	**2.03**	351	0.000647	0.645	5.57	0.252	< 0.448	< 0.448	7.87
	1/30/2013	20	8,370	**6.28**	19.9	4.74	0.283	7.41	2.95	4.92	**7,120**	**7.08**	251	0.00829	0.837	7.79	0.512	< 0.46	< 0.46	19.8
	1/30/2013	25	7,960	**3.22**	181	7.57	0.205	6.81	2.49	4.45	5,710	**5.57**	169	0.000757	0.381	6.75	0.433	< 0.409	< 0.409	17.8
MW-117	1/31/2013	1	15,200	**4.74**	182	8.67	0.374	15.4	**5.45**	9.7	**10,800**	**11.9**	410	0.00702	1.01	11.4	0.98	< 0.634	< 0.634	38.7
	1/31/2013	5	5,020	**1.4**	62.2	7.89	0.133	7.26	1.54	2.51	3,570	**2.9**	105	< 0.00417	0.457	3.48	0.415	< 0.593	< 0.593	11.6
	1/31/2013	10	6,140	**2.48**	49.2	5.92	0.195	8.28	2.23	2.09	5,340	**4.46**	69.2	0.00201	0.276	3.85	0.422	< 0.665	< 0.665	12.2
	1/31/2013	15	5,400	**7.29**	8.33	2.96	< 0.607	6.81	3.54	2.2	**8,050**	**3.04**	91	0.0011	0.606	5.09	< 0.607	< 0.607	< 0.607	10.1
	1/31/2013	20	11,200	**1.12**	23.2	2.45	0.234	11.9	3.43	4.44	6,600	**7.99**	72	0.0033	< 0.603	6.31	0.699	< 0.603	< 0.603	22
	1/31/2013	25	8,180	**0.526**	6.58	< 3.16	< 0.631	7.67	2.05	3.35	4,590	**4.74**	37.5	< 0.0044	< 0.631	4.4	< 0.631	< 0.631	< 0.631	14.5
MW-118	2/4/2013	1	14,300	**4.08**	105	7.25	0.353	14.1	4.33	21.3	**9,280**	**295**	261	0.0401	0.627	9.1	0.652	< 0.585	< 0.585	37.5
	2/4/2013	5	8,560	**3.53**	85.6	7.21	0.13	8.08	2.15	3.19	5,220	**3.67**	62.9	0.00739	0.416	4.78	0.286	< 0.715	0.953	13.5
	2/4/2013	10	7,230	**2.53**	84	4.16	0.172	7.53	1.81	3.38	4,430	**6.52**	98.8	0.00351	0.464	4.37	0.344	< 0.635	< 0.635	13.7
	2/4/2013	15	2,930	**0.76**	8.93	< 15.8	0.335	3.62	0.487	< 3.17	1,620	**2.99**	36.3	0.0013	< 0.633	1.58	1.49	< 0.633	< 0.633	6.21
	2/4/2013	20	3,230	**1.02**	6.44	< 14.7	0.457	3.22	0.982	0.614	1,960	**3.71**	58.4	0.000827	< 2.94	2.51	1.38	< 2.94	< 2.94	6.61
	2/4/2013	25	9,540	**3.21**	32.6	< 5.95	0.22	9.08	2.15	4.53	**7,200**	**4.81**	95.7	0.0028	0.545	7.1	0.724	< 1.19	< 1.19	22.8
MW-119	2/4/2013	1	13,800	**3.39**	89.9	6.94	0.483	13	4.37	12.1	**8,910**	**61**	131	0.0207	0.593	9.34	1.18	< 1.19	< 1.19	56.8
	2/4/2013	5	13,300	**4.21**	108	5.63	0.295	11.1	3.77	5.81	**8,220**	**6.75**	204	0.00731	0.743	8.08	0.895	< 1.09	< 1.09	27.1
	2/4/2013	10	9,390	**6.34**	50.7	6.02	0.167	9.37	3.84	4.42	**7,850**	**6.14**	252	0.00912	0.858	9.28	0.644	< 1.26	< 1.26	21.7
	2/4/2013	15	5,700	**2.98**	47.3	11.9	< 3.34	4.79	2.05	2.39	4,080	**2.84**	**523**	0.00611	2.16	8.56	1.32	< 3.34	< 3.34	11.8
	2/4/2013	20	10,300	**2.8**	208	4.44	0.188	8.86	2.77	3.91	6,080	**4.36**	88.8	0.00501	0.302	6.69	0.62	< 0.599	< 0.599	19.7
	2/4/2013	25	11,600	**2.38**	18.2	6.19	0.218	9.42	4.83	4.7	**8,790**	**5.31**	184	0.00225	< 1.23	8.83	0.663	< 1.23	< 1.23	23.2

Table 1 - Summary of Soil Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc
Units:			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ind/Occ SSL - Cancer:			--	3.59E+01	--	--	4.17E+05	5.05E+02	8.34E+04	--	--	--	--	--	--	2.89E+06	--	--	--	--
Ind/Occ SSL - Noncancer:			1.29E+06	2.08E+02	2.55E+05	2.59E+05	1.11E+03	3.14E+05	3.88E+02	5.19E+04	9.08E+05	8.00E+02	1.60E+05	1.11E+02	6.49E+03	2.57E+04	6.49E+03	6.49E+03	3.88E+03	3.89E+05
CW SSL - Cancer:			--	2.16E+02	--	--	3.61E+03	4.68E+02	7.22E+02	--	--	--	--	--	--	2.50E+04	--	--	--	--
CW SSL - Noncancer:			4.14E+04	4.12E+01	4.39E+03	5.14E+04	7.21E+01	1.34E+02	3.67E+01	1.42E+04	2.48E+05	8.00E+02	4.64E+02	2.05E+01	1.77E+03	7.53E+02	1.75E+03	1.77E+03	2.77E+02	1.06E+05
DAF 20 SSL - Risk-based:			5.97E+05	4.99E-01	2.70E+03	2.51E+02	9.39E+00	2.05E+05	5.40E+00	5.56E+02	6.96E+03	--	2.63E+03	6.54E-01	3.98E+01	4.85E+02	1.02E+01	1.38E+01	5.33E+02	7.41E+03
DAF 20 SSL - NMGW/MCL-based:			--	5.83E+00	1.65E+03	--	7.52E+00	3.60E+03	--	9.15E+02	--	5.20E-02	--	2.09E+00	--	--	5.17E+00	--	2.70E+02	--
Boring	**Date**	**Depth**																		
RO-SB-1	1/31/2013	1	10,800	**4.07**	149	6.67	0.266	10.6	4.17	8.25	**8,020**	**10.6**	236	0.00979	0.495	8.27	0.655	< 0.583	< 0.583	31.7
	1/31/2013	5	7,110	**3.42**	180	4.3	0.085	6.49	2.59	2.64	4,780	**3.75**	55.2	0.00395	0.205	4.83	0.542	< 0.612	< 0.612	14.4
	1/31/2013	10	4,110	**2.03**	186	4.47	0.103	5.94	1.28	2.52	2,390	**2.02**	32.3	0.00167	< 0.635	2.4	0.276	< 0.635	< 0.635	9.11
	2/1/2013	15	8,520	**1.68**	95.7	5.8	0.262	6.96	3.65	3.94	5,050	**7.03**	76.1	0.00335	0.165	5.53	0.943	< 0.549	< 0.549	20
	2/1/2013	20	6,090	**2.91**	268	3.56	0.245	6.61	1.2	2.38	3,230	**4.04**	35.3	0.00102	< 0.606	3.95	0.62	< 0.606	< 0.606	9.84
	2/1/2013	25	18,600	**3.12**	16.5	3.76	< 0.621	9.2	**6.52**	6.56	**9,750**	**12**	193	0.0274	0.42	10.4	0.414	< 0.621	< 0.621	30.7
	2/1/2013	30	7,810	**2.01**	40.7	3.67	0.151	6.41	1.97	2.72	4,870	**4.05**	78.8	0.000638	0.22	4.51	0.539	< 0.669	< 0.669	14.9
	2/1/2013	35	4,280	**1.82**	72.7	2.01	0.0817	4.22	1.87	1.7	3,220	**2.92**	58.1	< 0.00409	0.198	3.34	0.332	< 0.564	< 0.564	8.89
SS-1-20170804	8/4/2017	2	23,000	**5.86**	175	<14.7	1.31	17.9	4.28	10.3	**15,400**	**13.5**	**469**	<0.0277	1.42	15.2	4.1	0.0978	0.736	71.2
SS-2-20170804	8/4/2017	2	22,800	**7.74**	201	<14.7	1.36	18	5.09	15.8	**15,600**	**21.5**	**467**	<0.0266	0.88	16.4	3.62	0.117	0.689	71.8
SS-3-20170804	8/4/2017	2	24,100	**5.74**	172	<14.7	1.27	17.6	4.31	12	**16,500**	**15.4**	401	<0.026	1.27	15.1	2.95	0.101	0.751	70.5
SS-4-20170804	8/4/2017	2	20,700	**5.39**	166	<14.7	1.16	15.4	3.15	10.2	**14,300**	**14.6**	330	<0.0265	1.11	13.2	4.89	0.0784	0.828	59.1
SS-5-20170804	8/4/2017	2	20,200	**6.16**	206	<14.7	1.13	15.4	3.36	9.16	**14,100**	**12**	364	<0.0271	0.797	13.2	3.46	0.0751	0.65	56
SS-6-20170804	8/4/2017	2	15,800	**5.14**	167	<14.7	0.958	13	2.55	7.95	**10,900**	**10.1**	294	<0.0264	1.34	11.7	3.85	0.0728	0.791	49.2
SS-7-20170804	8/4/2017	2	14,300	**5.24**	181	<14.7	0.983	10.9	1.35	6.53	**9,570**	**9.85**	232	<0.0254	0.695	10.5	3.56	0.0534	0.678	37.1
SS-8-20170804	8/4/2017	2	16,400	**4.33**	159	<14.7	0.903	12.7	1.83	7.78	**11,500**	**10.1**	286	<0.0259	0.932	11.4	2.74	0.0698	0.594	50.3
SS-LY1-20170809	8/9/2017	2	21,100	**3.4**	167	<14.7	1.43	15.6	3.86	14	**14,500**	**24.7**	332	0.117	0.872	12.6	<0.252	0.122	0.697	74.4
SS-LY2-20170809	8/9/2017	2	19,400	**2.56**	238	<14.7	1.09	13.7	3.17	7.55	**13,400**	**11.3**	245	<0.0279	0.901	11.3	<0.252	0.106	0.869	60.6
SS-LY3-20170809	8/9/2017	2	14,100	**3.49**	154	<14.7	0.891	10.9	2.36	5.47	**9,770**	**7.75**	204	<0.0276	0.68	10.4	<0.252	0.0678	0.757	40.8
SS-LY4-20170809	8/9/2017	2	21,300	**3.16**	192	<14.7	1.56	16.2	3.92	8.74	**14,900**	**14.1**	305	<0.0287	0.923	13.2	<0.252	0.127	0.837	76.9
SS-1-20180329	3/29/2018	2	20,700	**8.38**	239	<14.7	1.52	19	**6.63**	13.9	**14,200**	**19.6**	406	<0.0268	1.14	17.8	1.64	0.133	0.85	90.6
SS-2-20180329	3/29/2018	2	23,100	**8.5**	230	<14.7	1.66	20.1	**7.93**	12.5	**15,700**	**18.2**	434	<0.0273	1.3	19.1	1.28	0.133	0.848	96.8
SS-3-20180329	3/29/2018	2	20,100	**5.65**	180	<14.7	1.37	16.6	**6.15**	10.2	**14,000**	**13.9**	374	<0.0276	1.38	16.4	0.92	0.0965	0.816	76.2
SS-4-20180329	3/29/2018	2	17,700	**5.59**	204	<14.7	1.21	15.4	5.28	9.01	**12,500**	**13**	220	<0.0275	1.29	15.5	0.762	0.0782	0.802	68.8
SS-5-20180329	3/29/2018	2	18,800	**6.54**	192	<14.7	1.33	16.8	**6.58**	9.74	**13,000**	**13.7**	316	<0.0275	0.956	17.2	0.851	0.0903	0.753	73.3
SS-6-20180329	3/29/2018	2	16,400	**4.95**	170	<14.7	1.16	13.5	5.15	8.67	**11,600**	**11.9**	259	<0.0278	1.12	14.4	0.747	0.0946	0.713	57.8
SS-7-20180329	3/29/2018	2	15,800	**5.18**	167	<14.7	1	13.4	4.81	8.09	**10,900**	**11.3**	304	<0.0278	0.758	15	0.599	0.0632	0.65	51.5
SS-8-20180329	3/29/2018	2	15,000	**5.17**	140	<14.7	1.02	12.6	5.07	7.13	**10,300**	**9.29**	315	<0.028	0.756	13.4	0.524	0.0594	0.592	51.9

Table 1 - Summary of Soil Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Moisture	Calcium	Chloride	Fluoride	Nitrate/Nitrite	Nitrate	Nitrite	Potassium	Sodium	Sulfate	Cyanide
Units:			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ind/Occ SSL - Cancer:			--	--	--	--	--	--	--	--	--	--	--
Ind/Occ SSL - Noncancer:			--	4.06E+07	5.84E+07	7.78E+04	--	2.08E+06	1.30E+05	7.62E+07	3.73E+07	--	6.28E+01
CW SSL - Cancer:			--	--	--	--	--	--	--	--	--	--	--
CW SSL - Noncancer:			--	1.11E+07	1.59E+07	1.81E+04	--	5.66E+05	3.54E+04	2.08E+07	1.02E+07	--	1.20E+01
DAF 20 SSL - Risk-based:			--	--	--	3.56E+03	--	4.25E+02	2.66E+01	--	--	--	5.22E-03
DAF 20 SSL - NMGW/MCL-based:			--	--	--	1.20E+04	--	1.35E+02	1.35E+01	--	--	--	7.13E-01
Boring	**Date**	**Depth**											
MW-114	1/28/2013	1	17.9	58,900	21	11.1		< 1.21	< 1.21	3520	157	1,120	*< 2.41*
	1/28/2013	5	28	150,000	24.9	7.73		< 1.39	< 1.39	1060	110	796	*< 2.66*
	1/28/2013	10	25.2	141,000	20.6	5.02		< 1.31	< 1.31	1650	136	6,970	*< 2.46*
	1/28/2013	15	19.9	146,000	27.8	7.12		< 1.24	< 1.24	1240	113	1,270	*< 2.29*
	1/28/2013	20	27	120,000	24.6	4.19		< 1.36	< 1.36	1610	108	320	*< 2.5*
	1/28/2013	25	23.6	138,000	19.8	4.63		< 1.3	< 1.3	1660	181	390	*< 2.49*
	1/28/2013	30	27.4	146,000	20.8	2.25		< 1.37	< 1.37	1840	208	338	*< 2.7*
	1/28/2013	35	17.5	50,400	19.6	3.2		< 1.2	< 1.2	1860	125	259	*< 2.18*
MW -115	1/29/2013	1	19	64,700	58.8	5.2		< 1.23	< 1.23	3360	327	1,160	*< 2.3*
	1/29/2013	5	26.9	90,500	51.5	5.92		< 1.36	< 1.36	2630	216	1,070	*< 2.71*
	1/29/2013	10	19.9	63,400	55	7.73		< 1.23	< 1.23	3490	288	722	*< 2.43*
	1/29/2013	15	16.3	157,000	49.1	3.85		< 1.19	< 1.19	860	122	383	*< 2.3*
	1/29/2013	20	18.9	161,000	51.6	5.04		< 1.23	< 1.23	1690	186	463	*< 2.3*
	1/29/2013	25	20.9	219,000	50.4	< 3.55		< 1.24	< 1.24	773	129	326	*< 2.52*
MW-116	1/29/2013	1	17.9	60,800	22.2	14.7		2.63	< 0.999	3770	135	330	*< 1.94*
	1/29/2013	5	16.1	122,000	29.8	4.51		< 0.992	< 0.992	2130	156	234	*< 1.8*
	1/30/2013	10	16.4	166,000	8.03	5.76		0.896	< 0.995	1620	121	82	*< 1.96*
	1/30/2013	15	15.3	216,000	31.6	8.7		< 0.984	< 0.984	956	108	891	*< 1.82*
	1/30/2013	20	19.2	104,000	33.3	3.92		< 0.997	< 0.997	1280	142	310	*< 1.96*
	1/30/2013	25	23.2	76,500	47.6	1.91		< 1	< 1	1700	120	254	*< 1.9*
MW-117	1/31/2013	1	22.5	83,700	81.1	15.4		0.804	< 1.28	3310	332	777	*< 2.52*
	1/31/2013	5	19	151,000	37.5	8.01		< 1.21	< 1.21	1110	164	3,960	*< 2.2*
	1/31/2013	10	26.4	119,000	28.7	6.49		< 1.35	< 1.35	1310	119	1,790	*< 2.53*
	1/31/2013	15	23.9	26,700	33.5	5.93		< 1.31	< 1.31	1230	154	2,100	*< 2.53*
	1/31/2013	20	20.7	95,400	24.4	5.11		0.415	< 1.26	1760	208	349	*< 2.45*
	1/31/2013	25	21	2,810	26.3	5.18		0.566	< 1.26	1490	153	396	*< 2.23*
MW-118	2/4/2013	1	25.7	55,400	34	5.27		< 1.22	< 1.22	3020	152	3,100	*< 2.5*
	2/4/2013	5	34.8	115,000	56.9	4.29		< 1.53	< 1.53	1610	248	10,700	*< 2.83*
	2/4/2013	10	29.3	187,000	74.6	3.8		< 1.37	< 1.37	1530	158	3,020	*< 2.67*
	2/4/2013	15	27.2	245,000	52	8.59		< 1.22	< 1.22	561	90.4	777	*< 2.51*
	2/4/2013	20	17.9	249,000	66.2	7.71		< 1.1	< 1.1	603	73.1	681	*< 2.29*
	2/4/2013	25	21	99,200						1740	226		
MW-119	2/4/2013	1	22.3	77,800						3310	149		
	2/4/2013	5	23	103,000	29.2	12.3		< 1.21	< 1.21	2680	131	1,680	*< 2.36*
	2/4/2013	10	24.8	89,200	22.6	5.94		< 1.21	< 1.21	2500	134	1,080	*< 2.58*
	2/4/2013	15	26	246,000	18.9	5.87		< 1.28	< 1.28	1280	< 334	1,310	*< 2.58*
	2/4/2013	20	20.7	65,300	33.4	4.97		< 1.09	< 1.09	1650	130	849	*< 2.4*
	2/4/2013	25	19.3	124,000	34.4	3.28		< 1.13	< 1.13	2210	140	495	*< 0.57*

Table 1 - Summary of Soil Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Moisture	Calcium	Chloride	Fluoride	Nitrate/Nitrite	Nitrate	Nitrite	Potassium	Sodium	Sulfate	Cyanide
Units:			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ind/Occ SSL - Cancer:			--	--	--	--	--	--	--	--	--	--	--
Ind/Occ SSL - Noncancer:			--	4.06E+07	5.84E+07	7.78E+04	--	2.08E+06	1.30E+05	7.62E+07	3.73E+07	--	6.28E+01
CW SSL - Cancer:			--	--	--	--	--	--	--	--	--	--	--
CW SSL - Noncancer:			--	1.11E+07	1.59E+07	1.81E+04	--	5.66E+05	3.54E+04	2.08E+07	1.02E+07	--	1.20E+01
DAF 20 SSL - Risk-based:			--	--	--	3.56E+03	--	4.25E+02	2.66E+01	--	--	--	5.22E-03
DAF 20 SSL - NMGW/MCL-based:			--	--	--	1.20E+04	--	1.35E+02	1.35E+01	--	--	--	7.13E-01
Boring	**Date**	**Depth**											
RO-SB-1	1/31/2013	1	17.7	105,000	6.56	16.4		< 1.21	< 1.21	2690	132	204	*< 2.36*
	1/31/2013	5	22.7	87,900	247	12.5		0.515	< 1.29	1430	183	2,350	*< 2.39*
	1/31/2013	10	31	184,000	180	21.5		< 1.43	< 1.43	808	125	1,900	*< 2.71*
	2/1/2013	15	23.5	204,000	80.6	15.3		0.94	< 1.3	1740	123	832	*< 2.35*
	2/1/2013	20	20.3	252,000	71.5	9.85		0.84	< 1.24	1250	101	703	**0.788**
	2/1/2013	25	20.9	11,500	108	14.6		< 1.25	< 1.25	3560	105	851	**0.747**
	2/1/2013	30	26.6	95,500	134	5.24		< 1.34	< 1.34	1450	100	763	*< 2.48*
	2/1/2013	35	16	73,200	46.7	5.8		< 1.17	< 1.17	932	53.7	614	**0.672**
SS-1-20170804	8/4/2017	2	22.9		73.5	36.3		3.47	0.141			3,750	
SS-2-20170804	8/4/2017	2	19.8		89	55.4		3.87	<0.031			1,320	
SS-3-20170804	8/4/2017	2	17.9		137	17.4		0.938	<0.030			6,190	
SS-4-20170804	8/4/2017	2	19.3		125	23.4		0.87	<0.031			7,970	
SS-5-20170804	8/4/2017	2	21.3		75.8	34.9		1.07	<0.031			4,590	
SS-6-20170804	8/4/2017	2	19		225	20.5		0.346	<0.030			7,430	
SS-7-20170804	8/4/2017	2	16.1		119	27.1		1.35	7.17			12,100	
SS-8-20170804	8/4/2017	2	17.5		156	43.3		0.606	<0.030			3,460	
SS-LY1-20170809	8/9/2017	2	25		35.2	21.3		0.832	<0.033			2,860	
SS-LY2-20170809	8/9/2017	2	23.5		67.2	15.2		0.361	<0.032			5,340	
SS-LY3-20170809	8/9/2017	2	22.6		144	22.5		1.52	<0.032			1,630	
SS-LY4-20170809	8/9/2017	2	25.7		33.9	8.84		2.85	<0.033			2,870	
SS-1-20180329	3/29/2018	2	20.2		229	36	0.812					4,780	
SS-2-20180329	3/29/2018	2	21.7		89.1	50.6	0.231					1,460	
SS-3-20180329	3/29/2018	2	22.7		71.8	22.5	0.159					5,640	
SS-4-20180329	3/29/2018	2	22.3		107	17.1	0.89					4,310	
SS-5-20180329	3/29/2018	2	22.3		81	39.7	0.556					2,920	
SS-6-20180329	3/29/2018	2	23.3		86.2	19.9	0.226					8,070	
SS-7-20180329	3/29/2018	2	23.2		83.1	27.5	0.475					13,700	
SS-8-20180329	3/29/2018	2	23.7		94.6	39.6	0.649					4,250	

Notes and Definitions:

Blue shaded, bold font indicates result is above the lowest SSL

< X = Not detected at a detection limit of X

Italics font indicates detection limit exceeds the lowest SSL

"--" in SSL cell means no SSL is published for that analyte

Blank cells mean that analyte was not analyzed in that sample

CW = Construction Worker

DAF = Dilution Attenuation Factor

Ind/Occ = Industrial Occupational

MCL = Maximum Contaminant Level

mg/kg = milligrams per kilogram

NMGW = New Mexico Ground Water

SSL = Soil Screening Level, from Table A-1, NMED *Risk Assessment Guidance for Site Investigations and Remediation,* March 2017

Table 2 - Summary of Groundwater Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

		Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WQCC	5	0.1	1	0.75	0.01	0.05	0.05	1	1.0	0.05	0.2	0.002	1	0.2	0.05	0.05	0.03	10
	EPA MCL	--	0.01	2	--	0.005	0.1	--	1.3	0.3	0.015	0.05	0.002	--	--	0.05	--	0.03	--
Sample ID*	**Date**																		
MW-114	2/3/2013	0.0265	0.00561	0.0204	0.139	< 0.002	< 0.005	0.00738	< 0.005	< 0.2	< 0.005	**1.51**	< 0.0002	0.0103	0.00651	0.00222 J	< 0.005	0.0156	0.00343 J
	5/15/2013	< 0.01	0.00437 J	0.0129	0.101	< 0.002	< 0.005	0.00451 J	< 0.005	< 0.2	< 0.005	**0.844**	< 0.0002	0.00978	0.0041 J	0.00636	< 0.005	0.0108	< 0.005
	9/5/2013	0.00848 J	0.00502	0.017	0.132	< 0.002	< 0.005	0.00718	0.00197	< 0.2	< 0.005	**1.42**	< 0.0002	0.0116	0.00558	0.00245 J	< 0.005	0.0138	< 0.005
	11/21/2013	0.00813 J	0.00539	0.0112	**0.816**	< 0.002	0.00119 J	< 0.005	< 0.005	0.167 J	< 0.005	0.035		0.00815	0.00369 J	0.00451 J	< 0.005	**0.0856**	0.0806
	4/29/2014		0.00292 J	0.0153			< 0.00100			0.0777 J	< 0.000700	**1.2**				< 0.00100 B			
	11/12/2014		0.0031	0.026			0.0023			**0.81**	0.00055 J	**1.2**				0.0018 J			
	4/16/2015		0.00279	0.0165			0.000896			**0.361**	0.000317	**0.927**				<0.000380			
	10/20/2015		0.00355	0.0134			<0.000540			0.0486	<0.000240	**0.905**				0.000757			
	4/29/2016		0.00344	0.0155			<0.00270			<0.0750	<0.00120	**1.15**				<0.00190			
	10/4/2016		0.00327	0.0119			0.00115			<0.0150	0.000617	**0.899**				0.00839			
	4/27/2017		0.00262	0.0138			<0.000540			<0.0150	<0.000240	**0.944**				0.00129			
	10/4/2017		0.00262	0.0129			<0.000540			0.0208	<0.000240	**0.873**				0.0179			
	4/4/2018		0.00226	0.0129			0.00708			0.0871 J	<0.000240	**0.9**				0.0105			
	10/3/2018		0.00225	0.0133			<0.000540			<0.0150	<0.000240	**0.867**				0.00985			
MW-115	2/3/2013	0.00888 J	0.00499 J	0.0309	**0.865**	< 0.002	< 0.005	0.0029 J	0.00704	< 0.2	< 0.005	**0.255**	< 0.0002	0.00877	0.00483 J	0.0081	< 0.005	**0.0843**	0.00973
	5/15/2013	0.00816 J	0.00478 J	0.0107	0.605	< 0.002	< 0.01	< 0.01	< 0.01	< 0.4	< 0.005	0.0267	< 0.0002	0.0075	< 0.01	0.00654 J	< 0.005	**0.0825**	0.00821 J
	5/15/2013 (Dup)	0.00865 J	0.00427 J	0.011	0.635	< 0.002	< 0.005	< 0.005	0.00151	< 0.2	< 0.005	0.023	< 0.0002	0.00723	0.00225 J	0.00734		**0.0731**	
	9/4/2013	0.00648 J	0.00467 J	0.0106	**0.782**	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.0362	< 0.0002	0.00663	0.00208 J	0.00568	< 0.005	**0.0936**	
	11/21/2013	0.00714 J	0.00616	0.011	**0.858**	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.0249		0.00738	0.00206 J	0.00506	< 0.005	**0.0874**	0.0257
	4/29/2014		0.00444 J	0.0102			< 0.00100			0.0685 J	< 0.000700	0.0262				< 0.00100 B			
	11/12/2014		0.0034	0.015			0.00086 J			0.13	0.00024 J	0.03				0.0028			
	4/16/2015		0.00697	0.0118			<0.000540			0.0684	<0.000240	**0.12**				<0.000380			
	10/20/2015		0.00761	0.0119			0.000763			0.0367	<0.000240	**0.124**				0.00059			
	4/29/2016		**0.023**	0.0415			<0.00270			0.134	0.00135	**0.308**				0.00217 J			
	10/4/2016		0.00838	0.00908			0.000944			0.116	0.000381	**0.146**				<0.000380			
	4/27/2017		0.00336	0.00809			<0.000540			0.0381	<0.000240	0.0455				<0.000380			
	10/4/2017		0.00342	0.00796			<0.000540			0.0264	<0.000240	**0.0553**				0.000723 J			
	4/4/2018		0.00333	0.00824			<0.000540			0.0246 J	<0.000240	**0.0564**				0.00159 J			
	10/3/2018		0.00298	0.00719			<0.000540			<0.0150	<0.000240	0.0425				0.00413			
MW-116	2/3/2013		0.00274 J	0.0161	0.22	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.0437	0.000131 J	0.00348 J	0.0012 J	0.00203 J	< 0.005	**0.0331**	< 0.005 B
	5/16/2013	0.349	0.00502	0.0111	0.238	< 0.002	0.00119 J	< 0.005	0.00176 J	0.201	< 0.01	0.0342	0.000046 J	0.00308 J	0.00204 J	0.00733	< 0.005	**0.0343**	< 0.005
	9/4/2013	0.0126	0.00535	0.00928	0.304	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.00478 J	0.000061 J	0.00304 J	0.00115 J	0.00493 J	< 0.005	**0.04**	< 0.005
	9/4/2013 (Dup)	0.0118	0.00467 J	0.00946	0.281	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.00366 J	0.00006 J	0.003 J	0.00112 J	0.00558	< 0.005	**0.0388**	< 0.005
	11/20/2013	0.00814 J	0.00525	0.00989	0.312	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.0092		0.0035 J	0.00245 J	0.00611	< 0.005	**0.0391**	0.0311
	11/20/2013 (Dup)	0.0073 J	0.00526	0.011	0.307	< 0.002	< 0.005	< 0.005	< 0.005	0.132 J	< 0.005	0.00576		0.00336 J	0.00144 J	0.00582	< 0.005	**0.0387**	0.0218
	4/29/2014		0.00442 J	0.0102			< 0.00100			0.108 J	< 0.000700	0.00627				< 0.00100 B			
	11/12/2014		0.0038	0.0098			0.001 J			0.11	< 0.00024	0.0042 J				0.0055			
	4/16/2015		0.00521	0.00931			<0.000540			<0.0150	<0.000240	0.00454				<0.000380			
	10/20/2015		0.00825	0.0434			0.00542			**2.45**	0.00183	**0.0815**				0.000668			
	4/29/2016		0.00422	0.0231			<0.00270			**0.8**	<0.00120	0.0396				<0.00190			
	10/5/2016		0.0072	0.0118			0.000922 JB			0.119	0.000397	**0.0506**				0.000738 J			
	4/26/2017		0.00357	0.0121			0.00056 J			0.224	0.000542	**0.0545**				0.00488			
	10/3/2017		0.00521	0.0178			0.00151 J			**0.598**	0.000647	0.0402				0.00741			

Table 2 - Summary of Groundwater Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

		Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WQCC	5	0.1	1	0.75	0.01	0.05	0.05	1	1.0	0.05	0.2	0.002	1	0.2	0.05	0.05	0.03	10
	EPA MCL	--	0.01	2	--	0.005	0.1	--	1.3	0.3	0.015	0.05	0.002	--	--	0.05	--	0.03	--
Sample ID*	**Date**																		
MW-116	4/3/2018		0.00492	0.00839			<0.000540			0.0594 J	<0.000240	0.0226				0.00743			
(continued)	10/3/2018		0.00304	0.00833			<0.000540			<0.0150	<0.000240	0.0211				0.00475			
MW-117	2/3/2013	0.0289	0.00498 J	0.0235	0.207	< 0.002	< 0.005	0.00256 J	0.0141	< 0.2	< 0.005	**0.108**	< 0.0002	0.0112	0.00413 J	0.00427 J	< 0.005	0.0263	0.0123
	5/15/2013	0.0184	0.00367 J	0.0113	0.175	< 0.002	< 0.01	< 0.01	< 0.01	*< 0.4*	< 0.005	0.00978 J	< 0.0002	0.00664	< 0.01	0.00585 J	< 0.005	0.0247	< 0.01
	9/4/2013	0.0169	0.00559	0.0108	0.202	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	0.00502	< 0.0002	0.014	0.00189 J	0.00316 J	< 0.005	0.0224	0.00266 J
	11/20/2013	0.0298	0.00347 J	0.0108	0.204	< 0.002	< 0.005	< 0.005	0.00345 J	0.11 J	0.00125 J	0.00982	< 0.0002	0.0114	0.00305 J	0.0038 J	< 0.005	0.0182	0.0343
	4/30/2014		0.00366 J	0.017			0.0021 J			**0.78**	0.00109 J	0.033				< 0.00100 B			
	11/13/2014		0.0025	0.02			0.0031			**0.95**	0.00072 J	0.014				0.0077			
	11/13/2014 (Dup)		0.0024	0.016			0.0024			**0.71**	0.00086 J	0.014				0.0079			
	4/15/2015		0.00249	0.0162			<0.00270			**0.492**	<0.00120	0.00809				0.0168			
	10/20/2015		0.00351	0.0214			0.00364			**1.42**	0.00113	0.0149				0.00486			
	4/26/2016		0.00266	0.0186			<0.00270			**0.684**	<0.00120	0.0103				0.00857			
	10/5/2016		0.00312	0.0249			0.00417			**1.57**	0.00137	0.0171				0.00403			
	4/26/2017		0.00255	0.0197			0.00209			**1.11**	0.000901	0.0147				0.00349			
	10/4/2017		0.00238	0.0177			0.00279			**1.15**	0.000777	0.011				0.00982			
	4/4/2018		0.00236	0.011			0.000952 J			0.2	0.000293 J	0.00405 J				0.0126			
	10/3/2018		0.00224	0.00996			<0.000540			0.0302 J	<0.000240	0.000557 J				0.0121			
MW-118	2/5/2013	< 0.0146 B	**0.011**	0.0145	0.226	< 0.002	< 0.005	< 0.005	0.00156 J	< 0.2	< 0.005	0.0232	0.000042 J	0.0195	0.00173 J	0.00861	< 0.005	**0.037**	< 0.005
	5/15/2013	0.00796 J	**0.0146**	0.00919	0.23	< 0.002	< 0.005	< 0.005	0.00156 J	< 0.2	< 0.005	< 0.005	< 0.0002	0.0179	0.00184 J	0.0127	< 0.005	**0.033**	< 0.005
	9/4/2013	0.00992 J	**0.0156**	0.0099	0.307	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	< 0.005	< 0.0002	0.0162	0.00131 J	0.0129	< 0.005	**0.0395**	< 0.005
	11/20/2013	0.0103	**0.0125**	0.00964	0.288	< 0.002	0.00105 J	< 0.005	0.00338 J	0.179 J	0.00107 J	0.00526	< 0.0002	0.0141	0.00214 J	0.00327 J	< 0.005	**0.0311**	0.0407
	4/30/2014		**0.0109**	0.0147			0.00312 J			**0.952**	0.00266 J	**0.0526**				< 0.00100			
	11/13/2014		**0.012**	0.033			0.0032			**1.1**	0.001 J	0.02				0.0065			
	4/15/2015		0.00977	0.018			<0.00270			0.253	0.00175	0.00454				0.00863			
	10/20/2015		**0.0117**	0.0131			0.00137			0.155	0.000329	0.00223				0.00509			
	4/26/2016		**0.0108**	0.0139			<0.00270			**0.426 J**	<0.00120	0.0048 J				0.00645			
	10/5/2016		**0.0117**	0.0111			0.000649 JB			0.0658 J	<0.000240	0.000302 J				0.0156			
	4/26/2017		**0.0105**	0.0091			<0.000540			0.0337 J	<0.000240	0.00067 J				0.0222			
	10/4/2017		**0.0109**	0.00884			0.000983 J			<0.0150	<0.000240	<0.000250				0.0196			
	4/4/2018		0.00991	0.00943			<0.000540			0.0223 J	0.00043 J	0.000501 J				0.00851			
	10/3/2018		**0.0103**	0.00867			0.000593 J			0.0156 J	<0.000240	0.000403 J				0.00774			

Table 2 - Summary of Groundwater Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

		Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WQCC	5	0.1	1	0.75	0.01	0.05	0.05	1	1.0	0.05	0.2	0.002	1	0.2	0.05	0.05	0.03	10
	EPA MCL	--	0.01	2	--	0.005	0.1	--	1.3	0.3	0.015	0.05	0.002	--	--	0.05	--	0.03	--
Sample ID*	**Date**																		
MW-119	2/5/2013	< 0.01 J	0.00294 J	0.00981	0.0987	< 0.002	< 0.005	0.000871 J	0.00309 J	< 0.2	< 0.005	0.0424	< 0.0002	0.0083	0.00174 J	0.00246 J	< 0.005	0.0244	< 0.005
	5/15/2013	0.0296	0.00537	0.00625	0.13	< 0.002	< 0.005	< 0.005	0.00137 J	< 0.2	< 0.005	< 0.005	< 0.0002	0.00745	0.00163 J	0.00506	< 0.005	0.0222	< 0.005
	9/4/2013	0.0113	0.00595	0.00864	0.183	< 0.002	< 0.005	< 0.005	< 0.005	< 0.2	< 0.005	< 0.005	< 0.0002	0.00846	0.0014 J	0.0066	< 0.005	0.0275	
	11/20/2013	0.0149	0.00438 J	0.00973	0.219	< 0.002	0.00116 J	< 0.005	0.00311 J	0.185 J	< 0.005	0.00459 J		0.00861	0.00222 J	0.00144 J	< 0.005	0.0213	0.0241
	4/30/2014		0.0047 J	0.0126			0.00119 J			**0.35**	< 0.000700	0.0148				< 0.00100 B			
	4/30/2014 (Dup)		0.00446 J	0.0126			0.00114 J			**0.341**	< 0.000700	0.0136				< 0.00100 B			
	11/13/2014		0.0062	0.06			0.0042			**2.3**	0.0016 J	**0.062**				0.0013 J			
	4/15/2015		0.00398	0.0156			<0.00270			**0.309**	<0.00120	0.0151				<0.00190			
	10/20/2015		0.00417	0.0105			0.000744			0.0886	<0.000240	0.00485				0.00189			
	4/26/2016		0.00315 J	0.00645			<0.00270			<0.0750	<0.00120	<0.00125				0.00259 J			
	10/5/2016		0.00404	0.00979			<0.000540			0.066 J	<0.000240	0.0019 J				0.00334			
	4/26/2017		0.00376	0.00966			<0.000540			0.0438 J	<0.000240	0.00331 J				0.00442			
	10/4/2017		0.00513	0.0108			0.000757 J			0.0324 J	<0.000240	0.00324 J				0.00145 J			
	4/4/2018		0.00392	0.00951			<0.000540			0.0347 J	0.000502 J	0.0025 J				0.00324			
	10/3/2018		0.00462	0.011			<0.000540			<0.0150	<0.000240	0.00375 J				0.00112 J			

Table 2 - Summary of Groundwater Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

		Calcium	Chloride	Fluoride	Nitrate/Nitrite	Potassium	Sodium	Sulfate	TDS
	Units	mg/L	mg/L	mg/L	mg/l	mg/l	mg/L	mg/L	mg/l
	WQCC	--	250	1.6	10	--	--	600	1000
	EPA MCL	--	250	4	1	--	--	250	500
Sample ID*	**Date**								
MW-114	2/3/2013	600	158	**1.76**	**1.43**	2.86	146	**2200**	**3760**
	5/15/2013	576	150	**1.91**	< 2	2.76	123	**1800**	**3990**
	9/5/2013	672	199	**1.82**	0.055 JH	2.94	138	**1950**	**3870**
	11/21/2013	558	**422**	1.37	< 1	0.678	250	**3060**	**5390**
	4/29/2014	611	167	**2.07**	< 0.150	2.84	152	**1920**	**3620**
	11/12/2014	620	200	**2.2**	0.36	2.7	130	**2300**	**3400**
	4/16/2015	570	80.3	**1.95**	0.0752	2.29	114	**2140**	**3640**
	10/20/2015	579	111	**1.89**	<0.197	2.46	104	**2250**	**2990**
	4/29/2016	681	88.6	**1.87**	0.416 J	2.59	126	**1170**	**3710**
	10/4/2016	569	231	**2.03**	**4.69**	2.49	89.3	**2100**	**4050**
	4/27/2017	599	**266**	**1.78**	0.26 JJ5	2.83	131	**2350**	**3480**
	10/4/2017	582	157	1.35	**2.8**	2.83	132	**1950**	**3700**
	4/4/2018	665	181	**1.97**	**1.5**	2.74	138	**2260**	**3000**
	10/3/2018	581	207	**1.77**	0.395	2.46	117	**1050**	**3730**
MW-115	2/3/2013	518	**422**	1.1	0.821 H	1.78	199	**2790**	**4960**
	5/15/2013	511	**373**	1.18	< 2	0.78	206	**2490**	**5510**
	5/15/2013 (Dup)	495	**364**	1.15	< 2	0.766	201	**2420**	**4990**
	9/4/2013	622	**530**	0.845	0.174 JH	0.782	247	**2900**	**6130**
	11/21/2013	606	**428**	1.36	< 1	0.709	261	**3090**	**5370**
	4/29/2014	569	222	1.29	< 0.150	0.645	227	**2470**	**4880**
	11/12/2014	690 V	**500**	1.5	< 0.02	0.72 J	340	**3000**	**5700**
	4/16/2015	546	**464**	**2.42**	0.0333	0.425	385	**3510**	**6200**
	10/20/2015	532	**326**	**2.8**	<0.197	0.578	320	**3640**	**4640**
	4/29/2016	2410	153	**1.93**	0.375 J	2.64	1290	**2020**	**5390**
	10/4/2016	541	**382**	**2.69**	0.113 B	0.395	144	**2750**	**4990**
	4/27/2017	394	**304**	1.51	<0.197	0.514	183	**2770**	**4190**
	10/4/2017	450	249	1.01	0.042 J	0.558	213	**2910**	**4480**
	4/4/2018	455	**262**	**1.76**	0.075 J	0.58 J	232	**2830**	**3420**
	10/3/2018	397	231	1.47	0.325	0.549 J	191	**1720**	**4410**
MW-116	2/3/2013	624	**389**	1.31 J	**1.37 J**	1.06	206	**2250**	**3650**
	5/16/2013	578	**330**	1.19	< 2	1.38	194	**2080**	**4480**
	9/4/2013	588	**344**	1.17	0.418 H	1.21	235	**2180**	**4440**
	9/4/2013 (Dup)	631	**339**	1.11	0.45 H	1.22	230	**2140**	**4470**
	11/20/2013	606	**331**	**1.61**	0.457 J	1.3	235	**2470**	**4570**
	11/20/2013 (Dup)	616	**331**	1.51	0.487 J	1.37	235	**2470**	**4210**
	4/29/2014	607	221	1.43	**2.86**	1.39	241	**2160**	**4520**
	11/12/2014	580	240	**1.7**	0.74	1.6	230	**2200**	**3700**
	4/16/2015	534	131	**2.28**	0.0753	3.57	92.1	**1800**	**3300**
	10/20/2015	644	223	**2.8**	<0.197	5.67	145	**2280**	**3800**
	4/29/2016	719	**500**	1.33	0.473 J	1.63	259	**3300**	**4580**
	10/5/2016	569	196	**2.91**	0.048 JB	4.26	114	**2040**	**3500**
	4/26/2017	501	**270**	**2**	0.258 J	2.22	154	**2060**	**3450**
	10/3/2017	614	233	**2.72**	**1.4**	4.47	147	**2080**	**3160**

Table 2 - Summary of Groundwater Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

		Calcium	Chloride	Fluoride	Nitrate/Nitrite	Potassium	Sodium	Sulfate	TDS
	Units	mg/L	mg/L	mg/L	mg/l	mg/l	mg/L	mg/L	mg/l
	WQCC	--	250	1.6	10	--	--	600	1000
	EPA MCL	--	250	4	1	--	--	250	500
Sample ID*	**Date**								
MW-116	4/3/2018	592	198	**2.55**	0.851	3.16	154	**2040**	**2950**
(continued)	10/3/2018	557	226	1.15	0.727	1.18	170	**2150**	**4090**
MW-117	2/3/2013	568	154	**2.73**	< 0.1 H	6.92	176	**2310**	**3910**
	5/15/2013	524	137	**2.29**	< 2	4.37	160	**2010**	**4260**
	9/4/2013	550	71	**2.8**	< 0.03	8.92	118	**2020**	**3970**
	11/20/2013	556	92.4	**3.95**	< 1	7.54	115	**2190**	**4150**
	4/30/2014	646	97	**3.03**	< 0.150	9.29	167	**2140**	**4980**
	11/13/2014	610	96	**3**	0.65	5.2	110	**2000**	**3000**
	11/13/2014 (Dup)	640	96	**2.4**	0.64	5	98	**2200**	**3300**
	4/15/2015	613	87.2	**3.79**	0.372	5.97	102	**2220**	**3670**
	10/20/2015	478	55.4	**3.4**	0.779	6.44	109	**1690**	**2980**
	4/26/2016	554	94.4	**3.45**	0.349	5.82	112	**2060**	**3390**
	10/5/2016	592	**272**	**3.57**	0.137 BJ6	6.9	115	**2240**	**3590**
	4/26/2017	548	245	**3.33**	0.266 J	6.5	96.7	**2090**	**3640**
	10/4/2017	559	216	**2.05**	0.196	5.82	105	<0.0774	**3450**
	4/4/2018	604	124	**3.2**	0.207	6.3	111	**1070**	**2920**
	10/3/2018	577	**327**	**2.78**	0.102	6.12	105	**1940**	**3500**
MW-118	2/5/2013	563	**296**	**5.16**	**2.39**	7.95	218	**2450**	**4610**
	5/15/2013	530	**287**	**5.39**	**2.09**	7.2	229	**2250**	**5090**
	9/4/2013	543	132	**4.48**	0.325 H	7.69	215	**2310**	**4550**
	11/20/2013	532	90.1	**6.78**	< 1	6.92	163	**2470**	**4640**
	4/30/2014	732	92.3	**5.58**	< 0.150	6.15	134	**2190**	**5200**
	11/13/2014	670	160	**4.9 J6**	0.98	6.2	140	**2700**	**3700**
	4/15/2015	601	**767**	**4.14**	**1.7**	5.3	153	**2510**	**3960**
	10/20/2015	583	86.6	**5.13**	0.622	5.64	162	**2690**	**3960**
	4/26/2016	573	189	**5.86**	**1.57**	4.8	152	**2480**	**3950**
	10/5/2016	559	131	**6.47**	**6.71**	5.92	164	**2640**	**4450**
	4/26/2017	544	175	**5.98**	**8.51**	5.06	139	**2630**	**3830**
	10/4/2017	550	192	**4.2**	**6.27**	5.72	118	**2890**	**3780**
	4/4/2018	607	**292**	**5.55**	**1.21**	4.86	136	**2480**	**3300**
	10/3/2018	559	**259**	**5.06**	**1.88**	4.98	136	**1730**	**4120**

Table 2 - Summary of Groundwater Analytical Data from Previous Investigations

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

		Calcium	Chloride	Fluoride	Nitrate/Nitrite		Potassium	Sodium	Sulfate	TDS
	Units	mg/L	mg/L	mg/L	mg/l		mg/l	mg/L	mg/L	mg/l
	WQCC	--	250	1.6	10		--	--	600	1000
	EPA MCL	--	250	4	1		--	--	250	500
Sample ID*	**Date**									
MW-119	2/5/2013	494	116	**2.36**	**2.35**		0.87	127	**2090**	**3670**
	5/15/2013	491	118	**2.43**	**1.91**	**J**	0.794	120	**1970**	**4030**
	9/4/2013	635	244	**2.28**	0.228	H	0.993	133	**1940**	**4030**
	11/20/2013	551	185	**3.17**	*< 1*		1.1	98.8	**2210**	**4130**
	4/30/2014	680	235	**2.61**	0.176	J	1.13	140	**1980**	**4200**
	4/30/2014 (Dup)	655	216	**2.62**	0.174	J	1.08	136	**1830**	**4140**
	11/13/2014	670	49	**2.6**	< 0.02		1.8	77	**2300**	**3200**
	4/15/2015	590	48.2	**1.99**	0.292		0.232	54.5	**2040**	**3030**
	10/20/2015	624	152	**2.65**	0.437		0.985	86.3	**2290**	**3500**
	4/26/2016	595	191	**2.5**	0.518	J	0.614	101	**1900**	**3330**
	10/5/2016	619	**280**	**2.91**	0.189	B	0.991	132	**2010**	**3690**
	4/26/2017	587	**290**	**2.86**	<0.197		0.965	123	**2420**	**3650**
	10/4/2017	612	**268**	**2.77**	<0.0197		1.27	172	**2240**	**3750**
	4/4/2018	616	**251**	**2.75**	0.288		1.1	177	**2240**	**2620**
	10/3/2018	596	**439**	**2.56**	0.061	J	1.49	225	**1390**	**4200**

Notes and Definitions:

Blue shaded, bold font indicates result is above the lower of the WQCC standard or MCL

< X = Not detected at a detection limit of X

Italics font indicates detection limit exceeds the lowest SSL

"--" in WQCC or MCL cell means that standard is not published for that analyte

Blank cells mean that analyte was not analyzed in that sample

* Analytical results shown for 2013 metals are dissolved concentrations; total concentrations of metals are reported for 2014 through 2018

B = Analyte detected in associated method blank

H = Sample analyzed outside of hold time

J = Estimated value reported below detection limit

J5 = The sample matrix interfered with the ability to make any accurate determination; spike value is high.

J6 = Spike value low; matrix interfered with accuracy

MCL = Maximum Contaminant Level published by USEPA

mg/L = milligrams per liter

USEPA = United States Environmental Protection Agency

WQCC = Water Quality Control Commission standard (New Mexico)

Table 3 - Summary of Vadose Zone Water Analytical Data, Phytoremediation Study, 2017-2018

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver
		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		WQCC	5	0.1	1	0.75	0.01	0.05	0.05	1	1.0	0.05	0.2	0.002	1	0.2	0.05	0.05
		EPA MCL	--	0.01	2	--	0.005	0.1	--	1.3	0.3	0.015	0.05	0.002	--	--	0.05	--
Location	**Sample ID**	**Date**																
LY-1	WS-LY1-20170815	8/15/2017	< 0.046	0.0077	0.122	0.381 J	< 0.0005	0.0083 J	0.0163	0.0029	< 0.102	0.0032	**3.11**	0.0001 J	0.0376	0.0446	0.005	< 0.0001
LY-1	WS-LY1-20170828	8/28/2017	< 0.092	< 0.0046	0.0637	0.584 J	< 0.001	< 0.0055	< 0.0007	0.0053	< 0.203	< 0.0008	< 0.0074	< 0.00005	0.0149	0.0297	0.0079 J	< 0.0002
LY-1	WS-LY1-20170912	9/12/2017	< 0.092	< 0.0046	0.0479	0.451 J	< 0.001	0.0109 J	0.0042 J	0.0138	**1.15**	0.0009 J	**1.48**	0.00006 J	0.0237	0.0418	< 0.0025	< 0.0002
LY-1	WS-LY1-20170929	9/29/2017	< 0.009	0.0023	0.0416	0.121 J	< 0.0001	0.0014	0.0007	0.0062	< 0.02	< 0.00008	0.0169	< 0.00005	0.0281	0.022	0.0078	< 0.00002
LY-1	WS-LY1-20171019	10/19/2017	< 0.184	< 0.0092	0.0315	**1.05 J**	< 0.0019	< 0.011	< 0.0014	0.007 J	< *0.406*	< 0.0016	0.0349 J	< 0.00005	0.0118	0.0392	0.0063 J	< 0.0004
LY-1	WS-LY1-20171103	11/3/2017	< 0.046	< 0.0023	0.0321	< 0.145	< 0.0005	< 0.0027	0.0022 J	0.0041	< 0.102	< 0.0004	**0.325**	< 0.0002	0.0189	0.0441	0.0035 J	< 0.0001
LY-1	WS-LY1-20171117	11/17/2017	< 0.046	0.0041 J	0.0255	0.269 J	< 0.0005	< 0.0027	0.001 J	0.0052	< 0.102	< 0.0004	0.0039 J	< 0.00005	0.011	0.026	0.0091	< 0.0001
LY-1	WS-LY1-20171201	12/1/2017	< 0.046	0.0048 J	0.0375	0.151 J	< 0.0005	< 0.0027	0.0017 J	0.0076	< 0.102	< 0.0004	< 0.0037	< 0.00005	0.0118	0.0482	0.0107	< 0.0001
LY-1	WS-LY1-20171215	12/15/2017	< 0.009	0.0035 J	0.0352	< 0.029	< 0.0005	0.0033 J	0.0017 J	0.0078	0.027 J	< 0.0004	< 0.0037	< 0.00005	0.0129	0.0483	0.0146	< 0.0001
LY-1	WS-LY1-20180105	1/5/2018	< 0.046	0.0036 J	0.0346	< 0.145	< 0.0005	< 0.0027	0.0011 J	0.0074	< 0.102	< 0.0004	0.0043 J	< 0.00005	0.0098	0.0306	0.0082	< 0.0001
LY-1	WS-LY1-20180119	1/19/2018	< 0.046	0.0034 J	0.03	0.606 J	< 0.0005	0.0049	0.0011 J	0.0062	< 0.102	< 0.0004	0.0044 J	< 0.00005	0.012	0.0292	0.0125	< 0.0001
LY-1	WS-LY1-20180202	2/2/2018	< 0.046	0.0042 J	0.0329	< 0.145	< 0.0005	0.0106	0.0011 J	0.005	< 0.102	< 0.00004	0.0096 J	< 0.00005	0.0101	0.0282	0.0163	< 0.0001
LY-1	WS-LY1-20180216	2/16/2018	< 0.046	0.0027 J	0.0332	< 0.145	< 0.0005	< 0.0027	0.0012 J	0.0053	< 0.102	< 0.00004	0.0054 J	< 0.00005	0.0108	0.0346	0.0073	< 0.0001
LY-1	WS-LY1-20180302	3/2/2018	< 0.046	0.0033 J	0.0321	0.163 J	< 0.0005	0.0037	0.0014 J	0.0064	< 0.102	< 0.00004	0.0059 J	< 0.00005	0.0112	0.0371	0.0081	< 0.0001
LY-1	WS-LY1-20180319	3/19/2018	< 0.046	0.0024 J	0.0286	< 0.145	< 0.0005	0.0036	0.001 J	0.0055	< 0.102	< 0.00004	0.0057 J	< 0.00005	0.0105	0.0299	0.0055	< 0.0001
LY-2	WS-LYZ-20170912	9/12/2017																
LY-2	WS-LY2-20170929	9/29/2017	0.047 J	0.0025	0.0386	0.134 J	0.0002 J	0.0007 J	0.0011	0.0055	0.021 J	0.0006	0.0174	< 0.00005	0.0249	0.0372	0.0171	< 0.00002
LY-2	WS-LY2-20171019	10/19/2017	< 0.184	0.0095 J	0.044	**0.89 J**	< 0.0019	< 0.011	0.0032 J	< 0.0041	< *0.406*	< 0.0016	**0.388**	< 0.00005	0.0176	0.0429	0.0063 J	< 0.0004
LY-2	WS-LY2-20171103	11/3/2017	< 0.046	0.0051	0.027	< 0.145	< 0.0005	< 0.0027	0.0047	0.0048	< 0.102	< 0.0004	**0.053**	< 0.00005	0.0193	0.06	0.0143	< 0.0001
LY-2	WS-LY2-20171117	11/17/2017	< 0.046	0.0092	0.0347	< 0.145	< 0.0005	< 0.0027	0.0019 J	0.0053	< 0.102	< 0.0004	**0.118**	< 0.00005	0.0126	0.0309	0.0058	< 0.0001
LY-2	WS-LY2-20171201	12/1/2017	< 0.046	0.007	0.0507	< 0.145	< 0.0005	< 0.0027	0.0017 J	0.0077	< 0.102	< 0.0004	< 0.0037	< 0.00005	0.0116	0.0457	0.011	< 0.0001
LY-2	WS-LY2-20171215	12/15/2017	< 0.009	0.0057	0.0375	< 0.029	< 0.0005	< 0.0027	0.0016 J	0.0098	0.03 J	< 0.0004	< 0.0037	< 0.00005	0.0125	0.0441	0.0136	< 0.0001
LY-2	WS-LY2-20180105	1/5/2018	< 0.046	0.0041 J	0.0391	< 0.145	< 0.0005	< 0.0027	0.0014 J	0.0079	< 0.102	< 0.0004	0.0041 J	< 0.00005	0.0086	0.0398	0.008	< 0.0001
LY-2	WS-LY2-20180119	1/19/2018	< 0.046	0.0075	0.0379	0.321 J	< 0.0005	< 0.0027	0.0014 J	0.0109	< 0.102	< 0.00004	< 0.0037	< 0.00005	0.0131	0.0319	0.0121	< 0.0001
LY-2	WS-LY2-20180216	2/16/2018	< 0.046	0.0054	0.0315	< 0.145	< 0.0005	< 0.0027	0.0012 J	0.0071	< 0.102	< 0.00004	0.0053 J	< 0.00005	0.0098	0.0382	0.0107	< 0.0001
LY-2	WS-LY2-20180302	3/2/2018	< 0.046	0.008	0.0336	< 0.145	< 0.0005	< 0.0027	0.0017 J	0.0095	< 0.102	< 0.00004	0.0077 J	< 0.00005	0.0164	0.0409	0.0137	< 0.0001
LY-2	WS-LY2-20180319	3/19/2018																
LY-3	WS-LY3-20170929	9/29/2017	0.056	0.0085	0.0456	0.092 J	< 0.0001	< 0.0005	0.0012	0.0086	0.026 J	0.00009 J	**0.0812**	< 0.00005	0.0213	0.0301	0.0084	< 0.00002
LY-3	WS-LY3-20171019	10/19/2017	< 0.184	< 0.0092	0.0388	0.612 J	< 0.0019	< 0.011	0.0016 J	0.0266	< *0.406*	< 0.0016	0.0381 J	< 0.00005	0.0343	0.0958	0.0127 J	< 0.0004
LY-3	WS-LY3-20171103	11/3/2017	< 0.046	0.0085	0.0354	< 0.145	< 0.0005	< 0.0027	0.0042	0.0025	**2.11**	< 0.0004	**0.229**	< 0.00005	0.0312	0.0654	0.0036 J	< 0.0001
LY-3	WS-LY3-20171117	11/17/2017	< 0.046	0.0077	0.0388	< 0.145	< 0.0005	< 0.0027	0.0019 J	0.0174	< 0.102	< 0.0004	0.0152	< 0.00005	0.0144	0.0437	0.0083	< 0.0001
LY-3	WS-LY3-20171201	12/1/2017	< 0.046	0.0046 J	0.0502	< 0.145	< 0.0005	< 0.0027	0.0021 J	0.0179	< 0.102	< 0.0004	< 0.0037	< 0.00005	0.0132	0.0539	0.0107	< 0.0001
LY-3	WS-LY3-20171215	12/15/2017	< 0.009	0.0045 J	0.051	< 0.029	< 0.0005	< 0.0027	0.0018 J	0.0176	0.041 J	< 0.0004	< 0.0037	< 0.00005	0.0113	0.0447	0.0106	< 0.0001
LY-3	WS-LY3-20180105	1/5/2018	< 0.046	0.0061	0.0449	< 0.145	< 0.0005	< 0.0027	0.0017 J	0.0154	< 0.102	< 0.0004	0.0038 J	< 0.00005	0.0111	0.04	0.0108	< 0.0001
LY-3	WS-LY3-20180119	1/19/2018	< 0.046	0.0036 J	0.0457	0.235 J	< 0.0005	< 0.0027	0.0017 J	0.0139	< 0.102	< 0.00004	< 0.0037	< 0.00005	0.0111	0.0417	0.0089	< 0.0001
LY-3	WS-LY3-20180202	2/2/2018	< 0.046	0.0078	0.0483	0.227 J	< 0.0005	< 0.0027	0.0026	0.0132	< 0.102	< 0.00004	0.0069 J	< 0.00005	0.0131	0.0406	0.0176	< 0.0001
LY-3	WS-LY3-20180216	2/16/2018	< 0.046	0.0085	0.0493	< 0.145	< 0.0005	< 0.0027	0.002 J	0.0162	< 0.102	< 0.00004	0.0097 J	< 0.00005	0.0161	0.0459	0.0143	< 0.0001
LY-3	WS-LY3-20180302	3/2/2018	< 0.046	0.0065	0.0486	< 0.145	< 0.0005	< 0.0027	0.0019 J	0.0124	< 0.102	< 0.00004	0.0052 J	< 0.00005	0.0116	0.0427	0.009	< 0.0001
LY-3	WS-LY3-20180319	3/19/2018	< 0.046	0.0059	0.0418	< 0.145	< 0.0005	< 0.0027	0.0018 J	0.0088	< 0.102	< 0.00004	0.0329	< 0.00005	0.0096	0.037	0.0044 J	< 0.0001

Table 3 - Summary of Vadose Zone Water Analytical Data, Phytoremediation Study, 2017-2018

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Aluminum	Arsenic	Barium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver
		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		WQCC	5	0.1	1	0.75	0.01	0.05	0.05	1	1.0	0.05	0.2	0.002	1	0.2	0.05	0.05
		EPA MCL	--	0.01	2	--	0.005	0.1	--	1.3	0.3	0.015	0.05	0.002	--	--	0.05	--
Location	**Sample ID**	**Date**																
LY-4	WS-LY4-20170912	9/12/2017	< 0.092	< 0.0046	0.0703	**0.819 J**	< 0.001	0.0137 J	0.0008 J	0.0063	< 0.203	< 0.0008	0.0437	< 0.00005	0.0344	0.0333	**0.0552**	< 0.0002
LY-4	WS-LY4-20171103	11/3/2017	< 0.046	< 0.0023	0.0315	< 0.145	< 0.0005	< 0.0027	0.0015 J	0.0072	< 0.102	< 0.0004	0.0078 J	< 0.00005	0.0116	0.0654	0.0067	< 0.0001
LY-4	WS-LY4-20171201	12/1/2017	< 0.046	< 0.0023	0.034	< 0.145	< 0.0005	< 0.0027	0.0019 J	0.0043	< 0.102	< 0.0004	0.009 J	< 0.00005	0.0149	0.0532	0.0082	< 0.0001
LY-4	WS-LY4-20171215	12/15/2017	< 0.009	< 0.0023	0.0215	< 0.029	< 0.0005	< 0.0027	0.0014 J	0.0041	< 0.02	< 0.0004	< 0.0037	< 0.00005	0.0112	0.0413	0.0089	< 0.0001
LY-4	WS-LY4-20180105	1/5/2018	< 0.046	< 0.0023	0.0189	0.211 J	< 0.0005	< 0.0027	0.0012 J	0.0035	< 0.102	< 0.0004	< 0.0037	< 0.00005	0.0092	0.0318	0.0047 J	< 0.0001
LY-4	WS-LY4-20180119	1/19/2018	< 0.046	0.004 J	0.0351	0.212 J	< 0.0005	< 0.0027	0.0022 J	0.0036	< 0.102	< 0.00004	**0.249**	< 0.00005	0.0202	0.0375	< 0.0013	< 0.0001
LY-4	WS-LY4-20180202	2/2/2018	< 0.046	0.0049 J	0.0324	0.185 J	< 0.0005	< 0.0027	0.0021 J	0.0046	< 0.102	< 0.00004	**0.263**	< 0.00005	0.017	0.0396	0.0066	< 0.0001
LY-4	WS-LY4-20180216	2/16/2018	< 0.046	0.005	0.038	< 0.145	< 0.0005	< 0.0027	0.0038	0.0051	< 0.102	< 0.00004	**0.761**	< 0.00005	0.0173	0.0465	0.0022	< 0.0001
LY-4	WS-LY4-20180319	3/19/2018																

Table 3 - Summary of Vadose Zone Water Analytical Data, Phytoremediation Study, 2017-2018

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Uranium	**Zinc**	**Chloride**	**Fluoride**	**Nitrate/Nitrite**	**Sulfate**	**TDS**
		Units	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/l
		WQCC	0.03	10	250	1.6	10	600	1000
		EPA MCL	0.03	--	250	4	1	250	500
Location	**Sample ID**	**Date**							
LY-1	WS-LY1-20170815	8/15/2017	0.0093	0.047 J	169	**3.53**	**1.66**	**2,000**	**3,850**
LY-1	WS-LY1-20170828	8/28/2017	0.0086	0.029 J	104	**3.1**	**2.08**	**2,060**	**3,440**
LY-1	WS-LY1-20170912	9/12/2017	0.0066	0.0466 J	189	**3.26**	0.08	**1,890**	**3,690**
LY-1	WS-LY1-20170929	9/29/2017	0.0104	0.0077 J	211	**3.59**	< 0.04	**2,140**	**4,030**
LY-1	WS-LY1-20171019	10/19/2017	0.0077	< 0.0549	183	**3.42**	**1.21**	**1,770**	**3,560**
LY-1	WS-LY1-20171103	11/3/2017	0.009	0.0142 J	181	**2.98**	**2.01**	**1,940**	**3,530**
LY-1	WS-LY1-20171117	11/17/2017	0.0066	0.0212 J	79.4	**3.39**	**1.16**	**1,730**	**3,160**
LY-1	WS-LY1-20171201	12/1/2017	0.0079	< 0.0137	185	**3.52**	**1.12**	**1,760**	**3,480**
LY-1	WS-LY1-20171215	12/15/2017	0.0084	< 0.0137	193	**3.14**	**2.06**	**2,030**	**3,750**
LY-1	WS-LY1-20180105	1/5/2018	0.0068	0.015 J	232	**3.35**	**1.04**	**1,860**	**3,420**
LY-1	WS-LY1-20180119	1/19/2018	0.008	0.0211 J	240	**3.04**	**1.81**	**2,030**	**3,640**
LY-1	WS-LY1-20180202	2/2/2018	0.0064	0.0259 J	196	**2.66**	**1.88**	**1,750**	
LY-1	WS-LY1-20180216	2/16/2018	0.0075	< 0.0137	128	**3.23**	**1.25**	**1,910**	**3,070**
LY-1	WS-LY1-20180302	3/2/2018	0.0062	< 0.0137	203	**3.29**	0.974	**1,940**	**3,570**
LY-1	WS-LY1-20180319	3/19/2018	0.0051	< 0.0137	**265**	**3.39**	0.351	**1,940**	**3,510**
LY-2	WS-LYZ-20170912	9/12/2017			**290**	**1.61**	< 0.4	**3,900**	
LY-2	WS-LY2-20170929	9/29/2017	0.0173	0.0191	162	**2.99**	< 0.4	**1,850**	**3,640**
LY-2	WS-LY2-20171019	10/19/2017	0.009	< 0.0549	179	**3.14**	< 0.4	**1,750**	**3,420**
LY-2	WS-LY2-20171103	11/3/2017	0.0107	< 0.0137	195	**2.74**	0.694	**2,030**	**3,620**
LY-2	WS-LY2-20171117	11/17/2017	0.0066	0.0158 J	97.2	**3.21**	0.264	**1,850**	**3,150**
LY-2	WS-LY2-20171201	12/1/2017	0.0075	< 0.0137	191	**3.37**	**1.19**	**1,780**	**3,710**
LY-2	WS-LY2-20171215	12/15/2017	0.007	< 0.0137	243	**3.48**	**3.74**	**1,960**	**4,150**
LY-2	WS-LY2-20180105	1/5/2018	0.0065	< 0.0137	222	**2.95**	**1.55**	**1,740**	**3,340**
LY-2	WS-LY2-20180119	1/19/2018	0.0081	< 0.0137	249	**3.21**	**2.89**	**1,790**	**3,740**
LY-2	WS-LY2-20180216	2/16/2018	0.0071	0.0231 J	178	**2.78**	**1.69**	**2,010**	**3,050**
LY-2	WS-LY2-20180302	3/2/2018	0.008	< 0.0137	221	**3.28**	0.641	**1,370**	**4,090**
LY-2	WS-LY2-20180319	3/19/2018			247	**2.88**		**2,160**	
LY-3	WS-LY3-20170929	9/29/2017	0.0087	0.0108	150	**3.78**	< 0.4	**1,700**	**3,410**
LY-3	WS-LY3-20171019	10/19/2017	0.015	< 0.0549	185	**4.22**	0.975	**1,850**	**3,540**
LY-3	WS-LY3-20171103	11/3/2017	0.0092	< 0.0137	202	**3.56**	< 0.2	**1,980**	**3,480**
LY-3	WS-LY3-20171117	11/17/2017	0.0065	0.0284 J	86.5	**3.44**	0.39	**1,830**	**3,250**
LY-3	WS-LY3-20171201	12/1/2017	0.0069	< 0.0137	170	**3.37**	**1.23**	**1,750**	**3,490**
LY-3	WS-LY3-20171215	12/15/2017	0.0072	< 0.0137	221	**3.56**	**2**	**2,000**	**3,970**
LY-3	WS-LY3-20180105	1/5/2018	0.0082	< 0.0137	228	**3.28**	**1.63**	**2,060**	**3,990**
LY-3	WS-LY3-20180119	1/19/2018	0.0074	< 0.0137	206	**3.36**	**1.99**	**1,840**	**3,700**
LY-3	WS-LY3-20180202	2/2/2018	0.0084	0.0147 J	189	**3.17**	**2.8**	**1,780**	**3,670**
LY-3	WS-LY3-20180216	2/16/2018	0.009	0.0496 J	152	**3.75**	**1.65**	**1,980**	**3,380**
LY-3	WS-LY3-20180302	3/2/2018	0.0073	< 0.0137	236	**3.52**	0.987	**1,550**	**3,850**
LY-3	WS-LY3-20180319	3/19/2018	0.0054	< 0.0137	**279**	**3.28**	0.396	**2,010**	**2,930**

Table 3 - Summary of Vadose Zone Water Analytical Data, Phytoremediation Study, 2017-2018

Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields

HollyFrontier Navajo Refining LLC

			Uranium	Zinc	Chloride	Fluoride	Nitrate/Nitrite	Sulfate	TDS
		Units	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/l
		WQCC	0.03	10	250	1.6	10	600	1000
		EPA MCL	0.03	--	250	4	1	250	500
Location	**Sample ID**	**Date**							
LY-4	WS-LY4-20170912	9/12/2017	0.0209	0.0427 J	**285**	**1.9**	**55.6**	**2,180**	**4,430**
LY-4	WS-LY4-20171103	11/3/2017	0.0099	< 0.0137	222	1.53	**3.67**	**2,050**	**3,610**
LY-4	WS-LY4-20171201	12/1/2017	0.0087	< 0.0137	200	**2.26**	0.55	**1,750**	**3,460**
LY-4	WS-LY4-20171215	12/15/2017	0.0072	< 0.0137	153	**2.17**	**2.18**	**1,930**	**3,590**
LY-4	WS-LY4-20180105	1/5/2018	0.0062	0.0141 J	219	**2.75**	0.742	**1,820**	**3,630**
LY-4	WS-LY4-20180119	1/19/2018	0.0073	0.0143 J	199	**2.72**	< 0.011	**1,710**	**3,300**
LY-4	WS-LY4-20180202	2/2/2018	0.0079	< 0.0137	205	**2.59**	< 0.011	**1,770**	**3,730**
LY-4	WS-LY4-20180216	2/16/2018	0.0054	0.0254 J	123	**2.74**	< 0.055	**1,960**	**3,490**
LY-4	WS-LY4-20180319	3/19/2018			212	**2.48**		**1,900**	

Notes and Definitions:

Blue shaded, bold font indicates result is above the lower of the WQCC standard or MCL

< X = Not detected at a detection limit of X

Italics font indicates detection limit exceeds the lowest SSL

"--" in WQCC or MCL cell means that standard is not published for that analyte

Blank cells mean that analyte was not analyzed in that sample

B = Analyte detected in associated method blank

J = Estimated value reported below detection limit

MCL = Maximum Contaminant Level published by USEPA

mg/L = milligrams per liter

USEPA = United States Environmental Protection Agency

WQCC = Water Quality Control Commission standard (New Mexico)

Table 4 - Proposed Stage 1 Abatement Plan Groundwater Monitoring Program

Stage 1 Abatement Plan for the Reverse Osmosis Rejet Discharge Fields

HollyFrontier Navajo Refining LLC

Well ID	Well Type	Location in Relation to Field	Well Diameter (in)	Water Bearing Zone	Abatement Plan [a]						
					Gauging Frequency	Purge Parameters	Total Metals (As, B, Co, Fe, Pb, Mn, U)	Dissolved Metals (As, B, Co, Fe, Pb, Mn, U)	Total Cations	Total Anions	TDS
North RO Reject Discharge Field Area											
MW-55	Monitoring	Upgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
New Well (~230 ft north of MW-55)	Monitoring	Upgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
New Well (~700 ft north of MW-55)	Monitoring	Upgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-117	Monitoring	Near discharge	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-118	Monitoring	Middle of field	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-119	Monitoring	Downgradient corner of field	2	Shallow	Q	Q	SA	SA	Q	Q	Q
New Well (~230 ft northwest of MW-119)	Monitoring	Downgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
New Well (~230 ft southeast of MW-119)	Monitoring	Downgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
South RO Reject Discharge Field Area											
MW-29	Monitoring	Upgradient	8	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-40	Monitoring	Upgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-56	Monitoring	Upgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-114	Monitoring	Near discharge	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-115	Monitoring	North edge of field	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-116	Monitoring	Downgradient edge of field	2	Shallow	Q	Q	SA	SA	Q	Q	Q
MW-125	Monitoring	Downgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q
RW-18A	Recovery [b]	Downgradient	4	Shallow	Q	Q	SA	SA	Q	Q	Q
New Well (~300 ft north of RW-18A)	Monitoring	Downgradient	2	Shallow	Q	Q	SA	SA	Q	Q	Q

Abbreviations:

"-" indicates parameter not required
ft = feet
in = inches
Q = Quarterly
RO = Reverse Osmosis
SA = Semi-annually
TDS = Total Dissolved Solids

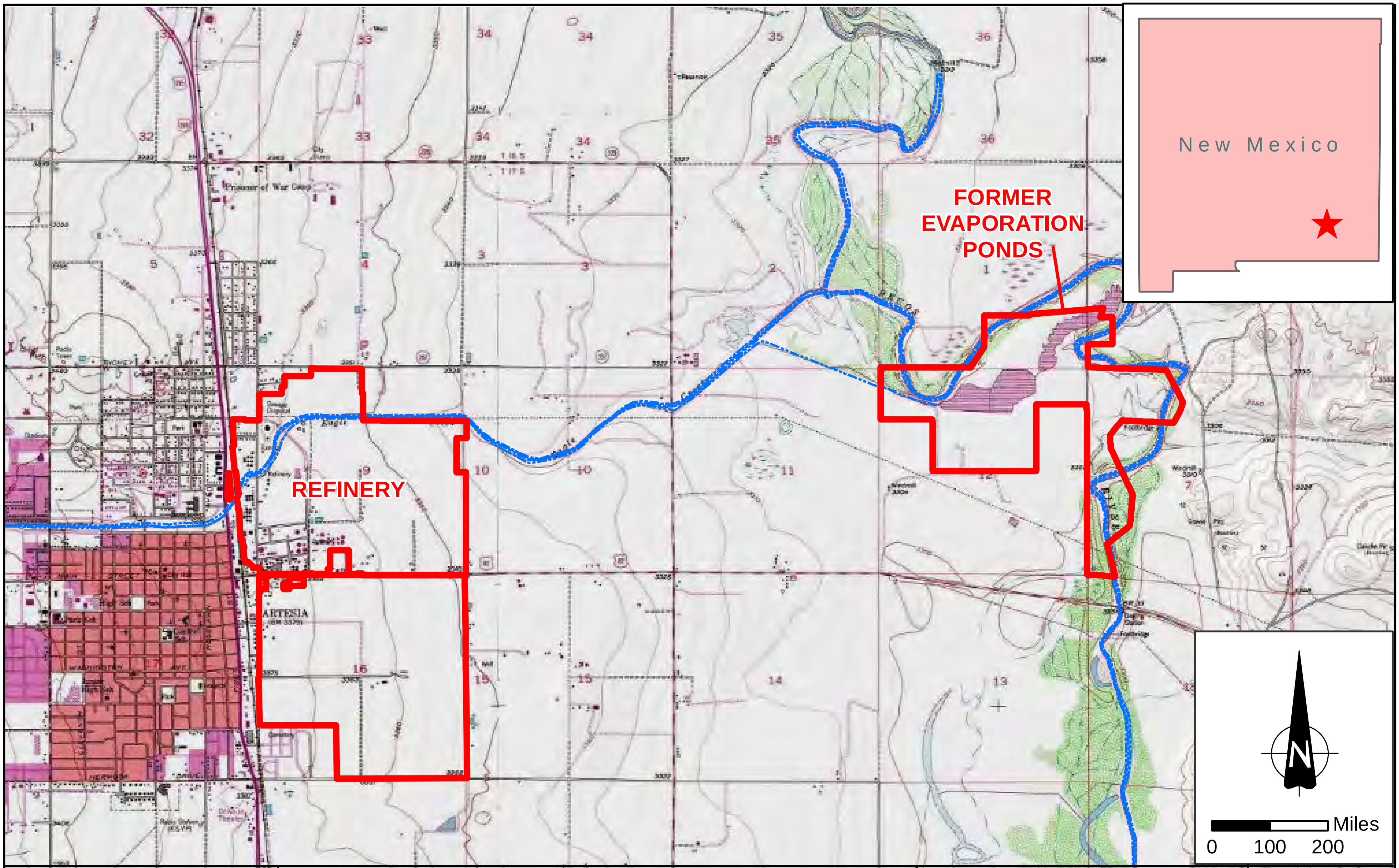
Footnotes:

[a] Abatement Plan Analytical Suite to include the following:

1. Purge parameters pH, temperature, specific conductivity, dissolved oxygen, and oxidation-reduction potential will be measured and recorded in the field.
2. Total metals by Method 6010/6020 and/or 7470. Specific metals shown in table heading (symbols from periodic chart).
3. Dissolved metals - same list as total metals, to be field-filtered.
4. Cations to include Calcium, Magnesium, Potassium, and Sodium by Method 6010 or 6020.
5. Anions to include Chloride, Fluoride, Sulfate, Carbonate, Bicarbonates, Nitrates/Nitrites (as Nitrogen) by Method 300
6. Total Dissolved Solids by Method 2540C.

[b] RW-18A is a standpipe in a trench installed for potential recovery. No PSH has ever been observed in this trench and it is used for groundwater monitoring purposes only.

FIGURES



HOLLYFRONTIER

wood.

Legend

🟥 Property Boundary

-·-·- Water Way

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields
Stage 1 Abatement Plan

Site Location Map

DATE	MARCH 2019
SCALE	1 " = 3,500 '
PROJECT NO.	6703180022
FIGURE	1

DRAWN BY: LK CHECKED BY: JKH

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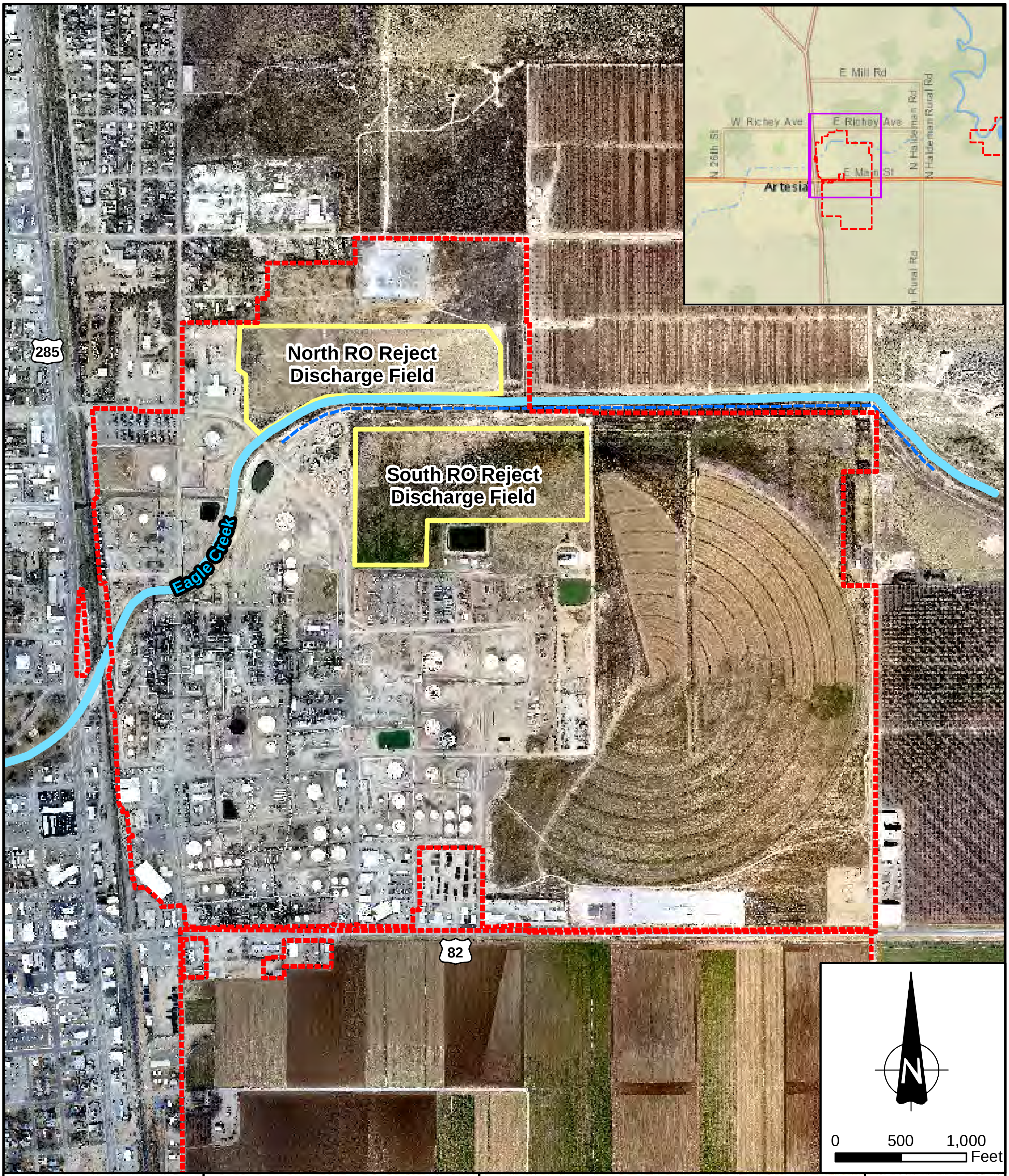


HOLLYFRONTIER

wood.

🟥 Property Boundary

╌ Three-Mile Ditch

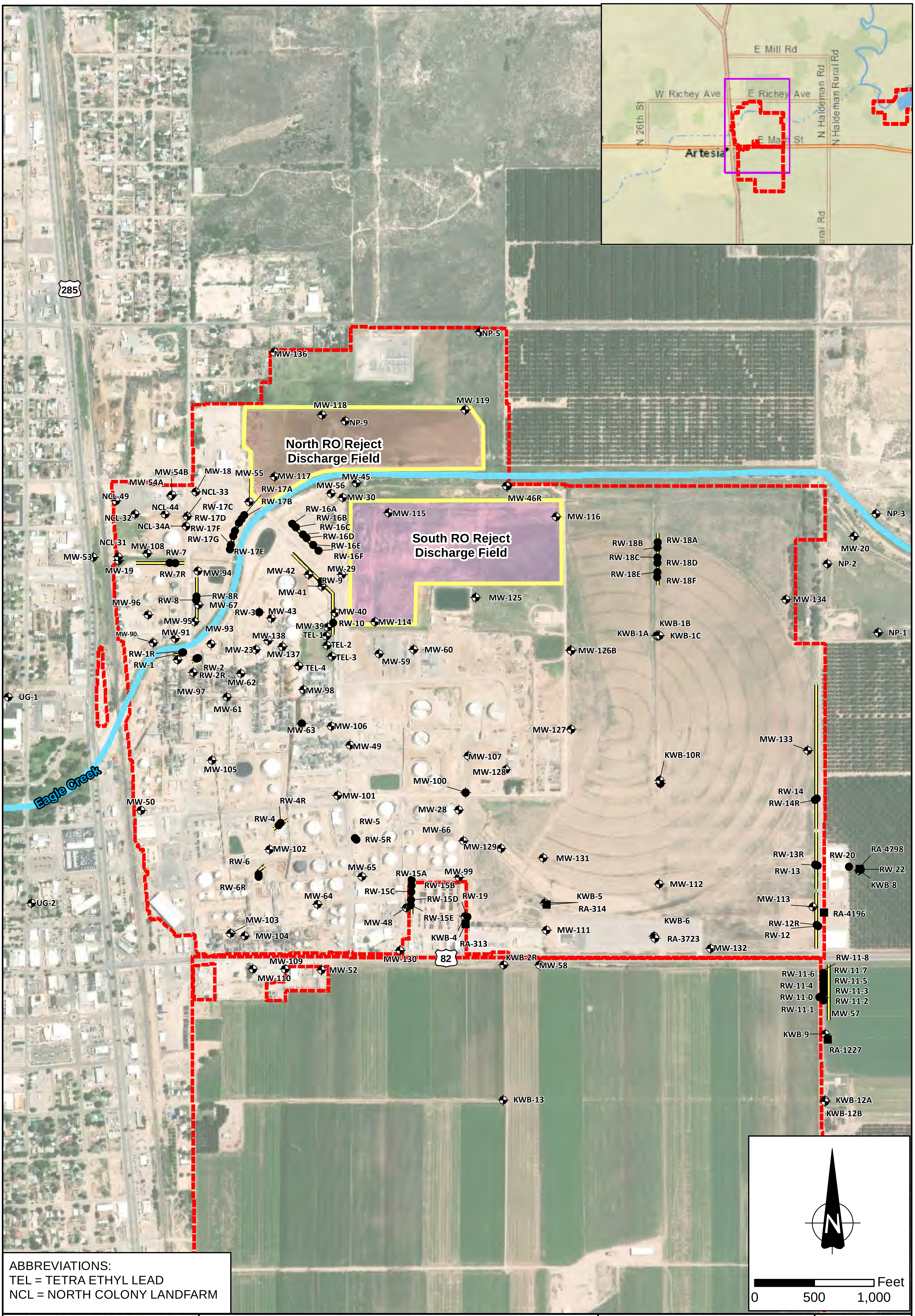
🟨 RO Reject Discharge Field Boundary

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields
Stage 1 Abatement Plan

RO Reject Discharge Field Locations

DATE	MARCH 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180022
FIGURE	2

DRAWN BY: SD CHECKED BY: JHK



ABBREVIATIONS:
TEL = TETRA ETHYL LEAD
NCL = NORTH COLONY LANDFARM

HOLLYFRONTIER

wood.

⌖	Abandoned Well	🟥	North RO Reject Discharge Field
■	Irrigation Well	🟪	South RO Reject Discharge Field
⌖	Monitoring Well	═	Trenches
●	Recovery Well	⬚	Property Boundary

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields
Stage 1 Abatement Plan

Monitoring Well
Location Map

DATE
MARCH 2019

SCALE
1 " = 750 '

PROJECT NO.
6703180022

FIGURE
3

DRAWN BY: PM CHECKED BY: JKH

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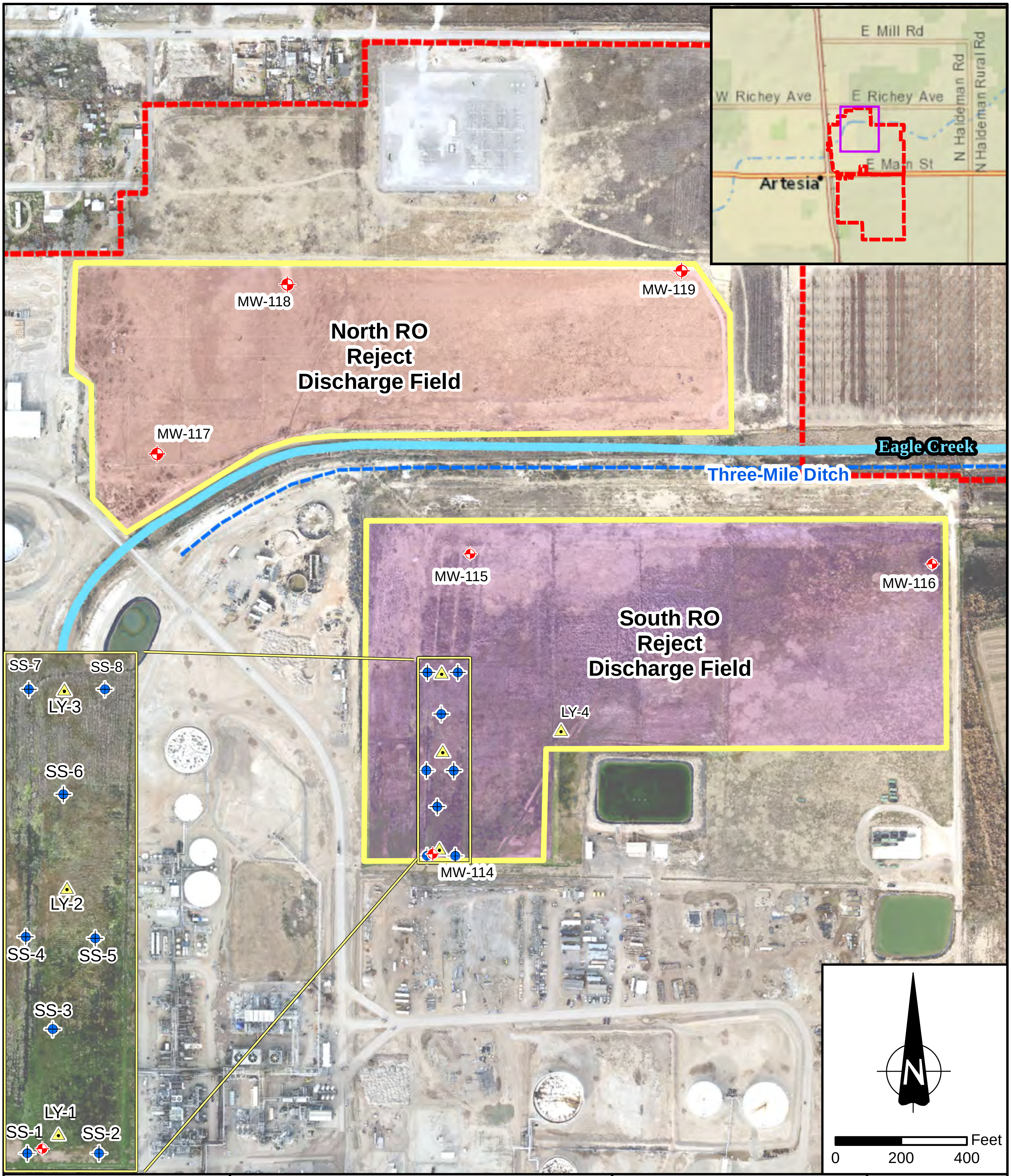

HOLLYFRONTIER

wood.

- ⊕ Monitoring Well
- ⊕ Historical Soil Sample Points
- ▲ Lysimeter Sample Points
- 🟥 North RO Reject Discharge Field
- 🟪 South RO Reject Discharge Field
- ▭ Property Boundary

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields
Stage 1 Abatement Plan

Historical Soil
Sample Locations

DATE	MARCH 2019
SCALE	1 " = 400 feet
PROJECT NO.	6703180022
FIGURE	4

DRAWN BY: SD CHECKED BY: JHK

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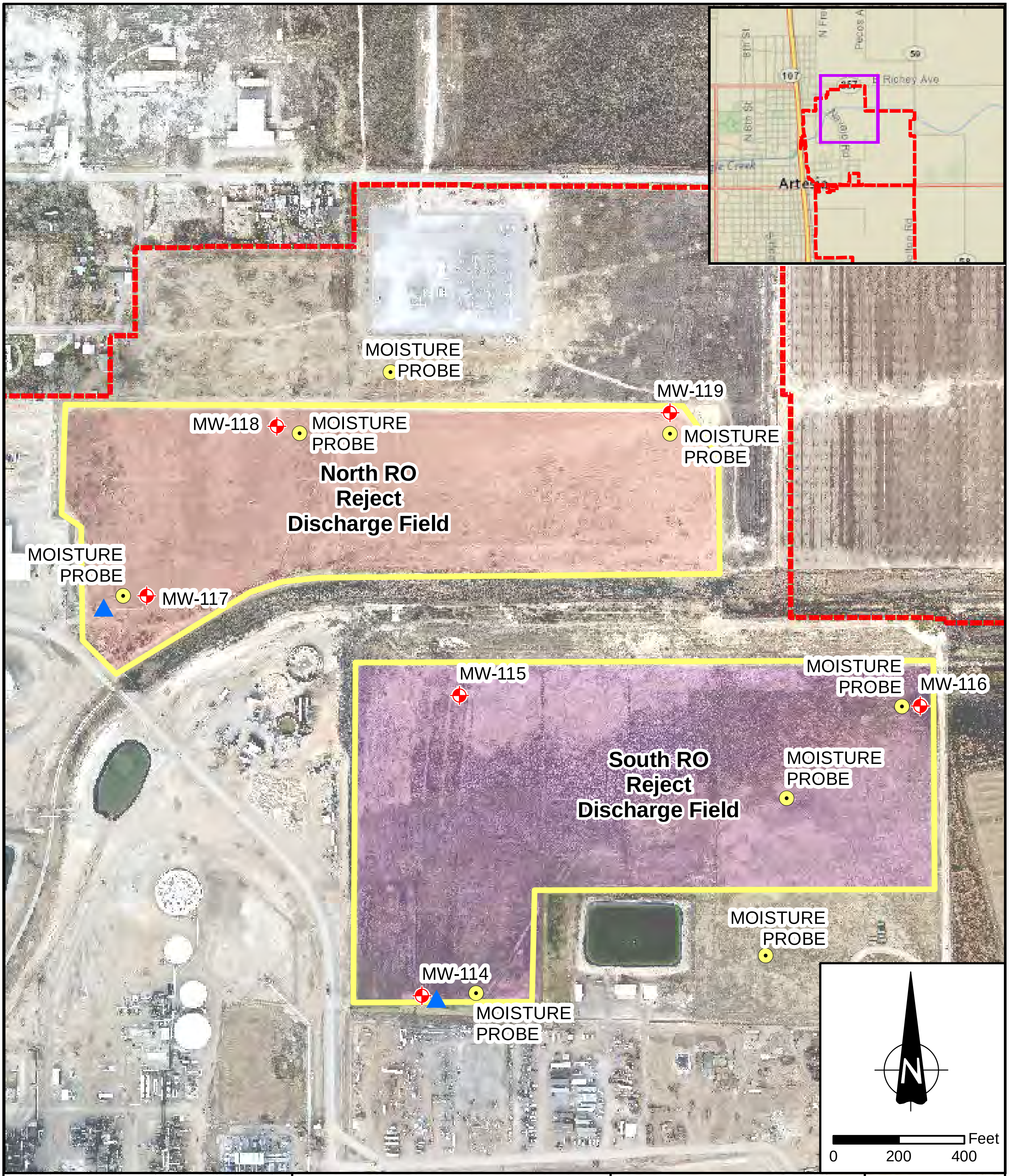

HOLLYFRONTIER

wood.

● Proposed Moisture Probe

⊕ Existing Well Proposed in Monitoring Plan

▲ Discharge Location

🟥 North RO Reject Discharge Field

🟪 South RO Reject Discharge Field

▭ Property Boundary

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields
Stage 1 Abatement Plan

Proposed Soil Moisture Probe Locations

DATE	MARCH 2019
SCALE	1 " = 400 feet
PROJECT NO.	6703180022
FIGURE	5

DRAWN BY: SD CHECKED BY: JHK

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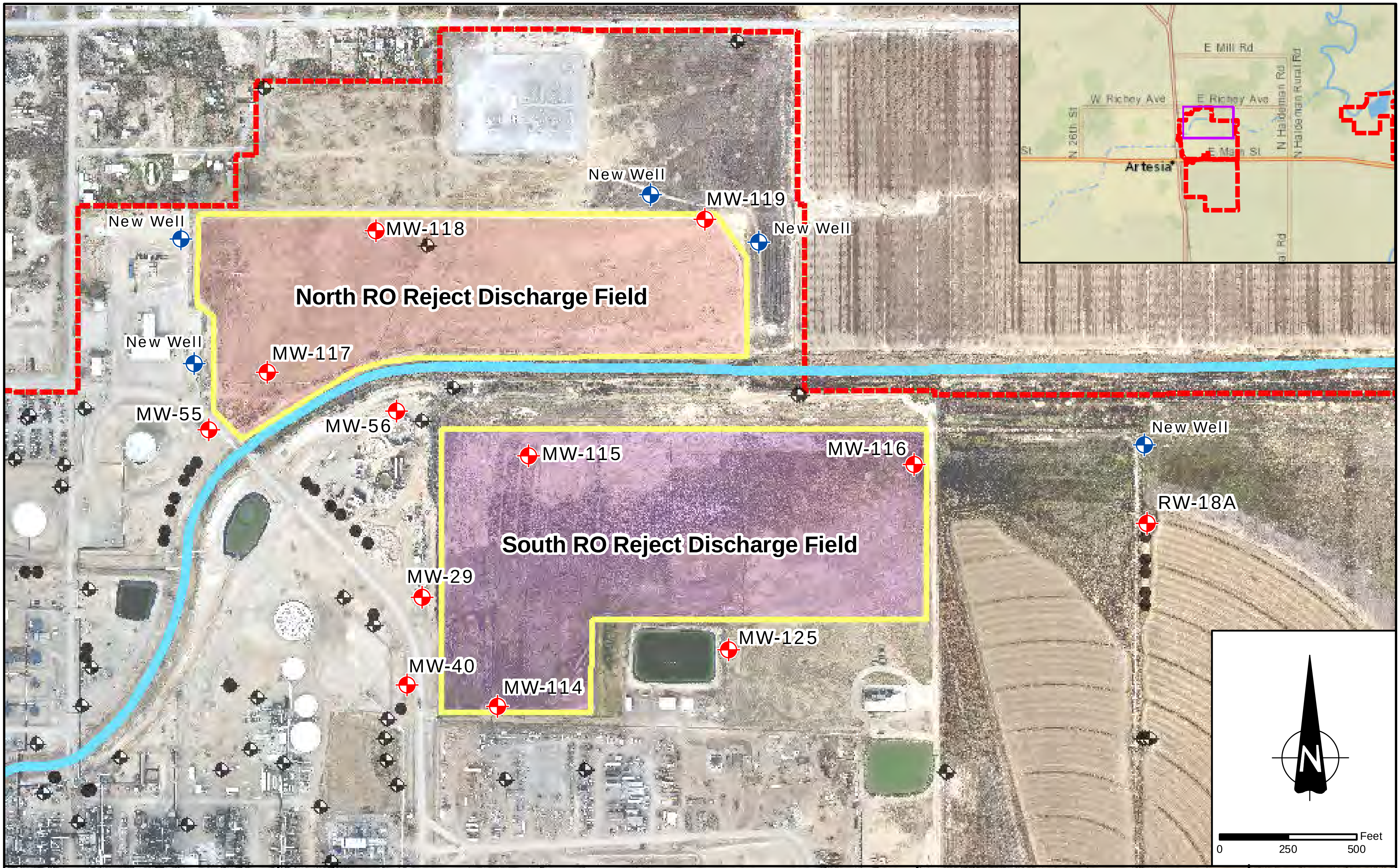

HOLLYFRONTIER

wood.

⊕	Proposed Wells in Proposed Monitoring Plan
⊕	Existing Wells in Proposed Monitoring Plan
●	ABANDONED WELL
■	IRRIGATION WELL
⊕	MONITORING WELL
●	RECOVERY WELL
🟥	North RO Reject Discharge Field
🟪	South RO Reject Discharge Field
▭	Property Boundary

HollyFrontier Navajo Refining LLC
RO Reject Discharge Fields
Stage 1 Abatement Plan

Proposed Groundwater Monitoring Well Locations

DATE
MARCH 2019

SCALE
1 " = 500 '

PROJECT NO.
6703180022

FIGURE
6

DRAWN BY: PM CHECKED BY: JKH

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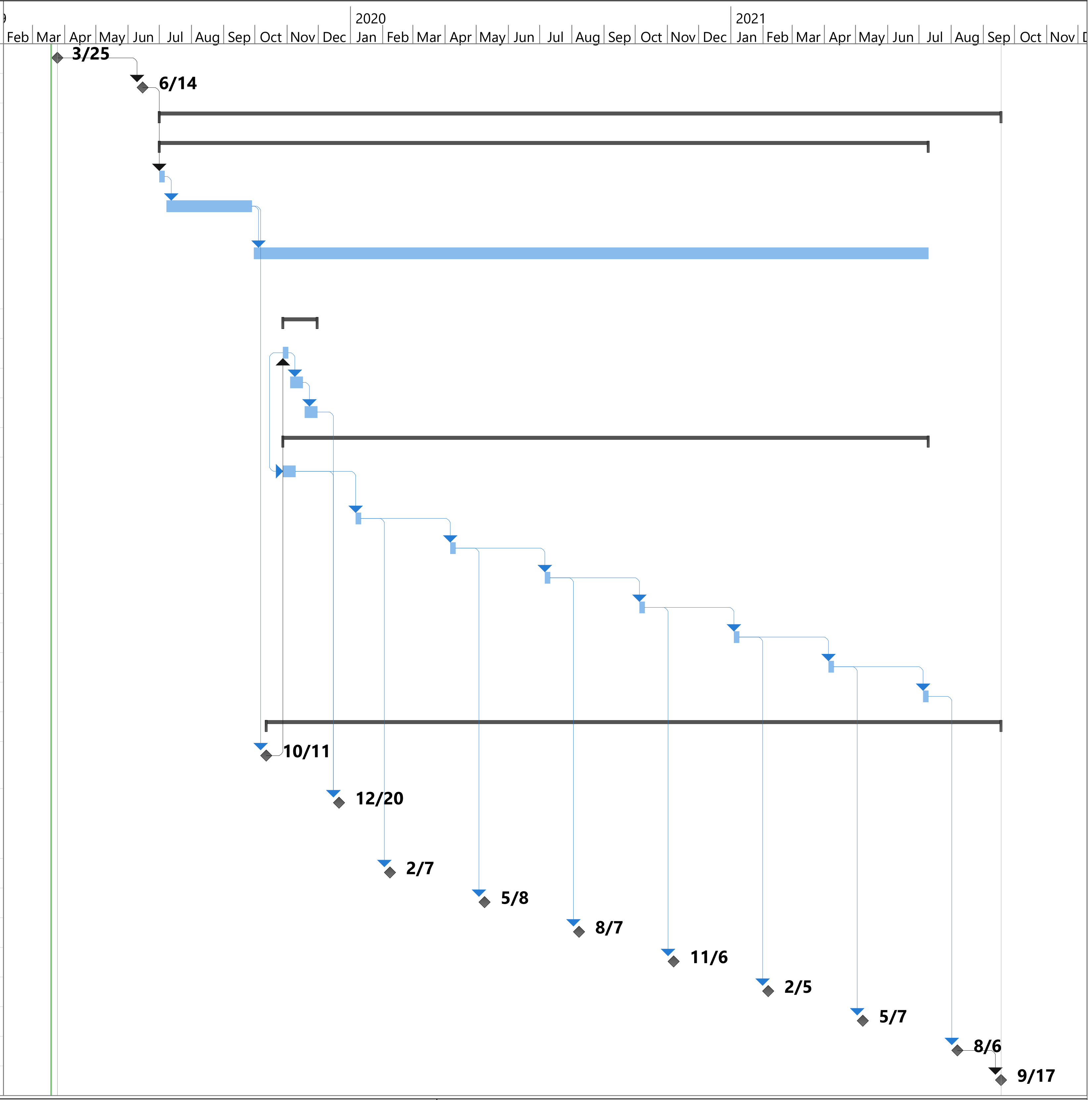
Figure 7 - Implementation Schedule

HollyFrontier Navajo Refining LLC

RO Reject Discharge Fields Stage 1 Abatement Plan

ID	Task Name	Duration	Start	Finish	Predecessors
1	Stage 1 AP Submitted to OCD	0 days	Mon 3/25/19	Mon 3/25/19	
2	OCD Approval of Stage 1 AP (projected)	0 days	Fri 6/14/19	Fri 6/14/19	1FS+3 mons
3	**Implement Stage 1 AP**	**580 days**	**Mon 7/1/19**	**Fri 9/17/21**	
4	**Soil Moisture Evaluation**	**530 days**	**Mon 7/1/19**	**Fri 7/9/21**	
5	Install Soil Moisture Probes	5 days	Mon 7/1/19	Fri 7/5/19	2FS+10 days
6	Monitor Soil Moisture Until Returned to Field Capacity (assumed 3 months)	3 mons	Mon 7/8/19	Fri 9/27/19	5
7	Continue Monitoring Soil Moisture Throughout Stage 1 AP (2 years from start of groundwater monitoring)	465 days	Mon 9/30/19	Fri 7/9/21	6
8	**Soil Evaluation**	**25 days**	**Mon 10/28/1**	**Fri 11/29/19**	
9	Collect Soil Samples (within discharge fields)	5 days	Mon 10/28/19	Fri 11/1/19	22FS+10 days
10	Laboratory Analyses of Soil Samples	10 days	Mon 11/4/19	Fri 11/15/19	9
11	Summarize Soil Data for Progress Report	10 days	Mon 11/18/19	Fri 11/29/19	10
12	**Groundwater Monitoring**	**445 days**	**Mon 10/28/1**	**Fri 7/9/21**	
13	Install Addtiional Monitoring Wells, Collect Initial GW Samples for Stage 1 AP Parameters (Q1)	10 days	Mon 10/28/19	Fri 11/8/19	9SS
14	Collect GW Samples (Q2)	5 days	Mon 1/6/20	Fri 1/10/20	13FS+40 days
15	Collect GW Samples (Q3)	5 days	Mon 4/6/20	Fri 4/10/20	14FS+3 mons
16	Collect GW Samples (Q4)	5 days	Mon 7/6/20	Fri 7/10/20	15FS+3 mons
17	Collect GW Samples (Q5)	5 days	Mon 10/5/20	Fri 10/9/20	16FS+3 mons
18	Collect GW Samples (Q6)	5 days	Mon 1/4/21	Fri 1/8/21	17FS+3 mons
19	Collect GW Samples (Q7)	5 days	Mon 4/5/21	Fri 4/9/21	18FS+3 mons
20	Collect GW Samples (Q8)	5 days	Mon 7/5/21	Fri 7/9/21	19FS+3 mons
21	**Report Submittal Dates**	**505 days**	**Fri 10/11/19**	**Fri 9/17/21**	
22	Progress Report 1 (soil moisture, decision whether to proceed with soil and groundwater monitoring)	0 days	Fri 10/11/19	Fri 10/11/19	6FS+10 days
23	Progress Report 2 (soil moisture, boring and well installation summary, soil and Q1 groundwater results)	0 days	Fri 12/20/19	Fri 12/20/19	11FS+10 days,13FS+30 days
24	Progress Report 3 (Q2 GW and moisture data)	0 days	Fri 2/7/20	Fri 2/7/20	14FS+20 days
25	Progress Report 4 (Q3 GW and moisture data)	0 days	Fri 5/8/20	Fri 5/8/20	15FS+20 days
26	Progress Report 5 (Q4 GW and moisture data)	0 days	Fri 8/7/20	Fri 8/7/20	16FS+20 days
27	Progress Report 6 (Q5 GW and moisture data)	0 days	Fri 11/6/20	Fri 11/6/20	17FS+20 days
28	Progress Report 7 (Q6 GW and moisture data)	0 days	Fri 2/5/21	Fri 2/5/21	18FS+20 days
29	Progress Report 8 (Q7 GW and moisture data)	0 days	Fri 5/7/21	Fri 5/7/21	19FS+20 days
30	Progress Report 9 (Q8 GW and moisture data)	0 days	Fri 8/6/21	Fri 8/6/21	20FS+20 days
31	Final Report (summary and recommendations)	0 days	Fri 9/17/21	Fri 9/17/21	30FS+30 days



Schedule assumes field capacity is reached within 3 months of soil moisture probe installation, then soil and groundwater monitoring begin the following month. Schedule will be adjusted if field capacity is reached sooner or later.

Task	▬	Milestone ◆	Summary ┏━┓

APPENDIX A

Holly Frontier Navajo Refining LLC Artesia Refinery – RO-Reject Water Application Area – Phytoremediation Feasibility Study Summary Report

PREPARED FOR
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December 21, 2018

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1.0 INTRODUCTION

In spring 2017, HollyFrontier Navajo Refining LLC (Navajo) and Geolex, Inc. (Geolex) met with the New Mexico Oil Conservation Division (NMOCD) staff to discuss the plan for replacement of land application of Reverse Osmosis reject water (RO-reject water) with deep well disposal at the Navajo Refinery in Artesia, New Mexico (Navajo). It was agreed through the process that Navajo would carry out a phytoremediation feasibility study on select plots within areas where RO-reject water has been historically land-applied. The intent of the study was two-fold: 1) Determine whether plants would uptake all the constituent loading for RO-reject water, allowing for some ongoing RO-reject water irrigation, and; 2) determine if it would be viable to use phytoremediation as an approach to reduce accumulated constituents in soils/vadose zone and groundwater after ceasing land application of RO-reject water. This report details the methods, results, and conclusions of this effort.

2.0 PROJECT OBJECTIVES

The goal of this feasibility project was to determine whether phytoremediation is successful as a stand-alone or complimentary abatement. If characterization data indicates that remediation is needed and phytoremediation is demonstrated to be an effective abatement technique, then phytoremediation may be proposed in the Abatement Plan to achieve one of the objectives listed in sections 2.1 and 2.2 below. Historically, NMOCD has indicated that abatement will be required and NMOCD has indicated a willingness to consider phytoremediation as a possible abatement tool.

2.1 PRIMARY OBJECTIVE

The main objective of this study was to provide the technical support, if possible, to allow for NMOCD approval of continued application of RO-reject water to the two RO Fields after installation and operation of injection well WDW-4. This would be contingent upon phytoremediation resulting in an overall mass balance where key chemical uptake in plants is greater than or equal to mass of chemicals placed on the RO Fields via RO-reject discharge water. If it is determined that by using phytoremediation, RO-reject water constituents are taken up fully by the plants, then continued application of RO-reject water to the RO fields would: 1) provide flexibility with respect to water management options, 2) promote water conservation by recharging shallow groundwater unit rather than deep saline aquifer disposal, and 3) reduce the burden on the three existing injection wells and future injection well WDW-4. Based on the data from this study, Navajo has elected to not pursue this option.

2.2 SECONDARY OBJECTIVE

If it is not feasible to continue application of RO-reject water to the RO Fields after injection well WDW-4 is operational, the use of the RO Fields will be ceased and abatement/financial assurance will be required according to Sections 1.I and 6.C of the Discharge Permit. If it is determined that abatement of the fields is needed, phytoremediation may be proposed as a method to abate the vadose and groundwater zones based on the mass of key chemical uptake in plants relative to the mass of chemicals in the vadose and groundwater zones. This secondary objective allows for the determination of the potential feasibility of using phytoremediation as an approach to reduce accumulated constituents in soil and shallow groundwater, thus improving groundwater quality over time.

2.3 BACKGROUND CONSIDERATION

The fundamental objective of this feasibility study was to determine the efficacy of uptake of constituents from soil and shallow groundwater vs the total mass of constituents in applied RO-reject water. The key chemicals in the RO-reject water appear to have similar concentrations to groundwater up-gradient and cross-gradient of the RO fields. Therefore, the RO-reject water does not appear to significantly increase the concentration of these key chemicals in groundwater as it migrates under the RO Fields. Alternatives to the Water Quality Control Commission (WQCC) discharge standards based on background may be proposed in accordance with New Mexico Administrative Code 20.6.2.3101 (WQCC list is 20.6.2.3103).

2.4 RELEVANT PERMIT CONDITIONS

The key permit conditions of Navajo's 2017 permit (Appendix A) are as follows:

- Section 1.B of the May 2017 Discharge Permit (GW-028) requires ceasing application of RO-reject discharge water to the RO Fields after injection well WDW-4 is operational. OCD approved an extension on October 25 and December 14, 2018, for land application of RO reject water to be continued until January 31, 2019.

- Section 6 of the May 2017 Discharge Permit (GW-028), along with the June 29, 2017 Permit Modification, require submittal of an Abatement Plan within 60 days of ceasing application of RO reject discharge water to the RO Fields. The Stage 1 Abatement Plan shall address characterization and abatement of vadose zone and groundwater contamination. This study is intended to provide data to develop an abatement plan, if determined to be appropriate.

3.0 PHYTOREMEDIATION PROCESS

Phytoremediation broadly refers to processes in which plants are used to decrease the concentration of constituents in air, soil, and water. Advantages of phytoremediation techniques are that phytoremediation uses natural organisms that limit disturbance of the local environment and that application of these methods are commonly less expensive than traditional remediation methods. However, the organic nature of this process results in constituent uptake over a long period of time, affected by overall evapotranspiration rates and the efficacy of removal of constituents is also affected by the root depth and overall health of the plants.

In this study, the specific phytoremediation technique applied was phytoextraction. Through this process, chemical uptake occurs by plant roots in the vadose and groundwater zones. Furthermore, chemicals adsorbed in soil are leached into water for plant uptake. The plant root zone is 1.5 - 2 feet for a short-term feasibility project. In this way, constituents are removed from the soil/vadose zone and groundwater and then concentrated in the plant matter. The phytoextraction plants are harvested to complete removal of constituents from the site.

Sudan Grass was the phytoremediation plant chosen for this study due to previous work (EPA, 2001; Biscaro, 2011; Bismer 2001; Meister, 2004) which observed effective uptake of constituents using Sudan Grass. These plants are particularly effective at accumulation and removal of anions such as nitrate, chloride, and fluoride, as well as metals including zinc, manganese, copper, and boron. Therefore, Sudan Grass was applied to an experimental plot to monitor uptake of constituents found in the RO-reject water and thereby assess feasibility of this remediation technique. The results of this assessment are found the sections below.

4.0 PRE-TEST LOGISTICS

4.1 PRE-SAMPLE

On May 22, 2017, samples of existing, native plants (grass and weeds) were collected from the RO Fields for analysis of anions and metals of concern listed in the Resource Conservation and Recovery Act (RCRA 8 Metals). The results of these samples provided evidence that key chemicals are taken up by plants.

4.2 FEASIBILITY PLOT (SOUTH RO FIELD)

A 1.25 acre area within the South RO Field was chosen as the experimental plot for this phytoremediation feasibility study (Figure 1). This feasibility plot was prepared by clearing existing vegetation and leveling the ground by plowing and tilling. Precautions were also taken to contain the applied RO-reject water by installing/modifying irrigation controls and berms, while existing irrigation diversion channels were rerouted. Plumbing was then installed to a new discharge location for RO-reject water approved by NMOCD on August 1, 2017. Next, a fence was constructed to contain the study area and a flow meter was installed to monitor irrigation flow and total volume.

Groundwater in the feasibility plot is shallow (<10 feet). To monitor this shallow groundwater as RO-reject water is applied, three lysimeters (LY-1, LY-2, and LY-3) were installed within the feasibility plot area (Figure 1). The RO-reject water discharges into the south-central margin of the plot and flows northward to reach the entire study area. The three lysimeter locations on this plot were chosen to provide a representative spread of groundwater data as the RO-reject water flows northward from the discharge location. LY-1 was installed proximal to this discharge location in the south-central portion of the field. LY-2 was installed in the center of the field, about halfway along the northward flow path of the RO-reject water. Finally, LY-3 was installed on the far north-central margin of the field. Additionally, a groundwater monitoring well (MW-114) was already present in the southwestern portion of the feasibility plot, so this well was also sampled as part of the study to ensure that any significant changes in groundwater constituent concentrations would be detected.

4.3 QUALITY CONTROL

For quality control (QC), a fourth lysimeter (LY-4) was installed in the South RO Field to the east of the feasibility plot in order to measure current uptake not influenced by the phytoremediation project.

4.4 CONTINUED RO-REJECT WATER DISCHARGE

RO-reject water was applied to the North RO Field and non-test portions of South RO Field to manage day-to-day RO reject water due to the limited volume needed for irrigation of the Feasibility Plot. During the test period, the extent of irrigation was varied to optimize performance of the crop vs. supply of water.

5.0 MEASUREMENT PARAMETERS

5.1 GENERAL

5.2 The feasibility plot was watered with RO-reject water to promote grass growth throughout the study. Using the area of the feasibility plot, average Sudan Grass uptake rate, and RO-reject water discharge, approximate rates of water application and uptake in the feasibility plot were established. Sudan Grass uptakes approximately 7 to 11 acre inches of water per month, which equates to an average flow rate of 5.5 to 8.5 gallons per minute (gpm) across the 1.25 acre feasibility plot. At this test rate, RO-reject water spread across 28 acres (area of South RO-reject field) would equate to approximately 150 to 240 gpm or 60% to 95% of the typical RO-reject water stream of 250 gpm. Therefore, the RO-reject water application rate on the feasibility plot was nearly representative of current application rates. There were approximately 1,257,218 gallons of RO-reject water placed onto the feasibility plot between August 8, 2017 and September 29, 2017, which equates to approximately 15.3 gpm. The fields were inspected at least twice per week for proper grass growth and to confirm RO-reject water was reaching the entire feasibility plot. In addition to plant uptake, some water was lost to evaporation prior to soaking into soils. Water in excess of anticipated plant uptake was applied to ensure evaporation losses were covered and soil was saturated enough to ensure the ability to reliably collect lysimeter samples. PLANTS

Sampling and analysis of plant samples from the feasibility plot occurred in several stages. The feasibility plot was seeded with Sudan Grass in August 2017. Initial sampling of soil and RO-reject discharge water occurred on August 4, 2017. At this time, a sample of existing grass was collected from the QC location next to LY-4. Also on August 4, 2017, a baseline sample of existing grass was collected from an area that doesn’t receive any RO-reject water (a field to the east of the Navajo Refinery). Another sample of this existing grass was collected from the QC location at the end of the feasibility study period.

Eight random plant samples were then collected at an early-stage of plant growth in late August 2017, followed by another eight random plant samples during a mature-stage of plant growth (stalks and leaves) in mid-October 2017. Samples of RO-reject water were simultaneously collected during each harvest. The plant samples were then run through an analytical program which focused on several constituents: chloride, fluoride, sulfate, nitrate/nitrite and metals[1].

Finally, uptake of these key constituents by the plants was then determined by performing a mass balance that compared the key constituents placed on RO Field by RO-reject water vs. mass of these constituents removed by plants.

5.3 VADOSE ZONE/GROUNDWATER

Groundwater is shallow (<10 feet) at the feasibility plot location so lysimeters were used to monitor shallow groundwater. Three of the lysimeters (LY-1, LY-2, and LY-3) were installed within the feasibility plot and one lysimeter (LY-4) was installed to the east of the plot for QC. These were installed in the first week of August 2017The existing monitoring well MW-114 located within the feasibility plot was also sampled during the study.

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[1] Metals Analyte List: Aluminum, Arsenic, Barium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Molybdenum, Nickel, Selenium, Silver, Uranium and Zinc, consistent with the current groundwater monitoring program

Lysimeter samples were collected twice a month for eight months, including a baseline sample. Samples were also collected from the RO-reject water during each lysimeter sampling event. Additional samples were collected from monitoring well MW-114 approximately every 8 weeks, including a baseline sample. Samples were collected from the RO-reject water during each MW-114 sampling event. The lysimeter, RO-reject water, and MW-114 samples were all then run through an analytical program which focused on the following constituents: chloride, fluoride, sulfate, nitrate/nitrite, metals[1], and total dissolved solids (TDS). Groundwater samples were collected to identify any significant variations in observed groundwater constituent concentrations over the study period.

Changes in the vadose/groundwater zone concentration of key chemicals were assessed at the beginning, during, and after the feasibility study period.

5.4 SOIL

Eight soil samples were collected at the beginning of the project (baseline) and again at the end of the feasibility period. The soil samples were then processed through an analytical program for the following constituents: chloride, fluoride, sulfate, and nitrate/nitrite, and metals[1]. By using samples from the beginning and end of the study, this data shows changes in key constituents over the course of the feasibility study. Furthermore, this data reflects the mass of key constituents adsorbed on soil that could leach to vadose and groundwater zones and/or were taken up by plants.

In order to simulate and constrain potential leaching into groundwater of constituents adsorbed onto soil, the Synthetic Precipitation Leaching Procedure (SPLP) method was also applied to the eight soil samples collected in March 2018 at the end of the feasibility study period. The purpose of the SPLP method is to simulate representative leaching in material that is exposed to rainfall. First, a 1:20 pH adjusted extraction is taken from each sample. This extract is then tumbled for 18 hours, filtered, and analyzed. This SPLP method simulates enhanced leaching of soils due to the improved contact with the entire soil sample vs limited contact during traditional column leaching methods. For this reason, results of these tests generally overpredict leaching which would occur in natural situations for equivalent soil samples.

5.5 RO-REJECT DISCHARGE WATER – IRRIGATION WATER

RO-reject discharge water samples were collected concurrently with each plant, soil, lysimeter, and MW-114 sampling event. These RO-reject water samples were then run through the same analytical program which focused on the following constituents: chloride, fluoride, sulfate, nitrate/nitrite, metals[1], and TDS.

6.0 RESULTS

Where sample results for all constituents were below method detection limits (MDL), one-half of the MDL was used. Additionally, nitrate/nitrite and nitrite were used in this analysis to show that nitrate concentrations contributed more to the overall nitrogen (i.e. nitrate/nitrite) detections. Most detections of nitrite were below MDL.

6.1 GROUNDWATER RESULTS

Groundwater was sampled in MW-114 just to determine whether or not any significant change would be observed in an adjacent well during and after the study and harvest periods. These results are summarized in Table 7. These samples demonstrate that applicable standards were only exceeded for TDS, Fluoride, Sulfate and Manganese although some other constituents exceeded screening levels. In addition, concentrations did not vary significantly throughout the study period.

6.2 LYSIMETER RESULTS

6.2.1 TDS

Results of TDS concentrations over time for the four lysimeters in this study are shown in Table 1a and Figure 3. Overall, the lysimeters showed variable trends for TDS concentration over time. LY-1, which is the closest to the discharge point, showed a gradual downward trend throughout the study period. LY-2 and LY-3, which are respectively located in the middle and along the northern edge of the feasibility plot, both show no significant trend up or down. Finally LY-4, which is located off the feasibility plot to the east and used for QC, shows an abrupt decrease in TDS early in the study period, but generally stabilized after the second sampling event.

6.2.2 Anions

Concentrations of key anions in the lysimeter samples are reported in Table 1, and Figure 2 shows the change in these anion concentrations over time. The constituents found in the lysimeter samples that had more than one detection above the critical groundwater screening levels (CGWSL) were TDS, chloride, fluoride, sulfate, aluminum, boron, and manganese. The only chemicals in the RO-reject water samples that had more than one detection above CGWSL were TDS (18), chloride (5), fluoride (18), and sulfate (18).

Sulfate, chloride, and fluoride showed consistent trends across the lysimeters, as concentrations for these constituents remained relatively stable at each of the four lysimeters over time. Nitrate/nitrite concentrations exhibited more variable results across the four lysimeters. For LY-1, nitrite detections were below MDL and remained constant across all sampling events. Nitrate/nitrite concentrations decreased significantly (i.e., one order of magnitude) during the last four sampling events. At LY-2, nitrate/nitrite concentrations generally increased. The LY-3 samples show nitrate/nitrite concentrations generally increased during the first half of study, and then decreased during the last four sampling events. Finally, nitrate/nitrite significantly decreased over time at LY-4.

6.2.3 Metals

Concentrations of metals in the lysimeter samples are reported in Table 1, while changes in concentration over time are displayed in Figure 4. The majority of metals analyzed were found below MDL. The following metals had concentrations above the MDL and the Reporting Limit (RL): Copper, manganese, molybdenum, nickel, selenium, uranium, and mercury. The metals that were above the MDL and RL in the lysimeter samples were detected in the RO-reject water, but below CGWSL.

For lysimeters LY-1, LY-2 and LY-3, the overall trend (as seen in the "Total 18 Metals" series in Figure 4) appears to be decreasing for all 18 metals early in the study and generally stable thereafter. This decrease is most significant at LY-1. The overall trend for lysimeter LY-4 was decreasing early in the study and increasing thereafter. In contrast to the general stability of the metal constituent concentrations in the lysimeters over time, lead concentrations decreased consistently in all the lysimeters over the course of the study.

In order to have a frame of reference and control to evaluate observed changes constituent concentrations in soil water (lysimeter) samples and soil samples, the RO-reject water which was being land applied was also analyzed and those results are presented in Figure 5 and Table 5. As can be seen from the trends observed in the graphs in this figure, average concentrations remained flat while the individual sample results were variable over the length of the study.

6.3 SOIL SAMPLE RESULTS

6.3.1 Anions

Concentrations of key anions measured in the soil samples are reported in Table 2, while changes in concentration over time for these anions are displayed in Figure 6.

Chloride, sulfate, fluoride, and nitrates were all well below NM Soil Sampling Levels (SSL, where applicable) (see Table 2) for each of the eight soil sample locations. Sulfate concentrations were generally stable across the soil samples, with slight overall decreases at soil sample locations 4 and 5. Fluoride concentrations were also generally stable across the soil samples, with a slight increase at soil sample location 3. Nitrate concentrations showed general decreases across the majority of samples, but were stable at sample locations 4 and 8. Finally, chloride concentrations generally decreased or were stable across soil sample locations, with the exception of a minor increase observed at soil sample location 1.

6.3.2 Metals

Concentrations of metals measured in the soil samples are reported in Table 2. The majority of metals analyzed were above the MDL and RL in each soil sample. However, boron, silver, and mercury were consistently below MDL and RL across all soil sample locations. Selenium was also below RL for locations 3-8 during the March 2018 sampling event.

Changes over time for metal concentration at the soil sample locations are displayed in Figures 7 and 8. The overall trend observed in this data is that concentrations for the majority of metals in the soil samples remained stable over the sampling period. However, slight increases in concentrations of lead over time occurred at most soil sample sites over time. Additionally, decreases in selenium concentration were observed in all soil sample locations.

6.4 SPLP LEACHING ESTIMATES

Results from the SPLP method for the eight soil sample locations are reported in Table 3. Overall, the SPLP results show that even though leaching of these constituents from the soil into groundwater likely occurred based on detected leaching concentrations, the majority of constituents were still well below the CGWSL. The only exceptions to this are fluoride, sulfate, and aluminum which were slightly above the CGWSL for the majority of samples.

6.5 PLANT SAMPLE RESULTS AND MASS BALANCE

6.5.1 Plant Sample Results

As described above in Section 5.2, the plant material was harvested dried and samples analyzed to evaluate the uptake of constituents from the applied RO-reject water and from existing soil water in the vadose zone. These results are presented in Table 6. It is clear that the plants take up substantial amounts of the constituents of interest although in some cases not enough to remove all the constituents in the mass which is applied via the RO-reject water as is discussed below.

6.5.2 Mass Balance

Mass balance results from comparison of plant uptake and RO-reject water application data are reported in Table 4. The mass balance for plant constituent uptake compared to constituents applied by RO-reject water was conducted using an average of the preliminary August 2017 sampling, an average of the October 2017 sampling, and finally a combined average of all plant samples. In each of these metrics, the plants took up more copper and manganese than was applied onto the feasibility plot. Additionally, the plants absorbed nearly 100% of all the zinc applied to the field. Positive results were also observed for aluminum, iron, and mercury where uptake was greater than 50%. However, plant uptake was relatively low for the remaining anions and metals of concern.

7.0 CONCLUSIONS

1) The lysimeter data shows that, for the anions of concern in this study, nitrate had mixed results and showed both increases and decreases at different lysimeters. Fluoride, chloride, and sulfate were at high levels in early sampling, and concentrations remained stable throughout the study period and did not increase despite additional constituent loading from the applied RO-reject water. Furthermore, metals showed generally decreasing trends across the lysimeters. This data shows that while constituents were not entirely removed from the vadose zone water, the Sudan Grass phytoremediation was able to prevent accumulation (stable concentrations), and in some cases steady decreases of constituent levels despite continual constituent loading by RO-reject water application.

2) The soil data shows a similar pattern to the lysimeter data. The anions of concern (sulfate, fluoride, chloride, and nitrates) were all below NM SSLs, as applicable, and concentrations either remained stable or generally decreased over time. Metal concentrations also remained generally stable or slightly decreased, with the exceptions of notably decreased selenium concentrations and increased lead concentrations across the soil samples. This again shows that Sudan Grass phytoremediation was able to prevent accumulation of constituents in the soil despite constituent loading through application of RO-reject water.

3) The mass balance results compare the uptake concentrations in the plants to the constituent loading from the RO-reject water. The data showed particularly positive results for copper, manganese, zinc, iron, aluminum, and mercury in that the plant uptake quantities exceeded the RO-reject water constituent loading. However, the anions and several metals were removed by the plants at lesser quantities than that applied to the field with the RO-reject water. For most constituents, as seen in the lysimeter and soil data, this still appears to be sufficient to prevent accumulation of these constituents.

4) Most constituents were well below CGWSL limits in the SPLP simulation for leaching. Only a few constituents (fluoride, sulfate, and aluminum) were slightly above CGWSL for the majority of samples. This fact paired with the relatively minor concentrations above CGWSL for only three constituents as well as the majority of constituents being well below CGWSL in the SPLP simulation, indicates that the constituents are relatively immobile in the feasibility plot and would likely not elevate groundwater above CGWSL limits via soil leaching at the study site.

5) Based on these findings, phytoremediation appears to a viable method to prevent accumulation of most constituents in groundwater and soil over time. However, chemical uptake by phytoremediation is not occurring at a significantly faster rate than the loading of constituents in shallow soil and groundwater via RO-reject water. The data from this study suggest that objective #1 may not be feasible (plants uptake exceeds loading from RO-reject water thus allowing for some ongoing RO-reject water irrigation) but objective #2 may be feasible whereby phytoremediation may be a viable option for abatement of soil and groundwater after ceasing land application of RO-reject water.

8.0 RECOMMENDATIONS

Based on the conclusions of this feasibility study, phytoremediation proves to be a viable option that could be proposed for an abatement plan to address soil and groundwater including the vadose zone. The mass balance, soil, and lysimeter data show that the plants are able to uptake chemicals at a rate approximately equal to the rate of RO-reject water application for several key constituents. For the remaining anions and metals, removal of constituents by phytoremediation was sufficient to maintain stable constituent levels and prevent accumulation despite continual constituent loading by application of RO-reject water. If abatement is appropriate, a Stage 2 abatement plan may be proposed to utilize phytoremediation in conjunction with a cleaner water source to irrigate the plants. In this way, the plants would continue to uptake chemicals at the same rate while much lower concentrations of chemicals would be loaded onto the field due to the cleaner water source. This method could also be enhanced with various plant varieties which could target different constituents, continue remediation across different seasons, and increase constituent removal throughout the vadose and groundwater zones by varying root depth. Over time, we expect that this approach would successfully remediate the groundwater and vadose zones beneath and downgradient of the RO Fields.

9.0 REFERENCES

EPA, 2001, Ground Water Issues, Phytoremediation of Contaminated Soil and Ground Water Hazardous Waste Sites: Office of Solid Waste and Emergency Response EPA/540/S-01/500.

Biscaro, A., 2011, Sudangrass Hay Production: University of California Cooperative Extension, High Desert Crop Notes, Summer 2011.

EPA, 2012, A Citizen’s Guide to Phytoremediation: Office of Solid Waste and Emergency Response, EPA 542-F-12-016.

Fisher, F. S., 2005, Uncompahgre River Basin Selenium Phytoremediation: State of Colorado and USEPA, Grant # WQC 01-00057.

Goldy, R., 2013, Anions and cations in plants, oh my! But why do we care?: Michigan State University Extension.

Grismer, M. E., 2001 , Sudangrass uses water at rates similar to alfalfa, depending on location: California Agriculture, v. 55, n. 4, p. 44-48.

LeMahieu, P.J., Oplinger, E.S., and Putnam, D. H., 1991, Kenaf: Corn Agronomy, University of Wisconsin.

MacIntire, W.h., Winterberg, S.H., Thompson, J.G., and Hatcher, B.W., 1942, Fluorine Content of Plants: Industrial and Engineering Chemistry, v. 34, no. 12.

Meister, H. S., 2004, Sample cost to establish and produce Sudangrass: U.C. Cooperative Extension, SU-IM-04.

Niazy, M.M., El-Nennah, M., El Kassas, H. I., Mousa, I. A. A., in-press, Phytoremediation of Salt Affected Soils Through Seed Treatments: J Environ. Sci.

SARE, 2012, Managing Cover Crops Profitability: Sustainable Agriculture Research and Education (SARE), Handbook Series Book 9, 3rd edition.

Tahery, Y., Ahukor, N.A., Abdul-Hamid, H., 2011, Comparative water relation of three varieties of Hibiscus Cannabinus L. (Kenaf): African Journal of Biotechnology, v. 10(63), p. 13797-13801.

Webber, C.L. III, H.L. Bhardwaj, and V.K. Bledsoe. 2002. Kenaf production: Fiber, feed, and seed. p. 327–339. In: J. Janick and A. Whipkey (eds.), Trends in new crops and new uses. ASHS Press, Alexandria, VA.

Figures

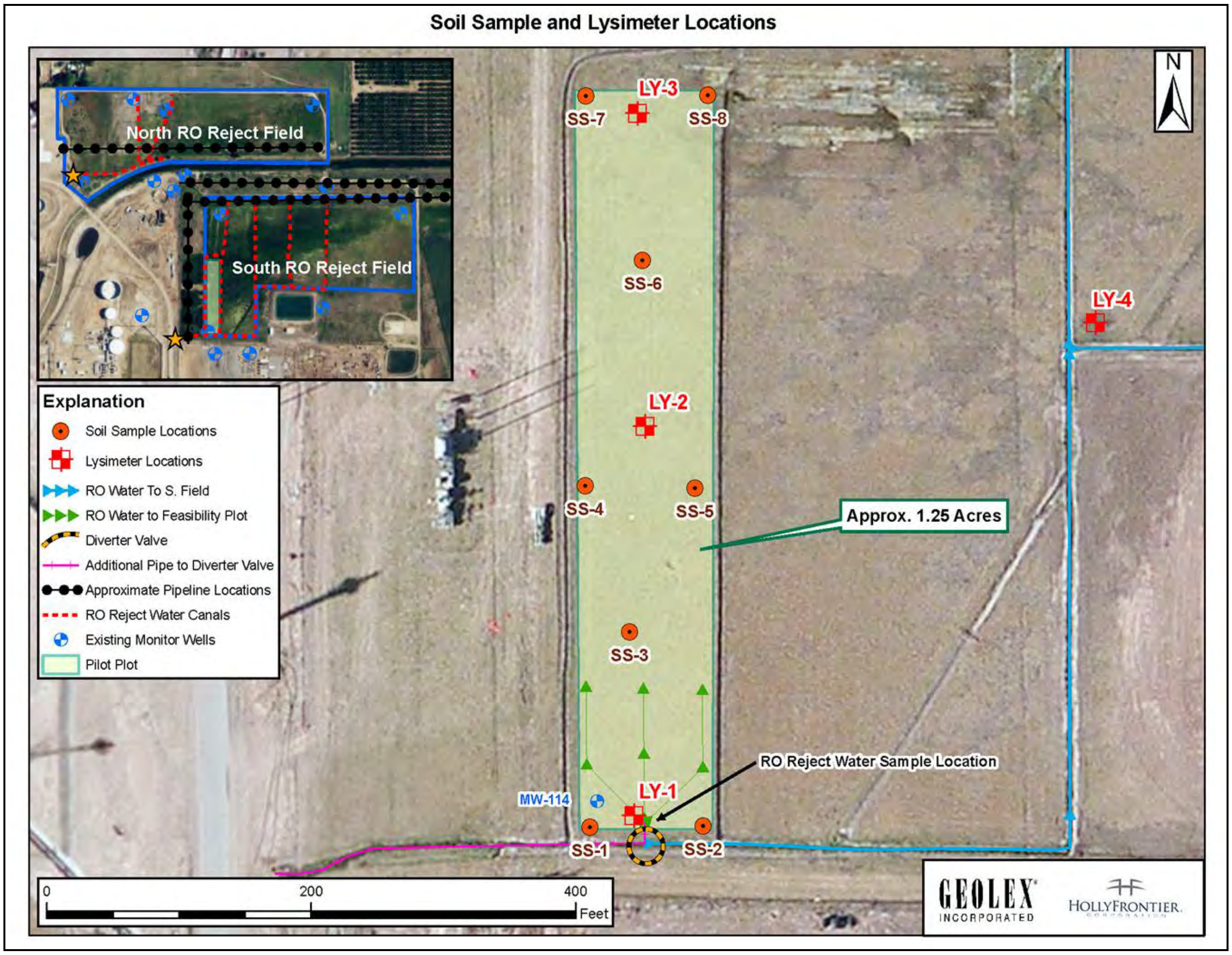

Figure 1: Map of Feasibility Plot with Locations of the Monitor Well, Soil Samples, and Lysimeters

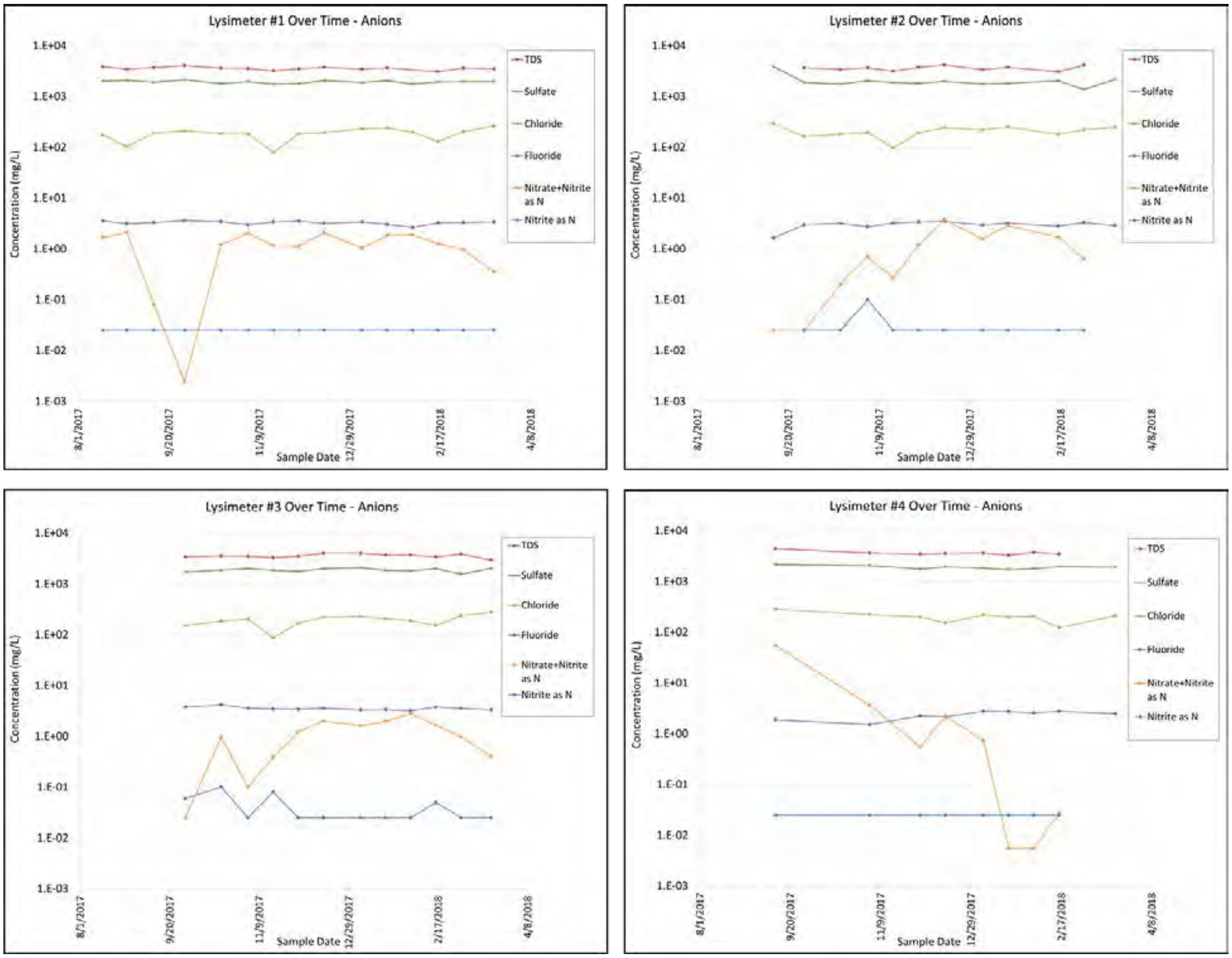

Figure 2: Concentration of Anions in Lysimeter Samples over Time

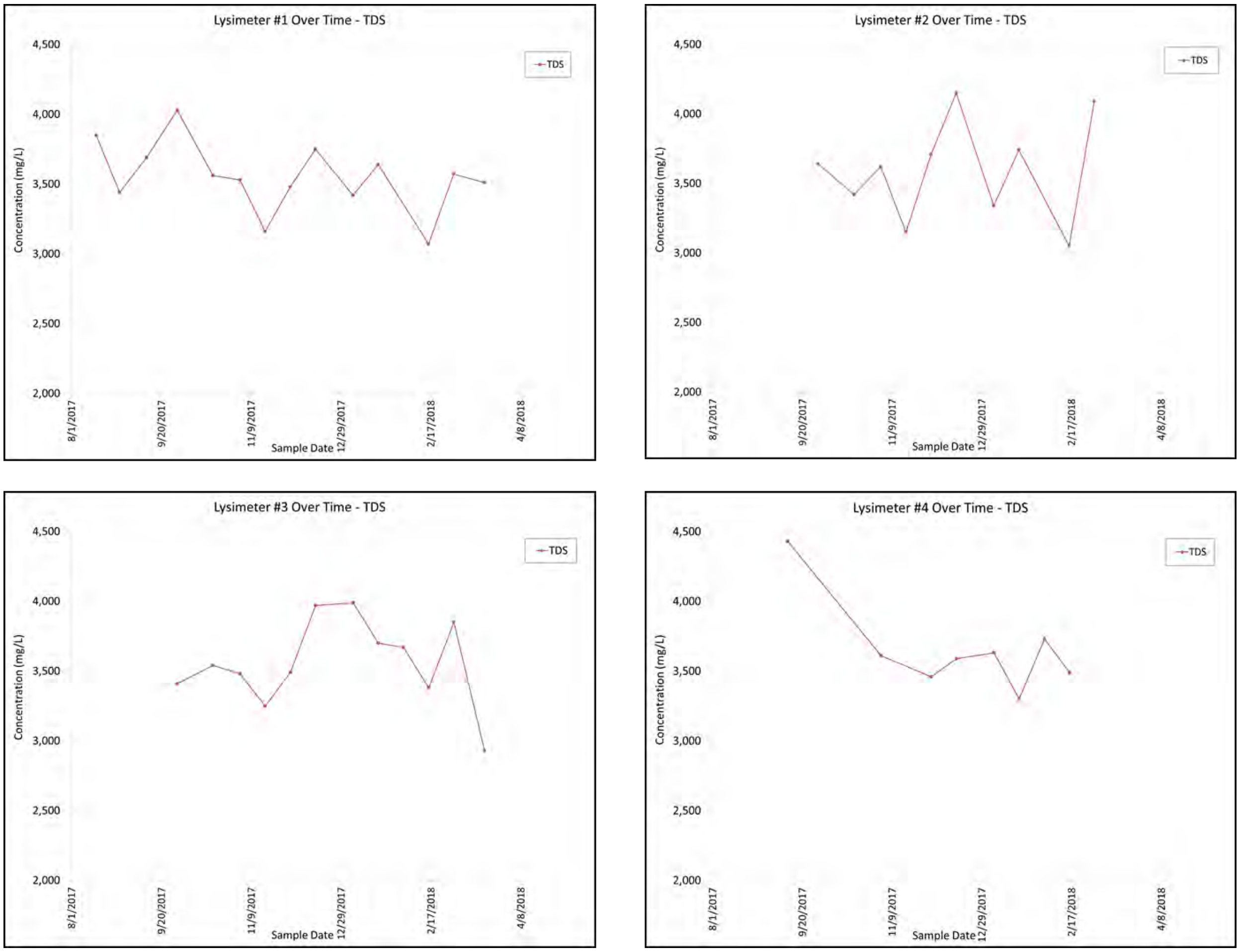

Figure 3: Concentration of TDS in Lysimeter Samples over Time

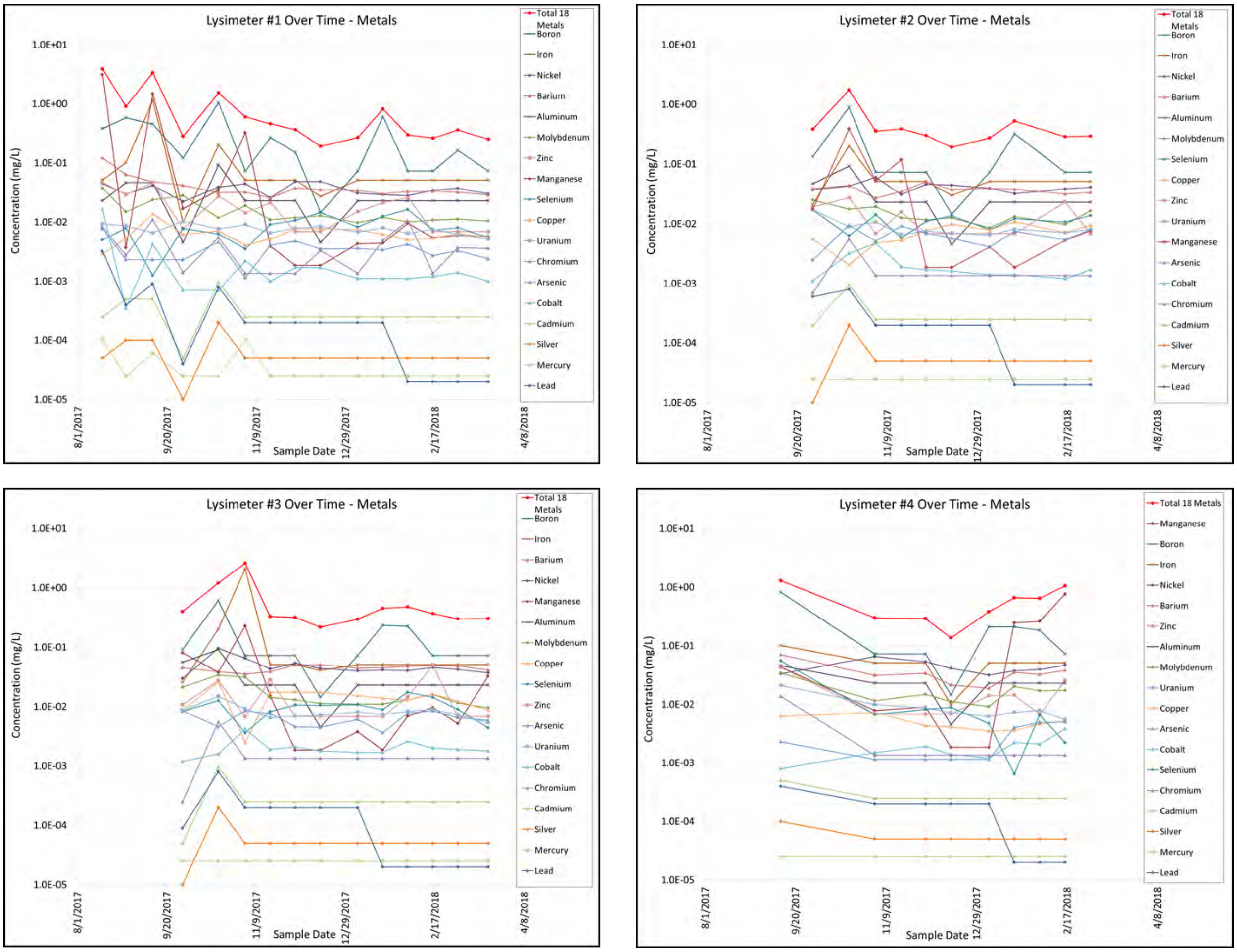

Figure 4: Concentration of Metals in Lysimeter Samples over Time

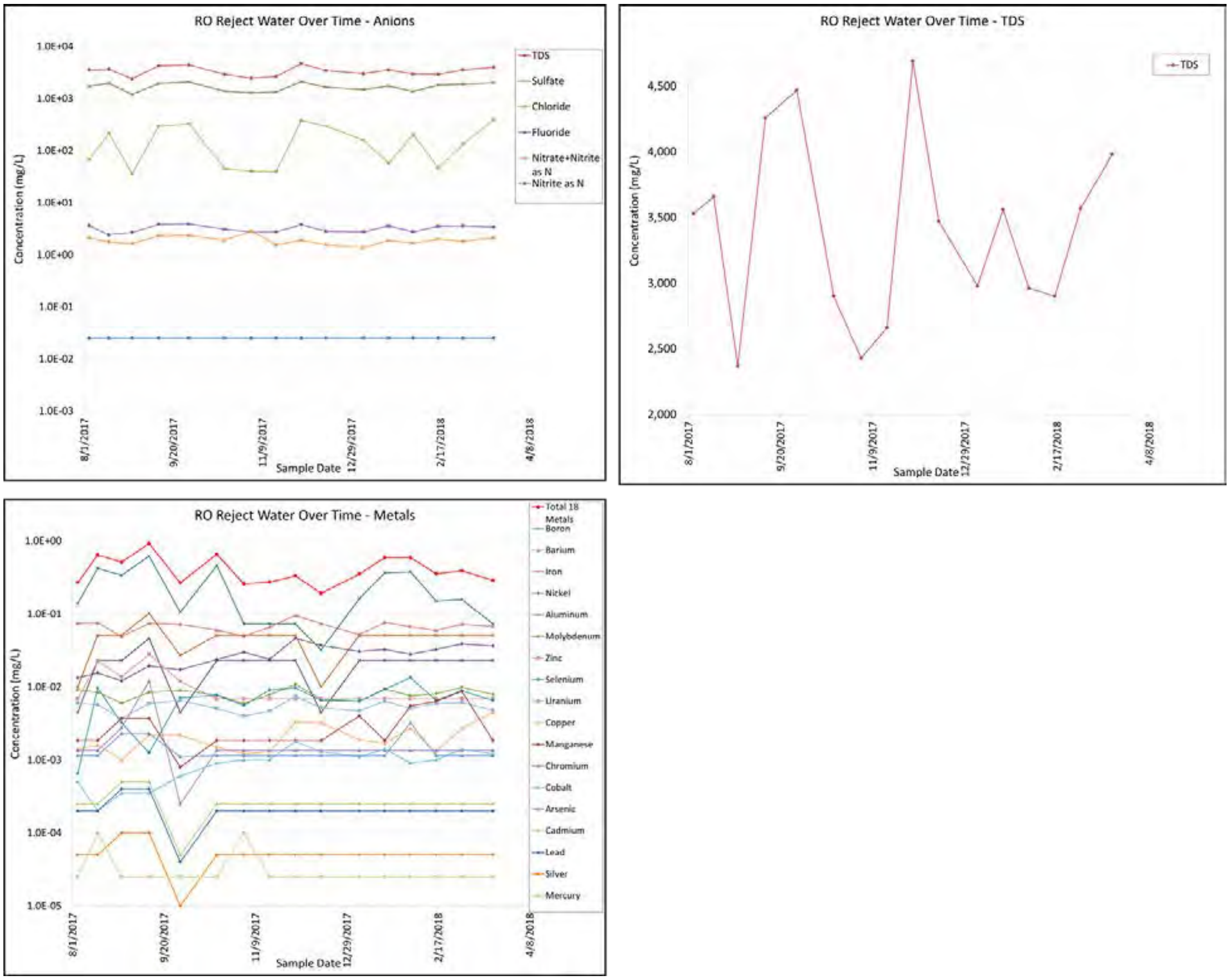

Figure 5: Concentration of COCs in RO-Reject Water Samples over Time

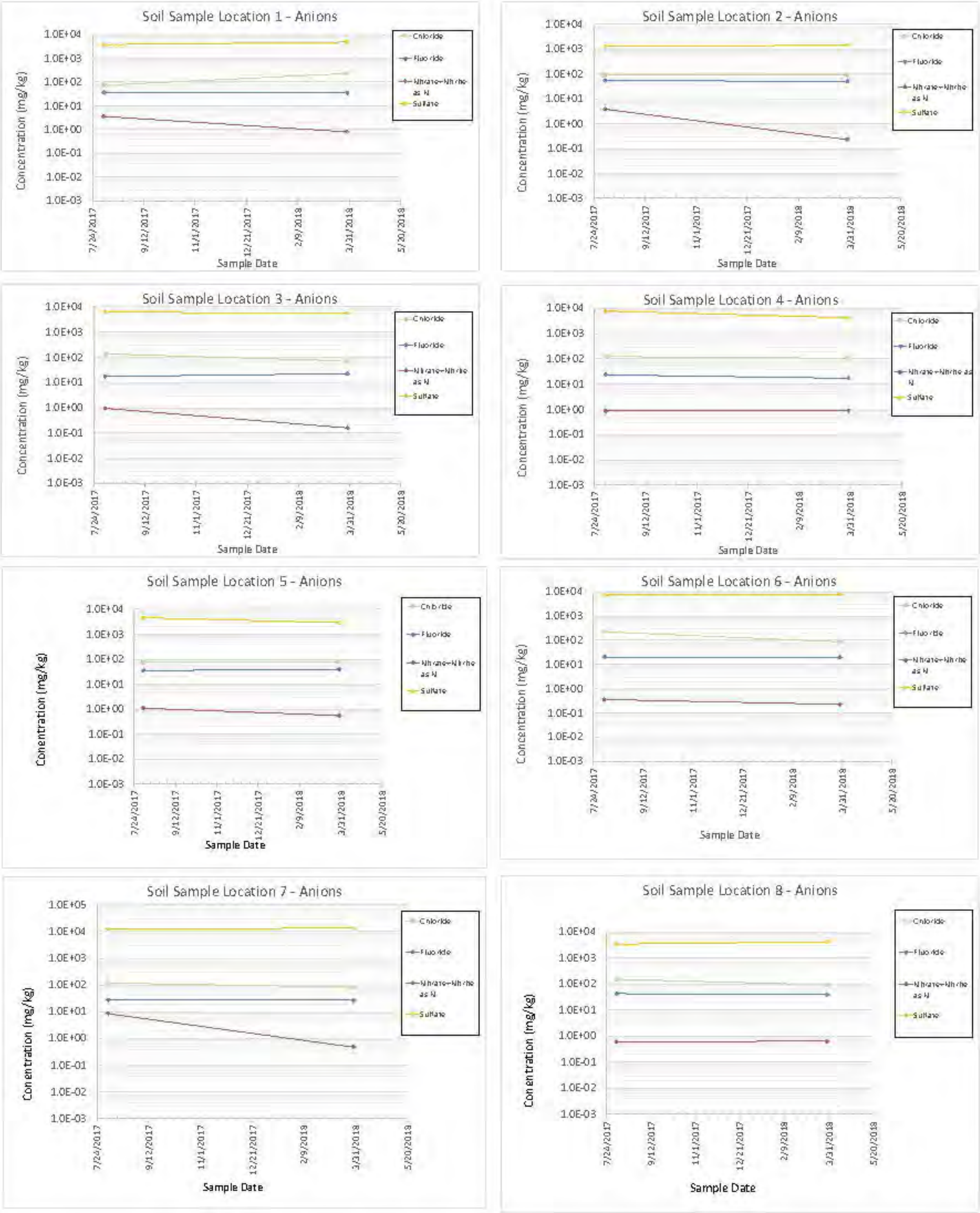

Figure 6: Concentration of Anions in Soil Samples over Time

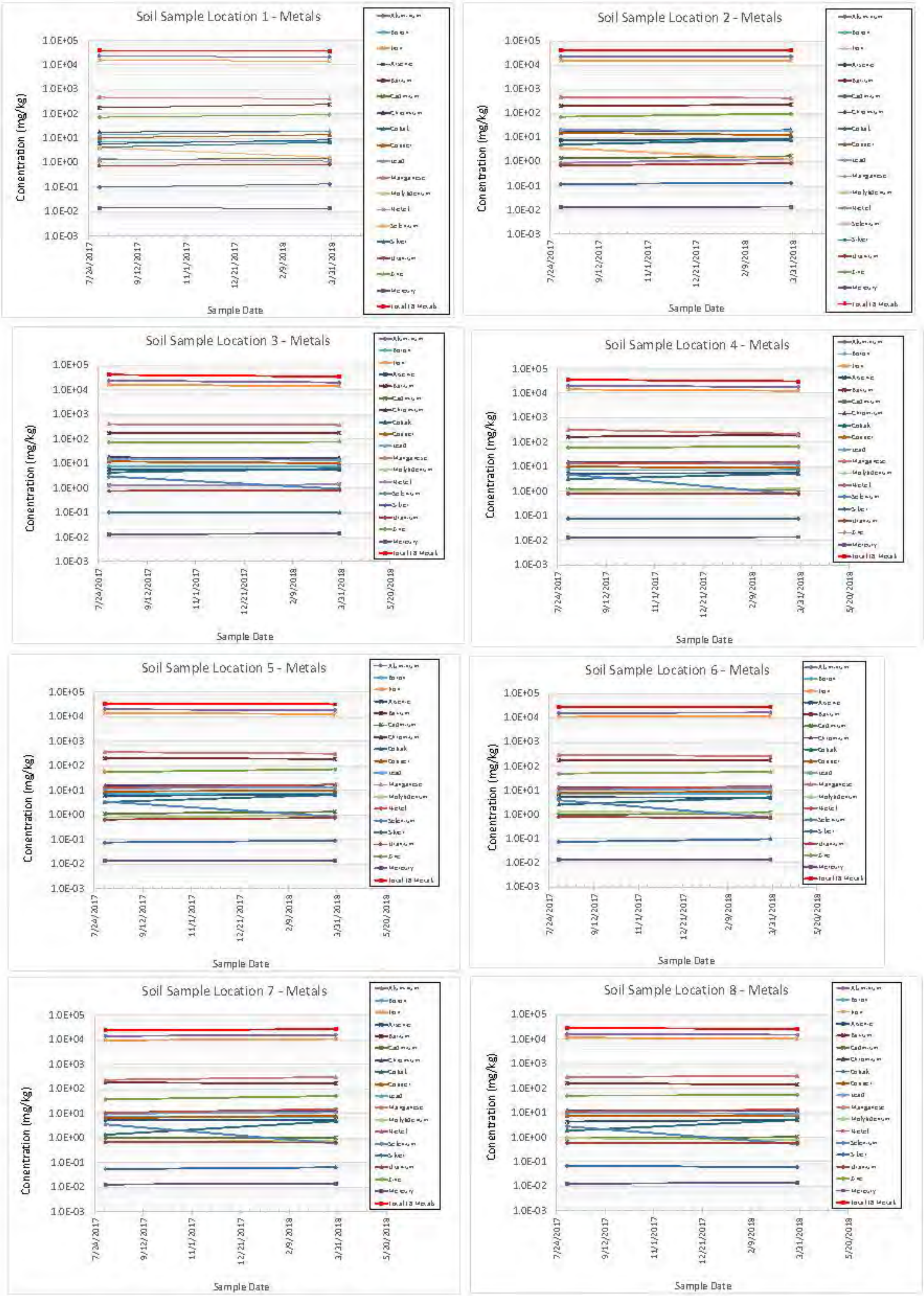

Figure 7: Concentration of Metals in Soil Samples over Time

Tables

				Anion		TDS		Anions					
Sample ID	Sample Date Time		Matrix	Nitrite as N	*Nitrite as N-RL*	TDS	*TDS-RL*	Chloride	*Chloride-MDL*	*Chloride-RL*	Fluoride	*Fluoride-MDL*	*Fluoride-RL*
				mg/L	*mg/L*	mg/L	*mg/L*	mg/L	*mg/L*	*mg/L*	mg/L	*mg/L*	*mg/L*
CGWSL				*1*		*500*		*250*			*1.6*		
*Screening Level Source**				*EPA MCL*		*EPA MCL2*		*WQCC Dom*			*WQCC HH*		
WS-LY1-20170815	8/15/2017	14:45	Ground Water	0.025	*0.05*	3850.0	*10.0*	169.0	*0.72*	5.0	3.53	*0.0798*	0.50
WS-LY1-20170828	8/28/2017	15:50	Ground Water	0.025	*0.05*	3440.0	*10.0*	104.0	*0.72*	5.0	3.10	*0.0798*	0.50
WS-LY1-20170912	9/12/2017	8:29	Ground Water	0.025	*0.05*	3690.0	*10.0*	189.0	*1.43*	10.0	3.26	*0.1600*	1.00
WS-LY4-20170912	9/12/2017	8:41	Ground Water	0.025	*0.05*	4430.0	*10.0*	285.0	*1.43*	10.0	1.90	*0.1600*	1.00
WS-LYZ-20170912	9/12/2017	11:37	Ground Water	NAF	*NAF*	NAF	*NAF*	290.0	*1.43*	10.0	1.61	*0.1600*	1.00
WS-LY1-20170929	9/29/2017	7:59	Ground Water	0.025	*0.05*	4030.0	*10.0*	211.0	*1.43*	10.0	3.59	*0.1600*	1.00
WS-LY2-20170929	9/29/2017	8:04	Ground Water	0.025	*0.05*	3640.0	*10.0*	162.0	*1.43*	10.0	2.99	*0.1600*	1.00
WS-LY3-20170929	9/29/2017	8:09	Ground Water	0.060	*0.05*	3410.0	*10.0*	150.0	*1.43*	10.0	3.78	*0.1600*	1.00
WS-LY1-20171019	10/19/2017	14:51	Ground Water	0.025	*0.05*	3560.0	*10.0*	183.0	*1.43*	10.0	3.42	*0.1600*	1.00
WS-LY2-20171019	10/19/2017	14:54	Ground Water	0.025	*0.05*	3420.0	*10.0*	179.0	*1.43*	10.0	3.14	*0.1600*	1.00
WS-LY3-20171019	10/19/2017	14:57	Ground Water	0.100	*0.05*	3540.0	*10.0*	185.0	*1.43*	10.0	4.22	*0.1600*	1.00
WS-LY1-20171103	11/3/2017	9:39	Ground Water	0.025	*0.05*	3530.0	*10.0*	181.0	*0.72*	5.0	2.98	*0.0798*	0.50
WS-LY2-20171103	11/3/2017	9:32	Ground Water	0.100	*0.05*	3620.0	*10.0*	195.0	*0.72*	5.0	2.74	*0.0798*	0.50
WS-LY3-20171103	11/3/2017	9:24	Ground Water	0.025	*0.05*	3480.0	*10.0*	202.0	*0.72*	5.0	3.56	*0.0798*	0.50
WS-LY4-20171103	11/3/2017	10:12	Ground Water	0.025	*0.05*	3610.0	*10.0*	222.0	*0.72*	5.0	1.53	*0.0798*	0.50
WS-LY1-20171117	11/17/2017	8:05	Ground Water	0.025	*0.05*	3160.0	*10.0*	79.4	*0.72*	5.0	3.39	*0.0798*	0.50
WS-LY2-20171117	11/17/2017	8:23	Ground Water	0.025	*0.05*	3150.0	*10.0*	97.2	*0.72*	5.0	3.21	*0.0798*	0.50
WS-LY3-20171117	11/17/2017	8:32	Ground Water	0.080	*0.05*	3250.0	*10.0*	86.5	*0.72*	5.0	3.44	*0.0798*	0.50
WS-LY1-20171201	12/1/2017	9:41	Ground Water	0.025	*0.05*	3480.0	*10.0*	185.0	*0.72*	5.0	3.52	*0.0798*	0.50
WS-LY2-20171201	12/1/2017	10:02	Ground Water	0.025	*0.05*	3710.0	*10.0*	191.0	*0.72*	5.0	3.37	*0.0798*	0.50
WS-LY3-20171201	12/1/2017	10:11	Ground Water	0.025	*0.05*	3490.0	*10.0*	170.0	*0.72*	5.0	3.37	*0.0798*	0.50
WS-LY4-20171201	12/1/2017	10:37	Ground Water	0.025	*0.05*	3460.0	*10.0*	200.0	*0.72*	5.0	2.26	*0.0798*	0.50
WS-LY1-20171215	12/15/2017	13:13	Ground Water	0.025	*0.05*	3750.0	*10.0*	193.0	*0.72*	5.0	3.14	*0.0798*	0.50
WS-LY2-20171215	12/15/2017	13:24	Ground Water	0.025	*0.05*	4150.0	*10.0*	243.0	*1.43*	10.0	3.48	*0.0798*	0.50
WS-LY3-20171215	12/15/2017	13:41	Ground Water	0.025	*0.05*	3970.0	*10.0*	221.0	*0.72*	5.0	3.56	*0.0798*	0.50
WS-LY4-20171215	12/15/2017	14:36	Ground Water	0.025	*0.05*	3590.0	*10.0*	153.0	*0.72*	5.0	2.17	*0.0798*	0.50
WS-LY1-20180105	1/5/2018	10:35	Ground Waer	0.025	*0.05*	3420.0	*10.0*	232.0	*0.72*	5.0	3.35	*0.0798*	0.50
WS-LY2-20180105	1/5/2018	10:20	Ground Water	0.025	*0.05*	3340.0	*10.0*	222.0	*0.72*	5.0	2.95	*0.0798*	0.50
WS-LY3-20180105	1/5/2018	10:42	Ground Water	0.025	*0.05*	3990.0	*10.0*	228.0	*7.17*	50.0	3.28	*0.0798*	0.50
WS-LY4-20180105	1/5/2018	10:02	Ground Water	0.025	*0.05*	3630.0	*10.0*	219.0	*7.17*	50.0	2.75	*0.0798*	0.50
WS-LY1-20180119	1/19/2018	9:25	Ground Water	0.025	*0.05*	3640.0	*10.0*	240.0	*0.72*	5.0	3.04	*0.0798*	0.50
WS-LY2-20180119	1/19/2018	9:43	Ground Water	0.025	*0.05*	3740.0	*10.0*	249.0	*0.72*	5.0	3.21	*0.0798*	0.50
WS-LY3-20180119	1/19/2018	9:54	Ground Water	0.025	*0.05*	3700.0	*10.0*	206.0	*0.72*	5.0	3.36	*0.0798*	0.50
WS-LY4-20180119	1/19/2018	10:06	Ground Water	0.025	*0.05*	3300.0	*10.0*	199.0	*0.72*	5.0	2.72	*0.0798*	0.50
WS-DUP-20180119	1/19/2018	0:00	Ground Water	0.025	*0.05*	3670.0	*10.0*	59.7	*0.72*	5.0	3.67	*0.0798*	0.50
WS-LY3-20180202	2/2/2018	11:53	Ground Water	0.025	*0.05*	3670.0	*10.0*	189.0	*0.72*	5.0	3.17	*0.0798*	0.50
WS-LY4-20180202	2/2/2018	11:22	Ground Water	0.025	*0.05*	3730.0	*10.0*	205.0	*0.72*	5.0	2.59	*0.0798*	0.50
WS-LY1-20180202	2/2/2018	13:28	Ground Water	0.025	*0.05*	NAF	*NAF*	196.0	*0.72*	5.0	2.66	*0.0798*	0.50
WS-LY1-20180216	2/16/2018	11:08	Ground Water	0.025	*0.05*	3070.0	*10.0*	128.0	*0.72*	5.0	3.23	*0.0798*	0.50
WS-LY2-20180216	2/16/2018	10:01	Ground Water	0.025	*0.05*	3050.0	*10.0*	178.0	*0.72*	5.0	2.78	*0.0798*	0.50
WS-LY3-20180216	2/16/2018	9:49	Ground Water	0.050	*0.05*	3380.0	*10.0*	152.0	*0.72*	5.0	3.75	*0.0798*	0.50
WS-LY4-20180216	2/16/2018	9:43	Ground Water	0.025	*0.05*	3490.0	*10.0*	123.0	*0.72*	5.0	2.74	*0.0798*	0.50
WS-LY1-20180302	3/2/2018	10:45	Ground Water	0.025	*0.05*	3570.0	*10.0*	203.0	*0.72*	5.0	3.29	*0.0798*	0.50
WS-LY2-20180302	3/2/2018	10:51	Ground Water	0.025	*0.05*	4090.0	*10.0*	221.0	*0.72*	5.0	3.28	*0.0798*	0.50
WS-LY3-20180302	3/2/2018	10:57	Ground Water	0.025	*0.05*	3850.0	*10.0*	236.0	*0.72*	5.0	3.52	*0.0798*	0.50
WS-DUP-20180319	3/19/2018	0:00	Ground Water	0.025	*0.05*	4150.0	*10.0*	409.0	*7.17*	50.0	3.52	*0.0798*	0.50
WS-LY1-20180319	3/19/2018	10:34	Ground Water	0.025	*0.05*	3510.0	*10.0*	265.0	*7.17*	50.0	3.39	*0.0798*	0.50
WS-LY3-20180319	3/19/2018	10:46	Ground Water	0.025	*0.05*	2930.0	*10.0*	279.0	*7.17*	50.0	3.28	*0.0798*	0.50
WS-LY4-20180319	3/19/2018	12:23	Ground Water	NAF	*NAF*	NAF	*NAF*	212.0	*0.72*	5.0	2.48	*0.0798*	0.50
WS-LY2-20180319	3/19/2018	12:31	Ground Water	NAF	*NAF*	NAF	*NAF*	247.0	*0.72*	5.0	2.88	*0.0798*	0.50
Average with 1/2 RL				***0.030638298***		***3594.1***		***196.5***			***3.10***		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results

					Anions Method: EPA300				
Sample ID	**Nitrate as N**	*Nitrate as N-MDL*	*Nitrate as N-RL*	**Nitrate+Nitrite as N**	*Nitrate+Nitrite as N-MDL*	*Nitrate+Nitrite as N-RL*	**Nitrite as N**	*Nitrite as N-MDL*	*Nitrite as N-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***10.0***			***10.0***			***10.0***		
*Screening Level Source**	***WQCC HH***			***WQCC HH***			***WQCC HH***		
WS-LY1-20170815	**NAF**	*NAF*	*NAF*	**1.660**	*0.051*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY1-20170828	**NAF**	*NAF*	*NAF*	**2.080**	*0.011*	*0.020*	**NAF**	*NAF*	*NAF*
WS-LY1-20170912	**NAF**	*NAF*	*NAF*	**0.080**	*0.011*	*0.020*	**NAF**	*NAF*	*NAF*
WS-LY4-20170912	**NAF**	*NAF*	*NAF*	**55.600**	*0.547*	*1.000*	**NAF**	*NAF*	*NAF*
WS-LYZ-20170912	**0.208**	*0.025*	*0.200*	**0.200**		*0.40*	**0.0125**	*0.025*	*0.200*
WS-LY1-20170929	**0.001**	*0.002*	*0.020*	**0.020**		*0.04*	**0.0010**	*0.002*	*0.020*
WS-LY2-20170929	**0.161**	*0.025*	*0.200*	**0.200**		*0.40*	**0.0125**	*0.025*	*0.200*
WS-LY3-20170929	**0.149**	*0.025*	*0.200*	**0.200**		*0.40*	**0.1090**	*0.025*	*0.200*
WS-LY1-20171019	**1.210**	*0.025*	*0.200*	**1.210**		*0.40*	**0.0125**	*0.025*	*0.200*
WS-LY2-20171019	**0.237**	*0.025*	*0.200*	**0.200**		*0.40*	**0.0125**	*0.025*	*0.200*
WS-LY3-20171019	**0.845**	*0.025*	*0.200*	**0.975**		*0.40*	**0.1300**	*0.025*	*0.200*
WS-LY1-20171103	**0.493**	*0.012*	*0.100*	**2.010**		*0.20*	**1.5200**	*0.012*	*0.100*
WS-LY2-20171103	**0.572**	*0.012*	*0.100*	**0.694**		*0.20*	**0.1220**	*0.012*	*0.100*
WS-LY3-20171103	**0.127**	*0.012*	*0.100*	**0.100**		*0.20*	**0.0540**	*0.012*	*0.100*
WS-LY4-20171103	**1.990**	*0.012*	*0.100*	**3.670**		*0.20*	**1.6800**	*0.012*	*0.100*
WS-LY1-20171117	**1.160**	*0.012*	*0.100*	**1.160**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY2-20171117	**0.264**	*0.012*	*0.100*	**0.264**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY3-20171117	**0.292**	*0.012*	*0.100*	**0.390**		*0.20*	**0.0990**	*0.012*	*0.100*
WS-LY1-20171201	**1.120**	*0.012*	*0.100*	**1.120**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY2-20171201	**1.190**	*0.012*	*0.100*	**1.190**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY3-20171201	**1.150**	*0.012*	*0.100*	**1.230**		*0.20*	**0.0820**	*0.012*	*0.100*
WS-LY4-20171201	**0.550**	*0.012*	*0.100*	**0.550**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY1-20171215	**2.060**	*0.012*	*0.100*	**2.060**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY2-20171215	**3.740**	*0.012*	*0.100*	**3.740**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY3-20171215	**2.000**	*0.012*	*0.100*	**2.000**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY4-20171215	**2.180**	*0.012*	*0.100*	**2.180**		*0.20*	**0.0060**	*0.012*	*0.100*
WS-LY1-20180105	**NAF**	*NAF*	*NAF*	**1.040**	*0.055*	*0.200*	**NAF**	*NAF*	*NAF*
WS-LY2-20180105	**NAF**	*NAF*	*NAF*	**1.550**	*0.055*	*0.200*	**NAF**	*NAF*	*NAF*
WS-LY3-20180105	**NAF**	*NAF*	*NAF*	**1.630**	*0.055*	*0.200*	**NAF**	*NAF*	*NAF*
WS-LY4-20180105	**NAF**	*NAF*	*NAF*	**0.742**	*0.011*	*0.040*	**NAF**	*NAF*	*NAF*
WS-LY1-20180119	**NAF**	*NAF*	*NAF*	**1.810**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY2-20180119	**NAF**	*NAF*	*NAF*	**2.890**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY3-20180119	**NAF**	*NAF*	*NAF*	**1.990**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY4-20180119	**NAF**	*NAF*	*NAF*	**0.006**	*0.011*	*0.020*	**NAF**	*NAF*	*NAF*
WS-DUP-20180119	**NAF**	*NAF*	*NAF*	**1.910**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY3-20180202	**NAF**	*NAF*	*NAF*	**2.800**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY4-20180202	**NAF**	*NAF*	*NAF*	**0.006**	*0.011*	*0.020*	**NAF**	*NAF*	*NAF*
WS-LY1-20180202	**NAF**	*NAF*	*NAF*	**1.880**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY1-20180216	**NAF**	*NAF*	*NAF*	**1.250**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY2-20180216	**NAF**	*NAF*	*NAF*	**1.690**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY3-20180216	**NAF**	*NAF*	*NAF*	**1.650**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY4-20180216	**NAF**	*NAF*	*NAF*	**0.028**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY1-20180302	**NAF**	*NAF*	*NAF*	**0.974**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY2-20180302	**NAF**	*NAF*	*NAF*	**0.641**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY3-20180302	**NAF**	*NAF*	*NAF*	**0.987**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-DUP-20180319	**NAF**	*NAF*	*NAF*	**2.110**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY1-20180319	**NAF**	*NAF*	*NAF*	**0.351**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY3-20180319	**NAF**	*NAF*	*NAF*	**0.396**	*0.055*	*0.100*	**NAF**	*NAF*	*NAF*
WS-LY4-20180319	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*
WS-LY2-20180319	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*
Average with 1/2 RL	**0.99**			***2.36***			**0.18**		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results continued

	Anions Method: EPA300			Total Recoverable Metals								
Sample ID	Sulfate	Sulfate-MDL	Sulfate-RL	Aluminum	Aluminum-MDL	Aluminum-RL	Boron	Boron-MDL	Boron-RL	Iron	Iron-MDL	Iron-RL
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CGWSL	250			0.05			0.75			0.3		
Screening Level Source*	EPA MCL2			EPA MCL2			WQCC Irr			EPA MCL2		
WS-LY1-20170815	2000	15.6	100.0	0.0230	0.046	0.250	0.381	0.145	1.50	0.051	0.102	0.250
WS-LY1-20170828	2060	7.82	50.0	0.0460	0.092	0.500	0.584	0.290	3.00	0.102	0.203	0.500
WS-LY1-20170912	1890	15.6	100.0	0.0460	0.092	0.500	0.451	0.290	3.00	1.150	0.203	0.500
WS-LY4-20170912	2180	15.6	100.0	0.0460	0.092	0.500	0.819	0.290	3.00	0.102	0.203	0.500
WS-LYZ-20170912	3900	31.3	200.0	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA
WS-LY1-20170929	2140	15.6	100.0	0.0045	0.009	0.050	0.121	0.029	0.30	0.010	0.020	0.050
WS-LY2-20170929	1850	15.6	100.0	0.0470	0.009	0.505	0.134	0.029	0.30	0.021	0.020	0.050
WS-LY3-20170929	1700	15.6	100.0	0.0560	0.009	0.050	0.092	0.029	0.30	0.026	0.020	0.050
WS-LY1-20171019	1770	15.6	100.0	0.0920	0.184	1.000	1.050	0.581	6.00	0.203	0.406	1.000
WS-LY2-20171019	1750	15.6	100.0	0.0920	0.184	1.000	0.890	0.581	6.00	0.203	0.406	1.000
WS-LY3-20171019	1850	15.6	100.0	0.0920	0.184	1.000	0.612	0.581	6.00	0.203	0.406	1.000
WS-LY1-20171103	1940	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY2-20171103	2030	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20171103	1980	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	2.110	0.102	0.250
WS-LY4-20171103	2050	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY1-20171117	1730	7.82	50.0	0.0230	0.046	0.250	0.269	0.145	1.50	0.051	0.102	0.250
WS-LY2-20171117	1850	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20171117	1830	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY1-20171201	1760	15.6	100.0	0.0230	0.046	0.250	0.151	0.145	1.50	0.051	0.102	0.250
WS-LY2-20171201	1780	15.6	100.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20171201	1750	15.6	100.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY4-20171201	1750	15.6	100.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY1-20171215	2030	7.82	50.0	0.0045	0.009	0.050	0.015	0.029	0.30	0.027	0.020	0.050
WS-LY2-20171215	1960	15.6	100.0	0.0045	0.009	0.050	0.015	0.029	0.30	0.030	0.020	0.050
WS-LY3-20171215	2000	7.82	50.0	0.0045	0.009	0.050	0.015	0.029	0.30	0.041	0.020	0.050
WS-LY4-20171215	1930	7.82	50.0	0.0045	0.009	0.050	0.015	0.029	0.30	0.010	0.020	0.050
WS-LY1-20180105	1860	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY2-20180105	1740	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20180105	2060	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY4-20180105	1820	7.82	50.0	0.0230	0.046	0.250	0.211	0.145	1.50	0.051	0.102	0.250
WS-LY1-20180119	2030	15.6	100.0	0.0230	0.046	0.250	0.606	0.145	1.50	0.051	0.102	0.250
WS-LY2-20180119	1790	15.6	100.0	0.0230	0.046	0.250	0.321	0.145	1.50	0.051	0.102	0.250
WS-LY3-20180119	1840	15.6	100.0	0.0230	0.046	0.250	0.235	0.145	1.50	0.051	0.102	0.250
WS-LY4-20180119	1710	15.6	100.0	0.0230	0.046	0.250	0.212	0.145	1.50	0.051	0.102	0.250
WS-DUP-20180119	1750	15.6	100.0	0.0230	0.046	0.250	0.203	0.145	1.50	0.051	0.102	0.250
WS-LY3-20180202	1780	15.6	100.0	0.0230	0.046	0.250	0.227	0.145	1.50	0.051	0.102	0.250
WS-LY4-20180202	1770	15.6	100.0	0.0230	0.046	0.250	0.185	0.145	1.50	0.051	0.102	0.250
WS-LY1-20180202	1750	15.6	100.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY1-20180216	1910	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY2-20180216	2010	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20180216	1980	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY4-20180216	1960	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY1-20180302	1940	7.82	50.0	0.0230	0.046	0.250	0.163	0.145	1.50	0.051	0.102	0.250
WS-LY2-20180302	1370	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20180302	1550	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-DUP-20180319	2100	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY1-20180319	1940	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY3-20180319	2010	7.82	50.0	0.0230	0.046	0.250	0.073	0.145	1.50	0.051	0.102	0.250
WS-LY4-20180319	1900	7.82	50.0	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
WS-LY2-20180319	2160	7.82	50.0	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Average with 1/2 RL	*1923.8*			*0.028*			*0.20*			*0.126*		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results continued

	Total Recoverable Metals											
Sample ID	Arsenic	Arsenic-MDL	Arsenic-RL	Barium	Barium-MDL	Barium-RL	Cadmium	Cadmium-MDL	Cadmium-RL	Chromium	Chromium-MDL	Chromium-RL
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CGWSL	0.01			1.0			0.01			0.05		
Screening Level Source*	EPA MCL			WQCC HH			WQCC HH			WQCC HH		
WS-LY1-20170815	0.0077	0.0023	0.005	0.1220	0.0013	0.0025	0.00025	0.0005	0.0025	0.00830	0.0027	0.010
WS-LY1-20170828	0.0023	0.0046	0.010	0.0637	0.0027	0.0050	0.00050	0.0010	0.0050	0.00275	0.0055	0.020
WS-LY1-20170912	0.0023	0.0046	0.010	0.0479	0.0027	0.0050	0.00050	0.0010	0.0050	0.01090	0.0055	0.020
WS-LY4-20170912	0.0023	0.0046	0.010	0.0703	0.0027	0.0050	0.00050	0.0010	0.0050	0.01370	0.0055	0.020
WS-LYZ-20170912	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA
WS-LY1-20170929	0.0023	0.0005	0.001	0.0416	0.0003	0.0005	0.00005	0.0001	0.0005	0.00140	0.0005	0.001
WS-LY2-20170929	0.0025	0.0005	0.001	0.0386	0.0003	0.0005	0.00020	0.0001	0.0005	0.00070	0.0005	0.001
WS-LY3-20170929	0.0085	0.0005	0.001	0.0456	0.0003	0.0005	0.00005	0.0001	0.0005	0.00025	0.0005	0.001
WS-LY1-20171019	0.0046	0.0092	0.02	0.0315	0.0054	0.0100	0.00095	0.0019	0.0100	0.00550	0.0110	0.040
WS-LY2-20171019	0.0095	0.0092	0.02	0.0440	0.0054	0.0100	0.00095	0.0019	0.0100	0.00550	0.0110	0.040
WS-LY3-20171019	0.0046	0.0092	0.02	0.0388	0.0054	0.0100	0.00095	0.0019	0.0100	0.00550	0.0110	0.040
WS-LY1-20171103	0.0012	0.0023	0.005	0.0321	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY2-20171103	0.0051	0.0023	0.005	0.0270	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY3-20171103	0.0085	0.0023	0.005	0.0354	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY4-20171103	0.0012	0.0023	0.005	0.0315	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY1-20171117	0.0041	0.0023	0.005	0.0255	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY2-20171117	0.0092	0.0023	0.005	0.0347	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY3-20171117	0.0077	0.0023	0.005	0.0388	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY1-20171201	0.0048	0.0023	0.005	0.0375	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.010
WS-LY2-20171201	0.0070	0.0023	0.005	0.0507	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20171201	0.0046	0.0023	0.005	0.0502	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20171201	0.0012	0.0023	0.005	0.0340	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY1-20171215	0.0035	0.0023	0.005	0.0352	0.0013	0.0025	0.00025	0.0005	0.0025	0.00330	0.0027	0.005
WS-LY2-20171215	0.0057	0.0023	0.005	0.0375	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20171215	0.0045	0.0023	0.005	0.0510	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20171215	0.0012	0.0023	0.005	0.0215	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY1-20180105	0.0036	0.0023	0.005	0.0346	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY2-20180105	0.0041	0.0023	0.005	0.0391	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20180105	0.0061	0.0023	0.005	0.0449	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20180105	0.0012	0.0023	0.005	0.0189	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY1-20180119	0.0034	0.0023	0.005	0.0300	0.0013	0.0025	0.00025	0.0005	0.0025	0.00490	0.0027	0.005
WS-LY2-20180119	0.0075	0.0023	0.005	0.0379	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20180119	0.0036	0.0023	0.005	0.0457	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20180119	0.0040	0.0023	0.005	0.0351	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-DUP-20180119	0.0012	0.0023	0.005	0.0849	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20180202	0.0078	0.0023	0.005	0.0483	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20180202	0.0049	0.0023	0.005	0.0324	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY1-20180202	0.0042	0.0023	0.005	0.0329	0.0013	0.0025	0.00025	0.0005	0.0025	0.01060	0.0027	0.005
WS-LY1-20180216	0.0027	0.0023	0.005	0.0332	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY2-20180216	0.0054	0.0023	0.005	0.0315	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20180216	0.0085	0.0023	0.005	0.0493	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20180216	0.0050	0.0023	0.005	0.0380	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY1-20180302	0.0033	0.0023	0.005	0.0321	0.0013	0.0025	0.00025	0.0005	0.0025	0.00370	0.0027	0.005
WS-LY2-20180302	0.0080	0.0023	0.005	0.0336	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY3-20180302	0.0065	0.0023	0.005	0.0486	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-DUP-20180319	0.0012	0.0023	0.005	0.0671	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY1-20180319	0.0024	0.0023	0.005	0.0286	0.0013	0.0025	0.00025	0.0005	0.0025	0.00360	0.0027	0.005
WS-LY3-20180319	0.0059	0.0023	0.005	0.0418	0.0013	0.0025	0.00025	0.0005	0.0025	0.00135	0.0027	0.005
WS-LY4-20180319	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
WS-LY2-20180319	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Average with 1/2 RL	*0.0046*			*0.042*			*0.00030*			*#REF!*		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results continued

	Total Recoverable Metals											
Sample ID	Cobalt	Cobalt-MDL	Cobalt-RL	Copper	Copper-MDL	Copper-RL	Lead	Lead-MDL	Lead-RL	Manganese	Manganese-MDL	Manganese-RL
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CGWSL	0.05			1.0			0.015			0.05		
Screening Level Source*	WQCC Irr			WQCC Irr			WQCC HH			EPA MCL2		
WS-LY1-20170815	0.0163	0.00040	0.0025	0.0029	0.0010	0.0025	0.00320	0.00040	0.00250	3.1100	0.004	0.010
WS-LY1-20170828	0.0004	0.00070	0.0050	0.0053	0.0020	0.0050	0.00040	0.00080	0.00500	0.0037	0.007	0.020
WS-LY1-20170912	0.0042	0.00070	0.0050	0.0138	0.0020	0.0050	0.00090	0.00080	0.00500	1.4800	0.007	0.020
WS-LY4-20170912	0.0008	0.00070	0.0050	0.0063	0.0020	0.0050	0.00040	0.00080	0.00500	0.0437	0.007	0.020
WS-LYZ-20170912	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA
WS-LY1-20170929	0.0007	0.00007	0.0005	0.0062	0.0002	0.0005	0.00004	0.00008	0.00050	0.0169	0.001	0.002
WS-LY2-20170929	0.0011	0.00007	0.0005	0.0055	0.0002	0.0005	0.00060	0.00008	0.00050	0.0174	0.001	0.002
WS-LY3-20170929	0.0012	0.00007	0.0005	0.0086	0.0002	0.0005	0.00009	0.00008	0.00050	0.0812	0.001	0.002
WS-LY1-20171019	0.0007	0.00140	0.0100	0.0070	0.0041	0.0100	0.00080	0.00160	0.01000	0.0349	0.015	0.040
WS-LY2-20171019	0.0032	0.00140	0.0100	0.0021	0.0041	0.0100	0.00080	0.00160	0.01000	0.3880	0.015	0.040
WS-LY3-20171019	0.0016	0.00140	0.0100	0.0266	0.0041	0.0100	0.00080	0.00160	0.01000	0.0381	0.015	0.040
WS-LY1-20171103	0.0022	0.00040	0.0025	0.0041	0.0010	0.0025	0.00020	0.00040	0.00250	0.3250	0.004	0.010
WS-LY2-20171103	0.0047	0.00040	0.0025	0.0048	0.0010	0.0025	0.00020	0.00040	0.00250	0.0530	0.004	0.010
WS-LY3-20171103	0.0042	0.00040	0.0025	0.0025	0.0010	0.0025	0.00020	0.00040	0.00250	0.2290	0.004	0.010
WS-LY4-20171103	0.0015	0.00040	0.0025	0.0072	0.0010	0.0025	0.00020	0.00040	0.00250	0.0078	0.004	0.010
WS-LY1-20171117	0.0010	0.00040	0.0025	0.0052	0.0010	0.0025	0.00020	0.00040	0.00250	0.0039	0.004	0.010
WS-LY2-20171117	0.0019	0.00040	0.0025	0.0053	0.0010	0.0025	0.00020	0.00040	0.00250	0.1180	0.004	0.010
WS-LY3-20171117	0.0019	0.00040	0.0025	0.0174	0.0010	0.0025	0.00020	0.00040	0.00250	0.0152	0.004	0.010
WS-LY1-20171201	0.0017	0.00040	0.0025	0.0076	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY2-20171201	0.0017	0.00040	0.0025	0.0077	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY3-20171201	0.0021	0.00040	0.0025	0.0179	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY4-20171201	0.0019	0.00040	0.0025	0.0043	0.0010	0.0025	0.00020	0.00040	0.00250	0.0090	0.004	0.010
WS-LY1-20171215	0.0017	0.00040	0.0025	0.0078	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY2-20171215	0.0016	0.00040	0.0025	0.0098	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY3-20171215	0.0018	0.00040	0.0025	0.0176	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY4-20171215	0.0014	0.00040	0.0025	0.0041	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY1-20180105	0.0011	0.00040	0.0025	0.0074	0.0010	0.0025	0.00020	0.00040	0.00250	0.0043	0.004	0.010
WS-LY2-20180105	0.0014	0.00040	0.0025	0.0079	0.0010	0.0025	0.00020	0.00040	0.00250	0.0041	0.004	0.010
WS-LY3-20180105	0.0017	0.00040	0.0025	0.0154	0.0010	0.0025	0.00020	0.00040	0.00250	0.0038	0.004	0.010
WS-LY4-20180105	0.0012	0.00040	0.0025	0.0035	0.0010	0.0025	0.00020	0.00040	0.00250	0.0019	0.004	0.010
WS-LY1-20180119	0.0011	0.00040	0.0025	0.0062	0.0010	0.0025	0.00020	0.00040	0.00250	0.0044	0.004	0.010
WS-LY2-20180119	0.0014	0.00040	0.0025	0.0109	0.0010	0.0025	0.00002	0.00004	0.00250	0.0019	0.004	0.010
WS-LY3-20180119	0.0017	0.00040	0.0025	0.0139	0.0010	0.0025	0.00002	0.00004	0.00250	0.0019	0.004	0.010
WS-LY4-20180119	0.0022	0.00040	0.0025	0.0036	0.0010	0.0025	0.00002	0.00004	0.00250	0.2490	0.004	0.010
WS-DUP-20180119	0.0012	0.00040	0.0025	0.0015	0.0010	0.0025	0.00002	0.00004	0.00250	0.0019	0.004	0.010
WS-LY3-20180202	0.0026	0.00040	0.0025	0.0132	0.0010	0.0025	0.00002	0.00004	0.00250	0.0069	0.004	0.010
WS-LY4-20180202	0.0021	0.00040	0.0025	0.0046	0.0010	0.0025	0.00002	0.00004	0.00250	0.2630	0.004	0.010
WS-LY1-20180202	0.0011	0.00040	0.0025	0.0050	0.0010	0.0025	0.00002	0.00004	0.00250	0.0096	0.004	0.010
WS-LY1-20180216	0.0012	0.00040	0.0025	0.0053	0.0010	0.0025	0.00002	0.00004	0.00250	0.0054	0.004	0.010
WS-LY2-20180216	0.0012	0.00040	0.0025	0.0071	0.0010	0.0025	0.00002	0.00004	0.00250	0.0053	0.004	0.010
WS-LY3-20180216	0.0020	0.00040	0.0025	0.0162	0.0010	0.0025	0.00002	0.00004	0.00250	0.0097	0.004	0.010
WS-LY4-20180216	0.0038	0.00040	0.0025	0.0051	0.0010	0.0025	0.00002	0.00004	0.00250	0.7610	0.004	0.010
WS-LY1-20180302	0.0014	0.00040	0.0025	0.0064	0.0010	0.0025	0.00002	0.00004	0.00250	0.0059	0.004	0.010
WS-LY2-20180302	0.0017	0.00040	0.0025	0.0095	0.0010	0.0025	0.00002	0.00004	0.00250	0.0077	0.004	0.010
WS-LY3-20180302	0.0019	0.00040	0.0025	0.0124	0.0010	0.0025	0.00002	0.00004	0.00250	0.0052	0.004	0.010
WS-DUP-20180319	0.0011	0.00040	0.0025	0.0045	0.0010	0.0025	0.00002	0.00004	0.00250	0.0019	0.004	0.010
WS-LY1-20180319	0.0010	0.00040	0.0025	0.0055	0.0010	0.0025	0.00002	0.00004	0.00250	0.0057	0.004	0.010
WS-LY3-20180319	0.0018	0.00040	0.0025	0.0088	0.0010	0.0025	0.00002	0.00004	0.00250	0.0329	0.004	0.010
WS-LY4-20180319	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
WS-LY2-20180319	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Average with 1/2 RL	*0.0021*			*0.0081*			*0.0003*			*0.16*		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results continued

	Total Recoverable Metals											
Sample ID	Molybdenum	Molybdenum-MDL	Molybdenum-RL	Nickel	Nickel-MDL	Nickel-RL	Selenium	Selenium-MDL	Selenium-RL	Silver	Silver-MDL	Silver-RL
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CGWSL	1.0			0.2			0.05			0.05		
Screening Level Source*	WQCC Irr			WQCC Irr			WQCC HH			WQCC HH		
WS-LY1-20170815	0.0376	0.00030	0.0025	0.0446	0.0015	0.005	0.0050	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20170828	0.0149	0.00060	0.0050	0.0297	0.0030	0.010	0.0079	0.0025	0.010	0.00010	0.00020	0.0050
WS-LY1-20170912	0.0237	0.00060	0.0050	0.0418	0.0030	0.010	0.0013	0.0025	0.010	0.00010	0.00020	0.0050
WS-LY4-20170912	0.0344	0.00060	0.0050	0.0333	0.0030	0.010	0.0552	0.0025	0.010	0.00010	0.00020	0.0050
WS-LYZ-20170912	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA	NAF	NA	NA
WS-LY1-20170929	0.0281	0.00006	0.0005	0.0220	0.0003	0.001	0.0078	0.0003	0.001	0.00001	0.00002	0.0005
WS-LY2-20170929	0.0249	0.00006	0.0005	0.0372	0.0003	0.001	0.0171	0.0003	0.001	0.00001	0.00002	0.0005
WS-LY3-20170929	0.0213	0.00006	0.0005	0.0301	0.0003	0.001	0.0084	0.0003	0.001	0.00001	0.00002	0.0005
WS-LY1-20171019	0.0118	0.00120	0.0100	0.0392	0.0059	0.020	0.0063	0.0050	0.020	0.00020	0.00040	0.0100
WS-LY2-20171019	0.0176	0.00120	0.0100	0.0429	0.0059	0.020	0.0063	0.0050	0.020	0.00020	0.00040	0.0100
WS-LY3-20171019	0.0343	0.00120	0.0100	0.0958	0.0059	0.020	0.0127	0.0050	0.020	0.00020	0.00040	0.0100
WS-LY1-20171103	0.0189	0.00030	0.0025	0.0441	0.0015	0.005	0.0035	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20171103	0.0193	0.00030	0.0025	0.0600	0.0015	0.005	0.0143	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20171103	0.0312	0.00030	0.0025	0.0654	0.0015	0.005	0.0036	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20171103	0.0116	0.00030	0.0025	0.0654	0.0015	0.005	0.0067	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20171117	0.0110	0.00030	0.0025	0.0260	0.0015	0.005	0.0091	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20171117	0.0126	0.00030	0.0025	0.0309	0.0015	0.005	0.0058	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20171117	0.0144	0.00030	0.0025	0.0437	0.0015	0.005	0.0083	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20171201	0.0118	0.00030	0.0025	0.0482	0.0015	0.005	0.0107	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20171201	0.0116	0.00030	0.0025	0.0457	0.0015	0.005	0.0110	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20171201	0.0132	0.00030	0.0025	0.0539	0.0015	0.005	0.0107	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20171201	0.0149	0.00030	0.0025	0.0532	0.0015	0.005	0.0082	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20171215	0.0129	0.00030	0.0025	0.0483	0.0015	0.005	0.0146	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20171215	0.0125	0.00030	0.0025	0.0441	0.0015	0.005	0.0136	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20171215	0.0113	0.00030	0.0025	0.0447	0.0015	0.005	0.0106	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20171215	0.0112	0.00030	0.0025	0.0413	0.0015	0.005	0.0089	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20180105	0.0098	0.00030	0.0025	0.0306	0.0015	0.005	0.0082	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20180105	0.0086	0.00030	0.0025	0.0398	0.0015	0.005	0.0080	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20180105	0.0111	0.00030	0.0025	0.0400	0.0015	0.005	0.0108	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20180105	0.0092	0.00030	0.0025	0.0318	0.0015	0.005	0.0047	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20180119	0.0120	0.00030	0.0025	0.0292	0.0015	0.005	0.0125	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20180119	0.0131	0.00030	0.0025	0.0319	0.0015	0.005	0.0121	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20180119	0.0111	0.00030	0.0025	0.0417	0.0015	0.005	0.0089	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20180119	0.0202	0.00030	0.0025	0.0375	0.0015	0.005	0.0007	0.0013	0.005	0.00005	0.00010	0.0025
WS-DUP-20180119	0.0109	0.00030	0.0025	0.0365	0.0015	0.005	0.0094	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20180202	0.0131	0.00030	0.0025	0.0406	0.0015	0.005	0.0176	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20180202	0.0170	0.00030	0.0025	0.0396	0.0015	0.005	0.0066	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20180202	0.0101	0.00030	0.0025	0.0282	0.0015	0.005	0.0163	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20180216	0.0108	0.00030	0.0025	0.0346	0.0015	0.005	0.0073	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20180216	0.0098	0.00030	0.0025	0.0382	0.0015	0.005	0.0107	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20180216	0.0161	0.00030	0.0025	0.0459	0.0015	0.005	0.0143	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20180216	0.0173	0.00030	0.0025	0.0465	0.0015	0.005	0.0022	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20180302	0.0112	0.00030	0.0025	0.0371	0.0015	0.005	0.0081	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY2-20180302	0.0164	0.00030	0.0025	0.0409	0.0015	0.005	0.0137	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20180302	0.0116	0.00030	0.0025	0.0427	0.0015	0.005	0.0090	0.0013	0.005	0.00005	0.00010	0.0025
WS-DUP-20180319	0.0079	0.00030	0.0025	0.0327	0.0015	0.005	0.0068	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY1-20180319	0.0105	0.00030	0.0025	0.0299	0.0015	0.005	0.0055	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY3-20180319	0.0096	0.00030	0.0025	0.0370	0.0015	0.005	0.0044	0.0013	0.005	0.00005	0.00010	0.0025
WS-LY4-20180319	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
WS-LY2-20180319	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF
Average with 1/2 RL	0.0156			0.0414			0.010			0.00006		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results continued

	Total Recoverable Metals						Total Mercury		
Sample ID	**Uranium**	*Uranium-MDL*	*Uranium-RL*	**Zinc**	*Zinc-MDL*	*Zinc-RL*	**Mercury**	*Mercury-MDL*	*Mercury-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***0.03***			***5.0***			***0.002***		
*Screening Level Source**	***WQCC HH***			***EPA MCL2***			***WQCC HH***		
WS-LY1-20170815	**0.0093**	*0.00008*	*0.0005*	0.0470	*0.0137*	*0.05*	0.000100	*0.00005*	*0.0002*
WS-LY1-20170828	**0.0086**	*0.00020*	*0.0010*	0.0290	*0.0274*	*0.10*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20170912	**0.0066**	*0.00020*	*0.0010*	0.0466	*0.0274*	*0.10*	0.000060	*0.00005*	*0.0002*
WS-LY4-20170912	**0.0209**	*0.00020*	*0.1000*	0.0427	*0.0274*	*0.10*	**0.000025**	*0.00005*	*0.0002*
WS-LYZ-20170912	**NAF**	*NA*	*NA*	**NAF**	*NA*	*NA*	**NAF**	*NA*	*NA*
WS-LY1-20170929	**0.0104**	*0.00002*	*0.0001*	0.0077	*0.0027*	*0.01*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20170929	**0.0173**	*0.00002*	*0.0001*	**0.0191**	*0.0027*	*0.01*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20170929	**0.0087**	*0.00002*	*0.0001*	**0.0108**	*0.0027*	*0.01*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20171019	**0.0077**	*0.00030*	*0.0020*	**0.0275**	*0.0549*	*0.20*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20171019	**0.0090**	*0.00030*	*0.0020*	**0.0275**	*0.0549*	*0.20*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20171019	**0.0150**	*0.00030*	*0.0020*	**0.0275**	*0.0549*	*0.20*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20171103	**0.0090**	*0.00008*	*0.0005*	0.0142	*0.0137*	*0.05*	**0.000100**	*0.00020*	*0.0010*
WS-LY2-20171103	**0.0107**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20171103	**0.0092**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20171103	**0.0099**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20171117	**0.0066**	*0.00008*	*0.0005*	0.0212	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20171117	**0.0066**	*0.00008*	*0.0005*	0.0158	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20171117	**0.0065**	*0.00008*	*0.0005*	0.0284	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20171201	**0.0079**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20171201	**0.0075**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20171201	**0.0069**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20171201	**0.0087**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20171215	**0.0084**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20171215	**0.0070**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20171215	**0.0072**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20171215	**0.0072**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20180105	**0.0068**	*0.00008*	*0.0005*	0.0150	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20180105	**0.0065**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20180105	**0.0082**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20180105	**0.0062**	*0.00008*	*0.0005*	0.0141	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20180119	**0.0080**	*0.00008*	*0.0005*	0.0211	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20180119	**0.0081**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20180119	**0.0074**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20180119	**0.0073**	*0.00008*	*0.0005*	0.0143	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-DUP-20180119	**0.0072**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20180202	**0.0084**	*0.00008*	*0.0005*	0.0147	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20180202	**0.0079**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20180202	**0.0064**	*0.00008*	*0.0005*	0.0259	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20180216	**0.0075**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20180216	**0.0071**	*0.00008*	*0.0005*	0.0231	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20180216	**0.0090**	*0.00008*	*0.0005*	0.0496	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20180216	**0.0054**	*0.00008*	*0.0005*	0.0254	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20180302	**0.0062**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY2-20180302	**0.0080**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20180302	**0.0073**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-DUP-20180319	**0.0048**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY1-20180319	**0.0051**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY3-20180319	**0.0054**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-LY4-20180319	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*
WS-LY2-20180319	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*
Average with 1/2 RL	***0.0082***			***0.016***			***0.0000***		

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results continued

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-
**	F-09-004 TDS used Method 160.1
1	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC) Irrigation
Irr	Use (20.6.2.3103.C NMAC) Lysimeter
LY	Maximum Contaminant Level, Primary
MCL	
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟥	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC
🟩	results. Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 1: Data Spreadsheet of Lysimeter Sample Analysis Results (Legend)

						Anions								
Sample ID	Sample Date	Time	Depth Collected (FBGS)	%Moisture	%DrySolids	Chloride	Chloride-MDL	Chloride-RL	Fluoride	Fluoride-MDL	Fluoride-RL	Nitrate/Nitrite as N	Nitrate/Nitrite MDL	Nitrate/Nitrite RL
						mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry			
*Residential Soil**						18771429			4693					
*Ind/Occ SSL (0 - 1 ft.)**						58400000			77849					
*Construction Worker SSL (< 10 ft.)**						15927273			18082					
SS-1-20170804	8/4/2017	13:45	2.0	22.9	77.1	73.5	9.29	64.9	36.3	1.03	6.49	NAF	NAF	NAF
SS-2-20170804	8/4/2017	13:52	2.0	19.8	80.2	89.0	1.79	12.5	55.4	0.199	1.25	NAF	NAF	NAF
SS-3-20170804	8/4/2017	14:00	2.0	17.9	82.1	137.0	17.50	122.0	17.4	1.94	12.2	NAF	NAF	NAF
SS-4-20170804	8/4/2017	14:06	2.0	19.3	80.7	125.0	17.80	124.0	23.4	1.98	12.4	NAF	NAF	NAF
SS-5-20170804	8/4/2017	14:11	2.0	21.3	78.7	75.8	9.10	63.5	34.9	1.01	6.35	NAF	NAF	NAF
SS-6-20170804	8/4/2017	14:18	2.0	19	81	225.0	17.70	123.0	20.5	1.97	12.3	NAF	NAF	NAF
SS-7-20170804	8/4/2017	14:27	2.0	16.1	83.9	119.0	17.10	119.0	27.1	1.9	11.9	NAF	NAF	NAF
SS-8-20170804	8/4/2017	14:33	2.0	17.5	82.5	156.0	8.69	60.6	43.3	0.967	6.06	NAF	NAF	NAF
SS-LY1-20170809	8/9/2017	13:49	2.0	25	75	35.2	1.91	13.3	21.3	0.213	1.33	NAF	NAF	NAF
SS-LY2-20170809	8/9/2017	13:40	2.0	23.5	76.5	67.2	1.87	13.1	15.2	0.208	1.13	NAF	NAF	NAF
SS-LY3-20170809	8/9/2017	13:30	2.0	22.6	77.4	144.0	1.85	12.9	22.5	0.206	1.29	NAF	NAF	NAF
SS-LY4-20170809	8/9/2017	14:00	2.0	25.7	74.3	33.9	1.93	13.5	8.84	0.215	1.35	NAF	NAF	NAF
SS-1-20180329	3/29/2018	11:32	2.0	20.2	79.8	229.0	8.98	62.7	36	1	6.27	0.812	0.137	0.251
SS-2-20180329	3/29/2018	11:56	2.0	21.7	78.3	89.1	9.15	63.9	50.6	1.02	6.39	0.231	0.14	0.255
SS-3-20180329	3/29/2018	12:12	2.0	22.7	77.3	71.8	9.26	64.6	22.5	1.03	6.46	0.159	0.141	0.259
SS-4-20180329	3/29/2018	12:27	2.0	22.3	77.7	107.0	9.23	64.4	17.1	1.03	6.44	0.89	0.141	0.258
SS-5-20180329	3/29/2018	12:39	2.0	22.3	77.7	81.0	9.23	64.4	39.7	1.03	6.44	0.556	0.141	0.258
SS-6-20180329	3/29/2018	12:50	2.0	23.3	76.7	86.2	9.35	65.2	19.9	1.04	6.52	0.226	0.143	0.261
SS-7-20180329	3/29/2018	13:03	2.0	23.2	76.8	83.1	9.33	65.1	27.5	1.04	6.51	0.475	0.142	0.26
SS-8-20180329	3/29/2018	13:19	2.0	23.7	76.3	94.6	9.39	65.6	39.6	1.05	6.56	0.649	0.143	0.262
Average with 1/2 RL						***106.12***			***28.95***					

Table 2: Data Spreadsheet of Soil Sample Analysis Results

	Anions									Total Metals					
Sample ID	**Nitrate**	*Nitrate-MDL*	*Nitrate-RL*	**Nitrite**	*Nitrite-MDL*	*Nitrite-RL*	**Sulfate**	*Sulfate-MDL*	*Sulfate-RL*	**Aluminum**	*Aluminum-MDL*	*Aluminum-RL*	**Boron**	*Boron-MDL*	*Boron-RL*
	mg/kg dry	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*
*Residential Soil**	***125143***			***7821.43***			***NA***			***78002***			***15641***		
*Ind/Occ SSL (0 - 1 ft.)**	***2076444***			***129778***			***NA***			***1285451***			***259431***		
*Construction Worker SSL (< 10 ft.)**	***566303***			***35393.9***			***NA***			***41352***			***51371***		
SS-1-20170804	**3.470**	*0.032*	*0.259*	**0.141**	*0.032*	*0.259*	**3750.0**	*20.3*	*130.0*	**23000**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-2-20170804	**3.870**	*0.031*	*0.249*	**0.016**	*0.031*	*0.249*	**1320.0**	*9.8*	*62.3*	**22800**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-3-20170804	**0.938**	*0.030*	*0.244*	**0.015**	*0.030*	*0.244*	**6190.0**	*38.1*	*244.0*	**24100**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-4-20170804	**0.870**	*0.031*	*0.248*	**0.016**	*0.031*	*0.248*	**7970.0**	*38.8*	*248.0*	**20700**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-5-20170804	**1.070**	*0.031*	*0.254*	**0.016**	*0.031*	*0.254*	**4590.0**	*19.9*	*127.0*	**20200**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-6-20170804	**0.346**	*0.030*	*0.247*	**0.015**	*0.030*	*0.247*	**7430.0**	*38.6*	*247.0*	**15800**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-7-20170804	**1.350**	*0.029*	*0.238*	**7.170**	*0.029*	*0.238*	**12100.0**	*93.2*	*596.0*	**14300**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-8-20170804	**0.606**	*0.030*	*0.242*	**0.015**	*0.030*	*0.242*	**3460.0**	*19.0*	*121.0*	**16400**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-LY1-20170809	**0.832**	*0.033*	*0.267*	**0.017**	*0.033*	*0.267*	**2860.0**	*20.9*	*133.0*	**21100**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-LY2-20170809	**0.361**	*0.032*	*0.261*	**0.016**	*0.032*	*0.261*	**5340.0**	*40.9*	*261.0*	**19400**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-LY3-20170809	**1.520**	*0.032*	*0.258*	**0.016**	*0.032*	*0.258*	**1630.0**	*10.1*	*64.6*	**14100**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-LY4-20170809	**2.850**	*0.033*	*0.269*	**0.017**	*0.033*	*0.269*	**2870.0**	*21.1*	*135.0*	**21300**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-1-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**4780.0**	*19.6*	*125.0*	**20700**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-2-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**1460.0**	*10.0*	*63.9*	**23100**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-3-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**5640.0**	*20.2*	*129.0*	**20100**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-4-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**4310.0**	*20.1*	*129.0*	**17700**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-5-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**2920.0**	*10.1*	*64.4*	**18800**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-6-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**8070.0**	*51.0*	*326.0*	**16400**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-7-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**13700.0**	*50.9*	*325.0*	**15800**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
SS-8-20180329	**NAF**	*NAF*	*NAF*	**NAF**	*NAF*	*NAF*	**4250.0**	*20.5*	*131.0*	**15000**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*
Average with 1/2 RL	***1.51***			***0.62***			***5232.00***			***19040.00***			***7.37***		

Table 2: Data Spreadsheet of Soil Sample Analysis Results continued

	Total Metals			Metals											
Sample ID	Iron	Iron-MDL	Iron-RL	Arsenic	Arsenic-MDL	Arsenic-RL	Barium	Barium-MDL	Barium-RL	Cadmium	Cadmium-MDL	Cadmium-RL	Chromium	Chromium-MDL	Chromium-RL
	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
*Residential Soil**	*54750*			*7.07*			*15558*			*70.5*			*96.6*		
*Ind/Occ SSL (0 - 1 ft.)**	*908444.44*			*35.88*			*254671*			*1107.9*			*504.6*		
*Construction Worker SSL (< 10 ft.)**	*247757.58*			*215.6*			*4392*			*72.2*			*133.7*		
SS-1-20170804	15400	6.72	10.0	5.86	0.46	1.00	175	0.268	0.5	1.31	0.0951	0.5	17.90	0.548	1.00
SS-2-20170804	15600	6.72	10.0	7.74	0.46	1.00	201	0.268	0.5	1.36	0.0951	0.5	18.00	0.548	1.00
SS-3-20170804	16500	6.72	10.0	5.74	0.46	1.00	172	0.268	0.5	1.27	0.0951	0.5	17.60	0.548	1.00
SS-4-20170804	14300	6.72	10.0	5.39	0.46	1.00	166	0.268	0.5	1.16	0.0951	0.5	15.40	0.548	1.00
SS-5-20170804	14100	6.72	10.0	6.16	0.46	1.00	206	0.268	0.5	1.13	0.0951	0.5	15.40	0.548	1.00
SS-6-20170804	10900	6.72	10.0	5.14	0.46	1.00	167	0.268	0.5	0.958	0.0951	0.5	13.00	0.548	1.00
SS-7-20170804	9570	6.72	10.0	5.24	0.46	1.00	181	0.268	0.5	0.983	0.0951	0.5	10.90	0.548	1.00
SS-8-20170804	11500	6.72	10.0	4.33	0.46	1.00	159	0.268	0.5	0.903	0.0951	0.5	12.70	0.548	1.00
SS-LY1-20170809	14500	6.72	10.0	3.4	0.46	1.00	167	0.268	0.5	1.43	0.0951	0.5	15.60	0.548	1.00
SS-LY2-20170809	13400	6.72	10.0	2.56	0.46	1.00	238	0.268	0.5	1.09	0.0951	0.5	13.70	0.548	1.00
SS-LY3-20170809	9770	6.72	10.0	3.49	0.46	1.00	154	0.268	0.5	0.891	0.0951	0.5	10.90	0.548	1.00
SS-LY4-20170809	14900	6.72	10.0	3.16	0.46	1.00	192	0.268	0.5	1.56	0.0951	0.5	16.20	0.548	1.00
SS-1-20180329	14200	6.72	10.0	8.38	0.46	1.00	239	0.268	0.5	1.52	0.0951	0.5	19.00	0.548	1.00
SS-2-20180329	15700	6.72	10.0	8.5	0.46	1.00	230	0.268	0.5	1.66	0.0951	0.5	20.10	0.548	1.00
SS-3-20180329	14000	6.72	10.0	5.65	0.46	1.00	180	0.268	0.5	1.37	0.0951	0.5	16.60	0.548	1.00
SS-4-20180329	12500	6.72	10.0	5.59	0.46	1.00	204	0.268	0.5	1.21	0.0951	0.5	15.40	0.548	1.00
SS-5-20180329	13000	6.72	10.0	6.54	0.46	1.00	192	0.268	0.5	1.33	0.0951	0.5	16.80	0.548	1.00
SS-6-20180329	11600	6.72	10.0	4.95	0.46	1.00	170	0.268	0.5	1.16	0.0951	0.5	13.50	0.548	1.00
SS-7-20180329	10900	6.72	10.0	5.18	0.46	1.00	167	0.268	0.5	1	0.0951	0.5	13.40	0.548	1.00
SS-8-20180329	10300	6.72	10.0	5.17	0.46	1.00	140	0.268	0.5	1.02	0.0951	0.5	12.60	0.548	1.00
Average with 1/2 RL	***13132.00***			***5.41***			***185.00***			***1.22***			***15.24***		

Table 2: Data Spreadsheet of Soil Sample Analysis Results continued

	Metals														
Sample ID	**Cobalt**	*Cobalt-MDL*	*Cobalt-RL*	**Copper**	*Copper-MDL*	*Copper-RL*	**Lead**	*Lead-MDL*	*Lead-RL*	**Manganese**	*Manganese-MDL*	*Manganese-RL*	**Molybdenum**	*Molybdenum-MDL*	*Molybdenum-RL*
	mg/kg dry	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*
*Residential Soil**	***23.5***			***3128.6***			***400 ‡***			***10547.7***			***391.1***		
*Ind/Occ SSL (0 - 1 ft.)**	***388.4***			***51911.1***			***800 ‡***			***160183.1***			***6488.9***		
*Construction Worker SSL (< 10 ft.)**	***36.7***			***14157.6***			***800 ‡***			***463.8***			***1769.7***		
SS-1-20170804	**4.28**	*0.0708*	*0.5*	**10.30**	*0.203*	*0.5*	**13.5**	*0.081*	*0.5*	**469**	*0.744*	*2*	**1.420**	*0.061*	*0.5*
SS-2-20170804	**5.09**	*0.0708*	*0.5*	**15.80**	*0.203*	*0.5*	**21.5**	*0.081*	*0.5*	**467**	*0.744*	*2*	**0.880**	*0.061*	*0.5*
SS-3-20170804	**4.31**	*0.0708*	*0.5*	**12.00**	*0.203*	*0.5*	**15.4**	*0.081*	*0.5*	**401**	*0.744*	*2*	**1.270**	*0.061*	*0.5*
SS-4-20170804	**3.15**	*0.0708*	*0.5*	**10.20**	*0.203*	*0.5*	**14.6**	*0.081*	*0.5*	**330**	*0.744*	*2*	**1.110**	*0.061*	*0.5*
SS-5-20170804	**3.36**	*0.0708*	*0.5*	**9.16**	*0.203*	*0.5*	**12.0**	*0.081*	*0.5*	**364**	*0.744*	*2*	**0.797**	*0.061*	*0.5*
SS-6-20170804	**2.55**	*0.0708*	*0.5*	**7.95**	*0.203*	*0.5*	**10.1**	*0.081*	*0.5*	**294**	*0.744*	*2*	**1.340**	*0.061*	*0.5*
SS-7-20170804	**1.35**	*0.0708*	*0.5*	**6.53**	*0.203*	*0.5*	**9.85**	*0.081*	*0.5*	**232**	*0.744*	*2*	**0.695**	*0.061*	*0.5*
SS-8-20170804	**1.83**	*0.0708*	*0.5*	**7.78**	*0.203*	*0.5*	**10.1**	*0.081*	*0.5*	**286**	*0.744*	*2*	**0.932**	*0.061*	*0.5*
SS-LY1-20170809	**3.86**	*0.0708*	*0.5*	**14.00**	*0.203*	*0.5*	**24.7**	*0.081*	*0.5*	**332**	*0.744*	*2*	**0.872**	*0.061*	*0.5*
SS-LY2-20170809	**3.17**	*0.0708*	*0.5*	**7.55**	*0.203*	*0.5*	**11.3**	*0.081*	*0.5*	**245**	*0.744*	*2*	**0.901**	*0.061*	*0.5*
SS-LY3-20170809	**2.36**	*0.0708*	*0.5*	**5.47**	*0.203*	*0.5*	**7.75**	*0.081*	*0.5*	**204**	*0.744*	*2*	**0.680**	*0.061*	*0.5*
SS-LY4-20170809	**3.92**	*0.0708*	*0.5*	**8.74**	*0.203*	*0.5*	**14.1**	*0.081*	*0.5*	**305**	*0.744*	*2*	**0.923**	*0.061*	*0.5*
SS-1-20180329	**6.63**	*0.0708*	*0.5*	**13.90**	*0.203*	*0.5*	**19.6**	*0.081*	*0.5*	**406**	*0.744*	*2*	**1.140**	*0.061*	*0.5*
SS-2-20180329	**7.93**	*0.0708*	*0.5*	**12.50**	*0.203*	*0.5*	**18.2**	*0.081*	*0.5*	**434**	*0.744*	*2*	**1.300**	*0.061*	*0.5*
SS-3-20180329	**6.15**	*0.0708*	*0.5*	**10.20**	*0.203*	*0.5*	**13.9**	*0.081*	*0.5*	**374**	*0.744*	*2*	**1.380**	*0.061*	*0.5*
SS-4-20180329	**5.28**	*0.0708*	*0.5*	**9.01**	*0.203*	*0.5*	**13**	*0.081*	*0.5*	**220**	*0.744*	*2*	**1.290**	*0.061*	*0.5*
SS-5-20180329	**6.58**	*0.0708*	*0.5*	**9.74**	*0.203*	*0.5*	**13.7**	*0.081*	*0.5*	**316**	*0.744*	*2*	**0.956**	*0.061*	*0.5*
SS-6-20180329	**5.15**	*0.0708*	*0.5*	**8.67**	*0.203*	*0.5*	**11.9**	*0.081*	*0.5*	**259**	*0.744*	*2*	**1.120**	*0.061*	*0.5*
SS-7-20180329	**4.81**	*0.0708*	*0.5*	**8.09**	*0.203*	*0.5*	**11.3**	*0.081*	*0.5*	**304**	*0.744*	*2*	**0.758**	*0.061*	*0.5*
SS-8-20180329	**5.07**	*0.0708*	*0.5*	**7.13**	*0.203*	*0.5*	**9.29**	*0.081*	*0.5*	**315**	*0.744*	*2*	**0.756**	*0.061*	*0.5*
Average with 1/2 RL	***4.34***			***9.74***			***13.79***			***327.85***			***1.03***		

Table 2: Data Spreadsheet of Soil Sample Analysis Results continued

	Metals														
Sample ID	**Nickel**	*Nickel-MDL*	*Nickel-RL*	**Selenium**	*Selenium-MDL*	*Selenium-RL*	**Silver**	*Silver-MDL*	*Silver-RL*	**Uranium**	*Uranium-MDL*	*Uranium-RL*	**Zinc**	*Zinc-MDL*	*Zinc-RL*
	mg/kg dry	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*
*Residential Soil**	***1559.6***			***391.1***			***391.1***			***234.4***$^{+}$			***23464.29***		
*Ind/Occ SSL (0 - 1 ft.)**	***25681.9***			***6488.8***			***6488.9***			***3879.38***$^{+}$			***389333.33***		
*Construction Worker SSL (< 10 ft.)**	***753.1***			***1753.1***			***1769.7***			***276.9***$^{+}$			***106181.82***		
SS-1-20170804	**15.2**	*0.295*	*1.00*	**4.10**	*0.252*	*1.00*	**0.0978**	*0.0204*	*0.5*	**0.736**	*0.0168*	*0.1*	**71.2**	*2.74*	*10.0*
SS-2-20170804	**16.4**	*0.295*	*1.00*	**3.62**	*0.252*	*1.00*	**0.117**	*0.0204*	*0.5*	**0.689**	*0.0168*	*0.1*	**71.8**	*2.74*	*10.0*
SS-3-20170804	**15.1**	*0.295*	*1.00*	**2.95**	*0.252*	*1.00*	**0.101**	*0.0204*	*0.5*	**0.751**	*0.0168*	*0.1*	**70.5**	*2.74*	*10.0*
SS-4-20170804	**13.2**	*0.295*	*1.00*	**4.89**	*0.252*	*1.00*	**0.0784**	*0.0204*	*0.5*	**0.828**	*0.0168*	*0.1*	**59.1**	*2.74*	*10.0*
SS-5-20170804	**13.2**	*0.295*	*1.00*	**3.46**	*0.252*	*1.00*	**0.0751**	*0.0204*	*0.5*	**0.650**	*0.0168*	*0.1*	**56.0**	*2.74*	*10.0*
SS-6-20170804	**11.7**	*0.295*	*1.00*	**3.85**	*0.252*	*1.00*	**0.0728**	*0.0204*	*0.5*	**0.791**	*0.0168*	*0.1*	**49.2**	*2.74*	*10.0*
SS-7-20170804	**10.5**	*0.295*	*1.00*	**3.56**	*0.252*	*1.00*	**0.0534**	*0.0204*	*0.5*	**0.678**	*0.0168*	*0.1*	**37.1**	*2.74*	*10.0*
SS-8-20170804	**11.4**	*0.295*	*1.00*	**2.74**	*0.252*	*1.00*	**0.0698**	*0.0204*	*0.5*	**0.594**	*0.0168*	*0.1*	**50.3**	*2.74*	*10.0*
SS-LY1-20170809	**12.6**	*0.295*	*1.00*	**0.13**	*0.252*	*1.00*	**0.122**	*0.0204*	*0.5*	**0.697**	*0.0168*	*0.1*	**74.4**	*2.74*	*10.0*
SS-LY2-20170809	**11.3**	*0.295*	*1.00*	**0.13**	*0.252*	*1.00*	**0.106**	*0.0204*	*0.5*	**0.869**	*0.0168*	*0.1*	**60.6**	*2.74*	*10.0*
SS-LY3-20170809	**10.4**	*0.295*	*1.00*	**0.13**	*0.252*	*1.00*	**0.0678**	*0.0204*	*0.5*	**0.757**	*0.0168*	*0.1*	**40.8**	*2.74*	*10.0*
SS-LY4-20170809	**13.2**	*0.295*	*1.00*	**0.13**	*0.252*	*1.00*	**0.127**	*0.0204*	*0.5*	**0.837**	*0.0168*	*0.1*	**76.9**	*2.74*	*10.0*
SS-1-20180329	**17.8**	*0.295*	*1.00*	**1.64**	*0.252*	*1.00*	**0.133**	*0.0204*	*0.5*	**0.850**	*0.0168*	*0.1*	**90.6**	*2.74*	*10.0*
SS-2-20180329	**19.1**	*0.295*	*1.00*	**1.28**	*0.252*	*1.00*	**0.133**	*0.0204*	*0.5*	**0.848**	*0.0168*	*0.1*	**96.8**	*2.74*	*10.0*
SS-3-20180329	**16.4**	*0.295*	*1.00*	**0.92**	*0.252*	*1.00*	**0.0965**	*0.0204*	*0.5*	**0.816**	*0.0168*	*0.1*	**76.2**	*2.74*	*10.0*
SS-4-20180329	**15.5**	*0.295*	*1.00*	**0.76**	*0.252*	*1.00*	**0.0782**	*0.0204*	*0.5*	**0.802**	*0.0168*	*0.1*	**68.8**	*2.74*	*10.0*
SS-5-20180329	**17.2**	*0.295*	*1.00*	**0.85**	*0.252*	*1.00*	**0.0903**	*0.0204*	*0.5*	**0.753**	*0.0168*	*0.1*	**73.3**	*2.74*	*10.0*
SS-6-20180329	**14.4**	*0.295*	*1.00*	**0.75**	*0.252*	*1.00*	**0.0946**	*0.0204*	*0.5*	**0.713**	*0.0168*	*0.1*	**57.8**	*2.74*	*10.0*
SS-7-20180329	**15**	*0.295*	*1.00*	**0.60**	*0.252*	*1.00*	**0.0632**	*0.0204*	*0.5*	**0.650**	*0.0168*	*0.1*	**51.5**	*2.74*	*10.0*
SS-8-20180329	**13.4**	*0.295*	*1.00*	**0.52**	*0.252*	*1.00*	**0.0594**	*0.0204*	*0.5*	**0.592**	*0.0168*	*0.1*	**51.9**	*2.74*	*10.0*
Average with 1/2 RL	***14.15***			***1.85***			***0.09***			***0.75***			***64.24***		

Table 2: Data Spreadsheet of Soil Sample Analysis Results continued

	Metals		
Sample ID	**Mercury**	Mercury-MDL	Mercury-RL
	mg/kg dry	*mg/kg dry*	mg/kg dry
*Residential Soil**	***23.56***$^{+}$		
*Ind/Occ SSL (0 - 1 ft.)**	***111.05***$^{+}$		
*Construction Worker SSL (< 10 ft.)**	***20.5***$^{+}$		
SS-1-20170804	**0.014**	*0.0277*	*0.130*
SS-2-20170804	**0.013**	*0.0266*	*0.125*
SS-3-20170804	**0.013**	*0.0260*	*0.122*
SS-4-20170804	**0.013**	*0.0265*	*0.124*
SS-5-20170804	**0.014**	*0.0271*	*0.127*
SS-6-20170804	**0.013**	*0.0264*	*0.123*
SS-7-20170804	**0.013**	*0.0254*	*0.119*
SS-8-20170804	**0.013**	*0.0259*	*0.121*
SS-LY1-20170809	**0.117**	*0.0285*	*0.133*
SS-LY2-20170809	**0.014**	*0.0279*	*0.131*
SS-LY3-20170809	**0.014**	*0.0276*	*0.129*
SS-LY4-20170809	**0.014**	*0.0287*	*0.135*
SS-1-20180329	**0.013**	*0.0268*	*0.125*
SS-2-20180329	**0.014**	*0.0273*	*0.128*
SS-3-20180329	**0.014**	*0.0276*	*0.129*
SS-4-20180329	**0.014**	*0.0275*	*0.129*
SS-5-20180329	**0.014**	*0.0275*	*0.129*
SS-6-20180329	**0.014**	*0.0278*	*0.130*
SS-7-20180329	**0.014**	*0.0278*	*0.130*
SS-8-20180329	**0.014**	*0.0280*	*0.131*
Average with 1/2 RL	***0.02***		

Table 2: Data Spreadsheet of Soil Sample Analysis Results continued

*	Soil Screening Levels from Soil Screening Guidance for Human Health Risk Assessment (March 2017 Revised), NMED. The lower concentration of the Residential Soil (cancer vs. noncancer) was used.
+	Uranium (soluble salts) SSLs . Mercury (elemental) SSLs.
‡	No 2017 SSLs available. Used Soil Screening Levels from Soil Screening Guidance for Human Health Risk Assessment (July 2015),
7.07	NMED. Concentration Exceeds Screening Level
FBGS	Feet Below Ground Surface
LY	Lysimeter
MDL	Method Detection Limit
NA	Not Available. NMED has no SSL for Sulfate
RL	Reporting Limit
SS	Soil Sample
🟦	Sample analysis performed past hold time specified by the method
🟧	Laboratory control sample recovery above laboratory acceptance criteria. Results for analyte potentially biased high.
🟨	Below Method Detection limit - 1/2 MDL listed
🟩	Estimated concentration. Analyte concentration between MDL and RL

Table 2: Data Spreadsheet of Soil Sample Analysis Results (Legend)

Sample ID	**Sample Date**	**Time**	**Depth Collected (FBGS)**	**%Moisture**	**%DrySolids**	**Chloride**	*Chloride-MDL*	*Chloride-RL*	**Fluoride**	*Fluoride-MDL*	*Fluoride-RL*
						mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL						***250***			***1.6***		
*Screening Level Source**						***WQCC Dom***			***WQCC HH***		
SS-1-20180329	3/29/2018	11:32	2.0	20.2	79.8	8.07	0.143	1	2.33	0.00388	0.2
SS-2-20180329	3/29/2018	11:56	2.0	21.7	78.3	2.52	0.143	1	3.55	0.00388	0.2
SS-3-20180329	3/29/2018	12:12	2.0	22.7	77.3	2.28	0.143	1	1.64	0.00388	0.2
SS-4-20180329	3/29/2018	12:27	2.0	22.3	77.7	4.03	0.143	1	1.21	0.00388	0.2
SS-5-20180329	3/29/2018	12:39	2.0	22.3	77.7	2.43	0.143	1	2.51	0.00388	0.2
SS-6-20180329	3/29/2018	12:50	2.0	23.3	76.7	2.54	0.143	1	1.31	0.00388	0.2
SS-7-20180329	3/29/2018	13:03	2.0	23.2	76.8	2.43	0.143	1	2.12	0.00388	0.2
SS-8-20180329	3/29/2018	13:19	2.0	23.7	76.3	2.79	0.143	1	2.49	0.00388	0.2
Average with 1/2 RL						***3.38625***			***2.145***		

Table 3: Data Spreadsheet of SPLP Results

Sample ID	**Nitrate as N**	*Nitrate as N MDL*	*Nitrate as N RL*	**Sulfate**	*Sulfate-MDL*	*Sulfate-RL*	**Aluminum**	*Aluminum-MDL*	*Aluminum-RL*	**Boron**	*Boron-MDL*	*Boron-RL*	**Iron**	*Iron-MDL*	*Iron-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***10.0***			***250***			***0.05***			***0.75***			***0.3***		
*Screening Level Source**	***WQCC HH***			***EPA MCL2***			***EPA MCL2***			***WQCC Irr***			***EPA MCL2***		
SS-1-20180329	0.174	0.003	0.025	229	1.56	10	0.088	0.009	0.05	0.044	0.029	0.3	0.062	0.02	0.05
SS-2-20180329	0.11	0.003	0.025	99.1	0.782	5	0.414	0.009	0.05	0.037	0.029	0.3	0.2	0.02	0.05
SS-3-20180329	0.121	0.003	0.025	350	1.56	10	0.075	0.009	0.05	0.0145	0.029	0.3	0.042	0.02	0.05
SS-4-20180329	0.166	0.003	0.025	383	1.56	10	0.051	0.009	0.05	0.0145	0.029	0.3	0.047	0.02	0.05
SS-5-20180329	0.165	0.003	0.025	282	1.56	10	0.12	0.009	0.05	0.0145	0.029	0.3	0.075	0.02	0.05
SS-6-20180329	0.149	0.003	0.025	352	1.56	10	0.107	0.009	0.05	0.0145	0.029	0.3	0.062	0.02	0.05
SS-7-20180329	0.23	0.003	0.025	892	7.82	50	0.04	0.009	0.05	0.0145	0.029	0.3	0.035	0.02	0.05
SS-8-20180329	1.67	0.003	0.025	260	1.56	10	0.075	0.009	0.05	0.0145	0.029	0.3	0.079	0.02	0.05
Average with 1/2 RL	***0.348125***			***355.8875***			***0.12125***			***0.021***			***0.07525***		

Table 3: Data Spreadsheet of SPLP Results continued

Sample ID	**Arsenic**	*Arsenic-MDL*	*Arsenic-RL*	**Barium**	*Barium-MDL*	*Barium-RL*	**Cadmium**	*Cadmium-MDL*	*Cadmium-RL*	**Chromium**	*Chromium-MDL*	*Chromium-RL*	**Cobalt**	*Cobalt-MDL*	*Cobalt-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***0.01***			***1.0***			***0.005***			***0.05***			***0.05***		
*Screening Level Source**	***EPA MCL***			***WQCC HH***			***EPA MCL***			***WQCC HH***			***WQCC Irr***		
SS-1-20180329	0.001	0.0005	0.001	0.053	0.0003	0.0005	0.00005	0.0001	0.0005	0.001	0.0005	0.002	0.0001	0.00001	0.00005
SS-2-20180329	0.001	0.0005	0.001	0.034	0.0003	0.0005	0.00005	0.0001	0.0005	0.001	0.0005	0.002	0.0008	0.00001	0.00005
SS-3-20180329	0.00025	0.0005	0.001	0.025	0.0003	0.0005	0.00005	0.0001	0.0005	0.001	0.0005	0.002	0.00015	0.0003	0.05
SS-4-20180329	0.00025	0.0005	0.001	0.023	0.0003	0.0005	0.00005	0.0001	0.0005	0.001	0.0005	0.002	0.0003	0.00001	0.00005
SS-5-20180329	0.00025	0.0005	0.001	0.034	0.0003	0.0005	0.00005	0.0001	0.0005	0.001	0.0005	0.002	0.0002	0.00001	0.00005
SS-6-20180329	0.00025	0.0005	0.001	0.02	0.0003	0.0005	0.00005	0.0001	0.0005	0.001	0.0005	0.002	0.0003	0.00001	0.00005
SS-7-20180329	0.00025	0.0005	0.001	0.03	0.0003	0.0005	0.00005	0.0001	0.0005	0.0008	0.0005	0.002	0.0008	0.00001	0.00005
SS-8-20180329	0.00025	0.0005	0.001	0.026	0.0003	0.0005	0.00005	0.0001	0.0005	0.0008	0.0005	0.002	0.0003	0.00001	0.00005
Average with 1/2 RL	***0.0004375***			***0.030625***			***0.00005***			***0.00095***			***0.0003688***		

Table 3: Data Spreadsheet of SPLP Results continued

Sample ID	**Copper**	*Copper-MDL*	*Copper-RL*	**Lead**	*Lead-MDL*	*Lead-RL*	*Manganese-MDL*	*Manganese-RL*	**Molybdenum**	*Molybdenum-MDL*	*Molybdenum-RL*	**Nickel**	*Nickel-MDL*	*Nickel-RL*	**Selenium**	*Selenium-MDL*	*Selenium-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***1.0***			***0.015***					***1.0***			***0.2***			***0.05***		
*Screening Level Source**	***WQCC Irr***			***EPA MCL***					***WQCC Irr***			***WQCC Irr***			***WQCC HH***		
SS-1-20180329	0.0011	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0062	0.00006	0.0005	0.0031	0.0003	0.001	0.004	0.0003	0.001
SS-2-20180329	0.0008	0.0002	0.0005	0.0002	0.00008	0.0005	0.00005	0.002	0.0084	0.00006	0.0005	0.002	0.0003	0.001	0.002	0.0003	0.001
SS-3-20180329	0.0005	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0089	0.00006	0.0005	0.0065	0.0003	0.001	0.00015	0.0003	0.001
SS-4-20180329	0.0005	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0114	0.00006	0.0005	0.0061	0.0003	0.001	0.001	0.0003	0.001
SS-5-20180329	0.0005	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0055	0.00006	0.0005	0.0058	0.0003	0.001	0.0008	0.0003	0.001
SS-6-20180329	0.0005	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0077	0.00006	0.0005	0.0081	0.0003	0.001	0.00015	0.0003	0.001
SS-7-20180329	0.0004	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0046	0.00006	0.0005	0.0223	0.0003	0.001	0.0007	0.0003	0.001
SS-8-20180329	0.0011	0.0002	0.0005	0.00004	0.00008	0.0005	0.00005	0.002	0.0048	0.00006	0.0005	0.0068	0.0003	0.001	0.00015	0.0003	0.001
Average with 1/2 RL	***0.000675***			***0.00006***					***0.0071875***			***0.0075875***			***0.00111875***		

Table 3: Data Spreadsheet of SPLP Results continued

Sample ID	**Silver**	*Silver-MDL*	*Silver-RL*	**Uranium**	*Uranium-MDL*	*Uranium-RL*	**Zinc**	*Zinc-MDL*	*Zinc-RL*	**Mercury**	Mercury-MDL	Mercury-RL
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***0.05***			***0.03***			***5.0***			***0.002***		
*Screening Level Source**	***WQCC HH***			***WQCC HH***			***EPA MCL2***			***WQCC HH***		
SS-1-20180329	0.00001	0.00002	0.0005	0.0001	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
SS-2-20180329	0.00001	0.00002	0.0005	0.00008	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
SS-3-20180329	0.00001	0.00002	0.0005	0.0003	0.00002	0.0001	0.0036	0.0027	0.01	0.000045	0.00009	0.0002
SS-4-20180329	0.00001	0.00002	0.0005	0.0002	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
SS-5-20180329	0.00001	0.00002	0.0005	0.0001	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
SS-6-20180329	0.00001	0.00002	0.0005	0.0002	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
SS-7-20180329	0.00001	0.00002	0.0005	0.0002	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
SS-8-20180329	0.00001	0.00002	0.0005	0.00009	0.00002	0.0001	0.00135	0.0027	0.01	0.000045	0.00009	0.0002
Average with 1/2 RL	***0.00001***			***0.00015875***			***0.001631***			***0.000045***		

Table 3: Data Spreadsheet of SPLP Results continued

*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
MCL	Primary Maximum Contaminant Level,
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
RL	Reporting Limit
SS	Soil Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit
🟩	(RL) Estimated concentration. Analyte concentration between MDL and RL
🟦	This result was analyzed outside of the EPA recommended holding time

Table 3: Data Spreadsheet of SPLP Results (Legend)

MASS OF COC APPLIED TO THE FIELD

	Chloride	Fluoride	Nitrate as N	Nitrite as N	Sulfate	Aluminum	Boron	Iron	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc	Mercury
	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
Average	8.28E+08	1.60E+07	1.06E+07	4.40E+04	8.40E+09	9.84E+04	1.64E+06	2.31E+05	7.26E+03	3.31E+05	1.43E+03	1.51E+04	1.74E+03	7.77E+03	1.14E+03	1.09E+04	3.91E+04	7.19E+04	2.53E+04	2.86E+02	2.65E+04	8.32E+04	2.38E+02

MASS OF COC REMOVED FROM FIELD BY PLANTS

	Chloride(mg)	Fluoride (mg)	Nitrate as N (mg)	Nitrite as N (mg)	Sulfate (mg)	Aluminum (mg)	Boron (mg)	Iron (mg)	Arsenic (mg)	Barium (mg)	Cadmium (mg)	Chromium (mg)	Cobalt (mg)	Copper (mg)	Lead (mg)	Manganese (mg)	Molybdenum (mg)	Nickel (mg)	Selenium (mg)	Silver (mg)	Uranium (mg)	Zinc (mg)	Mercury (mg)
All - AVG	1.18E+07	3.35E+05	2.69E+04	6.81E+02	1.44E+06	7.49E+04	1.27E+04	1.20E+05	5.20E+02	1.82E+03	2.05E+02	9.71E+02	6.63E+01	1.18E+04	2.33E+02	3.58E+04	2.36E+03	6.46E+02	1.21E+03	1.77E+01	1.46E+01	7.91E+04	1.54E+02
20170828-AVG	4.34E+06	5.37E+05	2.92E+03	5.74E+02	4.98E+05	7.52E+04	1.27E+04	1.26E+05	6.42E+02	1.79E+03	3.27E+02	4.75E+02	6.13E+01	1.38E+04	2.15E+02	3.05E+04	3.71E+03	2.56E+02	1.11E+03	1.77E+01	1.46E+01	7.39E+04	9.93E+01
20171016-AVG	1.92E+07	1.34E+05	5.09E+04	7.88E+02	2.38E+06	7.46E+04	1.27E+04	1.14E+05	3.99E+02	1.85E+03	8.24E+01	1.47E+03	7.12E+01	9.83E+03	2.52E+02	4.11E+04	1.00E+03	1.04E+03	1.32E+03	1.77E+01	1.46E+01	8.43E+04	2.09E+02

MASS APPLIED MINUS MASS REMOVED (mg)

	Chloride(mg)	Fluoride (mg)	Nitrate as N (mg)	Nitrite as N (mg)	Sulfate (mg)	Aluminum (mg)	Boron (mg)	Iron (mg)	Arsenic (mg)	Barium (mg)	Cadmium (mg)	Chromium (mg)	Cobalt (mg)	Copper (mg)	Lead (mg)	Manganese (mg)	Molybdenum (mg)	Nickel (mg)	Selenium (mg)	Silver (mg)	Uranium (mg)	Zinc (mg)	Mercury (mg)
All - AVG	816158377.33	15623421.28	10609639.71	43340.58	8398347462.45	23425.06	1628355.84	111578.66	6737.36	328853.44	1223.11	14139.45	1678.73	-4027.74	908.71	-24874.46	36746.45	71216.21	24087.62	267.87	26477.69	4077.12	83.91
20170828-AVG	823580056.44	15421894.95	10633634.82	43447.47	8399287907.84	23111.01	1628355.84	105503.30	6615.63	328883.98	1100.89	14635.33	1683.66	-5999.80	927.24	-19546.34	35393.63	71606.62	24187.90	267.87	26477.69	9242.79	138.67
20171016-AVG	808736698.22	15824947.61	10585644.60	43233.69	8397407017.06	23739.12	1628355.84	117654.01	6859.08	328822.90	1345.33	13643.56	1673.80	-2055.69	890.18	-30202.58	38099.27	70825.81	23987.34	267.87	26477.69	-1088.56	29.15

MASS APPLIED MINUS MASS REMOVED (g)

	Chloride(g)	Fluoride (g)	Nitrate as N (g)	Nitrite as N (g)	Sulfate (g)	Aluminum (g)	Boron (g)	Iron (g)	Arsenic (g)	Barium (g)	Cadmium (g)	Chromium (g)	Cobalt (g)	Copper (g)	Lead (g)	Manganese (g)	Molybdenum (g)	Nickel (g)	Selenium (g)	Silver (g)	Uranium (g)	Zinc (g)	Mercury (g)
All - AVG	816158.38	15623.42	10609.64	43.34	8398347.46	23.43	1628.36	111.58	6.74	328.85	1.22	14.14	1.68	-4.03	0.91	-24.87	36.75	71.22	24.09	0.27	26.48	4.08	0.08
20170828-AVG	823580.06	15421.89	10633.63	43.45	8399287.91	23.11	1628.36	105.50	6.62	328.88	1.10	14.64	1.68	-6.00	0.93	-19.55	35.39	71.61	24.19	0.27	26.48	9.24	0.14
20171016-AVG	808736.70	15824.95	10585.64	43.23	8397407.02	23.74	1628.36	117.65	6.86	328.82	1.35	13.64	1.67	-2.06	0.89	-30.20	38.10	70.83	23.99	0.27	26.48	-1.09	0.03

MASS APPLIED MINUS MASS REMOVED (lbs.)

	Chloride(lbs)	Fluoride (lbs)	Nitrate as N (lbs)	Nitrite as N (lbs)	Sulfate (lbs)	Aluminum (lbs)	Boron (lbs)	Iron (lbs)	Arsenic (lbs)	Barium (lbs)	Cadmium (lbs)	Chromium (lbs)	Cobalt (lbs)	Copper (lbs)	Lead (lbs)	Manganese (lbs)	Molybdenum (lbs)	Nickel (lbs)	Selenium (lbs)	Silver (lbs)	Uranium (lbs)	Zinc (lbs)	Mercury (lbs)
All - AVG	1799.323	34.444	23.390	0.096	18515.202	0.052	3.590	0.246	0.015	0.725	0.0027	0.031	0.004	-0.009	0.0020	-0.055	0.081	0.157	0.053	0.0006	0.058	0.0090	0.0002
20170828-AVG	1815.685	33.999	23.443	0.096	18517.275	0.051	3.590	0.233	0.015	0.725	0.0024	0.032	0.004	-0.013	0.0020	-0.043	0.078	0.158	0.053	0.0006	0.058	0.0204	0.0003
20171016-AVG	1782.961	34.888	23.337	0.095	18513.129	0.052	3.590	0.259	0.015	0.725	0.0030	0.030	0.004	-0.005	0.0020	-0.067	0.084	0.156	0.053	0.0006	0.058	-0.0024	0.0001

Percent Removed From Field

	Chloride	Fluoride	Nitrate as N	Nitrite as N	Sulfate	Aluminum	Boron	Iron	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Uranium	Zinc	Mercury
All - AVG	1.42%	2.10%	0.25%	1.55%	0.02%	76.18%	0.78%	51.74%	7.17%	0.55%	14.33%	6.42%	3.80%	151.82%	20.44%	328.08%	6.03%	0.90%	4.80%	6.19%	0.05%	95.10%	64.74%
20170828-AVG	0.52%	3.36%	0.03%	1.30%	0.01%	76.50%	0.78%	54.37%	8.85%	0.54%	22.89%	3.14%	3.52%	177.19%	18.82%	279.22%	9.49%	0.36%	4.40%	6.19%	0.05%	88.89%	41.72%
20171016-AVG	2.32%	0.84%	0.48%	1.79%	0.03%	75.86%	0.78%	49.11%	5.49%	0.56%	5.77%	9.71%	4.08%	126.45%	22.06%	376.93%	2.57%	1.44%	5.20%	6.19%	0.05%	101.31%	87.75%

Table 4: Spreadsheet for Calculation of Mass Balance

				Anion Method: 354.1		TDS Method: 2540C		Anions Method: EPA300																	
Sample ID	**Sample Date**	**Time**	**Matrix**	**Nitrite as N**	*Nitrite as N-RL*	**TDS**	*TDS-RL*	**Chloride**	*Chloride-MDL*	*Chloride-RL*	**Fluoride**	*Fluoride-MDL*	*Fluoride-RL*	**Nitrate as N**	*Nitrate as N-MDL*	*Nitrate as N-RL*	**Nitrate+Nitrite as N**	*Nitrate+Nitrite as N-MDL*	*Nitrate+Nitrite as N-RL*	**Nitrite as N**	*Nitrite as N-MDL*	*Nitrite as N-MDL*	**Sulfate**	*Sulfate-MDL*	*Sulfate-RL*
				mg/L	*mg/L*	**mg/L**	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL				*1*		*500*		*250*			*1.6*			*10.0*			*10.0*			*10.0*			*250*		
*Screening Level Source**				*EPA MCL*		*EPA MCL2*		*WQCC Dom*			*WQCC HH*			*WQCC HH*			*WQCC HH*			*WQCC HH*			*EPA MCL2*		
RO-20170804**	8/4/2017	15:16	Wastewater	🟨 0.025	0.05	3530.0	5.0	66.9	0.7	5.0	3.65	0.0798	0.5	🟧 2.12	0.012	0.100	2.12	0.0247	0.10	🟧 0.006	0.012	0.100	1720	7.82	50.0
WS-DUP-20170815	8/15/2017	0:00	Wastewater	🟫 0.025	0.05	3580.0	10.0	101.0	0.7	5.0	3.63	0.0798	0.5	NAF	NAF	NAF	2.15	0.051	0.10	NAF	NAF	NAF	1680	15.6	100.0
WS-RO-20170815	8/15/2017	14:10	Wastewater	🟨 0.025	0.05	3660.0	10.0	216.0	0.7	5.0	2.40	0.0798	0.5	NAF	NAF	NAF	1.75	0.051	0.10	NAF	NAF	NAF	1980	15.6	100.0
WS-RO-20170828	8/28/2017	11:15	Wastewater	🟨 0.025	0.05	2370.0	10.0	35.9	0.7	5.0	2.69	0.0798	0.5	NAF	NAF	NAF	1.62	0.011	0.02	NAF	NAF	NAF	1200	7.82	50.0
WS-RO-20170912	9/12/2017	8:20	Wastewater	🟨 0.025	0.05	4260.0	10.0	295.0	1.4	10.0	3.86	0.1600	1.0	NAF	NAF	NAF	🟪 2.33	0.011	0.02	NAF	NAF	NAF	1940	15.6	100.0
WS-RO-20170929	9/29/2017	7:52	Wastewater	🟨 0.025	0.05	4470.0	10.0	329.0	1.4	10.0	3.89	0.1600	1.0	2.35	0.025	0.200	2.34		0.40	🟧 0.0125	0.025	0.200	2070	15.6	100.0
WS-RO-20171019	10/19/2017	14:40	Wastewater	🟨 0.025	0.05	2900.0	10.0	45.2	1.4	10.0	3.11	0.1600	1.0	1.89	0.025	0.200	1.89		0.40	🟧 0.0125	0.025	0.200	1390	15.6	100.0
WS-RO-20171103	11/3/2017	8:28	Wastewater	🟦 0.025	0.05	2430.0	10.0	40.2	0.7	5.0	2.74	0.0798	0.5	1.57	0.012	0.100	2.82		0.20	🟧 1.25	0.012	0.100	1290	7.82	50.0
WS-DUP-20171103	11/3/2017		Wastewater	🟦 0.025	0.05	2570.0	10.0	40.0	0.7	5.0	2.72	0.0798	0.5	1.55	0.012	0.100	2.88		0.20	🟧 1.33	0.012	0.100	1280	7.82	50.0
WS-RO-20171117	11/17/2017	8:11	Wastewater	🟨 0.025	0.05	2660.0	10.0	39.3	0.7	5.0	2.74	0.0798	0.5	1.52	0.012	0.100	1.52		0.20	🟧 0.006	0.012	0.100	1330	7.82	50.0
WS-RO-20171201	12/1/2017	9:32	Wastewater	🟨 0.025	0.05	4690.0	10.0	381.0	1.4	10.0	3.79	0.0798	0.5	1.89	0.012	0.100	1.89		0.20	🟧 0.006	0.012	0.100	2110	15.6	100.0
WS-RO-20171215	12/15/2017	13:07	Wastewater	🟨 0.025	0.05	3470.0	10.0	296.0	1.4	10.0	2.83	0.0798	0.5	🟧 1.55	0.012	0.100	1.55		0.20	🟧 0.006	0.012	0.100	1650	7.82	50.0
WS-RO-20180105	1/5/2018	10:28	Wastewater	🟨 0.025	0.05	2980.0	10.0	159.0	0.7	5.0	2.75	0.0798	0.5	NAF	NAF	NAF	🟪 1.37	0.055	0.20	NAF	NAF	NAF	1490	7.82	50.0
WS-RO-20180119	1/19/2018	9:32	Wastewater	🟨 0.025	0.05	3560.0	10.0	57.3	0.7	5.0	3.62	0.0798	0.5	NAF	NAF	NAF	1.86	0.055	0.10	NAF	NAF	NAF	1740	15.6	100.0
WS-RO-20180202	2/2/2018	10:34	Wastewater	🟨 0.025	0.05	2960.0	10.0	205.0	0.7	5.0	2.77	0.0798	0.5	NAF	NAF	NAF	1.65	0.055	0.10	NAF	NAF	NAF	1370	15.6	100.0
WS-RO-20180216	2/16/2018	9:34	Wastewater	🟨 0.025	0.05	2900.0	10.0	45.9	0.7	5.0	3.54	0.0798	0.5	NAF	NAF	NAF	1.97	0.055	0.10	NAF	NAF	NAF	1810	7.82	50.0
WS-RO-20180302	3/2/2018	10:37	Wastewater	🟨 0.025	0.05	3570.0	10.0	134.0	0.7	5.0	3.59	0.0798	0.5	NAF	NAF	NAF	1.8	0.055	0.10	NAF	NAF	NAF	1890	7.82	50.0
WS-RO-20180319	3/19/2018	10:23	Wastewater	🟨 0.025	0.05	3980.0	10.0	390.0	7.2	50.0	3.39	0.0798	0.5	NAF	NAF	NAF	2.1	0.055	0.10	NAF	NAF	NAF	2000	7.82	50.0
Average with 1/2 RL				*0.025*		*3363.3*		*159.8*			*3.21*			*1.81*			*1.98*			0.33			*1663.3*		

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
**	TDS used Method 160.1
¹	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
LY	Lysimeter
MCL	Maximum Contaminant Level, Primary
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟫	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
🟩	Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 5 Results of RO-reject Water Analyses

	Total Recoverable Metals Method: ICP EPA200.7									Total Recoverable Metals Method: ICPMS EPA200.8																	
Sample ID	**Aluminum**	*Aluminum-MDL*	*Aluminum-RL*	**Boron**	*Boron-MDL*	*Boron-RL*	**Iron**	*Iron-MDL*	*Iron-RL*	**Arsenic**	*Arsenic-MDL*	*Arsenic-RL*	**Barium**	*Barium-MDL*	*Barium-RL*	**Cadmium**	*Cadmium-MDL*	*Cadmium-RL*	**Chromium**	*Chromium-MDL*	*Chromium-RL*	**Cobalt**	*Cobalt-MDL*	*Cobalt-RL*	**Copper**	*Copper-MDL*	*Copper-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***0.05***			***0.75***			***0.3***			***0.01***			***1.0***			***0.005***			***0.05***			***0.05***			***1.0***		
*Screening Level Source**	***EPA MCL2***			***WQCC Irr***			***EPA MCL2***			***EPA MCL***			***WQCC HH***			***EPA MCL***			***WQCC HH***			***WQCC Irr***			***WQCC Irr***		
RO-20170804**	**0.005**	*0.009*	*0.05*	**0.139**	*0.029*	*0.30*	**0.010**	*0.020*	*0.05*	**0.00115**	*0.0023*	*0.005*	**0.0741**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0005**	*0.0004*	*0.0025*	**0.0014**	*0.0010*	*0.0025*
WS-DUP-20170815	**0.023**	*0.046*	*0.25*	**0.450**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0717**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0002**	*0.0004*	*0.0025*	**0.0014**	*0.0010*	*0.0025*
WS-RO-20170815	**0.023**	*0.046*	*0.25*	**0.422**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0754**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0002**	*0.0004*	*0.0025*	**0.0016**	*0.0010*	*0.0025*
WS-RO-20170828	**0.023**	*0.046*	*0.25*	**0.337**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00230**	*0.0046*	*0.01*	**0.0491**	*0.0027*	*0.0050*	**0.00050**	*0.0010*	*0.0050*	**0.0028**	*0.0055*	*0.020*	**0.0004**	*0.0007*	*0.005*	**0.0010**	*0.0020*	*0.0050*
WS-RO-20170912	**0.046**	*0.092*	*0.5*	**0.615**	*0.29*	*3.00*	**0.102**	*0.203*	*0.5*	**0.00230**	*0.0046*	*0.010*	**0.0745**	*0.0027*	*0.0050*	**0.00050**	*0.0010*	*0.0050*	**0.0120**	*0.0055*	*0.020*	**0.0004**	*0.0007*	*0.005*	**0.0022**	*0.0020*	*0.0050*
WS-RO-20170929	**0.0045**	*0.009*	*0.05*	**0.106**	*0.029*	*0.30*	**0.027**	*0.02*	*0.05*	**0.00110**	*0.0005*	*0.001*	**0.0721**	*0.0003*	*0.0005*	**0.00005**	*0.0001*	*0.0005*	**0.0003**	*0.0005*	*0.001*	**0.0006**	*0.00007*	*0.0005*	**0.0022**	*0.0002*	*0.0005*
WS-RO-20171019	**0.023**	*0.046*	*0.25*	**0.461**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0599**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0009**	*0.0004*	*0.0025*	**0.0015**	*0.0010*	*0.0025*
WS-RO-20171103	**0.023**	*0.046*	*0.25*	**0.073**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0498**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0010**	*0.0004*	*0.0025*	**0.0012**	*0.0010*	*0.0025*
WS-DUP-20171103	**0.023**	*0.046*	*0.25*	**0.073**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0499**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0011**	*0.0004*	*0.0025*	**0.0012**	*0.0010*	*0.0025*
WS-RO-20171117	**0.023**	*0.046*	*0.25*	**0.073**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0661**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.010*	**0.0010**	*0.004*	*0.0025*	**0.0013**	*0.0010*	*0.0025*
WS-RO-20171201	**0.023**	*0.046*	*0.25*	**0.073**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0953**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0018**	*0.0004*	*0.0025*	**0.0033**	*0.0010*	*0.0025*
WS-RO-20171215	**0.0045**	*0.009*	*0.05*	**0.032**	*0.029*	*0.30*	**0.010**	*0.02*	*0.05*	**0.00115**	*0.0023*	*0.005*	**0.0733**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0013**	*0.0004*	*0.0025*	**0.0032**	*0.0010*	*0.0025*
WS-RO-20180105	**0.023**	*0.046*	*0.25*	**0.162**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.052**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0011**	*0.0004*	*0.0025*	**0.0019**	*0.0010*	*0.0025*
WS-RO-20180119	**0.023**	*0.046*	*0.25*	**0.365**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0761**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0014**	*0.0004*	*0.0025*	**0.0017**	*0.0010*	*0.0025*
WS-RO-20180202	**0.023**	*0.046*	*0.25*	**0.374**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00320**	*0.0023*	*0.005*	**0.0669**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0009**	*0.0004*	*0.0025*	**0.0027**	*0.0010*	*0.0025*
WS-RO-20180216	**0.023**	*0.046*	*0.25*	**0.151**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0596**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0010**	*0.0004*	*0.0025*	**0.0013**	*0.0010*	*0.0025*
WS-RO-20180302	**0.023**	*0.046*	*0.25*	**0.158**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0723**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0014**	*0.0004*	*0.0025*	**0.0027**	*0.0010*	*0.0025*
WS-RO-20180319	**0.023**	*0.046*	*0.25*	**0.073**	*0.145*	*1.50*	**0.051**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0673**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0012**	*0.0004*	*0.0025*	**0.0045**	*0.0010*	*0.0025*
Average with 1/2 RL	***0.021***			***0.23***			***0.05***			***0.0014***			***0.07***			***0.00027***			***0.002***			***0.00091***			***0.00202***		

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
**	TDS used Method 160.1
¹	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
LY	Lysimeter
MCL	Maximum Contaminant Level, Primary
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟫	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
🟩	Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 5 Results of RO-reject Water Analyses (continued)

	Total Recoverable Metals Method: ICPMS EPA200.8																								Total Mercury Method: CVAA EPA245.1		
Sample ID	**Lead**	*Lead-MDL*	*Lead-RL*	**Manganese**	*Manganese-MDL*	*Manganese-RL*	**Molybdenum**	*Molybdenum-MDL*	*Molybdenum-RL*	**Nickel**	*Nickel-MDL*	*Nickel-RL*	**Selenium**	*Selenium-MDL*	*Selenium-RL*	**Silver**	*Silver-MDL*	*Silver-RL*	**Uranium**	*Uranium-MDL*	*Uranium-RL*	**Zinc**	*Zinc-MDL*	*Zinc-RL*	**Mercury**	*Mercury-MDL*	*Mercury-RL*
	mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL	***0.015***			***0.05***			***1.0***			***0.2***			***0.05***			***0.05***			***0.03***			***5.0***			***0.002***		
*Screening Level Source**	***EPA MCL***			***EPA MCL2***			***WQCC Irr***			***WQCC Irr***			***WQCC HH***			***WQCC HH***			***WQCC HH***			***EPA MCL2***			***WQCC HH***		
RO-20170804**	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0091**	*0.00030*	*0.0025*	**0.0133**	*0.0015*	*0.005*	**0.0007**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0060**	*0.00008*	*0.0050*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-DUP-20170815	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0084**	*0.00030*	*0.0025*	**0.0133**	*0.0015*	*0.005*	**0.0101**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0056**	*0.00008*	*0.0005*	**0.0220**	*0.0137*	*0.05*	**0.00010**	*0.00005*	*0.0002*
WS-RO-20170815	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0084**	*0.00030*	*0.0025*	**0.0155**	*0.0015*	*0.005*	**0.0096**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0057**	*0.00008*	*0.0005*	**0.0224**	*0.0137*	*0.05*	**0.00010**	*0.00005*	*0.0002*
WS-RO-20170828	**0.00040**	*0.00080*	*0.0050*	**0.0037**	*0.0074*	*0.020*	**0.0060**	*0.00060*	*0.0050*	**0.0121**	*0.0030*	*0.010*	**0.0032**	*0.0025*	*0.010*	**0.00010**	*0.00020*	*0.0050*	**0.0037**	*0.00020*	*0.0010*	**0.0137**	*0.0274*	*0.10*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20170912	**0.00040**	*0.00080*	*0.0050*	**0.0037**	*0.0074*	*0.020*	**0.0084**	*0.00060*	*0.0050*	**0.0193**	*0.0030*	*0.010*	**0.0013**	*0.0025*	*0.010*	**0.00010**	*0.00020*	*0.005*	**0.0059**	*0.00020*	*0.0010*	**0.0280**	*0.0274*	*0.10*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20170929	**0.00004**	*0.00008*	*0.0005*	**0.0008**	*0.0007*	*0.002*	**0.0090**	*0.00006*	*0.0005*	**0.0171**	*0.0003*	*0.001*	**0.0071**	*0.0003*	*0.001*	**0.00001**	*0.00002*	*0.0005*	**0.0065**	*0.00002*	*0.0001*	**0.0119**	*0.0027*	*0.01*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20171019	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0077**	*0.00030*	*0.0025*	**0.0238**	*0.0015*	*0.005*	**0.0076**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0051**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20171103	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0059**	*0.00030*	*0.0025*	**0.0300**	*0.0015*	*0.005*	**0.0056**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0040**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00010**	*0.00020*	*0.0010*
WS-DUP-20171103	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0057**	*0.00030*	*0.0025*	**0.0323**	*0.0015*	*0.005*	**0.0056**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0038**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20171117	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0078**	*0.00030*	*0.0025*	**0.0240**	*0.0015*	*0.005*	**0.0091**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0047**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20171201	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0108**	*0.00030*	*0.0025*	**0.0462**	*0.0015*	*0.005*	**0.0097**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0074**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20171215	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0068**	*0.00030*	*0.0025*	**0.0369**	*0.0015*	*0.005*	**0.0065**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0052**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20180105	**0.00020**	*0.00040*	*0.0025*	**0.0040**	*0.0037*	*0.010*	**0.0063**	*0.00030*	*0.0025*	**0.0305**	*0.0015*	*0.005*	**0.0063**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0047**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20180119	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0094**	*0.00030*	*0.0025*	**0.0325**	*0.0015*	*0.005*	**0.0093**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0064**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20180202	**0.00020**	*0.00040*	*0.0025*	**0.0055**	*0.0037*	*0.010*	**0.0075**	*0.00030*	*0.0025*	**0.0279**	*0.0015*	*0.005*	**0.0134**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0051**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20180216	**0.00020**	*0.00040*	*0.0025*	**0.0063**	*0.0037*	*0.010*	**0.0080**	*0.00030*	*0.0025*	**0.0327**	*0.0015*	*0.005*	**0.0065**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0059**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20180302	**0.00020**	*0.00040*	*0.0025*	**0.0087**	*0.0037*	*0.010*	**0.0099**	*0.00030*	*0.0025*	**0.0388**	*0.0015*	*0.005*	**0.0088**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0061**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
WS-RO-20180319	**0.00020**	*0.00040*	*0.0025*	**0.0019**	*0.0037*	*0.010*	**0.0079**	*0.00030*	*0.0025*	**0.0364**	*0.0015*	*0.005*	**0.0065**	*0.0013*	*0.005*	**0.00005**	*0.00010*	*0.0025*	**0.0048**	*0.00008*	*0.0005*	**0.0069**	*0.0137*	*0.05*	**0.00003**	*0.00005*	*0.0002*
Average with 1/2 RL	***0.00021***			***0.003***			***0.0079***			***0.0268***			***0.0070***			***0.00005***			***0.0054***			***0.010***			***0.0000***		

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
**	TDS used Method 160.1
¹	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
LY	Lysimeter
MCL	Maximum Contaminant Level, Primary
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟥	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
🟩	Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 5 Results of RO-reject Water Analyses (continued)

Plant Sample Physical Characteristics Data								Anions Method: EPA300																	
Sample ID	Sample Date	Time	Plant_Type	%Moisture	%DrySolids	Total Mass(g)	Total Dry Mass(g)	Chloride	Chloride-MDL	Chloride-RL	Fluoride	Fluoride-MDL	Fluoride-RL	Nitrate + Nitrite as N	Nitrate/Nitrite as N-MDL	Nitrate/Nitrite as N-RL	Nitrate as N	Nitrate-MDL	Nitrate-RL	Nitrite as N	Nitrite-MDL	Nitrite-RL	Sulfate	Sulfate-MDL	Sulfate-RL
								mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry				mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
PS-QALY4-20170809	8/9/2017	15:15	Native Grass	28%	72%			2820.0	20.0	139.0	23.4	2.2	13.90	7.95			4.55	0.172	1.39	3.40	0.172	1.39	8730.0	109.0	6969.0
PS-QC-20170815	8/15/2017	14:00	Native Grass	31%	69%			1180.0	10.4	72.6	48.0	1.2	7.26	0.18			0.09	0.179	1.45	0.09	0.179	1.45	7820.0	56.8	363.0
PS-EF-20170815	8/15/2017	14:40	Alfalfa	62%	38%			1450.0	19.0	132.0	143.0	2.1	13.20	4.55			4.39	0.327	2.65	0.16	0.327	2.65	1250.0	20.7	132.0
PS-1-20170828	8/28/2017	12:15	Sudan Grass	83%	17%	186	31.992	3220.0	41.6	290.0	48.2	4.6	29.00	0.72			0.36	0.717	5.8	0.36	0.717	5.8	288.0	45.4	290.0
PS-2-20170828	8/28/2017	12:20	Sudan Grass	79%	22%	116	24.94	926.0	33.4	233.0	100.0	3.7	23.30	0.58			0.29	0.575	4.66	0.29	0.575	4.66	173.0	36.4	233.0
PS-3-20170828	8/28/2017	12:30	Sudan Grass	84%	16%	163	26.406	3170.0	44.4	310.0	208.0	4.9	31.00	4.50			4.12	0.765	6.19	0.38	0.765	6.19	368.0	48.4	310.0
PS-4-20170828	8/28/2017	12:35	Sudan Grass	82%	18%	156	28.236	2030.0	39.5	276.0	627.0	4.4	27.60	0.68			0.34	0.681	5.52	0.34	0.681	5.52	213.0	43.1	276.0
PS-5-20170828	8/28/2017	12:40	Sudan Grass	77%	23%	92	21.252	922.0	31.0	216.0	97.9	3.5	21.60	0.53			0.27	0.534	4.32	0.27	0.534	4.32	148.0	33.8	216.0
PS-6-20170828	8/28/2017	12:50	Sudan Grass	84%	17%	219	36.135	6200.0	43.4	303.0	1030.0	4.8	30.30	4.43			4.06	0.748	6.06	0.37	0.748	6.06	567.0	47.4	303.0
PS-7-20170828	8/28/2017	12:55	Sudan Grass	81%	19%	126	23.94	2110.0	37.8	264.0	340.0	4.2	26.40	4.07			3.74	0.651	5.27	0.33	0.651	5.27	357.0	41.2	264.0
PS-8-20170828	8/28/2017	13:00	Sudan Grass	80%	20%	142	27.832	1470.0	36.6	255.0	27.8	4.1	25.50	0.63			0.32	0.630	5.1	0.32	0.630	5.1	186.0	39.9	255.0
PS-1-20171016	10/16/2017	14:00	Sudan Grass	35%	65%	84.4	54.9444	11400.0	110.0	768.0	79.9	2.5	15.40	50.79			50.60	0.379	3.07	0.19	0.379	3.07	1960.0	24.0	154.0
PS-2-20171016	10/16/2017	14:00	Sudan Grass	27%	73%	165	120.45	12500.0	98.2	685.0	42.5	2.2	13.70	11.07			10.90	2.180	13.7	0.17	0.338	2.74	2530.0	21.4	137.0
PS-3-20171016	10/16/2017	14:00	Sudan Grass	27%	73%	230	167.9	13600.0	98.2	685.0	42.7	2.2	13.70	30.47			30.30	0.338	2.74	0.17	0.338	2.74	53.8	21.4	137.0
PS-4-20171016	10/16/2017	14:00	Sudan Grass	25%	75%	116	87.464	14000.0	95.0	663.0	99.1	2.1	13.30	36.86			36.70	0.328	2.65	0.16	0.328	2.65	52.4	20.7	133.0
PS-5-20171016	10/16/2017	14:00	Sudan Grass	22%	78%	140	109.48	11000.0	91.6	639.0	148.0	2.0	12.80	85.74			83.30	0.316	2.56	2.44	0.316	2.56	2750.0	20.0	128.0
PS-6-20171016	10/16/2017	14:00	Sudan Grass	28%	72%	307	220.426	8570.0	99.8	696.0	48.1	2.2	13.90	3.79			3.62	0.344	2.79	0.17	0.344	2.79	1980.0	21.8	139.0
PS-7-20171016	10/16/2017	14:00	Sudan Grass	30%	70%	216	152.064	8270.0	102.0	710.0	62.5	2.3	14.20	4.82			4.64	0.351	2.84	0.18	0.351	2.84	1610.0	22.2	142.0
PS-8-20171016	10/16/2017	14:00	Sudan Grass	22%	78%	117	91.026	9240.0	92.1	643.0	95.2	2.1	12.90	15.16			15.00	0.317	2.57	0.16	0.317	2.57	47.9	20.1	129.0
PS-COMPOSITE-20180216	2/16/2018	11:15	Triticale	78%	22%	93.3	20.2461	2150.0	66.0	461.0	27.2	7.4	46.10	4.46	0.50	0.92	NAF	NAF	NAF	NAF	NAF	NAF	10100.0	72.1	461.0
Average with 1/2 RL								*5811.4*			*#REF!*			*13.60*			*13.56*			*1.22*			*2059.2*		

EF	East Fiel
LY	Lysimeter
MDL	Method Detection Limit
PS	Plant Sample
QA	Quality Assurance
RL	Reporting Limit
🟨	Below Method Detection limit - 1/2 MDL listed.
🟦	Sample analysis performed past hold time specified by the method
🟩	Estimated concentration. Analyte concentration between MDL and Reporting Limit(RL).

Table 6 Plant Sample Analyses Results

Plant Sample Physical Characteristics Data							
Sample ID	Sample Date	Time	Plant_Type	%Moisture	%DrySolids	Total Mass(g)	Total Dry Mass(g)
PS-QALY4-20170809	8/9/2017	15:15	Native Grass	28%	72%		
PS-QC-20170815	8/15/2017	14:00	Native Grass	31%	69%		
PS-EF-20170815	8/15/2017	14:40	Alfalfa	62%	38%		
PS-1-20170828	8/28/2017	12:15	Sudan Grass	83%	17%	186	31.992
PS-2-20170828	8/28/2017	12:20	Sudan Grass	79%	22%	116	24.94
PS-3-20170828	8/28/2017	12:30	Sudan Grass	84%	16%	163	26.406
PS-4-20170828	8/28/2017	12:35	Sudan Grass	82%	18%	156	28.236
PS-5-20170828	8/28/2017	12:40	Sudan Grass	77%	23%	92	21.252
PS-6-20170828	8/28/2017	12:50	Sudan Grass	84%	17%	219	36.135
PS-7-20170828	8/28/2017	12:55	Sudan Grass	81%	19%	126	23.94
PS-8-20170828	8/28/2017	13:00	Sudan Grass	80%	20%	142	27.832
PS-1-20171016	10/16/2017	14:00	Sudan Grass	35%	65%	84.4	54.9444
PS-2-20171016	10/16/2017	14:00	Sudan Grass	27%	73%	165	120.45
PS-3-20171016	10/16/2017	14:00	Sudan Grass	27%	73%	230	167.9
PS-4-20171016	10/16/2017	14:00	Sudan Grass	25%	75%	116	87.464
PS-5-20171016	10/16/2017	14:00	Sudan Grass	22%	78%	140	109.48
PS-6-20171016	10/16/2017	14:00	Sudan Grass	28%	72%	307	220.426
PS-7-20171016	10/16/2017	14:00	Sudan Grass	30%	70%	216	152.064
PS-8-20171016	10/16/2017	14:00	Sudan Grass	22%	78%	117	91.026
PS-COMPOSITE-20180216	2/16/2018	11:15	Triticale	78%	22%	93.3	20.2461
Average with 1/2 RL							

	Total Metals Method: ICP 6010B								
Sample ID	Aluminum	*Aluminum-MDL*	*Aluminum-RL*	Boron	*Boron-MDL*	*Boron-RL*	Iron	*Iron-MDL*	*Iron-RL*
	mg/kg dry	*mg/kg dry*	*mg/kg dry*	***mg/kg dry***	*mg/kg dry*	*mg/kg dry*	**mg/kg dry**	*mg/kg dry*	*mg/kg dry*
PS-QALY4-20170809	**3660.0**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**2520.0**	*6.72*	*10.0*
PS-QC-20170815	**2530.0**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**1800.0**	*6.72*	*10.0*
PS-EF-20170815	**61.3**	*1.35*	*5.0*	**52.3**	*14.7*	*30.0*	**80.4**	*6.72*	*10.0*
PS-1-20170828	**111.0**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**65.7**	*6.72*	*10.0*
PS-2-20170828	**25.7**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**56.2**	*6.72*	*10.0*
PS-3-20170828	**35.6**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**80.7**	*6.72*	*10.0*
PS-4-20170828	**33.5**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**98.7**	*6.72*	*10.0*
PS-5-20170828	**24.1**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**58.0**	*6.72*	*10.0*
PS-6-20170828	**36.8**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**79.1**	*6.72*	*10.0*
PS-7-20170828	**27.4**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**57.4**	*6.72*	*10.0*
PS-8-20170828	**53.3**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**84.6**	*6.72*	*10.0*
PS-1-20171016	**80.9**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**86.5**	*6.72*	*10.0*
PS-2-20171016	**44.8**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**77.0**	*6.72*	*10.0*
PS-3-20171016	**54.9**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**77.4**	*6.72*	*10.0*
PS-4-20171016	**31.8**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**60.6**	*6.72*	*10.0*
PS-5-20171016	**42.7**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**66.3**	*6.72*	*10.0*
PS-6-20171016	**32.7**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**56.8**	*6.72*	*10.0*
PS-7-20171016	**33.8**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**57.6**	*6.72*	*10.0*
PS-8-20171016	**22.9**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**42.1**	*6.72*	*10.0*
PS-COMPOSITE-20180216	**788.0**	*1.35*	*5.0*	**7.4**	*14.7*	*30.0*	**596.0**	*6.72*	*10.0*
Average with 1/2 RL	***386.6***			***9.6***			***305.1***		

	Metals Method: ICPMS 6020A								
Sample ID	Arsenic	*Arsenic-MDL*	*Arsenic-RL*	Barium	*Barium-MDL*	*Barium-RL*	Cadmium	*Cadmium-MDL*	*Cadmium-RL*
	mg/kg dry	*mg/kg dry*	mg/kg dry	mg/kg dry	*mg/kg dry*	mg/kg dry	mg/kg dry	*mg/kg dry*	mg/kg dry
PS-QALY4-20170809	**0.23**	*0.46*	*1.0*	**29.500**	*0.268*	*0.5*	**0.1860**	*0.0951*	*0.5*
PS-QC-20170815	**0.23**	*0.46*	*1.0*	**24.300**	*0.268*	*0.5*	**0.2040**	*0.0951*	*0.5*
PS-EF-20170815	**0.23**	*0.46*	*1.0*	**2.050**	*0.268*	*0.5*	**0.1230**	*0.0951*	*0.5*
PS-1-20170828	**0.49**	*0.46*	*1.0*	**1.140**	*0.268*	*0.5*	**0.1960**	*0.0951*	*0.5*
PS-2-20170828	**0.82**	*0.46*	*1.0*	**1.010**	*0.268*	*0.5*	**0.1820**	*0.0951*	*0.5*
PS-3-20170828	**0.23**	*0.46*	*1.0*	**0.954**	*0.268*	*0.5*	**0.2290**	*0.0951*	*0.5*
PS-4-20170828	**0.23**	*0.46*	*1.0*	**1.050**	*0.268*	*0.5*	**0.2180**	*0.0951*	*0.5*
PS-5-20170828	**0.50**	*0.46*	*1.0*	**0.885**	*0.268*	*0.5*	**0.1590**	*0.0951*	*0.5*
PS-6-20170828	**0.23**	*0.46*	*1.0*	**1.090**	*0.268*	*0.5*	**0.2060**	*0.0951*	*0.5*
PS-7-20170828	**0.23**	*0.46*	*1.0*	**1.150**	*0.268*	*0.5*	**0.1880**	*0.0951*	*0.5*
PS-8-20170828	**0.23**	*0.46*	*1.0*	**1.000**	*0.268*	*0.5*	**0.1310**	*0.0951*	*0.5*
PS-1-20171016	**0.23**	*0.46*	*1.0*	**1.160**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-2-20171016	**0.23**	*0.46*	*1.0*	**1.300**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-3-20171016	**0.23**	*0.46*	*1.0*	**1.570**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-4-20171016	**0.23**	*0.46*	*1.0*	**0.692**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-5-20171016	**0.23**	*0.46*	*1.0*	**1.120**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-6-20171016	**0.23**	*0.46*	*1.0*	**0.724**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-7-20171016	**0.23**	*0.46*	*1.0*	**0.955**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-8-20171016	**0.23**	*0.46*	*1.0*	**1.040**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
PS-COMPOSITE-20180216	**0.47**	*0.46*	*1.0*	**12.400**	*0.268*	*0.5*	**0.0476**	*0.0951*	*0.5*
Average with 1/2 RL	***0.23***			***4.25***			***0.12***		

	Metals Method: ICPMS 6020A							
Sample ID	Chromium	*Chromium-MDL*	*Chromium-RL*	Cobalt	*Cobalt-MDL*	*Cobalt-RL*	Copper	*Copper-MDL*
	mg/kg dry	*mg/kg dry*	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	*mg/kg dry*
PS-QALY4-20170809	**2.600**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**7.36**	*0.203*
PS-QC-20170815	**1.800**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**7.22**	*0.203*
PS-EF-20170815	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**10.90**	*0.203*
PS-1-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**8.40**	*0.203*
PS-2-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**4.57**	*0.203*
PS-3-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**8.22**	*0.203*
PS-4-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**9.48**	*0.203*
PS-5-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**5.48**	*0.203*
PS-6-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**10.80**	*0.203*
PS-7-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**7.32**	*0.203*
PS-8-20170828	**0.274**	*0.548*	*1.0*	**0.0354**	*0.0708*	*0.5*	**9.32**	*0.203*
PS-1-20171016	**0.763**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**4.98**	*0.203*
PS-2-20171016	**0.810**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**8.49**	*0.203*
PS-3-20171016	**0.754**	*0.548*	*2.0*	**0.0809**	*0.0708*	*0.5*	**4.55**	*0.203*
PS-4-20171016	**0.853**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**6.59**	*0.203*
PS-5-20171016	**0.712**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**5.32**	*0.203*
PS-6-20171016	**0.828**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**4.97**	*0.203*
PS-7-20171016	**0.701**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**4.73**	*0.203*
PS-8-20171016	**1.350**	*0.548*	*2.0*	**0.0354**	*0.0708*	*0.5*	**5.75**	*0.203*
PS-COMPOSITE-20180216	**0.274**	*0.548*	*1.0*	**0.17**	*0.0708*	*0.5*	**8.95**	*0.203*
Average with 1/2 RL	***1.56***			***0.04***			***8.49***	

EF	East Fiel
LY	Lysimeter
MDL	Method Detection Limit
PS	Plant Sample
QA	Quality Assurance
RL	Reporting Limit
🟨	Below Method Detection limit - 1/2 MDL listed.
🟦	Sample analysis performed past hold time specified by the method
🟩	Estimated concentration. Analyte concentration between MDL and Reporting Limit(RL).

Table 6 Plant Sample Analyses Results (continued)

Plant Sample Physical Characteristics Data								Metals Method: ICPMS 6020A						
Sample ID	Sample Date	Time	Plant_Type	%Moisture	%DrySolids	Total Mass(g)	Total Dry Mass(g)	Copper-RL	Lead	Lead-MDL	Lead-RL	Manganese	Manganese-MDL	Manganese-RL
								mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
PS-QALY4-20170809	8/9/2017	15:15	Native Grass	28%	72%			0.5	4.65	0.081	0.5	191.0	0.744	2.0
PS-QC-20170815	8/15/2017	14:00	Native Grass	31%	69%			0.5	3.42	0.081	0.5	170.0	0.744	2.0
PS-EF-20170815	8/15/2017	14:40	Alfalfa	62%	38%			0.5	0.041	0.081	0.5	43.0	0.744	2.0
PS-1-20170828	8/28/2017	12:15	Sudan Grass	83%	17%	186	31.992	0.5	0.261	0.081	0.5	12.3	0.744	2.0
PS-2-20170828	8/28/2017	12:20	Sudan Grass	79%	22%	116	24.94	0.5	0.119	0.081	0.5	15.4	0.744	2.0
PS-3-20170828	8/28/2017	12:30	Sudan Grass	84%	16%	163	26.406	0.5	0.089	0.081	0.5	18.5	0.744	2.0
PS-4-20170828	8/28/2017	12:35	Sudan Grass	82%	18%	156	28.236	0.5	0.107	0.081	0.5	18.3	0.744	2.0
PS-5-20170828	8/28/2017	12:40	Sudan Grass	77%	23%	92	21.252	0.5	0.041	0.081	0.5	21.9	0.744	2.0
PS-6-20170828	8/28/2017	12:50	Sudan Grass	84%	17%	219	36.135	0.5	0.103	0.081	0.5	21.8	0.744	2.0
PS-7-20170828	8/28/2017	12:55	Sudan Grass	81%	19%	126	23.94	0.5	0.093	0.081	0.5	16.9	0.744	2.0
PS-8-20170828	8/28/2017	13:00	Sudan Grass	80%	20%	142	27.832	0.5	0.180	0.081	0.5	15.5	0.744	2.0
PS-1-20171016	10/16/2017	14:00	Sudan Grass	35%	65%	84.4	54.9444	0.5	0.160	0.081	0.5	19.3	0.744	2.0
PS-2-20171016	10/16/2017	14:00	Sudan Grass	27%	73%	165	120.45	0.5	0.160	0.081	0.5	33.6	0.744	2.0
PS-3-20171016	10/16/2017	14:00	Sudan Grass	27%	73%	230	167.9	0.5	0.175	0.081	0.5	18.1	0.744	2.0
PS-4-20171016	10/16/2017	14:00	Sudan Grass	25%	75%	116	87.464	0.5	0.041	0.081	0.5	13.8	0.744	2.0
PS-5-20171016	10/16/2017	14:00	Sudan Grass	22%	78%	140	109.48	0.5	0.165	0.081	0.5	26.3	0.744	2.0
PS-6-20171016	10/16/2017	14:00	Sudan Grass	28%	72%	307	220.426	0.5	0.138	0.081	0.5	29.4	0.744	2.0
PS-7-20171016	10/16/2017	14:00	Sudan Grass	30%	70%	216	152.064	0.5	0.135	0.081	0.5	24.6	0.744	2.0
PS-8-20171016	10/16/2017	14:00	Sudan Grass	22%	78%	117	91.026	0.5	0.190	0.081	0.5	24.7	0.744	2.0
PS-COMPOSITE-20180216	2/16/2018	11:15	Triticale	78%	22%	93.3	20.2461	0.5	0.921	0.081	0.5	24.2	0.744	2.0
Average with 1/2 RL									*0.56*			*37.9*		

	Metals Method: ICPMS 6020A											
Sample ID	Molybdenum	Molybdenum-MDL	Molybdenum-RL	Nickel	Nickel-MDL	Nickel-RL	Selenium	Selenium-MDL	Selenium-RL	Silver	Silver-MDL	Silver-RL
	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
PS-QALY4-20170809	1.29	0.0611	0.5	3.190	0.295	1.0	0.126	0.252	1.0	0.0102	0.0204	0.5
PS-QC-20170815	1.30	0.0611	0.5	2.530	0.295	1.0	0.126	0.252	1.0	0.0102	0.0204	0.5
PS-EF-20170815	8.33	0.0611	0.5	2.210	0.295	1.0	0.126	0.252	1.0	0.0102	0.0204	0.5
PS-1-20170828	2.26	0.0611	0.5	0.148	0.295	1.0	2.140	0.252	1.0	0.0102	0.0204	0.5
PS-2-20170828	1.37	0.0611	0.5	0.148	0.295	1.0	0.915	0.252	1.0	0.0102	0.0204	0.5
PS-3-20170828	2.12	0.0611	0.5	0.148	0.295	1.0	0.126	0.252	1.0	0.0102	0.0204	0.5
PS-4-20170828	2.16	0.0611	0.5	0.148	0.295	1.0	0.126	0.252	1.0	0.0102	0.0204	0.5
PS-5-20170828	1.88	0.0611	0.5	0.148	0.295	1.0	0.854	0.252	1.0	0.0102	0.0204	0.5
PS-6-20170828	3.04	0.0611	0.5	0.148	0.295	1.0	0.126	0.252	1.0	0.0102	0.0204	0.5
PS-7-20170828	2.39	0.0611	0.5	0.148	0.295	1.0	0.306	0.252	1.0	0.0102	0.0204	0.5
PS-8-20170828	1.91	0.0611	0.5	0.148	0.295	1.0	0.553	0.252	1.0	0.0102	0.0204	0.5
PS-1-20171016	0.584	0.0611	0.5	0.546	0.295	1.0	0.860	0.252	1.0	0.0102	0.0204	0.5
PS-2-20171016	0.672	0.0611	0.5	0.700	0.295	1.0	0.939	0.252	1.0	0.0102	0.0204	0.5
PS-3-20171016	0.703	0.0611	0.5	0.683	0.295	1.0	1.200	0.252	1.0	0.0102	0.0204	0.5
PS-4-20171016	0.353	0.0611	0.5	0.388	0.295	1.0	0.628	0.252	1.0	0.0102	0.0204	0.5
PS-5-20171016	0.633	0.0611	0.5	0.671	0.295	1.0	0.635	0.252	1.0	0.0102	0.0204	0.5
PS-6-20171016	0.676	0.0611	0.5	0.382	0.295	1.0	0.497	0.252	1.0	0.0102	0.0204	0.5
PS-7-20171016	0.526	0.0611	0.5	0.646	0.295	1.0	0.798	0.252	1.0	0.0102	0.0204	0.5
PS-8-20171016	0.491	0.0611	0.5	0.769	0.295	1.0	0.515	0.252	1.0	0.0102	0.0204	0.5
PS-COMPOSITE-20180216	0.831	0.0611	0.5	1.180	0.295	1.0	0.872	0.252	1.0	0.0102	0.0204	0.5
Average with 1/2 RL	*1.68*			*0.75*			*0.62*			*0.01*		

	Metals Method: ICPMS 6020A						Metals Method: CVAA EPA7471		
Sample ID	Uranium	Uranium-MDL	Uranium-RL	Zinc	Zinc-MDL	Zinc-RL	Mercury	Mercury-MDL	Mercury-RL
	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
PS-QALY4-20170809	0.235	0.0168	0.10	58.9	2.74	10.0	0.0149	0.0297	0.139
PS-QC-20170815	0.168	0.0168	0.10	77.3	2.74	10.0	0.0155	0.0310	0.145
PS-EF-20170815	0.109	0.0168	0.10	38.7	2.74	10.0	0.0283	0.0565	0.265
PS-1-20170828	0.008	0.0168	0.10	38.3	2.74	10.0	0.0620	0.1240	0.580
PS-2-20170828	0.008	0.0168	0.10	25.0	2.74	10.0	0.0498	0.0995	0.466
PS-3-20170828	0.008	0.0168	0.10	51.6	2.74	10.0	0.0660	0.1320	0.619
PS-4-20170828	0.008	0.0168	0.10	46.3	2.74	10.0	0.0590	0.1180	0.552
PS-5-20170828	0.008	0.0168	0.10	35.4	2.74	10.0	0.0462	0.0923	0.432
PS-6-20170828	0.008	0.0168	0.10	55.0	2.74	10.0	0.0645	0.1290	0.606
PS-7-20170828	0.008	0.0168	0.10	36.2	2.74	10.0	0.0565	0.1130	0.527
PS-8-20170828	0.008	0.0168	0.10	53.5	2.74	10.0	0.0545	0.1090	0.510
PS-1-20171016	0.008	0.0168	0.10	32.1	2.74	10.0	0.0376	0.0328	0.154
PS-2-20171016	0.008	0.0168	0.10	82.4	2.74	10.0	0.0146	0.0292	0.137
PS-3-20171016	0.008	0.0168	0.10	29.4	2.74	10.0	0.0146	0.0292	0.137
PS-4-20171016	0.008	0.0168	0.10	80.9	2.74	10.0	0.0444	0.0283	0.133
PS-5-20171016	0.008	0.0168	0.10	31.1	2.74	10.0	0.0448	0.0273	0.128
PS-6-20171016	0.008	0.0168	0.10	56.8	2.74	10.0	0.0299	0.0297	0.139
PS-7-20171016	0.008	0.0168	0.10	29.7	2.74	10.0	0.0152	0.0303	0.142
PS-8-20171016	0.008	0.0168	0.10	46.6	2.74	10.0	0.7630	0.0274	0.129
PS-COMPOSITE-20180216	0.064	0.0168	0.10	31.7	2.74	10.0	0.0492	0.0984	0.461
Average with 1/2 RL	*0.035*			*46.8*			*0.020*		

EF	East Fiel
LY	Lysimeter
MDL	Method Detection Limit
PS	Plant Sample
QA	Quality Assurance
RL	Reporting Limit
🟨	Below Method Detection limit - 1/2 MDL listed.
🟦	Sample analysis performed past hold time specified by the method
🟩	Estimated concentration. Analyte concentration between MDL and Reporting Limit(RL).

Table 6 Plant Sample Analyses Results (continued)

				Anion Method: 354.1		TDS Method: 2540C		Anions Method: EPA300																	
Sample ID	**Sample Date**	**Time**	**Matrix**	**Nitrite as N**	*Nitrite as N-RL*	**TDS**	*TDS-RL*	**Chloride**	*Chloride-MDL*	*Chloride-RL*	**Fluoride**	*Fluoride-MDL*	*Fluoride-RL*	**Nitrate as N**	*Nitrate as N-MDL*	*Nitrate as N-RL*	**Nitrate+Nitrite as N**	*Nitrate+Nitrite as N-MDL*	*Nitrate+Nitrite as N-RL*	**Nitrite as N**	*Nitrite as N-MDL*	*Nitrite as N-MDL*	**Sulfate**	*Sulfate-MDL*	*Sulfate-RL*
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CGWSL				1		500		250			1.6			10.0			10.0			10.0			250		
*Screening Level Source**				EPA MCL		EPA MCL2		WQCC Dom			WQCC HH			WQCC HH			WQCC HH			WQCC HH			EPA MCL2		
WS-MW118-20170816[1]	8/15/2017	12:20	Ground Water	0.025	0.05	3750.0	10.0	132.0	0.7	5.0	3.61	0.0798	0.5	NAF	NAF	NAF	4.00	0.051	0.100	NAF	NAF	NAF	1700.0	15.6	100.0
WS-MW114-20171201	12/1/2017	11:24	Ground Water	0.025	0.05	3700.0	10.0	206.0	0.7	5.0	2.35	0.0798	0.5	0.595	0.012	0.1	0.6		0.2	0.006	0.012	0.1	2020.0	15.6	100.0
WS-MW114-20180329	3/29/2018	14:05	Ground Water	0.025	0.05	3640.0	10.0	191.0	0.7	5.0	2.26	0.0798	0.5	NAF	NAF	NAF	1.59	0.011	0.020	NAF	NAF	NAF	2200.0	7.8	50.0
Average with 1/2 RL				0.025		3696.7		176.3			2.74			0.60			2.1			0.01			1973.3		

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
**	TDS used Method 160.1
¹	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
LY	Lysimeter
MCL	Maximum Contaminant Level, Primary
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟫	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
🟩	Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 7 Results of Groundwater Analyses

				Total Recoverable Metals Method: ICP EPA200.7									Total Recoverable Metals Method: ICPMS EPA200.8																				
Sample ID	**Sample Date**	**Time**	**Matrix**	**Aluminum**	*Aluminum-MDL*	*Aluminum-RL*	**Boron**	*Boron-MDL*	*Boron-RL*	**Iron**	*Iron-MDL*	*Iron-RL*	**Arsenic**	*Arsenic-MDL*	*Arsenic-RL*	**Barium**	*Barium-MDL*	*Barium-RL*	**Cadmium**	*Cadmium-MDL*	*Cadmium-RL*	**Chromium**	*Chromium-MDL*	*Chromium-RL*	**Cobalt**	*Cobalt-MDL*	*Cobalt-RL*	**Copper**	*Copper-MDL*	*Copper-RL*	**Lead**	*Lead-MDL*	*Lead-RL*
				mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL				***0.05***			***0.75***			***0.3***			***0.01***			***1.0***			***0.01***			***0.05***			***0.05***			***1.0***			***0.015***		
*Screening Level Source**				***EPA MCL2***			***WQCC Irr***			***EPA MCL2***			***EPA MCL***			***WQCC HH***			***WQCC HH***			***WQCC HH***			***WQCC Irr***			***WQCC Irr***			***WQCC HH***		
WS-MW118-20170816[1]	8/15/2017	12:20	Ground Water	**0.023**	*0.046*	*0.25*	**0.335**	*0.145*	*1.5*	**0.051**	*0.102*	*0.25*	**0.0029**	*0.0023*	*0.005*	**0.014**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.00135**	*0.0027*	*0.01*	**0.0049**	*0.0004*	*0.0025*	**0.0021**	*0.001*	*0.0025*	**0.0002**	*0.0004*	*0.0025*
WS-MW114-20171201	12/1/2017	11:24	Ground Water	**0.023**	*0.046*	*0.25*	**0.0725**	*0.145*	*1.5*	**0.051**	*0.102*	*0.25*	**0.0025**	*0.0023*	*0.005*	**0.0169**	*0.0013*	*0.0025*	**0.0003**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0065**	*0.0004*	*0.0025*	**0.0025**	*0.001*	*0.0025*	**0.0002**	*0.0004*	*0.0025*
WS-MW114-20180329	3/29/2018	14:05	Ground Water	**0.237**	*0.046*	*0.25*	**0.556**	*0.145*	*1.5*	**0.249**	*0.102*	*0.25*	**0.00115**	*0.0023*	*0.005*	**0.0173**	*0.0013*	*0.0025*	**0.00025**	*0.0005*	*0.0025*	**0.0014**	*0.0027*	*0.005*	**0.0063**	*0.0004*	*0.0025*	**0.0025**	*0.001*	*0.0025*	**0.0002**	*0.0004*	*0.0025*
Average with 1/2 RL				***0.094***			***0.32***			***0.117***			***0.0022***			***0.016***			***0.00027***			***0.001***			***0.0059***			***0.00237***			***0.00020***		

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
**	TDS used Method 160.1
[1]	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
LY	Lysimeter
MCL	Maximum Contaminant Level, Primary
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟫	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
🟩	Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 7 Results of Groundwater Analyses (continued)

				Total Recoverable Metals Method: ICPMS EPA200.8																					Total Mercury Method: CVAA EPA245.1		
Sample ID	**Sample Date**	**Time**	**Matrix**	**Manganese**	*Manganese-MDL*	*Manganese-RL*	**Molybdenum**	*Molybdenum-MDL*	*Molybdenum-RL*	**Nickel**	*Nickel-MDL*	*Nickel-RL*	**Selenium**	*Selenium-MDL*	*Selenium-RL*	**Silver**	*Silver-MDL*	*Silver-RL*	**Uranium**	*Uranium-MDL*	*Uranium-RL*	**Zinc**	*Zinc-MDL*	*Zinc-RL*	**Mercury**	*Mercury-MDL*	*Mercury-RL*
				mg/L	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*	**mg/L**	*mg/L*	*mg/L*
CGWSL				***0.05***			***1.0***			***0.2***			***0.05***			***0.05***			***0.03***			***5.0***			***0.002***		
*Screening Level Source**				***EPA MCL2***			***WQCC Irr***			***WQCC Irr***			***WQCC HH***			***WQCC HH***			***WQCC HH***			***EPA MCL2***			***WQCC HH***		
WS-MW118-20170816¹	8/15/2017	12:20	Ground Water	**0.81**	*0.0037*	*0.01*	**0.0196**	*0.0003*	*0.0025*	**0.0175**	*0.0015*	*0.005*	**0.0032**	*0.0013*	*0.005*	**0.00005**	*0.0001*	*0.0025*	**0.0134**	*0.00008*	*0.0005*	**0.0181**	*0.0181*	*0.05*	**0.0001**	*0.00005*	*0.0002*
WS-MW114-20171201	12/1/2017	11:24	Ground Water	**0.987**	*0.0037*	*0.01*	**0.0259**	*0.0003*	*0.0025*	**0.04**	*0.0015*	*0.005*	**0.0094**	*0.0013*	*0.005*	**0.00005**	*0.0001*	*0.0025*	**0.0143**	*0.00008*	*0.0005*	**0.00685**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
WS-MW114-20180329	3/29/2018	14:05	Ground Water	**0.955**	*0.0037*	*0.01*	**0.0225**	*0.0003*	*0.0025*	**0.0332**	*0.0015*	*0.005*	**0.0108**	*0.0013*	*0.005*	**0.00005**	*0.0001*	*0.0025*	**0.0145**	*0.00008*	*0.0005*	**0.00685**	*0.0137*	*0.05*	**0.000025**	*0.00005*	*0.0002*
Average with 1/2 RL				***0.92***			***0.0227***			***0.0302***			***0.0078***			***0.00005***			***0.0141***			***0.011***			***0.0001***		

	If no value in NMAC 20.6.2 was available, then the USEPA Federal MCL was used. If a screening level is availble from either the NMAC or USEPA, the lower concentration is used.
*	**WQCC:** Water Quality Control Commission Regulations and Standards, 20.6.2 NMAC. **EPA MCL:** National Primary Drinking Water Regulations, May 2009, EPA 816-F-09-004
**	TDS used Method 160.1
¹	Sample ID lists MW118, but sampled from MW114
330	Concentration Exceeds Screening Level
CGWSL	Critical Groundwater Screening Level
DOM	Domestic Water Supply (20.6.2.3103.B NMAC)
DUP	Duplicate
EPA	United States Environmental Protection Agency
HH	Human Health (20.6.2.3103.A NMAC)
Irr	Irrigation Use (20.6.2.3103.C NMAC)
LY	Lysimeter
MCL	Maximum Contaminant Level, Primary
MCL2	Maximum Contaminant Level, Secondary
MDL	Method Detection Limit
MW	Monitor Well
NA	Not Applicable
NAF	Not Analyzed For; and/or inadequate amount of sample
NR	Not Reported
RL	Reporting Limit
RO	Reverse Osmosis
WS	Water Sample
WQCC	Water Quality Control Commission
🟨	Below Method Detection limit - 1/2 MDL listed. Nitrite as N is reported as 1/2 Reporting Limit (RL)
🟫	Analyses are not controlled on RPD values from sample concentrations less than 10 times the reporting limit. QC batch accepted based on LCS and/or LCSD QC results.
🟩	Estimated concentration. Analyte concentration between MDL and RL
🟪	Sample was chosen for matrix spike. Spike recovery did not meet laboratory acceptance criteria, possible matrix interference in sample.
🟧	Sample was received several days after collected and subsequently analyzed past hold time.
🟦	This result was analyzed outside of the EPA recommended holding time

Table 7 Results of Groundwater Analyses (continued)

Appendices

Appendices A and B included on attached flash drive (hardcopy) or in zipped file in electronic version