2018 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

Prepared for:

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LIST OF ACRONYMS AND ABBREVIATIONS

bgs	Below Ground Surface
CAMP	Corrective Action Monitoring Plan
CAMU	Corrective Action Management Unit
cfs	Cubic Feet Per Second
CM	Corrective Measure
CMS	Corrective Measures Study
COC	Constituents of Concern
COEH	City of East Helena
Custodial Trust	Montana Environmental Custodial Trust
°C	Degrees Centigrade
DI	Deionized
DMP	Data Management Plan
DO	Dissolved Oxygen
EI	Environmental Indicator
ET	Evapotranspiration
HHS	Human Health Standard
IM	Interim Measures
METG	Montana Environmental Trust Group
mg/L	milligrams/liter
ORP	Oxidation-Reduction Potential
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAI	Source Area Investigations
SC	Specific Conductance
SPHC	South Plant Hydraulic Control
SWL	Static Water Level
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
µm	micrometer
USEPA	United States Environmental Protection Agency
WRM	Water Resources Monitoring

EXECUTIVE SUMMARY

Hydrometrics, Inc. conducted groundwater and surface water monitoring for the Former East Helena Smelter Project in 2018. The East Helena Smelter produced lead bullion from a variety of concentrates and other feed stock from 1888 until 2001 when the smelter was permanently shut down. Smelting activities have resulted in water quality impacts to local groundwater with the primary contaminants of concern arsenic and selenium. The 2018 monitoring program is a continuation of annual monitoring programs designed to document the effectiveness of remedial measures completed to date, with a focus on groundwater contaminant concentrations trends and status (expanding, contracting, stable) of the groundwater arsenic and selenium plumes.

The 2018 monitoring program included semi-annual streamflow and water quality sampling at nine sites on or adjacent to Prickly Pear Creek, one-time sampling at four sites on a small tributary drainage, seasonal groundwater level monitoring at 186 monitoring wells, groundwater quality sampling at 74 monitoring wells, and semiannual water quality monitoring at 20 residential/public water supply wells. All water quality samples were analyzed for an extended suite of parameters including general chemistry constituents and trace metals, including arsenic and selenium. All 2018 data was reviewed and validated for data quality, and entered into the East Helena Project electronic database.

The 2018 groundwater levels, surface water flows, and groundwater chemistry were affected to some degree by an exceptionally heavy 2017/18 snowpack and above average 2018 precipitation. Groundwater elevations on the former smelter site were generally two to four feet higher in 2018 as compared to previous years due to the climatic conditions. In general, groundwater arsenic concentrations continued their recent declines in response to the recently completed interim remedial measures with the arsenic concentration at the North Plant Arsenic Source Area, the primary arsenic source, the lowest on record. Conversely, selenium concentrations increased in some portions of the former smelter, including the West Selenium Area and the slag pile area. These increases are believed to be related to the increased groundwater levels resulting from the above average 2018 precipitation. Downgradient (north) of the former smelter, arsenic and selenium concentrations were generally stable or decreasing in 2018 in response to the completed interim remedial measures. Arsenic concentrations at some wells along the west margin of the downgradient arsenic plume increased in 2018 due to a slight westward shift in the plume caused by elimination of a large irrigation ditch located to the west and associated ditch leakage and recharge to groundwater. Plume stability metrics, including average plume concentrations, plume areas and plume centroid locations show the downgradient arsenic and selenium plumes to be largely stable, with a slight retraction of the downgradient selenium plume boundary noted in 2018. Plume metrics on the former smelter site show that the plumes continue to decrease in size and concentration in the groundwater contaminant source areas. In addition to the primary COCs arsenic and selenium, zinc showed a significant increase at one well in the North Plant Arsenic Source Area and cadmium increased in the former Acid Plant Area, presumably due to the increased groundwater levels and/or varying geochemical conditions. Both of these trends are localized in nature with zinc and cadmium concentrations near or less than detect at most plant site wells and offsite wells. These wells will be monitored in 2019 to further assess the long-term groundwater concentration trends.

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1.0 INTRODUCTION

This report presents a summary of water resources monitoring (WRM) activities conducted in 2018 for the former East Helena Smelter remediation project. For purposes of this WRM report, the project area includes the former East Helena smelter site or Facility[1], and the surrounding area encompassing two groundwater plumes and the project groundwater monitoring network. The WRM program has been implemented by the Montana Environmental Trust Group (METG), Trustee of the Montana Environmental Custodial Trust (the Custodial Trust). The 2018 monitoring activities are part of the Corrective Measures Study (CMS) implemented by the Custodial Trust to identify and address groundwater contamination originating from the Facility, under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program. This report summarizes the WRM activities and associated data collected in 2018 as outlined in the 2018 Corrective Action Monitoring Plan (CAMP). Information provided in this report will serve as a foundation for planning and implementation of future long-term WRM activities, along with ongoing remedial measure evaluations and other CMS-related activities.

1.1 PROJECT BACKGROUND

The former East Helena Smelter was a custom lead smelter located in Lewis and Clark County, Montana (Figure 1-1). The former smelter began operations in 1888 and produced lead bullion from smelting of a variety of foreign and domestic concentrates, ores, fluxes, and other non-ferrous metal bearing materials. In addition to lead bullion, the Facility produced copper by-products and food-grade sulfuric acid. The Facility ceased operation in April 2001.

The Facility covers approximately 142 acres located primarily on the Prickly Pear Creek alluvial plain. The Facility is bounded to the east and northeast by Prickly Pear Creek; to the west and southwest by uplands or foothills comprised of tertiary-age sediments; and to the north by U.S. Highway 12 and the American Chemet plant (a manufacturer of copper and zinc-based chemicals). The City of East Helena (COEH) business district and residential areas are located immediately north of Highway 12 (Figure 1-1). Prior to 2014, the Facility was bordered to the south by Upper Lake, a large manmade lake/marsh complex. Upper Lake has since been eliminated and the Prickly Pear Creek channel and floodplain lowered to reduce groundwater levels and groundwater interaction with contaminated soils (Section 1.2). The site background and history of the former smelter is described further in numerous reports including Hydrometrics, 1999, 2010, 2017 and GSI, 2014.

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[1] The former smelter site or Facility refers to the approximately 142 acres previously occupied by the East Helena Lead Smelter.

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 11/21/2019 4:05:59 PM	2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**PROJECT LOCATION AND FEATURES**	FIGURE **1-1**

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Soils and non-native fill material (i.e., slag, ore, concentrates, demolition debris) located on the Facility contain elevated concentrations of a number of contaminants, primarily arsenic, selenium, and certain trace metals. Contaminants within site soils and fill are the result of more than a century of ore handling and processing, storage and disposal of smelting wastes and byproducts, and periodic releases of plant process water. The contaminated soil/fill represents the primary historic source of contaminant loading to groundwater. Loading of contaminants to groundwater has resulted in the generation and migration of groundwater plumes (arsenic and selenium) from the Facility to the north and northwest. The Custodial Trust has implemented a number of interim corrective measures (IMs) concurrent with the CMS, including the South Plant Hydraulic Control project, contaminant source removal, and plant site capping (CH2M, 2018). The primary purpose of the IMs completed to date by the Custodial Trust is to reduce contaminant mass loading to groundwater and downgradient migration of contaminants from the Facility in order to protect public health and the environment.

1.2 CORRECTIVE MEASURES STUDY PROGRAM

The Custodial Trust is currently conducting a CMS for the East Helena Facility, under the oversight of the United States Environmental Protection Agency (USEPA). The CMS is one of the RCRA Corrective Actions being conducted at the Facility pursuant to the First Modification to the 1998 RCRA Consent Decree (U.S. District Court, 2012), and has involved the completion of several site investigations designed to delineate groundwater contaminant source areas and aid in selection of groundwater contaminant corrective measures. Concurrent with the CMS program, the Custodial Trust has implemented a number of IMs intended to address ongoing groundwater contaminant loading. The three IMs completed to date include:

1. The South Plant Hydraulic Control (SPHC) IM: The SPHC IM is a multicomponent remedial action intended to lower groundwater levels across the Facility. Since the primary source of contaminant loading to groundwater is groundwater flow through contaminated Facility soils and associated contaminant leaching, lowering the water table has reduced the volume of contaminated soil in contact with groundwater and associated contaminant leaching. Components of the SPHC include: dewatering of former Upper Lake immediately south of the Facility, previously a major source of recharge to the Facility groundwater system; removal of the Smelter Dam from Prickly Pear Creek thereby lowering the creek stage by up to 15 feet and reducing leakage from the creek to the shallow groundwater system; and reconstructing Prickly Pear Creek upstream of and adjacent to the Facility to further reduce the creek stage and leakage to groundwater.
2. Plant Site Evapotranspiration Cover IM: The evapotranspiration (ET) Cover IM included placement of an engineered soil cover over approximately 57 acres of the western portion of the Facility where smelting operations and associated activities occurred (the Former Plant Site). The ET Cover is designed to store precipitation infiltration in the engineered soil cap for subsequent evapotranspiration during the growing season. The purpose of the ET Cover IM is to minimize deep percolation of incident precipitation and snowmelt water through contaminated vadose zone soils and associated leaching of contaminants to groundwater.
3. Contaminant Source Removal IM: Source removal actions were performed on the Facility to remove areas of localized, higher contaminant concentration soils from below the

groundwater table. Source removal actions were completed in the southern portion of the Facility (South Plant Area), including the former Tito Park and Upper Ore Storage areas, and in the Former Acid Plant Area. The excavated soils were placed beneath the ET Cover and the excavations backfilled with clean soil.

Additional information on the completed IMs is available in the CMS Report (CH2M, 2018). Evaluation of the IM effectiveness in terms of the groundwater system response is a primary focus of the East Helena Project CAMP.

1.3 CORRECTIVE ACTION MONITORING PROGRAM

The groundwater and surface water monitoring activities performed in 2018 were conducted in accordance with the 2018 CAMP (Hydrometrics, 2018a). As described in the CAMP, the overall objective of the 2018 monitoring program was to continue assessment of groundwater quality status and trends within and downgradient of the former smelter, and to evaluate the effectiveness of interim and other remedial measures at reducing concentrations and migration of groundwater contaminants. Similar to 2017, the 2018 program focused on performance monitoring appropriate to the CMS phase of a RCRA Corrective Action remediation project including the following performance evaluation-specific monitoring objectives:

[1] Document and track groundwater level and flow trends across the project area;
[2] Document and track groundwater chemistry trends in former smelter contaminant source areas and at the downgradient edge of the selenium plume; and
[3] Evaluate downgradient arsenic and selenium plume stability, in terms of plume area, average plume concentrations, and location of plume centroids.

Additional 2018 monitoring objectives included:

[4] Collect ongoing data on residential/public water supply well water quality in the vicinity of the former smelter to track groundwater use and provide information to water users;
[5] Evaluate surface water quality and potential interactions with the groundwater plumes, specifically any effects of surface water recharge on groundwater flow and plume migration, and surface water quality and flow in the Prickly Pear Creek realignment area; and
[6] Monitor current groundwater chemistry in Corrective Action Management Unit (CAMU) area wells.

This document presents a summary of the 2018 groundwater and surface water monitoring activities and resulting data. The scope of monitoring activities is presented in Section 2 and monitoring results presented in Section 3.

2.0 2018 MONITORING SCOPE

The 2018 monitoring program included semi-annual monitoring at an extensive network of groundwater and surface water locations spanning the project area. The sampling protocol is detailed in the 2018 CAMP (Hydrometrics, 2018a), and followed established standard operating procedures included in the Project Quality Assurance Project Plan (QAPP; Hydrometrics, 2015a) and the Project Data Management Plan (DMP; Hydrometrics, 2011). The scope of the 2018 monitoring is described below.

2.1 SURFACE WATER MONITORING

The 2018 surface water monitoring program included semi-annual surface water level or stage measurements, streamflow measurements and water quality sampling in July and October, and a supplemental sampling event in May. The semi-annual monitoring events included nine monitoring sites, (Table 2-1, Figure 2-1) with eight sites located on Prickly Pear Creek and one site (Trib-1D) located on a spring-fed drainage flowing from the southwest through the former Upper and Lower Lake areas on the south end of the Facility (Figure 2-1). Surface water elevations were measured in June and October at all sites using a survey grade GPS. The elevation surveys were conducted concurrently with site-wide groundwater static water level (SWL) measurements to allow development of site-wide potentiometric maps incorporating groundwater and surface water elevation data. Besides documenting groundwater flow directions and gradients, the resulting data was used to assess potential gaining and losing reaches of Prickly Pear Creek. The surface water monitoring schedule is in Table 2-1.

Streamflow and water quality monitoring was conducted at seven of the nine surface water sites during high flow (July) and low flow (October) conditions (Table 2-1). Although the 2018 CAMP called for high flow sampling in June, flows were too high at that time for safe wading and measurement so the high flow event was moved to July. One site, PPC-5A located adjacent to the former smelter site (Figure 2-1) was sampled in both June and July to allow for comparison of water quality between the originally scheduled and actual high flow surface water sampling conditions.

The May supplemental surface water sampling event included streamflow and water quality monitoring at four sites along the tributary drainage in the southern portion of the Facility (Figure 2-1). The purpose of the supplemental sampling was to document current water quality in the drainage where previous sampling has identified elevated levels of some metals in the spring-fed drainage. The supplemental sampling protocol followed that described in the 2018 CAMP for the semi-annual sampling events.

Surface water samples were analyzed for the parameters shown in Table 2-2, including field analysis of pH, specific conductance (SC), dissolved oxygen (DO) and water temperature, and laboratory analysis of common constituents and total recoverable metals by Energy Laboratories in Helena, Montana. All of the 2018 surface water stage, flow, and water quality results have been entered into the project database and validated for data quality and usability per the project QAPP (Hydrometrics, 2015a). The 2018 validated database is included in Appendix A.

Table 2-1. 2018 Surface Water Monitoring Locations and Schedule

Site ID	Northing	Easting	Description	June/October Water Elevation	July/October Flow and Water Quality	May Flow/ Water Quality
Semi-Annual Sampling Sites						
PPC-3A	856283.87	1361694.37	Prickly Pear Creek upstream of former smelter site	**X**	**X**	
PPC-4A	858437.51	1361223.39	Prickly Pear Creek realigned channel upstream of former smelter dam, in former Upper Lake area	**X**	**X**	
Trib-1D	859392.30	1361402.33	Tributary drainage immediately upstream of Prickly Pear Creek confluence	**X**	**X**	
PPC-5A	859568.08	1361450.05	Prickly Pear Creek realigned channel downstream of former smelter dam; near historic site PPC-5	**X**	**X**	
PPC-7	861473.74	1360743.50	Prickly Pear Creek channel upstream of Highway 12 bridge; between slag pile and Highway 12	**X**	**X**	
PPC-8	863372.55	1360137.99	Prickly Pear Creek at West Gail Street in East Helena	**X**		
PPC-36A	864556.11	1358753.31	Prickly Pear Creek approximately 3,500 feet downstream of former smelter site	**X**	**X**	
PPC-9A	865555.92	1357841.22	Prickly Pear Creek approximately 5,250 feet downstream of former smelter site	**X**		
SG-16	872677.17	1350559.96	Prickly Pear Creek downstream of Canyon Ferry Road bridge	**X**	**X**	
Supplemental Sampling Sites						
Trib-1	857986.50	1360215.04	Head of tributary drainage near railroad bridge			**X**
Trib-1B	858476.27	1360181.89	Tributary drainage at inlet to ponded area			**X**
Trib-1C	859047.02	1360566.76	Tributary drainage downstream (north) of access road			**X**
Trib-1D	859392.30	1361402.33	Tributary drainage immediately upstream of Prickly Pear Creek confluence			**X**

Site locations shown on Figure 2-1.
Sites listed in upstream to downstream order.

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 12/19/2019 9:09:58 AM	2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2018 SURFACE WATER MONITORING LOCATIONS	FIGURE 2-1

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Table 2-2. 2018 Surface Water Sample Analytical Parameter List

Parameter	Analytical Method [1]	Project Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	5
Magnesium	242.1/200.7	5
Sodium	273.1/200.7	5
Potassium	258.1/200.7	5
Trace Constituents (Total Recoverable)		
Antimony (Sb)	200.7/200.8	0.0005
Arsenic (As)	200.8/SM 3114B	0.001
Cadmium (Cd)	200.7/200.8	0.00003
Copper (Cu)	200.7/200.8	0.002
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.0003
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.000005
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Thallium (Tl)	200.7/200.8	0.0002
Zinc (Zn)	200.7/200.8	0.008
Field Parameters		
Stream Flow	HF-SOP-37/-44/-46	NA
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L
pH	HF-SOP-20	0.01 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

Notes:

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewater* (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).

2.2 2018 GROUNDWATER MONITORING

The 2018 groundwater monitoring program included groundwater level and water quality monitoring at a wide network of monitoring wells and residential/public water supply wells. The current monitoring well network includes more than 180 monitoring wells with well coverage extending from south (upgradient) of the Facility northward approximately four miles beyond Canyon Ferry Road. Monitoring well depths range from less than 10 feet for some wells located near Prickly Pear Creek, to 247 feet (EH-145D) north of Canyon Ferry Road. The groundwater monitoring network is shown on Exhibit 1.

2.2.1 Groundwater Level Monitoring

Groundwater level monitoring has been a key component of the monitoring program during recent years due to its relevance to the groundwater remediation program. As described in Section 1, the objective of the SPHC IM is to lower groundwater levels on the Facility thereby reducing groundwater interaction with, and contaminant leaching from, plant site soils. The groundwater level data also provides information on changing hydraulic gradients and groundwater (and contaminant) flow directions, and provides for development of project-area groundwater potentiometric maps.

Groundwater levels were measured at approximately 186 wells in May, June, and October. All water levels were measured manually with electronic meters with depths to water from the top of the well casing recorded to the nearest 0.01 foot. The depth to water measurements were converted to elevations (relative to mean sea level) using surveyed casing elevations for each well. The water level monitoring events were all completed in a single day to provide a snapshot of seasonal groundwater elevation conditions, and were coordinated with the surface water elevation surveys (Section 2.1) to provide more comprehensive water level datasets for the project area. The 2018 water level monitoring schedule is included in Table 2-3 with results presented in Section 3.2.

2.2.2 Groundwater Quality Monitoring

The 2018 groundwater monitoring program included groundwater quality sampling at 19 monitoring wells in June and 74 wells in October (Table 2-3). In addition, residential and public water supply well sampling was conducted in June and October to monitor the quality of local drinking water sources at 20 residential/public water supply wells (Table 2-4, Exhibit 1). The residential/public water supply well sampling program includes measurement of water levels (where well access permits) and collection of groundwater samples for water quality analyses, with the water quality data provided to the well owners. The COEH public water supply wells (numbers R18, R19, and R20, Table 2-4 and Exhibit 1) are included in each semi-annual sampling event.

Groundwater quality samples were analyzed for the parameters shown in Table 2-5, including field analysis of pH, SC, DO, turbidity, oxidation/reduction potential, and water temperature, and laboratory analysis of common constituents and trace metals (dissolved at monitoring wells and total and dissolved at residential/water supply wells) by Energy Laboratories in Helena, Montana. All groundwater data collected under the 2018 CAMP has been entered into the project database and validated for data quality and usability. The validated database is included in Appendix A.

Table 2-3. 2018 Monitoring Well Sampling Schedule

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring	
				May / June / October	June	October
2843 Canyon Ferry	872346.4170	1354330.0040	NA	X	X	X
2853 Canyon Ferry	872391.5330	1354773.2360	NA	X	X	X
Amchem4	861677.0140	1359836.2390	NA			X[1]
Amchem Injection	861628.3080	1360331.4230	NA			X[1]
ASIW-1	859803.7500	1362064.5200	3913.75	X		
ASIW-2	860471.8300	1363184.5870	3909.13	X		
DH-1	861171.5317	1359021.4900	3910.89	X		
DH-10A	861456.8081	1360608.8168	3886.97	X		
DH-13	860561.0489	1359795.4104	3909.66	X		
DH-14	859527.8759	1361225.1135	3916.06	X		
DH-15	861541.0629	1360256.9955	3889.82	X		X
DH-17	860997.4140	1359668.6307	3904.84	X	X	X
DH-18	860535.2929	1359814.8334	3910.21	X		
DH-2	859910.4322	1358532.4429	3936.91	X		
DH-20	858989.3710	1360128.4527	3930.89	X		
DH-22	859690.0706	1359816.2344	3930.08	X		
DH-23	860270.2165	1360217.4896	3915.93	X		
DH-24	861412.6262	1359442.0091	3899.59	X		
DH-27	859923.8461	1360046.4609	3912.70	X		
DH-3	858002.5720	1359985.2180	3947.48	X		
DH-30	859935.1871	1360099.5558	3914.23	X		
DH-36	860631.4997	1359936.3381	3907.98	X		
DH-4	859526.8209	1361217.1986	3917.26	X		
DH-42	859587.2008	1359938.7981	3931.61	X		X
DH-47	859460.0231	1360402.0232	3922.33	X		
DH-48	861493.5490	1358990.7080	3905.96	X		
DH-5	859641.3787	1360792.8184	3921.18	X		
DH-50	861385.2562	1359571.7629	3904.76	X		
DH-51	861330.2543	1359700.3266	3904.34	X		
DH-52	861372.1393	1360876.1592	3889.18	X		X
DH-53	861343.6803	1361117.6658	3892.87	X		
DH-54	862057.3039	1359471.1481	3890.27	X		
DH-55	860568.8169	1360945.5551	3972.76	X		X
DH-56	861098.4318	1360350.7443	3958.17	X	X	X
DH-57	860328.9453	1360256.3855	3915.26	X		
DH-58	860620.3468	1360149.7987	3899.64	X		
DH-59	859632.0757	1360058.6049	3917.74	X		
DH-5A	859639.6847	1360786.2674	3921.92	X		
DH-6	861527.0799	1360252.4195	3889.85	X		X
DH-61	860401.8562	1359292.9314	3919.62	X		
DH-62	860406.7352	1359291.4704	3919.40	X		

Table 2-3. 2018 Monitoring Well Sampling Schedule

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring	
				May / June / October	June	October
DH-63	861507.1600	1359149.8337	3905.37	X		
DH-64	861382.7472	1359476.2570	3904.02	X		
DH-65	861207.1996	1360879.4052	3945.85	X		
DH-66	861005.1400	1359333.4093	3913.43	X	X	X
DH-67	861657.6447	1359095.5118	3899.77	X		X
DH-68	859814.1624	1361072.1959	3943.28	X		
DH-69	859899.5982	1360783.8944	3934.40	X		X
DH-7	861281.5224	1361580.6838	3898.66	X		
DH-70	859738.6045	1360346.8143	3918.94	X		
DH-71	859876.6862	1359640.5437	3925.12	X		
DH-72	859627.5477	1360069.2019	3918.51	X		
DH-73	860573.7778	1360394.4012	3899.82	X		
DH-74	860942.4611	1360679.4656	4001.49	X		
DH-75	860942.0961	1360685.1136	4001.55	X		
DH-76	860173.6276	1360887.0582	3994.28	X		
DH-77	860292.4800	1359639.2500	3930.04	X		
DH-78	860848.9600	1359368.2200	3918.86	X		
DH-79	860422.2150	1359937.1910	3916.04	X		X
DH-8	860693.1656	1359404.7242	3916.83	X		X
DH-80	859665.4470	1360005.8920	3919.52	X	X	X
DH-82	861377.1610	1359161.9690	3908.18	X		
DH-83	860783.4290	1359388.4600	3918.83	X		
DH-9	860570.6829	1360370.6073	3896.56	X		
East-PZ-1	860384.3830	1362260.6940	3911.93	X		
East-PZ-2	859218.0970	1362203.2540	3924.58	X		
East-PZ-4	857903.6430	1362039.5880	3935.66	X		
East-PZ-6	857123.2100	1362002.4930	3943.83	X		
East-PZ-7	858720.4890	1361949.2990	3928.83	X		
EH-100	862197.1906	1358800.8944	3889.83	X		X
EH-101	862185.0606	1359841.7343	3879.95	X		X
EH-102	862174.5306	1360751.1015	3880.45	X		X
EH-103	862095.3328	1359303.1174	3890.54	X		X
EH-104	862312.6614	1358282.5224	3887.83	X		X
EH-106	862709.9336	1358337.1193	3882.07	X		X
EH-107	862700.4946	1358801.9914	3880.15	X		X
EH-109	862428.7931	1358738.2975	3885.67	X		
EH-110	862408.9392	1359199.7346	3884.05	X		X
EH-111	863063.8249	1358121.6708	3876.50	X		X
EH-112	863053.5629	1358509.6340	3875.78	X		
EH-113	863390.2062	1357972.3721	3871.34	X		
EH-114	863127.7487	1357769.7575	3878.07	X	X	X

Table 2-3. 2018 Monitoring Well Sampling Schedule

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring	
				May / June / October	June	October
EH-115	862717.8146	1357963.0351	3883.29	X	X	
EH-116	863344.5863	1357810.9784	3874.52	X		
EH-117	863491.1940	1357815.1024	3871.33	X		X
EH-118	863059.9069	1357370.9703	3879.95	X		X
EH-119	863617.6238	1357263.0875	3873.75	X		X
EH-120	864330.2403	1357409.9332	3865.78	X	X	
EH-121	864410.1362	1358127.8227	3869.49	X		X
EH-122	864415.3102	1358469.6481	3868.08	X		
EH-123	863027.3459	1356631.3057	3885.71	X	X	X
EH-124	863928.3931	1356666.4917	3874.46	X		X
EH-125	864978.4430	1357089.9698	3863.22	X		X
EH-126	865515.7970	1356002.7980	3870.00	X		X
EH-127	865361.5553	1357810.2814	3860.75	X		
EH-128	863371.5473	1355903.6412	3892.17	X		
EH-129	865649.6907	1355425.0881	3870.21	X	X	X
EH-130	866018.0120	1356641.2087	3858.55	X	X	X
EH-131	867032.6409	1356912.0212	3834.44	X		
EH-132	864040.3529	1355360.4083	3893.90	X		X
EH-133	864766.2675	1355354.8343	3884.36	X		
EH-134	865643.4817	1355425.5451	3870.21	X	X	X
EH-135	865688.5946	1357384.9762	3852.25	X		X
EH-136	866625.8837	1357248.9015	3838.59	X		
EH-137	867047.7809	1357895.6672	3839.66	X		
EH-138	867179.0458	1355646.4718	3839.70	X	X	X
EH-139	867197.4533	1354635.3043	3839.78	X	X	X
EH-140	867962.2620	1356224.7870	3812.08	X		
EH-141	868713.2950	1354782.7040	3813.32	X	X	X
EH-142	870077.4710	1353868.6000	3804.68	X		
EH-143	870683.7490	1354372.7630	3803.37	X	X	X
EH-144D	874170.1440	1354086.1220	3778.86	X		
EH-144M	874170.2050	1354096.2940	3778.95	X		
EH-144S	874170.3570	1354091.1800	3778.70	X		
EH-145D	873225.3800	1355535.0100	3789.60	X		
EH-145S	873230.4000	1355543.7500	3790.09	X		
EH-200	862018.2570	1353065.2499	3953.33	X		
EH-201	861475.9040	1353968.1921	3973.48	X		
EH-202	861250.6755	1357113.7358	3930.56	X		
EH-203	860233.8575	1356623.2108	4003.92	X		
EH-204	860660.9927	1358703.6006	3925.69	X	X	X
EH-205	861652.5237	1358687.0616	3900.66	X		
EH-206	862969.4011	1356012.7840	3898.10	X		X

Table 2-3. 2018 Monitoring Well Sampling Schedule

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring	
				May / June / October	June	October
EH-208	863930.4941	1354401.5732	3910.58	X		
EH-209	864742.1995	1353102.0008	3898.34	X		
EH-210	861653.6027	1358674.6787	3901.19	X	X	X
EH-211	862223.9360	1356747.9170	3905.75	X		
EH-212	862222.6280	1356753.3600	3905.90	X		
EH-50	862195.6926	1358817.9994	3889.39	X		X
EH-51	862186.9796	1359828.4153	3880.09	X		X
EH-52	862191.6556	1360752.3375	3880.50	X		X
EH-53	863387.4722	1358268.8315	3872.82	X		X
EH-54	863345.3893	1359822.3324	3869.66	X		X
EH-57	862618.4258	1357736.4835	3885.05	X		
EH-57A	862625.8977	1357731.0375	3885.45	X		X
EH-58	861985.3850	1361553.1999	3888.15	X		X
EH-59	862766.0055	1361023.2440	3876.57	X		X
EH-60	862093.3668	1359295.7834	3888.46	X		X
EH-61	862095.8588	1359282.0974	3889.77	X		X
EH-62	863373.6172	1358812.9774	3875.07	X		X
EH-63	862682.4886	1359427.4311	3878.32	X		X
EH-64	862710.9196	1359200.8666	3882.67	X		
EH-65	862702.9806	1358789.9274	3879.96	X		X
EH-66	864406.8992	1358105.3308	3869.48	X		X
EH-67	864405.9092	1358454.5661	3869.46	X		
EH-68	863877.1312	1360331.4723	3867.60	X		
EH-69	863791.1154	1360852.6083	3869.10	X		X
EH-70	864971.9141	1357077.7828	3863.48	X		X
EHMW-3	868386.9702	1356618.4238	3825.45	X		
EHTW-3	868576.0698	1356692.1916	3827.66	X		
IW-01	864945.8740	1354765.6430	3888.28	X		
IW-02	865731.8830	1353973.5110	3871.08	X		
MW-1	858771.6535	1358766.7575	3953.05	X		X
MW-10	858554.2009	1359549.2659	3946.28	X		X
MW-11	857959.4701	1358516.7490	3973.33	X		X
MW-2	859191.6356	1358745.8415	3945.97	X		X
MW-3	859196.8246	1359132.3857	3940.95	X		X
MW-4	858802.4764	1359150.0127	3947.06	X		X
MW-5	858414.7012	1358930.2411	3956.18	X		X
MW-6	858876.2702	1359556.4689	3938.14	X		X
MW-7	858777.0044	1358177.7736	3963.67	X		X
MW-8	857962.2351	1359400.9312	3958.65	X		X
MW-9	857977.4420	1358978.9840	3965.36	X		X
PBTW-1	861055.8909	1359662.6777	3907.85	X		

Table 2-3. 2018 Monitoring Well Sampling Schedule

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring	
				May / June / October	June	October
PBTW-2	861165.7887	1359622.4268	3906.73	X		
PPCRPZ-02	858388.3477	1360904.9182	3923.17	X		
PRB-1	861019.3720	1359488.1840	3910.83	X		
PRB-2	861114.8098	1359753.5985	3905.34	X		
PRB-3	860983.8120	1359418.5272	3912.96	X		
PZ-36A	864560.5170	1358731.2910	3858.96	X		
PZ-36B	864557.5720	1358724.5180	3858.75	X		
PZ-36C	864554.6450	1358718.7630	3859.60	X		
PZ-9A	865510.3780	1357868.3890	3850.70	X		
PZ-9B	865507.2270	1357867.0950	3849.43	X		
SC-1	862196.3525	1358838.9750	3890.42	X		
SDMW-1	860514.5930	1359962.8781	3914.28	X		
SDMW-2	860448.2571	1359851.2283	3914.17	X		
SDMW-3	860203.9396	1359859.3573	3918.07	X		
SDMW-4	860218.1176	1360144.9397	3917.66	X		
SDMW-5	860446.6991	1359750.3085	3921.29	X		
SP-3	861487.4030	1358277.0514	3905.91	X		
SP-4	861277.8344	1358887.3922	3908.16	X		
SP-5	861578.6048	1358912.3022	3903.52	X		
TW-1	860392.8781	1359940.7995	3918.26	X		
TW-2	860351.2000	1359895.9000	3931.43	X		
ULM-PZ-1	857498.2490	1360521.7270	3924.24	X		
ULTP-1	858779.0631	1360264.2920	3919.63	X		
ULTP-2	858262.1761	1360427.4600	3921.23	X		
			Total # Wells Per Event	**186**	**19**	**74**

All monitoring locations shown on Exhibit 1.
NA - Not Available

Table 2-4. 2018 Residential/Public Water Supply Well Sampling Sites and Schedule

Map Key (see Exhibit 1)	Northing	Easting	Water Quality Monitoring	
			June	October
R1	863425.39	1359501.01	X	X
R2	863266.68	1359337.84	X	X
R3	863296.03	1360955.74	X	X
R4	863053.71	1361184.11	X	X
R5	864206.53	1358674.56	X	X
R6	866156.57	1356934.48	X	X
R7	872346.42	1354330.00	X	X
R8	872391.53	1354773.24	X	X
R9	872086.41	1355030.70	X	X
R10	863376.30	1361815.27	X	X
R11	863255.39	1358240.44	X	X
R12	861502.42	1362101.41	X	X
R13	855347.37	1359909.48	X	X
R14	863233.58	1359840.14	X	X
R15	861784.41	1356574.41	X	X
R16	861925.29	1356400.09	X	X
R17	861781.59	1356290.54	X	X
R18	872558.37	1356681.06	X	X
R19	871444.75	1356882.84	X	X
R20	868437.60	1356673.10	X	X

Well locations shown on Exhibit 1.

Table 2-5. 2018 Groundwater Sample Analytical Parameter List

Parameter	Analytical Method (1)	Project Required Detection Limit (mg/L)	Montana Groundwater Human Health Standards (mg/L)(2)
Physical Parameters			
pH	150.2/SM 4500H-B	0.1 s.u.	NA
Specific Conductance	120.1/SM 2510B	1 µmhos/cm	NA
TDS	SM 2540C	10	NA
TSS	SM 2540D	10	NA
Common Ions			
Alkalinity	SM 2320B	1	NA
Bicarbonate	SM 2320B	1	NA
Sulfate	300.0	1	NA
Chloride	300.0/SM 4500CL-B	1	NA
Bromide	300.0	0.05	NA
Calcium	215.1/200.7	1	NA
Magnesium	242.1/200.7	1	NA
Sodium	273.1/200.7	1	NA
Potassium	258.1/200.7	1	NA
Trace Constituents (Total and/or Dissolved) (3)(4)			
Antimony (Sb)	200.7/200.8	0.003	0.006
Arsenic (As)	200.8/SM 3114B	0.002	0.01
Cadmium (Cd)	200.7/200.8	0.001	0.005
Copper (Cu)	200.7/200.8	0.001	1.3
Iron (Fe)	200.7/200.8	0.02	NA
Lead (Pb)	200.7/200.8	0.005	0.015
Manganese (Mn)	200.7/200.8	0.01	NA
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.001	0.002
Selenium (Se)	200.7/200.8/SM 3114B	0.001	0.05
Thallium (Tl)	200.7/200.8	0.001	0.002
Zinc (Zn)	200.7/200.8	0.01	2
Field Parameters (5)			
Static Water Level	HF-SOP-10	0.01 ft	NA
Water Temperature	HF-SOP-20	0.1 °C	NA
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L	NA
pH	HF-SOP-20	0.01 pH standard unit	NA
Turbidity		0.1 NTU	NA
ORP/Eh	HF-SOP-23	1 mV	NA
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm	NA

Notes:

(1) Analytical methods are from *Standard Methods for the Examination of Water and Wastewater* (SM) or EPA's *Methods for Chemical Analysis of Water and Waste* (1983).

(2) Standards from Montana Circular DEQ-7 (May 2017 Version). NA = not applicable (no human health standard).

(3) Residential/water supply well samples analyzed for total and dissolved trace constituents; monitoring well samples analyzed for dissolved metals only.

(4) Samples to be analyzed for dissolved constituents will be field-filtered through a 0.45 µm filter.

(5) Field parameters measured in a flow-through cell in accordance with project SOPs.

2.3 DATA MANAGEMENT AND QUALITY CONTROL

Procedures for data review, validation, and reporting are presented and discussed in the East Helena QAPP (Hydrometrics, 2015a), the Data Management Plan (DMP) (Hydrometrics, 2011), and the 2018 CAMP (Hydrometrics, 2018a). Included in these documents are control limits and criteria for specific types of field and laboratory quality control (QC) samples, data validation and verification methods, potential corrective actions if criteria are not met, and database management procedures. Field QC samples collected for the groundwater monitoring program included deionized (DI) water blanks, equipment rinsate blanks (to evaluate the effectiveness of the decontamination procedure), and field duplicate samples, all collected at a minimum frequency of 1 per 20 field samples or 1 per day (whichever was greater) for monitoring wells, and 1 per 20 total samples for residential wells. Field QC samples for surface water included DI blanks and field duplicate samples, both collected at a minimum frequency of 1 per 20 samples or 1 per day, whichever was greater.

The DMP includes checklists for review of both field and laboratory documentation (prior to formal validation of laboratory data), and post-validation review and approval of the East Helena database (Hydrometrics, 2011). All data collected under the 2018 WRM program has been reviewed and validated in accordance with these procedures and entered into the East Helena Project water quality database. The 2018 data validation and verification process resulted in qualification of a small percentage of the total data points collected as estimated due to minor QC sample exceedances (e.g., field duplicate control limit exceedances). For the spring 2018 data set, 97.2% of the surface water results, 99.1% of the monitoring well results, and 99.8% of the residential well results were accepted without any qualifiers applied; for the fall 2018 data set, 100% of the surface water, monitoring well, and residential well results were accepted without any qualifiers applied. All WRM data collected during 2018 was categorized as usable, since no data were rejected during the validation process.

3.0 2018 WATER RESOURCES MONITORING RESULTS

3.1 SURFACE WATER MONITORING RESULTS

The 2018 surface water monitoring program included measurement of surface water elevations, streamflow rates, and surface water quality sampling (Section 2.1). The surface water elevation data was used in conjunction with concurrent groundwater elevation data to develop site-wide groundwater potentiometric maps and evaluate groundwater flow directions and groundwater / surface water interactions. The streamflow and surface water quality data was used to delineate gaining and losing segments of Prickly Pear Creek, and document current water quality conditions in the project area.

3.1.1 Surface Water Elevation and Flow

Streamflow and elevation measurements were recorded in July and October 2018. Although the 2018 CAMP included spring season monitoring in June, streamflows were too high in June for safe wading and measurement so the event was rescheduled for July. The streamflow and stream stage data is included in Table 3-1 with site locations shown on Figure 2-1. The 2018 streamflow rates were higher than typical due to an exceptionally heavy 2017/2018 snowpack and wet spring. Figure 3-1 shows continuous streamflow data from a USGS gaging station on Prickly Pear Creek approximately five miles upstream of the Facility. The peak flow in June 2018 approached 600 cubic feet per second (cfs) while peak flows the previous two years ranged between 100 and 200 cfs. The higher flows persisted throughout 2018 with December 2018 flows of about 40 cfs compared to typical late season flows closer to 20 cfs. The higher streamflow and precipitation experienced in 2018 had a direct impact on the plant site and downgradient groundwater conditions.

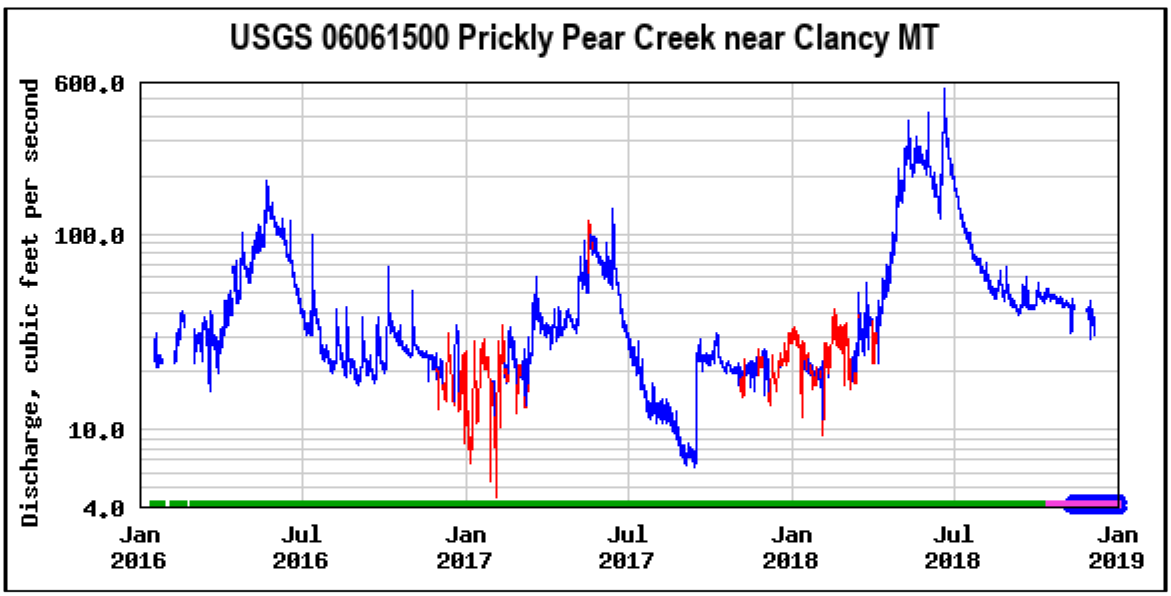
TABLE 3-1. 2018 PRICKLY PEAR CREEK STREAMFLOW AND STAGE MEASUREMENTS

Monitoring Site	Location	Stream Stage - ft AMSL		Stream Flow - cfs	
		6/18/2018	10/10/2018	7/19/2018	10/12/2018
PPC-3A	PPC Upstream of Facility	3929.65	3928.07	118	49
PPC-4A	PPC Adjacent to Facility	3910.94	3910.38	115	51
Trib-1D	Tributary site at PPC Confluence	3904.81	3905.17	0.010	0.038
PPC-5A	PPC Adjacent to Facility	3903.31	3902.59	112	50
PPC-7	PPC Downstream Facility Boundary	3883.23	3882.05	111	52
PPC-8	PPC at West Gail Street in East Helena	3869.02	3868.11	nm	nm
PPC-36A	PPC 0.7 miles downstream of Facility	3856.06	3854.86	112	51
PPC-9A	PPC 1.0 mile downstream of smelter	3846.48	3845.72	nm	nm
SG-16	PPC 2.9 miles downstream of Facility	3767.83	3766.45	93	43

PPC - Prickly Pear Creek
AMSL - Above Mean Sea Level
Sites listed in upstream to downstream order; locations shown on Figure 2-1.
nm - not measured per 2018 CAMP

Similar to past years, the 2018 data indicates that Prickly Pear Creek flow adjacent to the Facility (PPC-3A to PPC-7) was relatively consistent in both July and October (Table 3-1). The 2018 results are consistent with previous flow data, suggesting there is limited net interaction between Prickly Pear Creek and the local groundwater system adjacent to the Facility. The 2018 flow measurements in this reach included two locations (PPC-4A and PPC-5A) on the realigned creek channel; these results therefore suggest that the realignment project, completed as part of the SPHC IM, has maintained the historic condition of no significant flow gains or losses adjacent to the Facility. Downstream of the Facility, however, the 2018 (and previous) flow data shows flow rates consistently decrease in a downstream direction indicating leakage from the creek to groundwater. Although irrigation diversion flows were not measured in 2018, previous comprehensive synoptic flow events have shown leakage losses on the order of 10 to 20 cfs between Highway 12 and Canyon Ferry Road (sites PPC-7 and SG-16, Figure 2-1; Hydrometrics, 2018b). The June and October surface water elevations are also included in Table 3-1.

FIGURE 3-1. 2016 THROUGH 2018 PRICKLY PEAR CREEK FLOWS UPSTREAM OF THE FORMER SMELTER



3.1.2 Semi-Annual Surface Water Quality Results

The 2018 semi-annual surface water quality data is presented in Tables 3-2 (July) and 3-3 (October). The seasonal data shows Prickly Pear Creek water to be a calcium-bicarbonate type water with slightly alkaline pH and total dissolved solids (TDS) concentrations ranging from approximately 150 to 250 mg/L seasonally. Major ion constituent concentrations are very consistent from upstream of the smelter site (site PPC-3A) to downstream site SG-16 near Canyon Ferry Road. For example, calcium concentrations in this reach ranged from 31 to 32 mg/L in July, and from 36 to 40 mg/L in October, and the sulfate concentration was 43 mg/L at all Prickly Pear Creek site in July, and ranged from 59 to 61 mg/L in October.

Table 3-2. July 2018 Surface Water Quality Monitoring Results

Monitoring Site	Prickly Pear Creek						TRIB-1D
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	SG-16	
Sample Date	7/19/18	7/19/18	7/19/18	7/19/18	7/19/18	7/19/18	7/19/18
Field Parameters							
pH (s.u.)	8.00	8.01	7.93	7.94	7.61	7.62	9.72
SC (µmhos/cm)	260	243	261	260	260	261	551
Diss O_2	9.52	9.53	9.60	9.47	9.44	9.67	11.79
Water Temp (°C)	14.8	14.4	13.9	13.6	13	13.3	25.3
Flow (cfs)	118	115	112	111	112	93	0.0097
Laboratory Analyses							
pH (s.u.)	8.2	8.2	8.2	8.2	8.2	8.2	9.8
SC (µmhos/cm)	271	271	270	271	271	272	563
Total Alkalinity as CaCO3	77	77	77	77	77	77	63
Total Dissolved Solids	185	182	183	183	186	187	404
Total Suspended Solids	<10	<10	10	10	11	<10	<10
Calcium	31	32	30	31	31	31	62
Magnesium	7	7	7	7	7	7	16
Sodium	10	11	10	10	10	11	24
Potassium	3	3	3	3	3	3	2
Bicarbonate	93	93	93	93	93	93	27
Chloride	6	6	6	6	6	6	6
Sulfate	43	43	43	43	43	43	209
Trace Metals (Total Recoverable)							
Antimony	< 0.0005	< 0.0005	<0.0005	< 0.0005	0.0007	< 0.0005	0.0008
Arsenic	0.005	0.006	0.005	0.005	0.005	0.005	0.021
Cadmium	0.00030	0.00040	0.00027	0.00027	0.00035	0.00030	0.0002
Copper	0.004	0.007	0.004	0.005	0.005	0.005	0.003
Iron	0.45	0.65	0.47	0.47	0.48	0.49	0.19
Lead	0.0039	0.0045	0.0047	0.0048	0.0059	0.0060	0.0012
Manganese	0.09	0.08	0.08	0.07	0.08	0.07	0.03
Mercury	< 0.000005	< 0.000005	<0.000005	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Selenium	< 0.001	< 0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001
Thallium	< 0.0002	< 0.0002	<0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Zinc	0.080	0.087	0.079	0.078	0.081	0.078	0.011

All concentrations in mg/L unless otherwise noted

(shaded cell) Concentration exceeds applicable surface water quality standard.

Prickly Pear Creek sites listed in upstream to downstream order.

Table 3-3. October 2018 Surface Water Quality Monitoring Results

Monitoring Site	Prickly Pear Creek						TRIB-1D
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	SG-16	
Sample Date	10/12/18	10/12/18	10/12/18	10/12/18	10/12/18	10/12/18	10/12/18
Field Parameters							
pH (s.u.)	7.52	7.34	7.53	7.35	7.25	6.73	8.36
SC (µmhos/cm)	325	325	328	328	329	327	770
Diss O_2	11.11	11.51	11.40	11.30	11.64	11.72	13.22
Water Temp (°C)	6.5	6.2	6.1	5.8	5.1	4.8	9.3
Flow (cfs)	49	51	50	52	51	43	0.038
Laboratory Analyses							
pH (s.u.)	8	8.1	8.1	8.1	8.1	8.1	8.7
SC (µmhos/cm)	337	338	339	340	342	345	792
Total Alkalinity as CaCO3	89	90	90	89	90	90	96
Total Dissolved Solids	211	215	220	218	224	224	573
Total Suspended Solids	<10	<10	<10	<10	<10	<10	<10
Calcium	40	39	37	36	39	38	105
Magnesium	9	9	8	8	9	8	22
Sodium	14	14	13	13	14	13	25
Potassium	3	3	3	3	3	3	5
Bicarbonate	110	110	110	110	110	110	110
Chloride	7	7	7	7	7	7	8
Sulfate	61	60	59	60	61	60	276
Trace Metals (Total Recoverable)							
Antimony	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Arsenic	0.004	0.004	0.004	0.004	0.004	0.004	0.007
Cadmium	0.00039	0.00044	0.00043	0.00041	0.00042	0.00042	0.00021
Copper	<0.002	0.002	0.002	0.002	0.003	0.003	0.002
Iron	0.2	0.22	0.22	0.22	0.23	0.23	0.47
Lead	0.0014	0.0017	0.0016	0.0016	0.002	0.0027	0.0032
Manganese	0.05	0.05	0.06	0.06	0.06	0.05	0.63
Mercury	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.000009
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Zinc	0.141	0.146	0.142	0.142	0.149	0.143	0.019

All concentrations in mg/L unless otherwise noted

Concentration exceeds applicable surface water quality standard (shaded)

Prickly Pear Creek sites listed in upstream to downstream order.

Total recoverable trace metal concentrations are also relatively low and consistent throughout the sampled reach of Prickly Pear Creek (Tables 3-2 and 3-3). A number of trace metals including antimony, mercury, selenium, and thallium were below the laboratory reporting limits in all 2018 samples. Water quality criterion exceedances (DEQ-7 surface water standards; MDEQ, 2019) for both sampling events were limited to total recoverable lead, which exceeded the hardness-dependent chronic aquatic life criteria in all six July Prickly Pear Creek samples (Table 3-2). The water quality exceedances for lead occurred both upstream and downstream of the Facility, indicating the contaminant sources responsible for the exceedances are located upstream. The occurrence of elevated metals concentrations far upstream of the Facility has been noted in numerous studies, including the watershed total maximum daily load (TMDL) document (USEPA, 2004b). Water quality standard exceedances at the Trib-1D site are limited to arsenic (0.021 mg/L compared with the 0.01 human health standard) in the July sample (Table 3-2). Overall, the 2018 surface water sampling results are consistent with previous results dating back to the 1980s.

3.1.3 Supplemental Surface Water Monitoring Results

In addition to the seasonal Prickly Pear Creek sampling, four sites along the spring creek tributary drainage traversing the south portion of the Facility were sampled in May. The supplemental monitoring was conducted to document current water quality conditions along the tributary drainage where previous sampling had shown elevated concentrations of some metals.

The May tributary sampling results are summarized in Table 3-4 with complete analyses included in Appendix A and site locations shown on Figure 2-1. Consistent with previous monitoring results, the tributary drainage water quality exceeds applicable water quality standards for a number of metals at multiple sites, including cadmium, copper, lead and zinc. Downstream-most site Trib-1D also exceeded the arsenic and iron surface water standards. Comparison of the May, July, and October data from Trib-1D shows the elevated metals concentrations at this site are restricted to the early spring runoff season. Due to the relatively low flow, metals loading from the tributary drainage has no measurable effect on Prickly Pear Creek water quality as exhibited by the consistent concentrations (and loads based on similar flows) at Prickly Pear Creek sites PPC-4A and PPC-5A, located upstream and downstream of the tributary drainage confluence, respectively.

TABLE 3-4. MAY 2018 TRIBUTARY DRAINAGE MONITORING RESULTS

SITE	Field pH	Flow	TDS	Sulfate	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Selenium	Zinc
	s.u.	gpm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TRIB-1	6.68	nm	342	79	0.010	0.0009	0.002	0.78	0.0086	0.169	<0.001	0.016
TRIB-1B	6.25	31	288	87	0.007	0.0239	0.022	0.18	0.008	0.197	<0.001	1.38
TRIB-1C	7.36	305	316	122	0.009	0.0265	0.023	0.26	0.008	0.254	<0.001	2.02
TRIB-1D	7.6	224	342	134	0.011	0.0088	0.015	1.22	0.0061	0.388	<0.001	0.894

All sites sampled on May 25, 2018.
nm - not measured
Site locations shown on Figure 2-1; complete data in Appendix A.
Concentration exceeds applicable surface water quality standard.

3.2 RESIDENTIAL/PUBLIC WATER SUPPLY SAMPLING RESULTS

Table 3-5 includes a statistical summary of the 2018 residential/water supply well arsenic and selenium concentrations along with an exceedance summary of State of Montana human health standards (HHSs) for groundwater (MDEQ, 2019). Complete analytical results, including both total and dissolved metals concentrations, are included in Appendix A with residential well locations shown on Exhibit 1. With the exception of iron and manganese at a few residential wells, the total and dissolved metals concentrations are virtually identical.

As shown in the table, no water supply wells exhibited HHS exceedances for selenium in 2018, while four of the twenty wells showed HHS exceedances for arsenic, consistent with previous results for these wells. The four wells with arsenic exceedances are located either south (upgradient) of the Facility or to the west in an area of known naturally occurring groundwater arsenic (see Section 3.3). There were no exceedances recorded in 2018 or in previous years at the three COEH municipal water supply wells located north of the Facility (Well IDs R18, R19, and R20 in Table 3-5).

3.3 GROUNDWATER MONITORING RESULTS AND DATA ANALYSIS

This section presents a summary of the current groundwater quality conditions and trends, and the status of the groundwater arsenic and selenium plumes. With completion of the scheduled IMs in 2016, the CAMP program has transitioned from a contaminant source area characterization and plume delineation program, to a remedy performance monitoring program appropriate to the remediation and CMS phase of a RCRA Corrective Action remediation project (Hydrometrics, 2018a). In their *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action* (USEPA, 2004a), USEPA defines performance monitoring as "the periodic measurement of physical and/or chemical parameters to evaluate whether a remedy is performing as expected." More recently published USEPA guidance on groundwater remediation completion strategies (USEPA, 2013, 2014a, 2014b) include discussions of recommended remedy evaluation strategies. Based on these guidance documents, and goals and objectives specific to the East Helena Project (Section 1), the 2018 performance monitoring program included two components:

(1) Groundwater level and contaminant concentration trend analyses at selected wells in Facility contaminant source areas, and near the leading edges of the arsenic and selenium plumes; and
(2) Contaminant plume stability analyses.

Following is a summary of 2018 groundwater conditions in the Project area, followed by discussions of the two performance monitoring components.

3.3.1 General Groundwater Conditions

The hydrogeology and geochemistry of the East Helena Facility and Project Area has been described in several documents including Hydrometrics, 2010, 2015b, and 2016; GSI, 2014; and CH2M 2018. The alluvial aquifer on the Facility extends from the top of the saturated zone or water table, downward to a low permeability tertiary ash/clay basal layer. On the Facility, the depth to groundwater varies from less than 10 feet below ground surface (bgs) in the south and near Prickly

Table 3-5. Summary of 2018 Residential/Public Water Supply Well Water Quality Data

Map Key (see Exhibit 1)	Use	# of 2018 Samples	Dissolved Arsenic (mg/L)					Dissolved Selenium (mg/L)				
			Concentration			HHS Exceedances		Concentration			HHS Exceedances	
			Min	Max	Mean	No.	%	Min	Max	Mean	No.	%
R1	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%
R2	Irrigation	1	<0.002	<0.002	<0.002	0	0%	0.002	0.002	0.002	0	0%
R3	Drinking	2	<0.002	<0.002	<0.002	0	0%	0.002	0.006	0.004	0	0%
R4	Irrigation	2	<0.002	<0.002	<0.002	0	0%	0.003	0.003	0.003	0	0%
R5	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%
R6	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0%	0.001	0.002	0.0015	0	0%
R7	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0%	0.001	0.001	0.001	0	0%
R8	Drinking/Irrigation	3	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%
R9	Drinking/Irrigation	3	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%
R10	Irrigation	1	<0.002	<0.002	<0.002	0	0%	0.002	0.002	0.002	0	0%
R11	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0%	0.044	0.045	0.0445	0	0%
R12	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0%	0.003	0.003	0.003	0	0%
R13	Drinking/Irrigation	2	0.014	0.015	0.0145	2	100%	0.002	0.002	0.002	0	0%
R14	Irrigation	2	<0.002	<0.002	<0.002	0	0%	<0.001	0.002	0.002	0	0%
R15	Drinking/Irrigation	2	0.016	0.016	0.016	2	100%	0.002	0.002	0.002	0	0%
R16	Drinking/Irrigation	1	0.018	0.018	0.018	1	100%	0.002	0.002	0.002	0	0%
R17	Drinking/Irrigation	2	0.017	0.017	0.017	2	100%	0.002	0.002	0.002	0	0%
R18	Public Water Supply	2	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%
R19	Public Water Supply	2	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%
R20	Public Water Supply	2	<0.002	<0.002	<0.002	0	0%	<0.001	<0.001	<0.001	0	0%

All concentrations are dissolved fraction; total metals concentrations included in Appendix A.
HHS - Human Health Standard from MDEQ, 2019: arsenic = 0.010 mg/L, selenium 0.050 mg/L

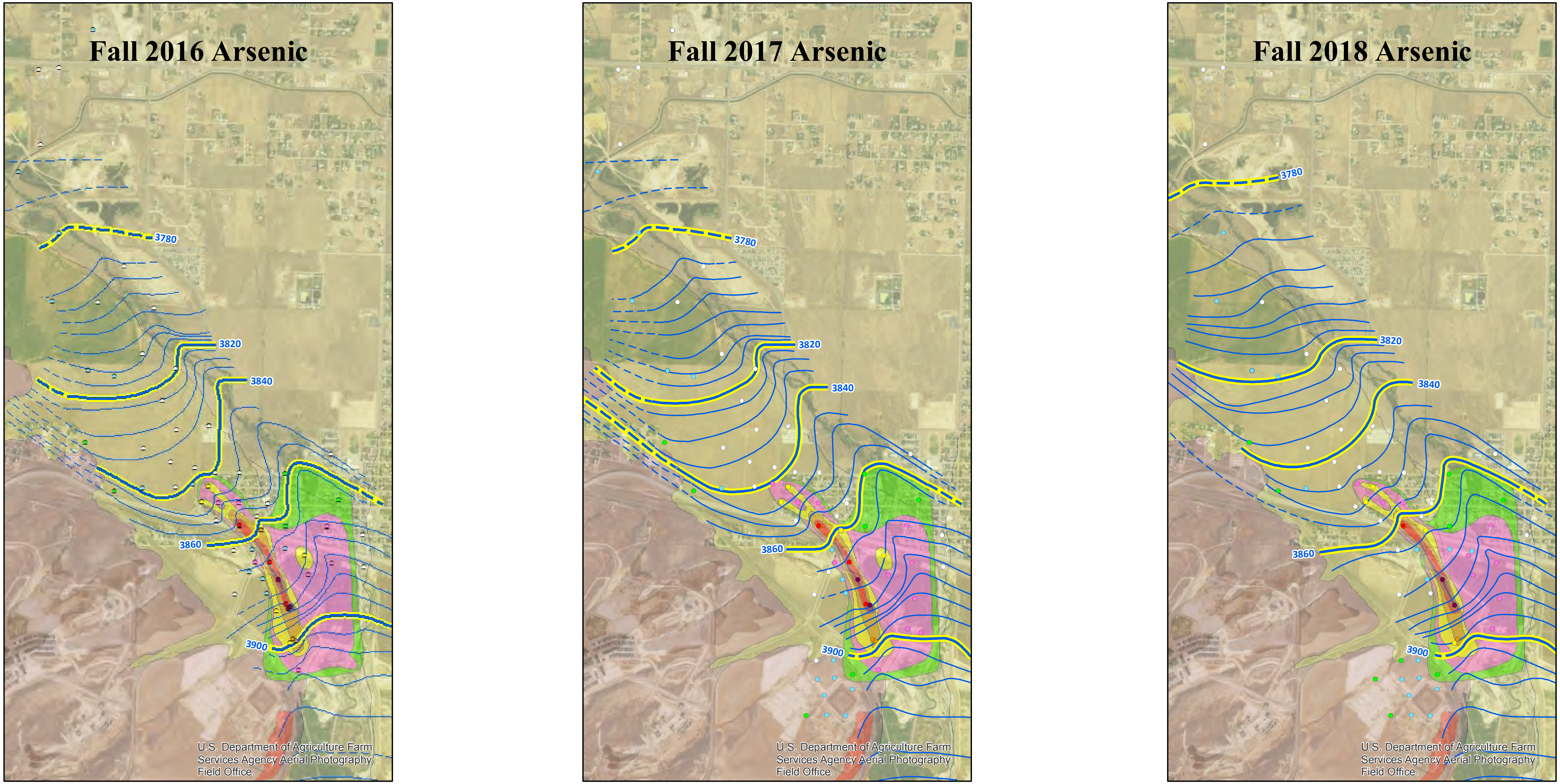
Pear Creek, to about 50 feet bgs in the northwest portion of the Facility. The base of the aquifer (the ash/clay layer) varies in depth from about 20 feet bgs in the southwest portion of the Facility, to more than 70 feet in the northeast portion. As a result, the saturated thickness of the alluvial aquifer ranges from about 10 feet in the south, to about 20 feet in the north of the Facility. A deeper groundwater system also occurs beneath the Facility with the deeper system comprised of isolated to poorly interconnected sandy lenses or zones within the Tertiary sediment unit. The contaminated soils/fill and groundwater plumes are restricted to the upper alluvial aquifer.

As previously noted, the primary groundwater constituents of concern (COCs) are arsenic and selenium, both of which exceed applicable HHSs in groundwater beneath and downgradient of the Facility. Secondary COCs exceeding HHSs in localized portions of the Facility, and rarely if ever in downgradient groundwater, include antimony, cadmium and zinc. The 2018 arsenic and selenium groundwater plumes, as well as the 2016 and 2017 plumes for comparison, are shown on Figures 3-2 and 3-3, respectively.

Groundwater contaminant source areas have been delineated through a number of studies dating back more than two decades, with the two most recent investigations presented in Hydrometrics 2015b and 2016. Based on results of prior investigations, confirmed or suspected historic groundwater contaminant sources include the South Plant Area (Tito Park, former Acid Plant Sediment Drying area, and Upper Ore Storage Area), former Lower Lake, the former Acid Plant settling pond area, former Speiss/Dross Area, and the former Lower Ore Storage Area (Figure 3-4). Based on the 2014 and 2015 Source Area Investigations (SAIs) and other data evaluations conducted as part of the CMS, primary current contaminant source areas included portions of the South Plant Area, the former Acid Plant settling pond area (both areas where source removal IMs were subsequently implemented), the West Selenium Source Area, the North Plant Arsenic Source Area, and the slag pile. The SPHC, source removals and ET Cover IMs, and the planned slag pile remedial action (regrading and capping) are intended to address these source areas.

The configuration and geometry of the current arsenic plume (Figure 3-2) shows the primary plant site plume extending approximately 0.5 miles northwest of the Facility into the City of East Helena, with a more diffuse (lower concentration) plume extending north from the slag pile. Maximum concentrations near 100 mg/L arsenic occur isolated within the Speiss/Dross slurry wall, with maximum concentrations outside of the slurry wall typically in the 20 to 35 mg/L range in the North Plant Site Source Area (Figure 3-4). The downgradient boundary of the arsenic plume as defined by the 0.01 mg/L (HHS) concentration contour is located along the north and west edges of East Helena, and has remained relatively stable since at least 2001 when the Facility was shutdown. An area of arsenic-bearing groundwater south and west of the former smelter (the “west arsenic area”), with arsenic concentrations in the 0.005 to 0.025 mg/L range, is believed to be derived from groundwater interactions with naturally-occurring arsenic-bearing Tertiary-age volcanoclastic sediments.

The selenium plume (Figure 3-3) extends offsite significantly further than the arsenic plume, due to a lower rate of geochemical attenuation (adsorption or coprecipitation) and relatively conservative transport behavior of selenium, with the 0.05 mg/L (HHS) selenium plume extending approximately 2.75 miles northwest of the Facility. The primary current groundwater selenium sources are the West Selenium Source Area (west lobe), and the slag pile (east lobe) (Figure 3-4).



Legend

As Contours	As Conc (mg/L)	Surficial Geology	Groundwater Potentiometric Contour
0.011 - 0.100 mg/L	<0.002	Qac - Alluvium/Colluvium	5-foot Contour
0.101 - 1.00 mg/L	0.002 - 0.010	Qa - Alluvium	5-foot Contour (Inferred)
1.01 - 5.00 mg/L	0.011 - 0.100	Qt - Terrace Gravel	
5.01 - 10.0 mg/L	0.101 - 1.0	QTg - Older Gravel	
10.1 - 20.0 mg/L	1.01 - 5.0	OGts - Tuff and Tuffaceous Sediment	
> 20.0 mg/L	5.01 - 10.0	Ys - Spokane Formation	
	10.01 - 20.0		
	> 20.0		

N

0 0.5 1

Scale in Miles

2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2016-2018 GROUNDWATER ARSENIC PLUMES AND POTENTIOMETRIC CONTOURS EAST HELENA FACILITY	FIGURE 3-2

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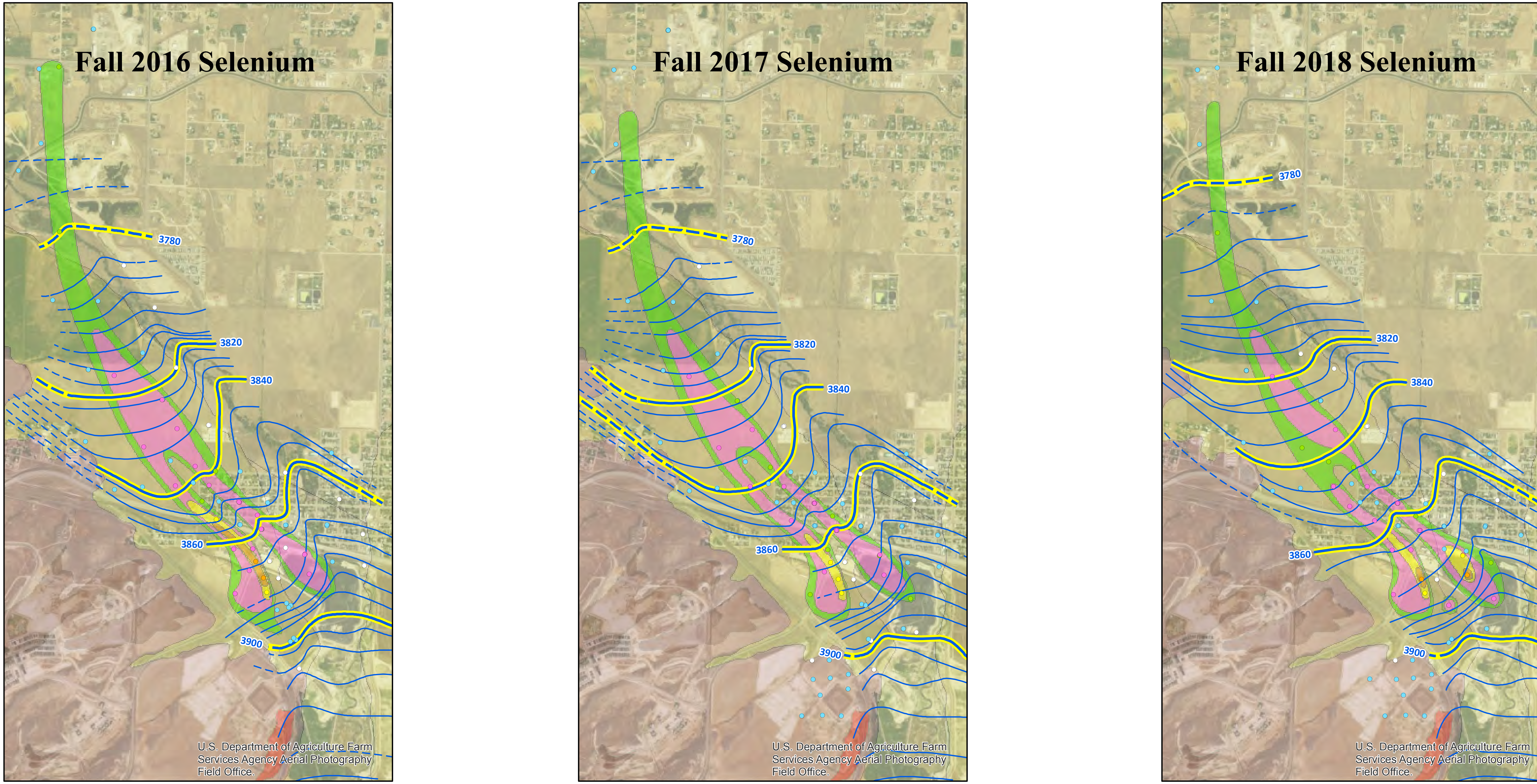

Legend

Se Contours	Se Conc (mg/L)	Surficial Geology	Groundwater Potentiometric Contours
0.051 - 0.100 mg/L	<0.001	Qac - Alluvium/Colluvium	5-foot Contour
0.101 - 0.500 mg/L	0.001-0.050	Qa - Alluvium	5-foot Contour (Inferred)
0.501 - 1.0 mg/L	0.051-0.100	Qt - Terrace Gravel	
1.01 - 3.0 mg/L	0.101-0.500	QTg - Older Gravel	
> 3.0 mg/L	0.501-1.0	OGts - Tuff and Tuffaceous Sediment	
	1.01-3.0	Ys - Spokane Formation	
	>3.0		

N

0 0.5 1

Scale in Miles

2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**2016-2018 GROUNDWATER SELENIUM PLUMES AND POTENTIOMETRIC CONTOURS EAST HELENA FACILITY**	**FIGURE** **3-3**

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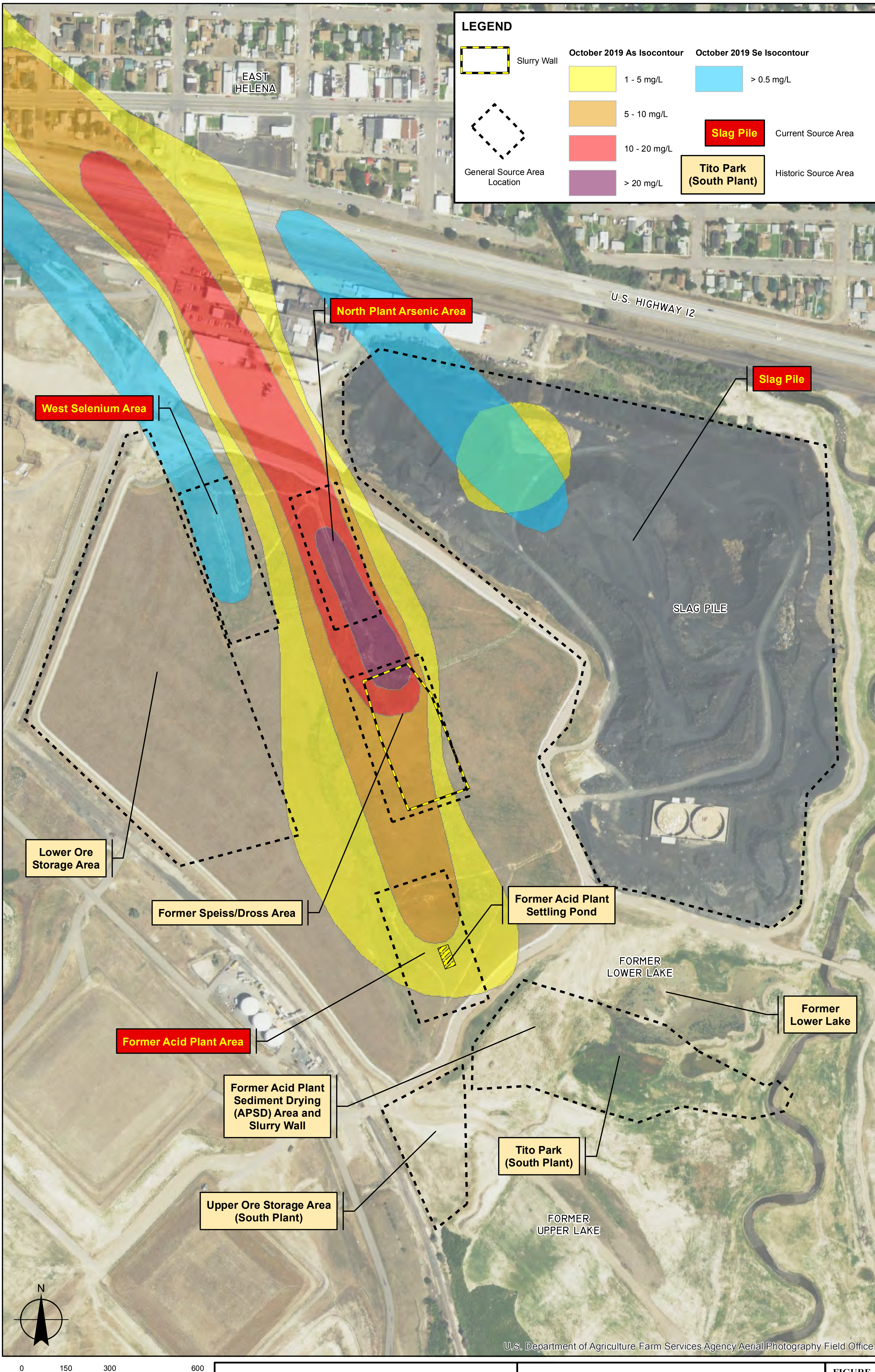

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2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	CURRENT AND HISTORIC GROUNDWATER CONTAMINANT SOURCE AREAS	FIGURE 3-4

3.3.2 Groundwater Level and Concentration Trends

3.3.2.1 <u>Groundwater Level Trends</u>

Groundwater level trends on the Facility are of particular interest since reducing groundwater levels is a large component of the corrective measures program. As previously noted, the main objective of the SPHC IM is to reduce groundwater levels on the Facility, thereby reducing groundwater interaction with contaminated soils and associated contaminant leaching to groundwater.

Figure 3-5 includes groundwater level hydrographs illustrating groundwater level trends for various portions of the Facility. Groundwater levels over most of the Facility have decreased since 2012 in response to the various SPHC IM components and other IM-related activities. Groundwater levels in the Acid Plant Area, illustrated by well DH-59, have declined by close to 10 feet from 2012 through 2017, before increasing approximately two feet in 2018 in response to the above average precipitation (Section 3.1.1). The hydrograph from well DH-66 (Figure 3-5) shows that water levels in the West Selenium Source Area declined by 6 to 8 feet from 2012 through 2017 before increasing 2 to 4 feet in 2018. In the North Plant Site Arsenic Source Area (well DH-17), water levels declined 6 to 8 feet through 2017 before increasing 2 to 3 feet in 2018. Beneath the slag pile (well DH-55), groundwater levels have shown very little change over time with water levels in that portion of the Facility controlled by the relatively constant Prickly Pear Creek stage.

The IM-induced groundwater level declines from 2012 through October 2018 have resulted in the desaturation of some of the most contaminated Facility soils. Shown on the Figure 3-5 hydrographs is the elevation of the Tertiary ash/clay layer representing the base of the plume-bearing upper alluvial groundwater system. In the former Acid Plant area, groundwater elevations have decreased from about 3901 feet AMSL to 3894 feet as of October 2018 with the ash/clay layer at about 3885 feet. This represents a decrease from 16 feet to 9 feet in the saturated thickness in this source area. The reduced saturated thickness and similar 2010 and 2018 hydraulic gradients represent an approximate 45% reduction in the groundwater flux through the former Acid Plant area. Using similar comparisons for the West Selenium Source Area (well DH-66) and North Plant Arsenic Source Area (DH-17) yields reductions in the saturated thickness and groundwater flux of about 30% and 25%, respectively for these areas. The reduced groundwater flux through the contaminant source areas results in a corresponding reduction in the groundwater contaminant load leaving the Facility, thereby reducing downgradient groundwater loads and concentrations. Changes in saturated thickness beneath the slag pile cannot be estimated since the aquifer base (ash/clay layer) has not been intercepted by any wells in this area. Based on the relatively consistent groundwater levels in this area however, the saturated thickness and groundwater flux has remained relatively unchanged since the pre-IM period.

3.3.2.2 <u>Groundwater Concentration Trends</u>

The 2018 CAMP specified trend analysis at 23 wells for both the primary COCs at the Facility (arsenic and selenium), as well as the indicator geochemical parameters sulfate and chloride, and groundwater levels. Remediation phase performance trend analyses currently focus on wells in three primary areas of interest: (1) the Facility source areas, including the Acid Plant area, slag pile area,

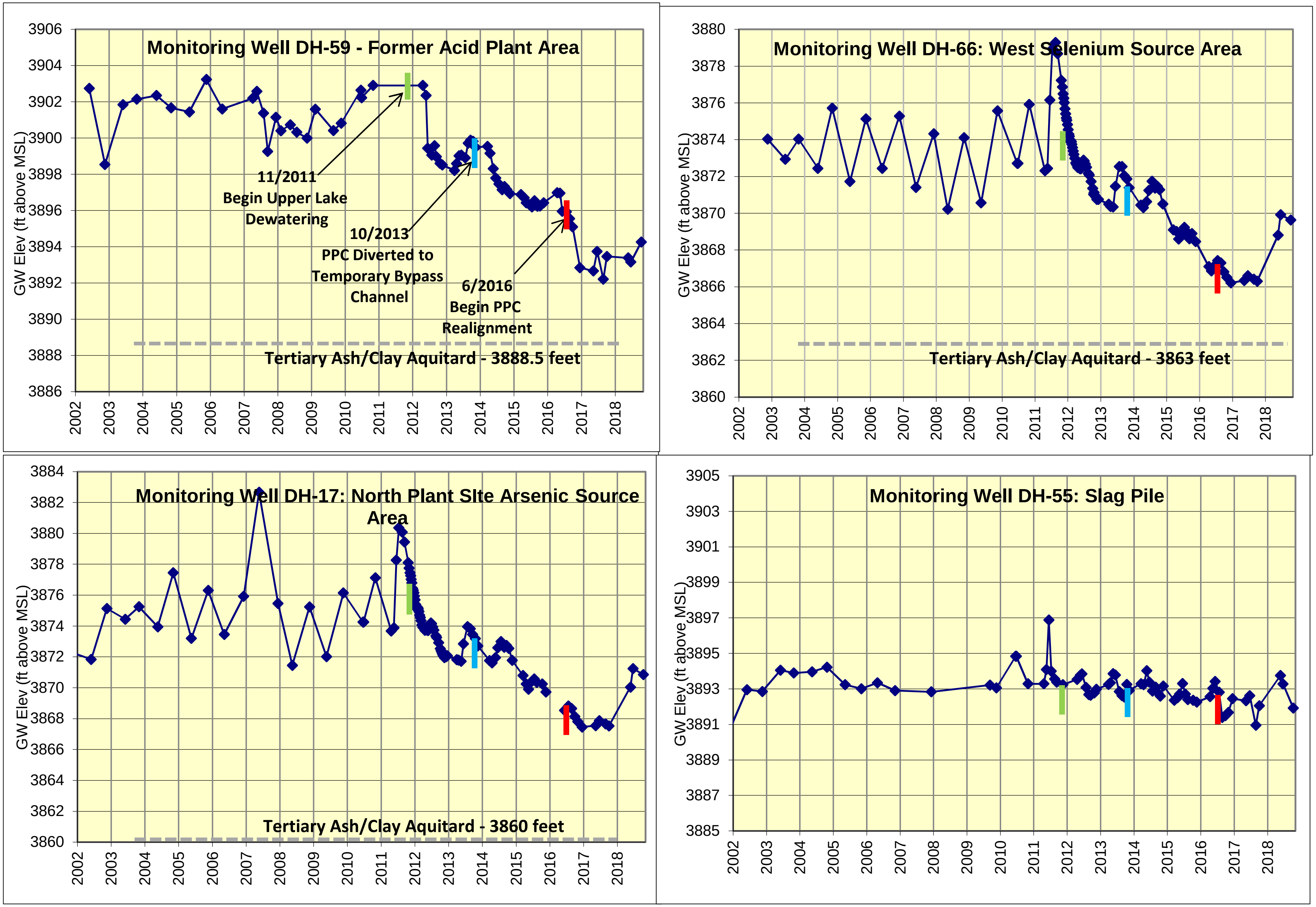


FIGURE 3-5.GROUNDWATER LEVEL HYDROGRAPHS
FROM FACILITY SOURCE AREA MONITORING WELLS

West Selenium area, and North Plant Site Arsenic area; (2) wells defining the downgradient extent of the arsenic plume, and (3) wells defining the downgradient extent of the selenium plume. Wells selected for concentration trend analyses are listed in Table 3-6 and are shown on Figure 3-6. The parameter trends have been segregated into the two periods prior to and following the initial implementation of IMs in late 2011 including:

1. RCRA Facility Investigation (RFI) period (2002-October 2011); and
2. RCRA Interim Measure/Corrective Measure (IM/CM) implementation period (November 2011-2018).

The complete set of concentration trend plots for the trend analysis wells shown on Figure 3-6 is included in Appendix C. Appendix D includes COC (arsenic and selenium) trend plots for a larger set of wells throughout the plant site and downgradient plume monitoring areas. Based on the trend plots presented in Appendices C and D, arsenic and selenium concentration trends are summarized below.

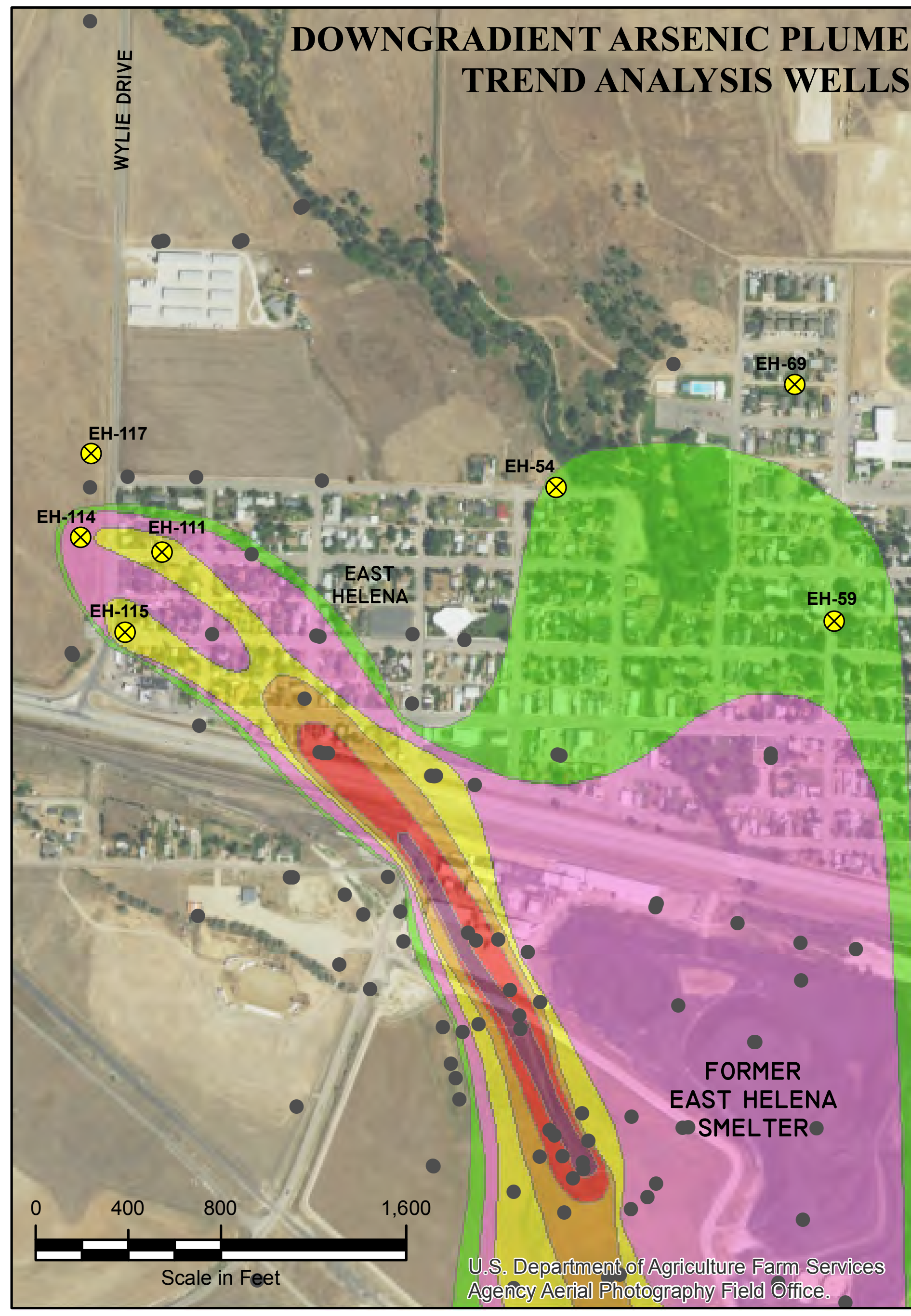
Concentration trend plots for wells in the Acid Plant, slag pile, West Selenium Area and North Plant Arsenic Area are included in Appendix C. In the Acid Plant area, both arsenic and selenium concentrations have decreased at well DH-42 during both the 2002 to 2012 RFI phase and 2013 to 2018 IM/CM phase. Monitoring well DH-80, completed in 2015 to document the water quality response to the acid plant area soil removal IM showed a significant decrease in arsenic concentrations following the 2016 removal action, from about 15 mg/L to 10 mg/L, and has remained relatively constant since October 2016. The selenium concentration at DH-80 increased in 2018, presumably in response to short-term increase in groundwater levels and possible associated changes in geochemical conditions.

Concentration trend plots for slag pile area wells DH-6, DH-15, DH-52, and DH-56 are included in Appendix C. Arsenic concentrations at all four wells were either stable or increased during the RFI phase, and decreased significantly during the 2013 to present IM/CM phase. For example, the arsenic concentration at DH-6 has decreased from a high of 3.38 mg/L in November 2012 to a low of 0.72 mg/L in October 2018, and DH-56 decreased from 3.7 to 0.45 mg/L from 2012 to 2018 (79% and 88% reductions, respectively). Conversely, selenium concentrations increased notably in 2018 at two of the slag pile wells; DH-6 and DH-56. Similar increases also occurred for indicator parameters chloride and sulfate at these two wells, indicative of a slag pile source. Similar to well DH-80 described above, the increase is believed to be attributable to the above average precipitation in 2018, with saturation of the slag pile base and/or increased infiltration through the slag pile being potential leaching and transport mechanisms. Groundwater levels and concentrations will be evaluated further in 2019 at these wells to better assess the exact loading mechanism(s).

Concentration trend plots for West Selenium Area wells DH-66 and DH-8 are included in Appendix C. Arsenic concentrations in wells DH-66 and DH-8 have historically been relatively low (0.1 mg/L or lower), and decreased to near or below the 0.002 mg/L analytical detection limit after 2011. Selenium concentrations at wells DH-8 and DH-66 were highly variable historically, ranging from

Table 3-6. 2018 Concentration Trend Analysis Monitoring Wells

Well	Northing	Easting	Target Area
DH-42	859587.20	1359938.80	Acid Plant
DH-80	859665.45	1360005.89	Acid Plant
DH-17	860997.41	1359668.63	North Plant Arsenic
DH-79	860422.215	1359937.191	North Plant Arsenic
DH-6	861527.08	1360252.42	Slag Pile
DH-15	861541.06	1360257.00	Slag Pile
DH-52	861372.14	1360876.16	Slag Pile
DH-56	861098.43	1360350.74	Slag Pile
DH-66	861005.14	1359333.41	West Selenium
DH-8	860693.17	1359404.72	West Selenium
2843 Canyon Ferry Road	872346.42	1354330.00	Downgradient Selenium Plume
2853 Canyon Ferry Road	872391.53	1354773.24	Downgradient Selenium Plume
EH-138	867179.05	1355646.47	Downgradient Selenium Plume
EH-139	867197.45	1354635.30	Downgradient Selenium Plume
EH-141	868713.30	1354782.70	Downgradient Selenium Plume
EH-143	870683.75	1354372.76	Downgradient Selenium Plume
EH-54	863345.39	1359822.33	Downgradient Arsenic Plume
EH-59	862766.01	1361023.24	Downgradient Arsenic Plume
EH-69	863791.12	1360852.61	Downgradient Arsenic Plume
EH-111	863063.82	1358121.67	Downgradient Arsenic Plume
EH-114	863127.75	1357769.76	Downgradient Arsenic Plume
EH-115	862717.81	1357963.04	Downgradient Arsenic Plume
EH-117	863491.19	1357815.10	Downgradient Arsenic Plume



2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**2018 PERFORMANCE EVALUATION TREND ANALYSIS MONITORING WELLS**	**FIGURE 3-6**

Path: V:\10022\GIS\2018 GW Report\Fig3-6_Trend_Analysis_Wells.mxd Date Saved: 12/19/2019 11:27:41 AM approximately 1 to nearly 8 mg/L. After IM implementation began in 2011, selenium concentrations increased consistently at DH-66 through 2014, possibly due to nearby construction activities, and have since decreased to near historic minimum levels of about 1.0 mg/L. Selenium concentrations at DH-66 did spike in June 2018 (2.72 mg/L) but were decreasing again by October (2.1 mg/L). The groundwater level in well DH-66 peaked at about 3870 feet in early July 2018, the highest level recorded since 2014, and may be related to the short-term spike in the selenium concentration.

Concentration trend plots for North Plant Area wells DH-17 and DH-79 are included in Appendix C. Arsenic concentrations at DH-17 continued to decrease in 2018 with the 2018 concentrations (approximately 20 mg/L), less than half the RFI phase concentrations of 40 to 50 mg/L. Conversely, arsenic concentrations at well DH-79, located immediately downgradient of the Speiss/Dross slurry wall, spiked from 33 to 62 mg/L between fall 2017 and 2018. Similarly, selenium concentrations remained low at DH-17 in 2018 (near or below the 0.001 mg/L reporting limit) while concentrations spiked at DH-79 between 2017 and 2018 (0.007 to 0.39 mg/L).

Downgradient Concentration Trends

Appendix C includes concentration trends for wells along the downgradient end of the arsenic plume, including EH-111, EH-114, EH-115, and EH-117 in the higher concentration western portion of the plume, and EH-54, EH-59, and EH-69 in the lower concentration eastern portion of the plume (refer to Figure 3-6). Well EH-111, which has historically represented the furthest downgradient extent of arsenic concentrations greater than 1 mg/L, has shown a significant decrease from 2015 through 2018. The October 2018 arsenic concentration at EH-111 (1.56 mg/L) is approximately 70% lower than the peak concentration of 5.1 mg/L in February 2014. Concentrations of other constituents at EH-111 have shown variable trends: selenium concentrations initially increased in the post-2011 period but have since stabilized at about 0.15 mg/L.

Water quality trends at wells EH-114 and EH-115 (south and west of EH-111; Figure 3-6) show the impacts of the westward plume shift observed in the IM/CM period. Prior to 2011, arsenic concentrations were below detect and selenium, sulfate, and chloride concentrations were highly variable as these wells received seasonal influxes of water from the West Selenium source area, with low arsenic concentrations and elevated selenium concentrations. In the last several years, arsenic concentrations have increased at both wells and selenium concentrations have decreased (Appendix C). These trends are attributable to the lack of seasonal recharge and altered flow direction, and possibly altered geochemical conditions, due to the decommissioning of Wilson Ditch in 2012.

In the eastern, lower concentration portion of the arsenic plume, arsenic concentrations are currently between 0.015 and 0.02 mg/L at EH-54 and EH-59, and below reporting limits (<0.002 mg/L) at EH-69, similar to pre-IM/CM concentrations. Selenium and sulfate concentrations at EH-59 and EH-69 have both decreased during the IM/CM period, while groundwater quality at EH-54 has remained relatively consistent. Selenium concentrations at all three wells are less than the 0.05 mg/L HHS.

Trends analyses wells near the downgradient end of the selenium plume include former residential wells 2843 and 2853 Canyon Ferry Road, EH-138, EH-139, EH-141, and EH-143 (Figure 3-6). Available data for the pre-IM period before 2011 is limited to three to four samples for this well set, precluding RFI phase trend analyses. The downgradient well trend plots in Appendix C show the following:

- Arsenic – concentrations in the downgradient area are consistently low, ranging from <0.001 to 0.006 mg/L, less than the 0.01 mg/L HHS, and showing no trends over time.
- Selenium – At EH-139 on the west side of the downgradient plume, the selenium concentration increased from <0.001 to 0.003 mg/L pre-2018, to approximately 0.011 mg/L in October 2018, due to the slight westward plume shift. At well EH-138, located along the east side of the plume between the plume and East Helena municipal well #3, the selenium concentration decreased from 0.031 to 0.006 mg/L between October 2017 and 2018. At the other wells defining the downgradient selenium plume, selenium trends during the IM/CM period either show decreasing trends (EH-143) or slightly increasing trends followed by stable concentrations or recent slight decreases (2843 and 2853 Canyon Ferry Road wells, EH-141). As of October 2018, the selenium concentration exceeded the 0.05 mg/L groundwater standard in only one downgradient trend analysis well (EH-141, at 0.07 and 0.063 mg/L in June and October, respectively).
- Chloride and Sulfate – concentrations of these indicator parameters generally show trends similar to selenium, with recent trends either stable or decreasing.

Downgradient wells have exhibited a mixture of increasing, decreasing, and stable water quality trends for selenium, sulfate, and chloride in the IM/CM period, although recent concentration trends are either stable or decreasing. Concentration increases observed at some wells in 2018 are believed to be related to the 2018 above average precipitation and higher groundwater levels, either through saturation of contaminated soils previously desaturated through the SPHC IM, and/or short-term alteration of geochemical conditions. Ongoing trend analyses will be performed in 2019 at these wells to assess the duration of any concentrations spikes.

3.3.3 Contaminant Plume Stability

Another component of the East Helena groundwater remedy performance evaluation is plume stability analyses for the primary groundwater COCs arsenic and selenium. While contaminant concentration trends at individual wells within and downgradient of the primary source areas on the Facility may show varying trends (increasing or decreasing), particularly during the remediation phase of remedy monitoring, evaluation of plume stability allows an additional comprehensive assessment of plume characteristics in the area directly downgradient of the Facility, including any changes over time in metrics such as total plume area, average plume concentration, and plume concentration centroid location.

The calculation methods for arsenic and selenium plume stability are based on methods outlined in Ricker (2008). This method was originally developed as a tool to evaluate the stabilization of contaminated groundwater migration, in accordance with the requirements of Government Performance and Results Act Environmental Indicator (EI) RCRIS Code CA 750 (Migration of Contaminated Groundwater Under Control). The evaluation procedure involves the following steps:

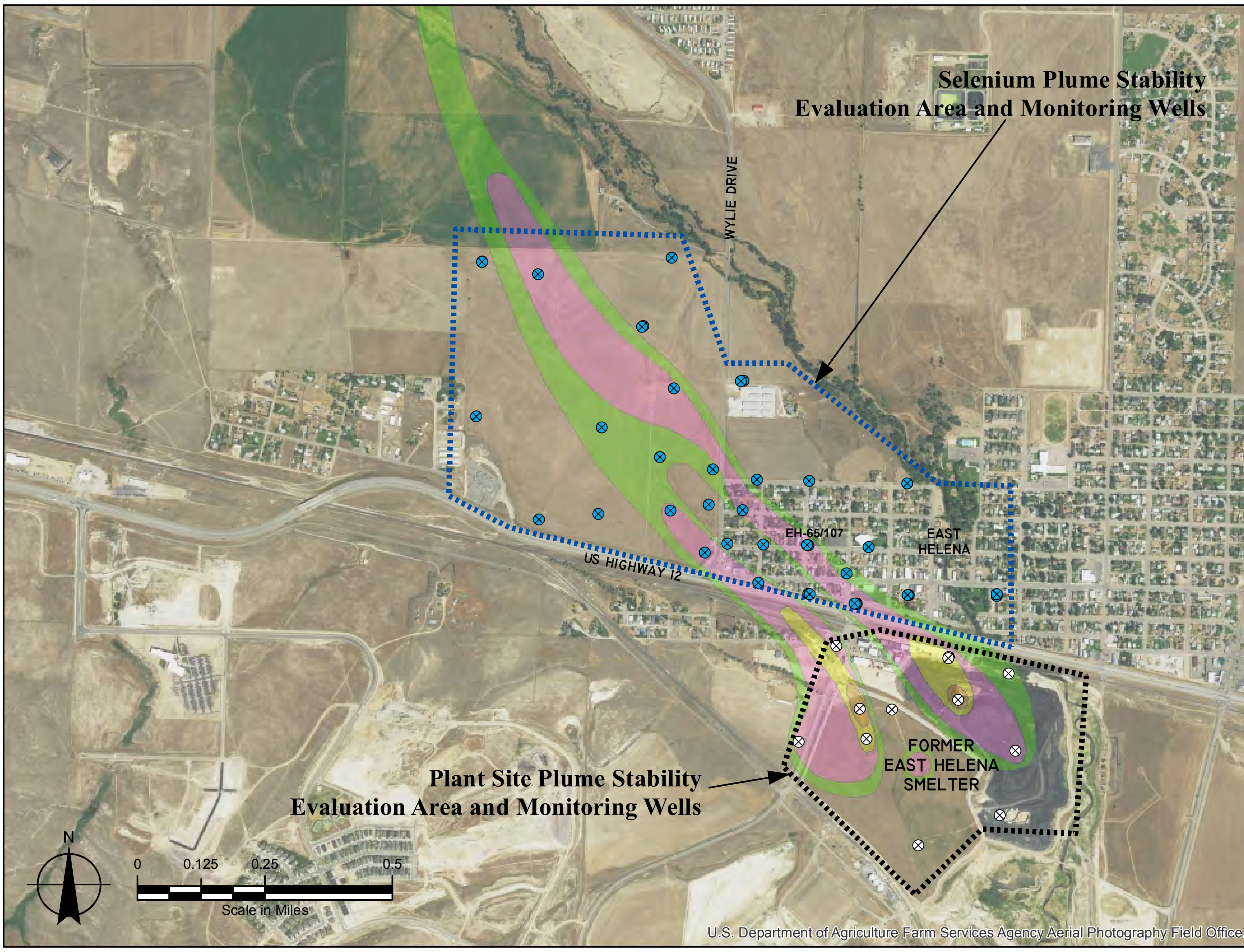
1. Define the areas for which plume characteristics will be calculated. For the purposes of remediation phase performance evaluation monitoring described in the 2018 CAMP, arsenic

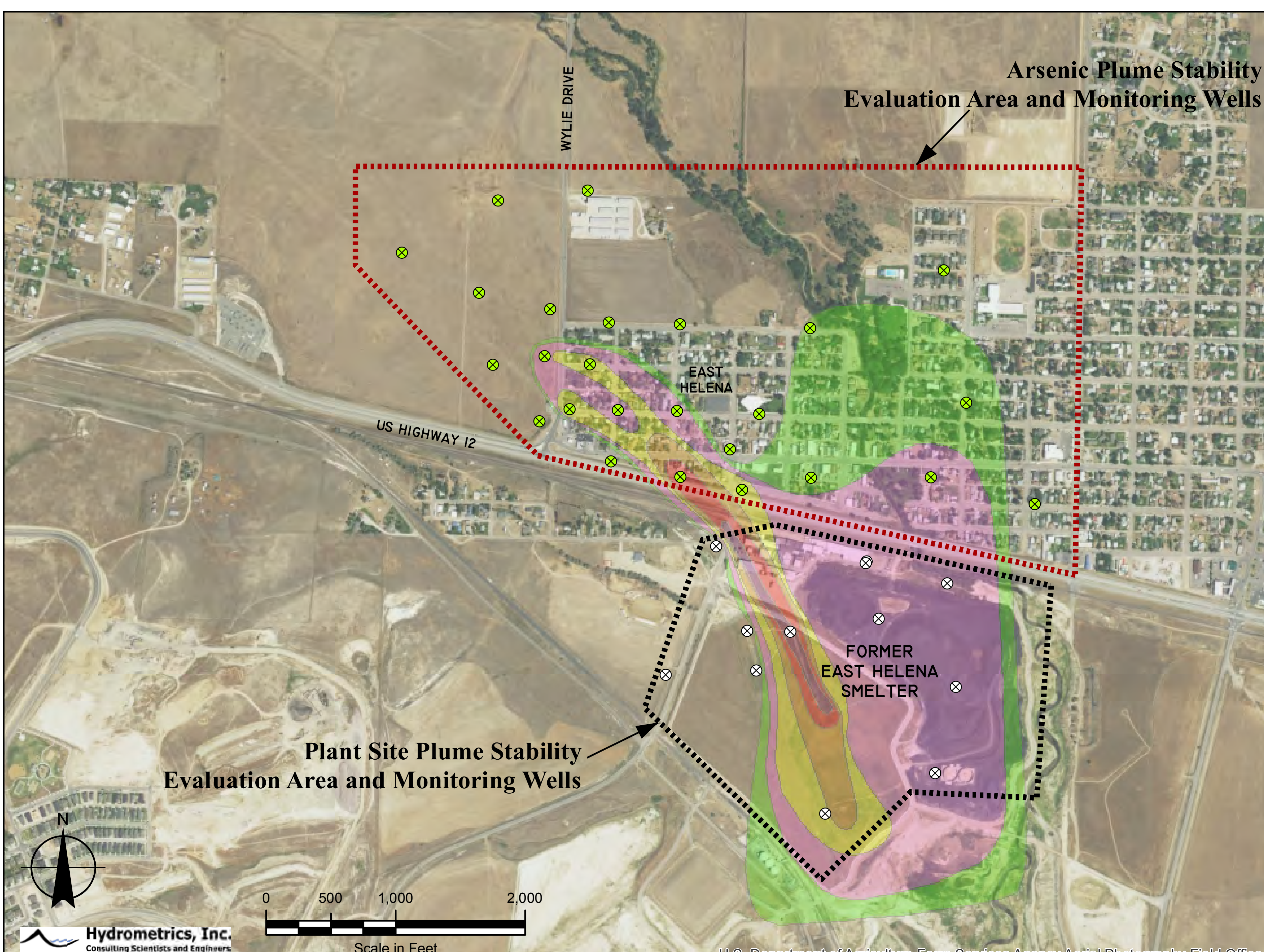
and selenium plume areas on the former smelter site ("plant site plume stability"), and in the near downgradient areas in the City of East Helena and in Lamping Field were selected, to allow integration of results from multiple monitoring points into a single analytically-derived measure of plume characteristics. The arsenic and selenium plume stability evaluation areas are shown on Figure 3-7.

2. Select a representative set of monitoring wells from the monitoring well network with sufficient spatial distribution to define the extent of the contaminant plume within the plume stability evaluation areas over multiple years. The selected well sets for the plume stability analyses are shown on Figure 3-7 and summarized in Table 3-7. Note that the selected off-site well set for selenium covers a greater area than the off-site well set for arsenic, since the plume configurations are different.
3. For each well, calculate an annual average concentration of the COC. Below detect values were replaced with the detection limit for calculation of averages.
4. Generate a grid file of interpolated concentration values within the given plume stability area for an individual monitoring year and contaminant, using spatial analysis software such as Surfer® by Golden Software. As suggested in Ricker (2008), grid files were generated on log-transformed concentration data (for smoother interpolation), then transformed back to original concentration units prior to further calculations.
5. Use the grid file to calculate various average plume metrics for the monitoring year, including:
    a. Plume area;
    b. Average plume concentration; and
    c. Plume centroid of concentration.

Calculated values are then compared over time to determine any trends in total plume area or average plume concentration. In addition, Ricker (2008) notes that for shrinking plumes, the plume centroid of concentration (or mass) should recede toward the source over time; if the plume is transient (migrating away from the source) or expanding, the centroid of concentration will show migration downgradient away from the source. Therefore, by calculating and plotting centroids of concentration over a number of years, plume stability (expanding, stable, shrinking, or transient) can be evaluated.

Based on the available groundwater data for the plume stability well sets shown in Table 3-7, off-site arsenic and selenium plume stability metrics were calculated for monitoring years 2010 (representing conditions prior to implementation of IMs), 2014, 2015, 2016, 2017, and 2018 (representing conditions during ongoing implementation of IMs). Due to variable monitoring frequencies for some plant site wells and the potential effects on plume stability calculations, plant site plume stability metrics have been calculated for monitoring years 2010 (prior to IM implementation), 2016, 2017, and 2018 (during IM implementation).





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2018 WATER RSOURCES MONITORING REPORT EAST HELENA FACILITY	**2018 PLUME STABILITY EVALUATION AREAS AND MONITORING WELLS**	**FIGURE** **3-7**

Table 3-7. 2018 Plume Stability Analysis Monitoring Wells

Arsenic Plume Stability Analysis Wells

Well/Well Set*	X	Y
EH-104	1358282.522	862312.6614
EH-106	1358337.119	862709.9336
EH-110	1359199.735	862408.9392
EH-111	1358121.671	863063.8249
EH-114	1357769.757	863127.7487
EH-115	1357963.035	862717.8146
EH-117	1357815.102	863491.194
EH-118	1357370.97	863059.9069
EH-119	1357263.087	863617.6238
EH-120	1357409.933	864330.2403
EH-124	1356666.492	863928.3931
EH-50/100	1358817.999	862195.6926
EH-51/101	1359828.415	862186.9796
EH-52/102	1360752.337	862191.6556
EH-53	1358268.831	863387.4722
EH-54	1359822.332	863345.3893
EH-57A	1357731.038	862625.8977
EH-58	1361553.2	861985.385
EH-59	1361023.244	862766.0055
EH-60/61/103	1359295.783	862093.3668
EH-62	1358812.977	863373.6172
EH-63	1359427.431	862682.4886
EH-65/107	1358789.927	862702.9806
EH-66/121	1358105.331	864406.8992
EH-69	1360852.608	863791.1154

Selenium Plume Stability Analysis Wells

Well/Well Set*	X	Y
EH-104	1358282.522	862312.6614
EH-106	1358337.119	862709.9336
EH-110	1359199.735	862408.9392
EH-111	1358121.671	863063.8249
EH-114	1357769.757	863127.7487
EH-115	1357963.035	862717.8146
EH-117	1357815.102	863491.194
EH-118	1357370.97	863059.9069
EH-119	1357263.087	863617.6238
EH-120	1357409.933	864330.2403
EH-123	1356631.306	863027.3459
EH-124	1356666.492	863928.3931
EH-126	1356002.798	865515.797
EH-129/134	1355425.088	865649.6907
EH-132	1355360.408	864040.3529
EH-135	1357384.976	865688.5946
EH-206	1356012.784	862969.4011
EH-50/100	1358817.999	862195.6926
EH-51/101	1359828.415	862186.9796
EH-52/102	1360752.337	862191.6556
EH-53	1358268.831	863387.4722
EH-54	1359822.332	863345.3893
EH-57A	1357731.038	862625.8977
EH-60/61/103	1359295.783	862093.3668
EH-62	1358812.977	863373.6172
EH-63	1359427.431	862682.4886
EH-65/107	1358789.927	862702.9806
EH-66/121	1358105.331	864406.8992
EH-70/125	1357077.783	864971.9141

Plant Site Plume Stability Analysis Wells

Well/Well Set*	X	Y
DH-6/15	1360252.419	861527.0799
DH-7	1361580.684	861281.5224
DH-8	1359404.724	860693.1656
DH-17	1359668.631	860997.414
DH-42	1359938.798	859587.2008
DH-52	1360876.159	861372.1393
DH-55	1360945.555	860568.8169
DH-56	1360350.744	861098.4318
DH-66	1359333.409	861005.14
DH-67	1359095.512	861657.6447
DH-69	1360783.894	859899.5982
EH-204	1358703.601	860660.9927

*NOTE: Data from well sets (paired wells) will be combined to yield a single overall average concentration for a given monitoring year for plume stability calculations.

3.3.3.1 Arsenic Plume Stability Results

The arsenic plume stability analysis results are summarized on Figure 3-8, including software-generated arsenic contours, a table summarizing plume areas and average concentrations, and a map showing the locations of the calculated plume centroids for 2010, 2014, 2015, 2016, 2017, and 2018. The overall plume area with arsenic concentrations above the 0.01 mg/L groundwater standard is virtually unchanged from 2010 (66 acres) to 2018 (68 acres). Average arsenic concentrations within the 0.01 mg/L contour showed a modest decline from 0.203 mg/L in 2010 to 0.173 mg/L in 2017 before increasing to 0.211 mg/L in 2018. The locations of the calculated plume centroids for 2010, 2014, 2015, and 2016 are in approximately the same location, with a slight centroid shift to the west observed in 2017 and 2018 (Figure 3-8).

Overall, the plume area and average concentration metrics suggest that the arsenic plume is relatively stable; a slight westward shift in the arsenic plume centroid in 2017 and 2018 is attributable to the concentration increases previously discussed at two wells on the western margin of the arsenic plume. The plume stability results are generally consistent with observations based on preparation of hand-drawn arsenic isocontour maps. The fall 2011 and fall 2018 0.01 mg/L hand-drawn arsenic contours shown on Figure 3-8 illustrate the stability in overall plume area, along with the recent shift to the west in the western portion of the arsenic plume.

3.3.3.2 Selenium Plume Stability Results

Selenium plume stability analysis results are summarized on Figure 3-9. In contrast to arsenic, the overall plume area with selenium concentrations above the 0.05 mg/L groundwater standard increased from 74 acres in 2010 to a maximum of 114 acres in 2016, before decreasing to 79 and 74 acres in 2017 and 2018, respectively. Average selenium concentrations showed an overall decrease from 2010 (0.112 mg/L) to 2018 (0.078 mg/L). Finally, the plume centroid location for selenium shifted to the west and north between 2010 and 2016, shifted slightly northward in 2017, before retreating southward in 2018 (Figure 3-9). Also apparent in Figure 3-9, particularly in the 2017 and 2018 computer generated plume map, is the apparent fragmentation of the plume between the Facility and Lamping Field. This is attributable to the significant decreases observed in the upgradient West Selenium source area since 2015.

3.3.3.3 Plant Site Arsenic and Selenium Plume Stability Results

Plume stability metrics for pre-IM (2010) and post-IM (2016, 2017 and 2018) conditions were also calculated for arsenic and selenium, based on data from 13 Facility (source area) wells. The plant site plume stability results are summarized on Figure 3-10. Plume stability results for 2010, 2016, 2017 and 2018 show a reduction in overall selenium plume area from 67 to 52 acres, and a reduction in the arsenic plume area of 82 to 69 acres. Average 2010 to 2018 concentrations have decreased from 0.45 to 0.34 mg/L for selenium, and 2.25 to 0.94 mg/L for arsenic. These trends reflect the generally decreasing concentration trends for arsenic and selenium observed in the plant site source areas. The locations of the calculated arsenic and selenium plume centroids showed little change from 2010 to 2018. As source area contaminant concentrations of both arsenic and selenium continue to decrease over time, average plant site plume concentrations should also continue to decrease.

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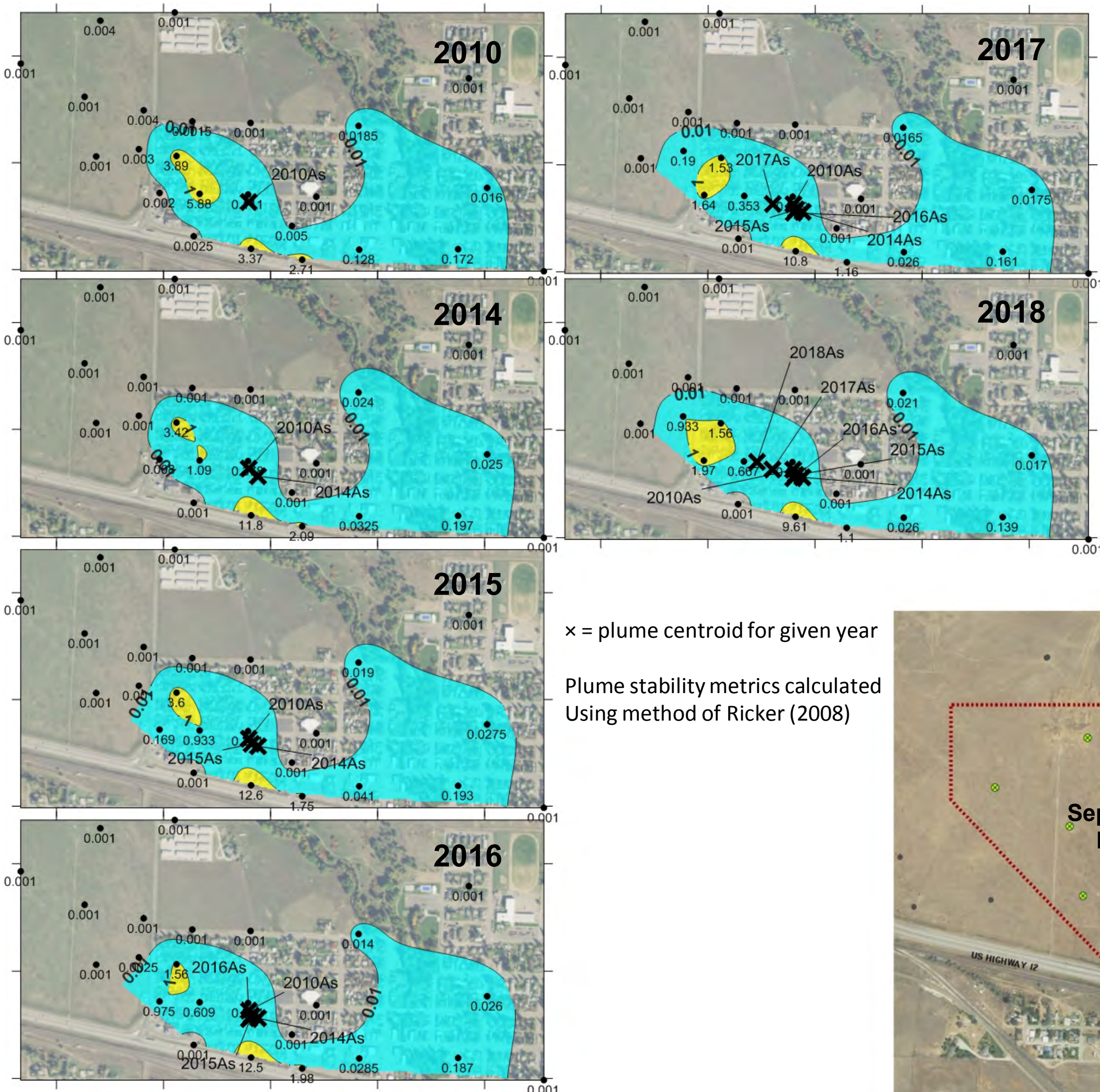
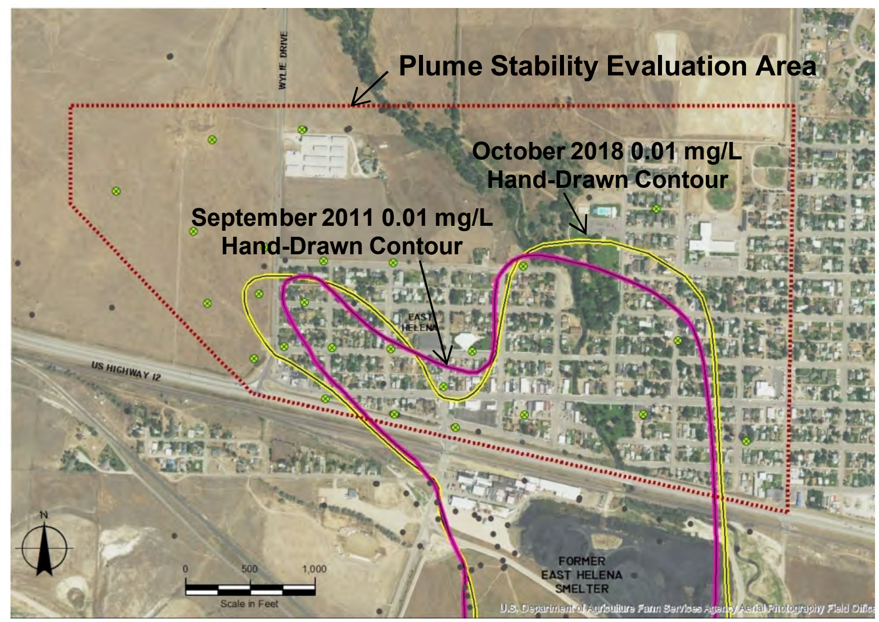
Software-Generated As Isocontours



Year	Planar Area (acres)	Avg Conc (mg/L)
2010	66	0.203
2014	68	0.167
2015	68	0.175
2016	64	0.167
2017	65	0.173
2018	**68**	**0.211**

× = plume centroid for given year

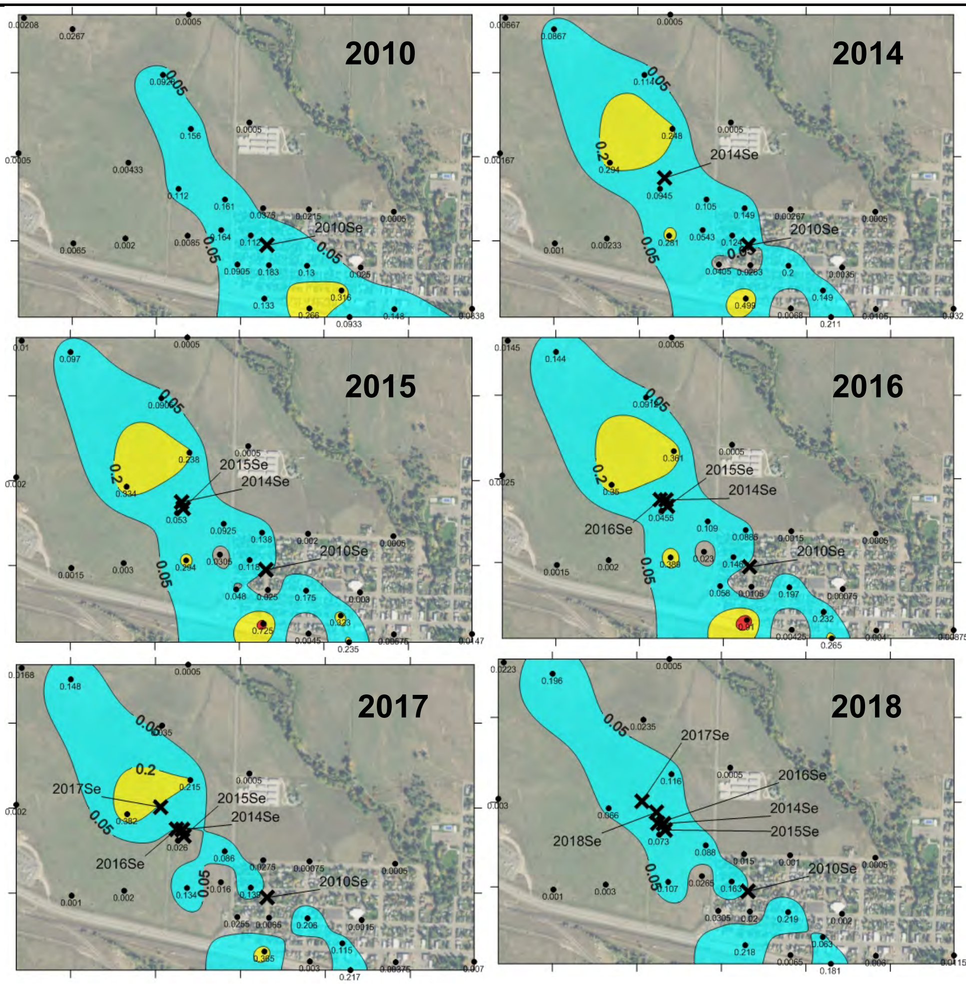
Plume stability metrics calculated Using method of Ricker (2008)



2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY

Arsenic Plume Stability Evaluation Results

FIGURE **3-8**

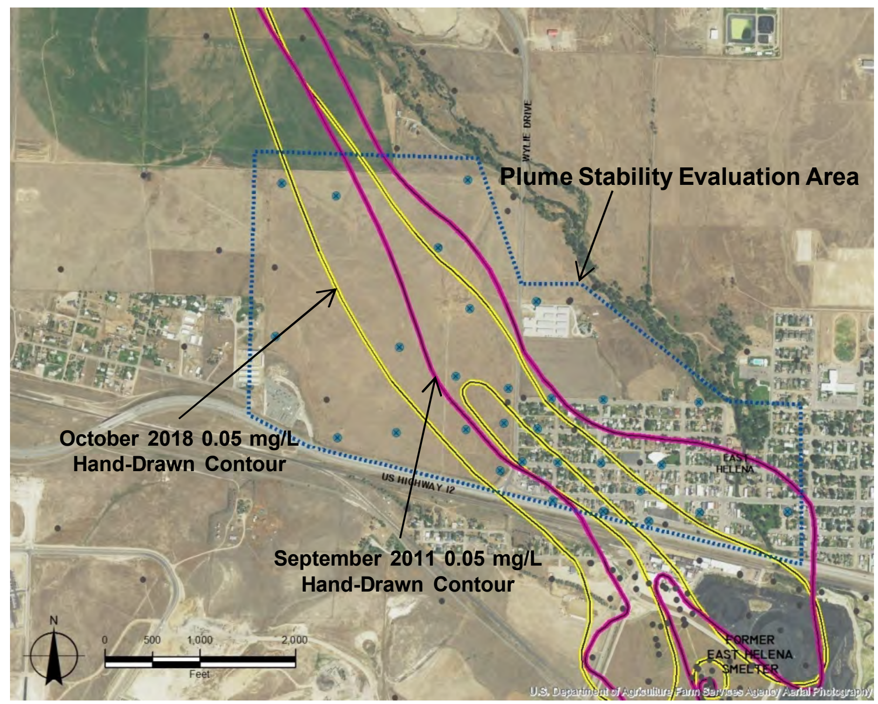


Software-Generated Se Isocontours

× = plume centroid for given year

Plume stability metrics calculated
Using method of Ricker (2008)

Year	Planar Area (acres)	Avg Conc (mg/L)
2010	74	0.112
2014	111	0.123
2015	112	0.121
2016	114	0.136
2017	79	0.108
2018	**74**	**0.078**



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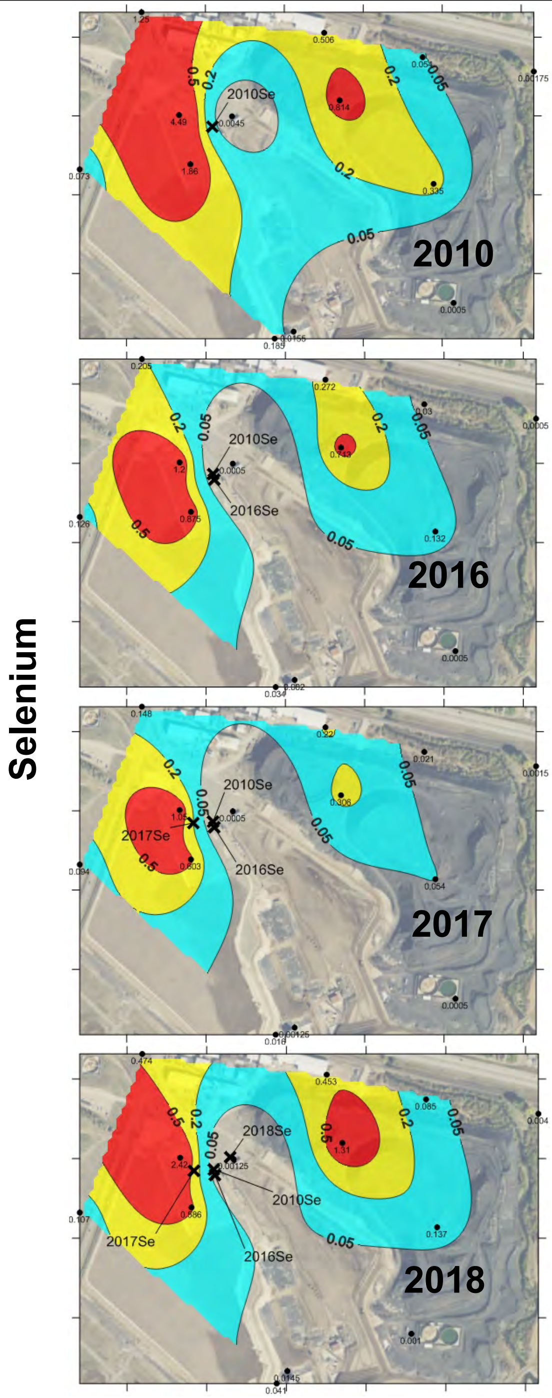
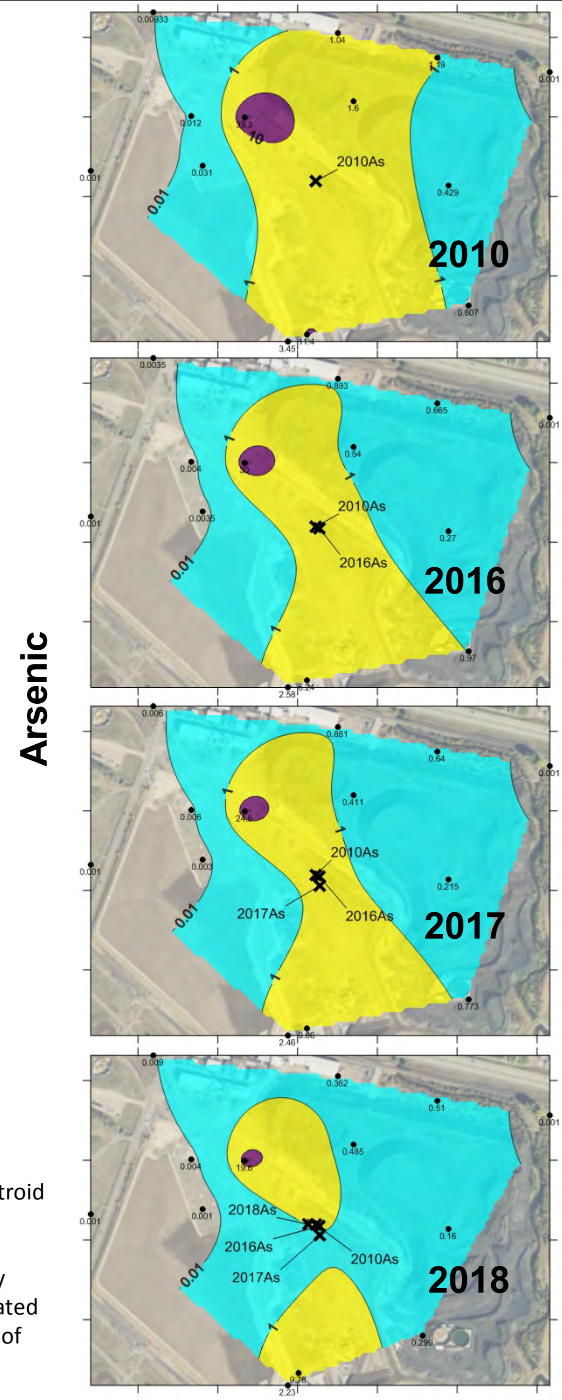
2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	Selenium Plume Stability Evaluation Results	FIGURE 3-9





× = plume centroid for given year

Plume stability metrics calculated Using method of Ricker (2008)

Year	Parameter	Planar Area (acres)	Avg Conc (mg/L)
2010	Se	67	0.45
2016		48	0.27
2017		35	0.23
2018		52	0.34

Year	Parameter	Planar Area (acres)	Avg Conc (mg/L)
2010	As	82	2.25
2016		77	1.29
2017		77	1.19
2018		69	0.94

2018 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

Plant Site Plume Stability Evaluation Results

FIGURE

3-10

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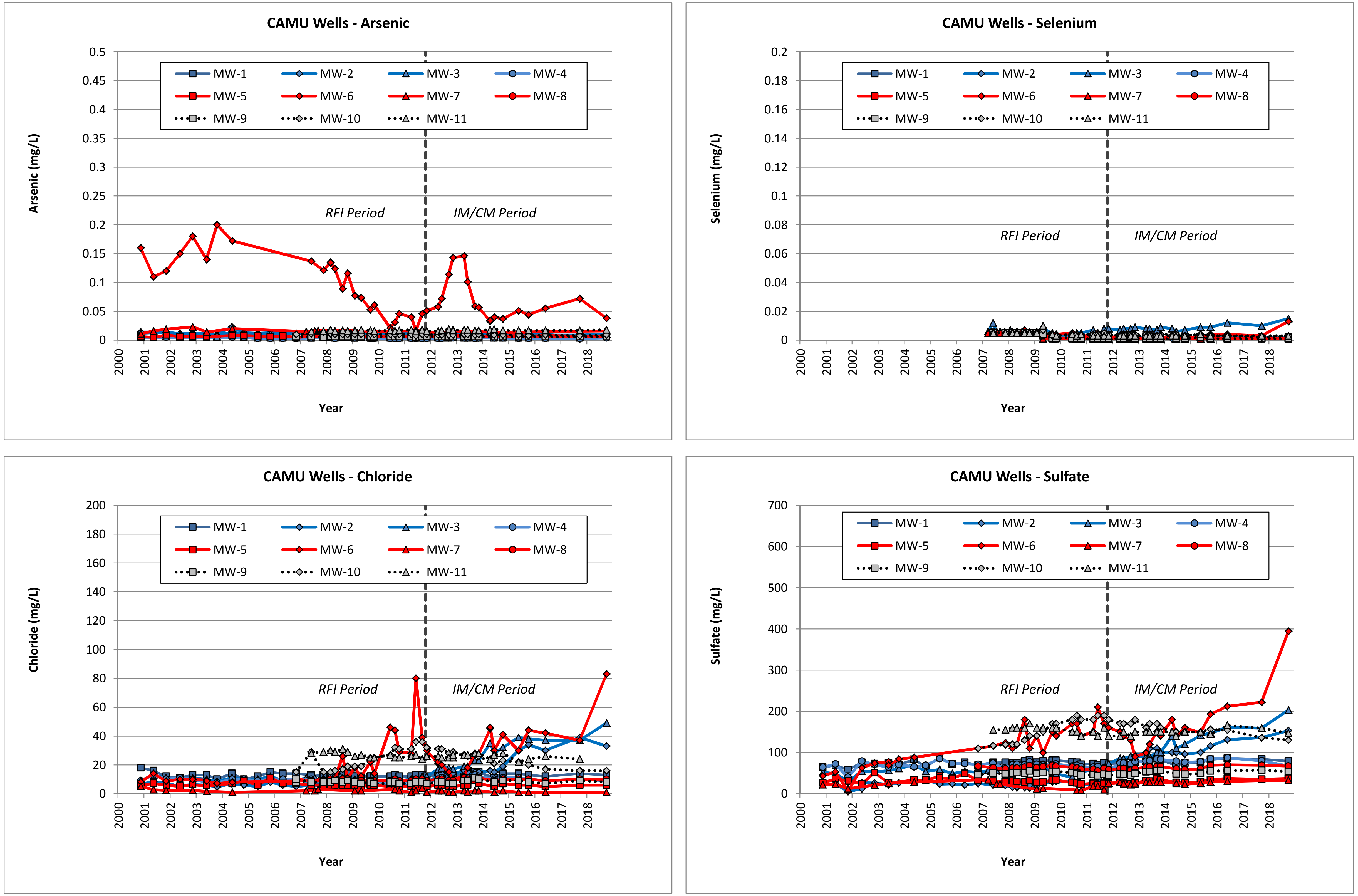
3.3.4 CAMU Area Monitoring Results

One objective of the 2018 monitoring program was to continue to evaluate groundwater quality in the vicinity of the two RCRA landfills, the CAMUs, located immediately southwest of the Facility (Figure 1-1). The CAMU groundwater monitoring network includes 11 monitoring wells ranging from 40 to 72 feet. All 11 wells were sampled in October 2018 to document current groundwater quality. Trend plots for arsenic, selenium, chloride, and sulfate at the CAMU wells through October 2018 are shown on Figure 3-11.

Overall the 2018 CAMU monitoring results are consistent with previous monitoring results. Sulfate and chloride concentrations at MW-2, MW-3, and MW-6 along the north and northeast sides of the CAMU (adjacent to the plant site) indicate influence from plant site groundwater, with concentrations increasing significantly at all three wells over time, particularly since the implementation of the SPHC IM in 2011 and the accompanying decrease in water levels (Figure 3-11). Sulfate and chloride concentration increases were most notable from October 2017 to October 2018 at well MW-6, with chloride increasing from 37 to 83 mg/L, and sulfate increasing from 222 to 394 mg/L. Current chloride and sulfate concentrations at MW-2 (33 mg/L chloride and 149 mg/L sulfate) and MW-3 (49 mg/L chloride and 203 mg/L sulfate) are about 40% to 60% lower than MW-6 concentrations.

Consistent with past results, CAMU wells MW-2, MW-3, MW-7, MW-10 and MW-11 (Exhibit 1) yielded arsenic concentrations in the 0.10 to 0.02 mg/L range (HHS=0.1 mg/L). These results are attributable to naturally occurring groundwater arsenic derived from the tertiary volcanoclastic sediments in this area. Arsenic at well MW-6 has been higher than other wells since the beginning of the monitoring record (Figure 3-11), again suggesting some plant site influence; in October 2018, however, the arsenic concentration at MW-6 decreased to 0.038 mg/L from the October 2017 value of 0.072 mg/L. Selenium concentrations at all CAMU monitoring wells were well below the 0.05 mg/L HHS although the October selenium concentrations at wells MW-3 and MW-6 did show increases from 2017. From October 2017 to October 2018, the selenium concentration increased from 0.01 to 0.015 mg/L at well MW-3 and 0.003 to 0.013 mg/L at MW-6 (Figure 3-11). Despite these increases, selenium concentrations remain well below the HHS in all CAMU area wells. The only other notable trends at the CAMU wells were for manganese at wells MW-2 and MW-6. Manganese at MW-2 in October 2018 was the highest on record for that well (0.45 mg/L) and the lowest on record at well MW-6 (1.05 mg/L). The lower manganese concentration at MW-6 could indicate more oxidizing groundwater conditions, which could also lead to the increase in selenium (more mobile under oxidizing conditions) and the decrease in arsenic (less mobile under oxidizing conditions) observed in October 2018. All other metals were near or less than analytical detection limits in the CAMU well samples (Appendix A).



Hydrometrics, Inc.
Consulting Scientists and Engineers

2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	CAMU AREA GROUNDWATER QUALITY TRENDS	FIGURE 3-11

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3.3.5 Additional Parameter Trends

Although arsenic and selenium are the primary groundwater COCs for the former East Helena Smelter Site, the water resources monitoring program includes a number of other parameters that have been detected at elevated concentrations on the Facility in the past or can be associated with metal smelting operations (Table 2-5). Noteworthy trends for these additional parameters in 2018 are summarized below.

Zinc has been detected at elevated concentrations in the plant site groundwater in the past, but has largely been present at relatively low concentrations since the 2001 smelter shutdown. In 2018 however, the zinc concentration at monitoring well DH-17, located in the North Plant Arsenic Source Area, increased from less than 0.1 mg/L in the previous several years, to 5.72 mg/L in June and 3.39 mg/L in October 2018 (Figure 3-12). Zinc concentrations above the HHS of 2.0 mg/L occurred frequently at DH-17 prior to 2003, but had decreased to near or less than 0.1 mg/L since then, shortly after the 2001 smelter shutdown. The increased zinc concentration at this well in 2018 is believed to be related to the higher groundwater levels in 2018 and/or varying geochemical conditions related to the increased groundwater recharge (pH decreased slightly in 2018 from approximately 7.2 to 6.8). Zinc concentrations at Former Acid Plant Area wells DH-42 and DH-80 also exceed the 2.0 mg/L HHS in 2018 (3.39 and 2.29 mg/L in October 2018, respectively), although these concentrations are similar to other IM period concentrations at these wells. Zinc concentrations were near or less than the 0.01 mg/L analytical detection limit in all other plant site and offsite monitoring wells, with the exception of slightly higher concentrations at onsite wells DH-66 (0.15 mg/L) and DH-69 (0.31 mg/L), and offsite well EH-100 (0.26 mg/L).

The October 2018 cadmium concentration at Acid Plant Area well DH-42 (5.92 mg/L) was the highest recorded since the well was completed in 1999. Cadmium concentrations have consistently been elevated at in the Acid Plant Area with concentrations at DH-42 approximately 5 mg/L in 1999 and 2004. Since 2014, the concentration has increased steadily from about 2 mg/L to 5.92 mg/L in 2018 (Figure 3-12). The increasing trend at DH-42 has not resulted in increases in downgradient well DH-66 where cadmium concentrations have been on the order of 0.2 to 0.3 mg/L since 2014. One offsite well (EH-100) contained a detectable concentration of cadmium in 2018 (0.002 mg/L, just above the 0.001 mg/L detection limit), indicating the elevated cadmium is confined to the former Acid Plant Area at this time.

Water resources monitoring at the East Helena Facility will continue in 2019 (and subsequent years) to further assess arsenic and selenium concentration trends and plume stability, and to identify other notable concentration trends such as the zinc and cadmium trends noted above. Offsite groundwater concentration trends will be evaluated to assess the effectiveness of corrective measures and institutional controls at controlling offsite migration of groundwater contaminants and document the quality of downgradient residential and municipal water sources.

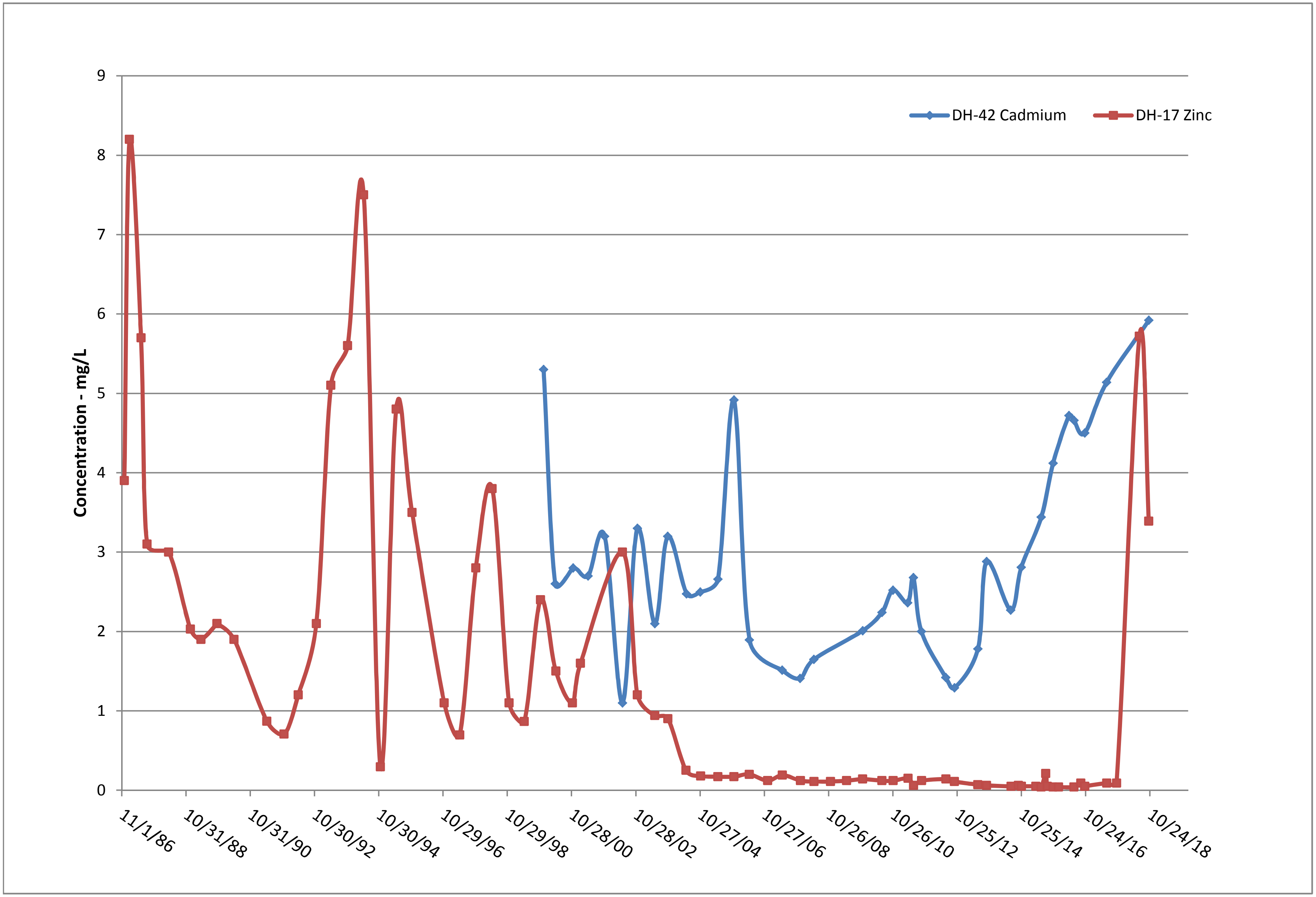

FIGURE 3-12. DH-17 ZINC AND DH-42 CADMIUM CONCENTRATION TRENDS

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APPENDIX A

2018 SURFACE WATER AND GROUNDWATER DATABASE

APPENDIX A1

2018 MONITORING WELL WATER QUALITY DATABASE

			Field Parameters							General Chemistry				
Station ID	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids
2843 Canyon Ferry Rd	6/20/2018	24.90	7.21	633	5.60	49	270	0.0	10.3	7.3	645	130	<10	442
2843 Canyon Ferry Rd	10/16/2018	24.10	7.24	645	5.30	7	228	7.4	10.5	7.4	650	130	<10	415
2853 Canyon Ferry Rd	6/20/2018		7.14	691	5.09	96	317	1.6	10.0	7.2	706	130	<10	480
2853 Canyon Ferry Rd	10/16/2018	25.24	6.87	704	4.80	31	252	4.4	10.3	7.3	711	140	<10	470
Amchem Injection	10/17/2018		6.99	383	2.69	107	308	0.7	35.4	7.4	340	120	<10	254
Amchem4	10/17/2018		6.93	333	4.14	121	339	1.0	13.2	7.3	338	120	<10	259
Dartman	6/21/2018		7.02	332	1.40	9	231	10.3	9.0	7.1	339	94	<10	220
Dartman	10/18/2018	27.00	6.58	330	1.25	11	233	9.3	8.9	7.2	331	95	<10	205
DH-6	10/16/2018	17.46	7.20	2520	3.46	86	307	0.9	10.3	7.3	2560	150	<10	1820
DH-8	10/12/2018	50.88	7.14	4131	2.84	94	313	1.7	12.7	7.3	4190	290	<10	3590
DH-15	10/16/2018	17.40	6.94	1859	0.15	65	286	0.8	10.6	7.1	1880	160	<10	1410
DH-17	6/27/2018	45.59	6.80	1297	0.10	3	221	8.1	13.6	7.1	1350	280	12 J	895
DH-17	10/12/2018	46.71	6.97	1342	0.03	-4	215	3.3	12.8	7.1	1360	310	<10	888
DH-42	10/12/2018	48.60	6.62	1081	0.79	90	308	1.6	14.2	6.8	1110	190	<10	787
DH-52	10/16/2018	6.97	7.36	1205	0.62	61	281	3.2	11.2	7.5	1220	130	<10	816
DH-55	10/12/2018	80.79	7.42	1774	0.61	46	267	1.1	9.6	7.6	1800	130	<10	1250
DH-56	6/26/2018	78.72	7.23	6045	6.19	81	301	5.9	11.7	7.3	5990	250	38	4950
DH-56	10/12/2018	82.05	7.35	8846	1.17	49	269	3.4	10.7	7.5	8880	460	<10	7310
DH-66	6/27/2018	48.67	6.67	2435	3.04	110	327	1.9	14.1	7	2620	250	<10	2050
DH-66	10/12/2018	49.73	6.70	2518	2.79	99	318	3.8	12.7	6.9	2560	240	<10	1960
DH-66 (Dup)	10/12/2018	49.73	6.70	2520	2.78	99	318	3.8	12.7	6.9	2580	240	<10	2000
DH-67	10/11/2018	33.57	6.39	1529	2.25	67	287	2.4	11.8	6.5	1550	180	<10	1140
DH-69	10/16/2018	36.07	7.03	941	0.43	-144	76	30.0	11.6	7	945	190	31	611
DH-79	10/12/2018	52.65	8.09	2939	0.12	-115	101	23.1	15.7	8	2890	390	57	1970
DH-80	6/27/2018	48.36	4.43	1049	0.14	204	421	8.5	14.3	4.6	1100	4	16 J	831
DH-80 (Dup)	6/27/2018	48.36	4.43	1049	0.13	203	421	8.5	14.3	4.6	1250	3	31 J	834
DH-80	10/12/2018	48.98	4.50	1014	0.06	121	339	10.3	13.5	4.6	1030	3	23	766
EH-50	10/16/2018	28.00	6.49	1255	1.68	56	275	1.5	12.2	6.7	1280	180	<10	835
EH-50 (Dup)	10/16/2018	28.00	6.52	1254	1.69	56	275	1.5	12.2	6.7	1250	180	<10	821
EH-51	10/11/2018	15.26	6.87	429	5.28	149	370	1.7	9.8	7.1	431	93	<10	249
EH-52	10/11/2018	7.42	6.78	547	2.42	147	366	0.5	12.6	6.9	565	110	<10	344
EH-53	10/11/2018	26.13	6.92	646	9.15	158	379	1.5	10.3	7.1	671	170	<10	403
EH-54	10/11/2018	7.59	6.74	346	1.72	123	342	5.7	12.0	7	360	100	<10	219
EH-57A	10/11/2018	37.59	6.82	1505	4.77	71	291	1.1	11.5	6.9	1510	270	<10	1010
EH-58	10/11/2018	12.46	6.73	586	2.53	62	281	0.7	12.4	6.9	597	120	<10	376
EH-59	10/11/2018	7.47	6.77	439	0.92	14	234	1.9	11.6	6.9	452	130	<10	268
EH-60	10/12/2018	23.37	6.05	1625	1.62	75	294	4.4	12.6	6.3	1810	150	<10	1190
EH-61	10/12/2018	25.10	6.99	1594	0.32	40	259	0.9	11.9	7.1	1690	180	<10	1160
EH-62	10/11/2018	25.09	6.88	385	5.72	149	370	0.7	9.6	7.2	403	120	<10	235
EH-62 (Dup)	10/11/2018	25.09	6.88	385	5.72	149	370	0.7	9.6	7.2	404	120	<10	234
EH-63	10/11/2018	20.12	6.83	451	6.67	155	376	2.8	9.7	7	471	96	15	275
EH-65	10/12/2018	25.23	6.54	1537	0.72	62	281	24.3	12.1	6.7	1620	170	25	1100
EH-66	10/10/2018	27.69	7.18	405	9.93	245	467	3.1	9.0	7.6	428	130	<10	248
EH-69	10/11/2018	17.60	6.74	476	5.69	137	358	11.7	10.2	7	503	130	30	297
EH-70	10/10/2018	31.86	7.08	706	7.86	71	292	2.1	10.5	7.1	729	130	<10	470
EH-100	10/16/2018	28.54	6.54	1407	0.11	52	271	0.7	12.6	6.7	1400	180	<10	931
EH-101	10/12/2018	15.63	7.15	367	4.57	65	286	0.7	10.3	7.1	395	86	<10	248
EH-101 (Dup)	10/12/2018	15.63	7.14	366	4.59	65	286	0.7	10.3	7.1	395	85	<10	247
EH-102	10/11/2018	8.50	6.86	422	0.82	134	355	0.6	9.4	7.1	433	100	<10	259
EH-103	10/15/2018	25.88	6.89	1624	0.74	114	333	2.7	11.9	7.1	1680	170	<10	1240
EH-104	10/11/2018	34.59	6.75	1576	3.85	62	282	0.9	11.5	6.9	1580	230	<10	1120
EH-106	10/12/2018	28.91	6.62	1099	3.25	72	291	2.1	12.2	6.7	1220	160	<10	822
EH-107	10/12/2018	22.35	6.80	1444	0.14	38	257	4.3	12.7	6.9	1490	170	<10	1050
EH-110	10/12/2018	21.02	7.22	787	0.15	43	262	1.0	12.3	7.3	834	150	<10	521
EH-111	10/12/2018	28.43	6.58	1644	1.16	49	268	1.5	11.9	6.7	1730	150	<10	1230
EH-114	6/26/2018	32.56	6.56	1242	1.01	104	323	4.3	11.9	6.7	1270	160	12	903
EH-114 (Dup)	6/26/2018	32.56	6.56	1243	1.01	103	323	4.3	11.9	6.7	1270	160	13	912
EH-114	10/11/2018	31.86	6.58	1316	0.77	72	292	3.3	11.6	6.7	1330	170	<10	913
EH-115	6/26/2018	35.08	6.42	1195	0.17	101	320	1.8	12.6	6.6	1230	170	10	879

			Field Parameters								General Chemistry				
Station ID	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids
EH-115	10/12/2018	34.34	6.53	1206	0.84	54	273	2.1	12.1	6.6	1290	180	<10	908
EH-117	10/11/2018	26.59	6.80	1161	7.68	73	293	3.3	11.0	6.9	1160	180	12	780
EH-118	10/11/2018	35.53	6.60	1209	2.82	71	291	8.9	11.4	6.8	1210	200	52	836
EH-119	10/10/2018	32.38	6.61	1265	0.44	223	444	3.5	10.3	6.8	1330	170	<10	936
EH-120	6/25/2018	25.19	6.80	1099	2.43	103	323	1.7	12.0	6.8	1100	130	<10	806
EH-120	10/11/2018	28.57	6.76	1019	2.68	95	315	1.8	11.4	6.9	1020	130	<10	714
EH-121	10/10/2018	28.04	7.70	272	4.63	267	489	0.8	8.5	7.2	288	80	<10	172
EH-123	6/25/2018	34.90	7.19	628	7.08	97	315	2.0	13.0	7.3	645	150	<10	446
EH-123 (Dup)	6/25/2018	34.90	7.19	628	7.08	97	315	2.0	13.0	7.2	646	150	<10	447
EH-123	10/10/2018	42.34	7.21	676	8.02	71	290	2.1	12.1	7.3	687	150	12	464
EH-124	10/11/2018	36.05	7.06	1125	0.98	57	277	1.1	10.9	7.2	1130	230	<10	790
EH-124 (Dup)	10/11/2018	36.05	7.06	1125	0.97	57	277	1.1	10.9	7.2	1130	230	<10	780
EH-125	10/10/2018	32.71	7.00	341	4.59	258	479	2.2	9.9	7.2	356	91	<10	212
EH-126	10/11/2018	50.43	7.24	1036	5.95	61	281	1.4	10.9	7.3	1050	180	<10	742
EH-129	6/25/2018	51.37	7.38	662	6.70	90	309	7.3	12.4	7.4	680	160	17	473
EH-129	10/10/2018	51.14	7.41	610	7.69	62	282	1.5	11.8	7.5	622	160	<10	417
EH-130	6/25/2018	37.42	7.11	279	5.62	59	279	1.8	10.7	7.1	289	78	11	185
EH-130	10/10/2018	41.06	6.95	276	4.48	220	442	2.9	9.3	7.2	294	80	10	170
EH-132	10/10/2018	58.95	7.37	628	5.36	58	276	5.1	13.3	7.4	643	130	<10	425
EH-132 (Dup)	10/10/2018	58.95	7.37	627	5.36	58	276	5.1	13.3	7.4	643	130	12	429
EH-134	6/25/2018	51.42	7.52	438	7.14	86	304	2.2	13.5	7.6	450	140	<10	312
EH-134	10/10/2018	51.07	7.54	442	7.01	60	279	1.4	12.5	7.6	452	140	<10	297
EH-135	10/10/2018	26.30	6.90	277	4.43	238	461	2.0	7.9	7.2	296	82	<10	169
EH-138	10/10/2018	39.73	7.05	357	7.50	222	444	0.8	8.9	7.4	378	96	<10	226
EH-138 (Dup)	10/10/2018	39.73	7.06	357	7.49	221	443	0.8	8.9	7.4	378	97	<10	224
EH-139	10/10/2018	44.55	7.23	628	8.25	211	432	2.5	10.1	7.4	665	210	<10	412
EH-141	6/26/2018	23.12	7.23	790	5.10	101	321	0.7	11.1	7.3	815	160	<10	572
EH-141	10/10/2018	26.08	7.30	760	5.02	74	294	1.5	10.9	7.4	785	160	<10	536
EH-143	6/25/2018	26.76	7.29	521	5.79	106	327	0.3	10.7	7.3	520	120	<10	346
EH-143	10/10/2018	27.94	7.20	422	5.98	229	450	1.3	9.5	7.4	435	110	<10	272
EH-204	6/26/2018	56.66	7.09	1853	3.00	84	303	3.8	11.8	7.2	1930	270	40	1500
EH-204	10/11/2018	55.91	7.13	1887	2.97	52	272	2.0	11.3	7.2	1910	260	13	1450
EH-206	10/10/2018	48.28	7.61	509	6.11	56	275	2.3	12.9	7.7	519	180	20	327
EH-210	6/26/2018	36.90	7.21	985	7.75	92	311	1.4	12.7	7.3	1010	130	<10	733
EH-210	10/11/2018	36.94	7.25	1009	8.27	61	280	1.3	12.1	7.3	1020	140	11	704
MW-1	10/15/2018	53.23	7.46	443	8.95	60	280	32.7	11.5	7.6	464	120	70	319
MW-2	10/15/2018	40.17	7.05	815	1.31	35	255	0.6	11.3	7.2	845	230	<10	558
MW-3	10/16/2018	35.48	6.98	938	0.60	112	333	0.5	10.5	7.1	959	230	<10	665
MW-4	10/15/2018	49.27	7.39	468	8.70	64	284	5.1	11.5	7.5	494	160	14	325
MW-5	10/15/2018	54.21	7.74	353	9.11	48	268	31.5	11.5	7.8	371	140	32	249
MW-5 (Dup)	10/15/2018	54.21	7.74	353	9.11	48	268	31.5	11.5	7.8	374	140	25	248
MW-6	10/16/2018	32.08	7.02	1363	1.04	82	302	1.7	10.7	7.2	1380	240	<10	1010
MW-7	10/15/2018	57.54	7.65	257	9.88	120	341	57.0	9.4	7.8	265	88	85	207
MW-8	10/15/2018	52.90	7.40	467	7.45	64	284	7.4	11.6	7.5	491	160	53	328
MW-9	10/15/2018	52.77	7.57	433	8.81	65	285	26.4	11.2	7.7	450	150	55	294
MW-10	10/15/2018	44.94	7.38	754	6.04	57	277	3.6	11.4	7.5	775	240	13	520
MW-11	10/15/2018	64.05	7.67	623	9.56	74	293	6.4	12.2	7.8	651	110	<10	444

NOTES: All concentrations in mg/L except as indicated.
J = QC criterion exceeded (estimated value)

		Major Ions								Dissolved (D) Metals										
Station ID	**Sample Date**	**Calcium**	**Magnesium**	**Sodium**	**Potassium**	**Bicarbonate**	**Chloride**	**Sulfate**	**Bromide**	**Sb (D)**	**As (D)**	**Cd (D)**	**Cu (D)**	**Fe (D)**	**Pb (D)**	**Mn (D)**	**Hg (D)**	**Se (D)**	**Tl (D)**	**Zn (D)**
2843 Canyon Ferry Rd	6/20/2018	73	16	32	5	160	15	156	0.65	<0.003	<0.002	<0.001	<0.001	0.29	<0.005	<0.01	<0.001	0.04	<0.001	<0.01
2843 Canyon Ferry Rd	10/16/2018	75	16	30	4	160	16	154	0.83	<0.003	<0.002	<0.001	<0.001	0.06	<0.005	<0.01	<0.001	0.04	<0.001	<0.01
2853 Canyon Ferry Rd	6/20/2018	83	18	33	5	160	19	181	0.8	<0.003	<0.002	<0.001	0.001	0.39	<0.005	<0.01	<0.001	0.045	<0.001	<0.01
2853 Canyon Ferry Rd	10/16/2018	82	18	31	4	160	18	177	0.99	<0.003	<0.002	<0.001	<0.001	0.05	<0.005	<0.01	<0.001	0.047	<0.001	<0.01
Amchem Injection	10/17/2018	36	9	16	4	140	5	50	0.27	<0.003	0.006	<0.001	0.004	<0.02	<0.005	<0.01	<0.001	0.002	<0.001	<0.01
Amchem4	10/17/2018	36	9	16	4	140	5	51	0.26	<0.003	0.006	<0.001	0.005	0.02	<0.005	<0.01	<0.001	0.002	<0.001	<0.01
Dartman	6/21/2018	39	8	16	3	110	3	58	0.07	<0.003	<0.002	<0.001	<0.001	0.25	<0.005	0.03	<0.001	<0.001	<0.001	<0.01
Dartman	10/18/2018	37	8	15	3	110	4	66	0.09	<0.003	<0.002	<0.001	<0.001	0.26	<0.005	0.03	<0.001	<0.001	<0.001	<0.01
DH-6	10/16/2018	143	23	271	187	180	22	1130	1.1	0.038	0.723	<0.001	0.01	<0.02	<0.005	<0.01	<0.001	0.545	<0.001	<0.01
DH-8	10/12/2018	690	161	115	17	360	336	1590	25	<0.003	<0.002	<0.001	0.002	<0.02	<0.005	<0.01	0.001	0.586	0.002	<0.01
DH-15	10/16/2018	203	44	161	7	190	21	801	1.46	<0.003	<0.002	<0.001	0.003	<0.02	<0.005	0.02	<0.001	0.36	<0.001	<0.01
DH-17	6/27/2018	45	12	227	15	340	20	345	1.89	<0.003	18.5	<0.001	0.002 J	0.2	<0.005	1.28	<0.001	0.002	<0.001	5.72
DH-17	10/12/2018	54	15	219	15	380	19	322	2.08	<0.003	20.6	<0.001	0.001	0.28	<0.005	1.58	<0.001	<0.001	<0.001	3.39
DH-42	10/12/2018	137	37	34	8	230	18	341	1.22	<0.003	2.23	5.92	0.006	<0.02	<0.005	7.09	<0.001	0.041	0.004	2.99
DH-52	10/16/2018	82	15	106	78	150	9	453	0.33	0.026	0.51	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.085	<0.001	<0.01
DH-55	10/12/2018	88	16	211	109	160	11	665	0.5	0.032	0.16	<0.001	0.003	<0.02	<0.005	0.11	<0.001	0.137	0.009	0.06
DH-56	6/26/2018	252	58	665	668	310	61	2750	3.6	0.028	0.52	<0.001	0.003	0.04	<0.005	<0.01	<0.001	0.882	<0.001	<0.01
DH-56	10/12/2018	388	76	1160	889	560	74	4230	5.6	0.023	0.45	<0.001	0.006	<0.02	<0.005	<0.01	<0.001	1.74	<0.001	<0.01
DH-66	6/27/2018	298	93	147	11	310	168	905	11.4	<0.003	0.004	0.222	0.003 J	<0.02	<0.005	<0.01	<0.001	2.72	<0.001	0.13
DH-66	10/12/2018	331	104	112	10	290	153	887	11.5	<0.003	0.004	0.234	0.003	<0.02	<0.005	<0.01	<0.001	2.12	<0.001	0.15
DH-66 (Dup)	10/12/2018	332	105	112	10	290	156	910	11.7	<0.003	0.004	0.241	0.003	<0.02	<0.005	<0.01	<0.001	2.16	<0.001	0.15
DH-67	10/11/2018	145	48	109	7	220	51	551	2.27	<0.003	0.009	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.474	<0.001	<0.01
DH-69	10/16/2018	68	11	94	12	230	8	274	0.24	<0.003	0.299	<0.001	0.002	16	<0.005	5.22	<0.001	0.001	0.001	0.31
DH-79	10/12/2018	26	11	610	18	470	71	876	4.1	0.008	61.9	0.001	0.06	0.07	<0.005	0.97	<0.001	0.392	<0.001	<0.01
DH-80	6/27/2018	90	23	52	11	4	12	504	0.36	<0.003	10.1	5.08	0.004 J	14	<0.005	4.46	<0.001	0.014	0.276	8.31
DH-80 (Dup)	6/27/2018	91	23	51	11	3	12	507	0.36	<0.003	9.78	6.19	0.009 J	13.7	<0.005	4.55	<0.001	0.017	0.278	8.63
DH-80	10/12/2018	90	23	43	10	3	12	442	0.4	<0.003	9.45	5.4	0.002	13.4	<0.005	4.41	<0.001	0.015	0.258	8.16
EH-50	10/16/2018	70	22	173	6	220	63	365	1.63	<0.003	7.04	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.009	<0.001	<0.01
EH-50 (Dup)	10/16/2018	68	21	176	6	220	63	359	1.6	<0.003	7.52	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.008	<0.001	<0.01
EH-51	10/11/2018	26	5	39	20	110	21	71	0.05	<0.003	0.049	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.006	<0.001	<0.01
EH-52	10/11/2018	46	10	35	29	130	8	144	0.08	0.014	0.276	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.016	<0.001	<0.01
EH-53	10/11/2018	40	12	84	4	200	18	122	0.14	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.015	<0.001	<0.01
EH-54	10/11/2018	39	8	15	4	120	8	63	<0.05	<0.003	0.021	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	<0.001	<0.001	<0.01
EH-57A	10/11/2018	147	42	97	7	330	110	352	2.19	<0.003	<0.002	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.231	<0.001	<0.01
EH-58	10/11/2018	61	15	25	4	140	23	140	0.06	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.004	<0.001	<0.01
EH-59	10/11/2018	41	9	25	14	160	10	79	<0.05	0.005	0.017	<0.001	0.002	0.09	<0.005	0.07	<0.001	<0.001	<0.001	<0.01
EH-60	10/12/2018	100	30	225	12	190	170	456	1	<0.003	3.31	<0.001	0.003	<0.02	<0.005	4.36	<0.001	0.002	<0.001	<0.01
EH-61	10/12/2018	114	21	220	14	220	31	586	1	<0.003	<0.002	<0.001	0.001	<0.02	<0.005	0.65	<0.001	0.255	<0.001	<0.01
EH-62	10/11/2018	41	10	19	4	140	12	57	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
EH-62 (Dup)	10/11/2018	42	10	19	4	140	12	57	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
EH-63	10/11/2018	46	10	23	5	120	28	62	0.08	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.002	<0.001	<0.01
EH-65	10/12/2018	119	31	194	10	200	59	527	0.9	<0.003	0.307	<0.001	0.002	<0.02	<0.005	1.09	<0.001	0.174	<0.001	<0.01
EH-66	10/10/2018	48	12	16	3	160	6	49	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	<0.001	<0.001	<0.01
EH-69	10/11/2018	45	10	36	5	150	21	75	0.06	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.005	<0.001	<0.01
EH-70	10/10/2018	50	16	72	3	160	14	191	0.44	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.043	<0.001	<0.01
EH-100	10/16/2018	49	18	225	9	220	23	485	2.14	<0.003	11.7	0.002	0.004	<0.02	<0.005	5.63	<0.001	0.004	<0.001	0.26
EH-101	10/12/2018	28	6	31	16	100	18	62	0.05	<0.003	0.003	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.006	<0.001	<0.01
EH-101 (Dup)	10/12/2018	28	5	31	16	100	18	63	0.05	<0.003	0.003	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.006	<0.001	<0.01
EH-102	10/11/2018	28	6	51	7	130	11	86	0.21	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.007	<0.001	<0.01
EH-103	10/15/2018	169	34	162	10	200	30	616	2.23	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	0.14	<0.001	0.285	<0.001	<0.01
EH-104	10/11/2018	152	39	124	7	280	77	480	2.84	<0.003	<0.002	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.218	<0.001	<0.01
EH-106	10/12/2018	91	22	128	6	200	33	361	1.6	<0.003	0.667	<0.001	<0.001	<0.02	<0.005	0.04	<0.001	0.02	<0.001	<0.01
EH-107	10/12/2018	136	30	152	6	210	28	512	0.86	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	0.07	<0.001	0.264	<0.001	<0.01
EH-110	10/12/2018	35	7	129	6	180	23	196	0.15	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.063	<0.001	<0.01
EH-111	10/12/2018	116	31	214	10	180	29	656	2	<0.003	1.56	<0.001	0.002	<0.02	<0.005	6.68	<0.001	0.163	<0.001	<0.01
EH-114	6/26/2018	88	23	157	6	190	27	420	1.68	<0.003	0.802	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.025	<0.001	<0.01
EH-114 (Dup)	6/26/2018	81	21	143	6	190	27	421	1.68	<0.003	0.866	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.026	<0.001	<0.01
EH-114	10/11/2018	83	22	168	7	200	30	458	2.09	<0.003	0.999	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.028	<0.001	<0.01
EH-115	6/26/2018	90	24	139	6	200	28	394	1.65	<0.003	2.07	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.029	<0.001	<0.01

		Major Ions								Dissolved (D) Metals										
Station ID	**Sample Date**	**Calcium**	**Magnesium**	**Sodium**	**Potassium**	**Bicarbonate**	**Chloride**	**Sulfate**	**Bromide**	**Sb (D)**	**As (D)**	**Cd (D)**	**Cu (D)**	**Fe (D)**	**Pb (D)**	**Mn (D)**	**Hg (D)**	**Se (D)**	**Tl (D)**	**Zn (D)**
EH-115	10/12/2018	98	27	142	6	220	38	376	1.82	<0.003	1.86	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.032	<0.001	<0.01
EH-117	10/11/2018	82	22	132	6	220	36	332	1.21	<0.003	<0.002	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.088	<0.001	<0.01
EH-118	10/11/2018	104	32	94	6	250	45	351	1.9	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.107	<0.001	<0.01
EH-119	10/10/2018	107	30	132	6	200	27	435	2.14	<0.003	<0.002	<0.001	0.001	<0.02	<0.005	<0.01	<0.001	0.073	<0.001	<0.01
EH-120	6/25/2018	113	24	94	5	160	21	388	0.87	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.121	<0.001	<0.01
EH-120	10/11/2018	92	20	95	5	160	20	346	0.97	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.11	<0.001	<0.01
EH-121	10/10/2018	29	7	13	2	97	5	46	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	<0.001	<0.001	<0.01
EH-123	6/25/2018	64	17	38	7	180	27	117	0.19	<0.003	0.006	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01
EH-123 (Dup)	6/25/2018	65	17	37	7	180	28	117	0.19	<0.003	0.006	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01
EH-123	10/10/2018	67	18	39	7	190	31	128	0.27	<0.003	0.006	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01
EH-124	10/11/2018	120	32	61	7	280	27	324	1.93	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.066	<0.001	<0.01
EH-124 (Dup)	10/11/2018	122	32	62	7	280	27	323	1.9	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.065	<0.001	<0.01
EH-125	10/10/2018	27	7	33	3	110	7	62	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.004	<0.001	<0.01
EH-126	10/11/2018	92	41	54	4	220	38	299	1.99	<0.003	0.003	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.196	<0.001	<0.01
EH-129	6/25/2018	67	22	36	7	200	21	139	0.58	<0.003	0.004	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.055	<0.001	<0.01
EH-129	10/10/2018	60	19	33	6	200	18	114	0.45	<0.003	0.005	<0.001	0.002	<0.02	<0.005	<0.01	<0.001	0.03	<0.001	<0.01
EH-130	6/25/2018	30	7	15	2	94	5	47	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	<0.001	<0.001	<0.01
EH-130	10/10/2018	29	7	16	2	97	5	48	<0.05	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	<0.001	<0.001	<0.01
EH-132	10/10/2018	58	18	36	9	160	22	138	0.52	<0.003	0.021	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01
EH-132 (Dup)	10/10/2018	58	18	35	9	160	21	137	0.52	<0.003	0.021	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01
EH-134	6/25/2018	46	13	23	6	170	10	64	0.08	<0.003	0.005	<0.001	<0.001	0.03	<0.005	<0.01	<0.001	0.002	<0.001	<0.01
EH-134	10/10/2018	45	13	23	6	170	10	64	0.1	<0.003	0.005	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.002	<0.001	<0.01
EH-135	10/10/2018	31	7	14	3	100	5	46	<0.05	<0.003	<0.002	<0.001	0.003	<0.02	<0.005	<0.01	<0.001	<0.001	<0.001	<0.01
EH-138	10/10/2018	30	8	32	3	120	7	68	0.08	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.006	<0.001	<0.01
EH-138 (Dup)	10/10/2018	30	8	32	3	120	7	67	0.08	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.006	<0.001	<0.01
EH-139	10/10/2018	56	27	34	8	250	14	94	0.2	<0.003	0.005	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.011	<0.001	<0.01
EH-141	6/26/2018	87	22	46	7	190	21	210	0.9	<0.003	0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.07	<0.001	<0.01
EH-141	10/10/2018	80	21	44	7	190	18	190	0.96	<0.003	0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.063	<0.001	<0.01
EH-143	6/25/2018	55	13	30	4	140	11	116	0.34	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.026	<0.001	<0.01
EH-143	10/10/2018	43	10	26	3	130	8	83	0.2	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.015	<0.001	<0.01
EH-204	6/26/2018	273	63	73	11	330	89	638	3.7	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.106	<0.001	<0.01
EH-204	10/11/2018	260	57	78	12	320	93	682	4.7	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.108	<0.001	<0.01
EH-206	10/10/2018	59	14	18	9	210	20	49	0.09	<0.003	0.029	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
EH-210	6/26/2018	118	25	49	10	160	38	298	3.6	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.123	<0.001	<0.01
EH-210	10/11/2018	111	24	50	10	170	40	310	4.43	<0.003	<0.002	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.115	<0.001	<0.01
MW-1	10/15/2018	47	10	26	5	140	13	79	0.14	<0.003	0.008	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.002	<0.001	<0.01
MW-2	10/15/2018	109	23	25	6	280	33	149	0.23	<0.003	0.011	<0.001	<0.001	<0.02	<0.005	0.45	<0.001	<0.001	<0.001	<0.01
MW-3	10/16/2018	118	27	26	7	290	49	203	0.35	<0.003	0.01	<0.001	0.001	<0.02	<0.005	0.04	<0.001	0.015	<0.001	<0.01
MW-4	10/15/2018	53	12	28	6	200	9	67	0.07	<0.003	0.004	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
MW-5	10/15/2018	37	7	25	4	170	6	37	0.06	<0.003	0.006	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
MW-5 (Dup)	10/15/2018	38	8	25	4	170	6	37	<0.05	<0.003	0.006	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
MW-6	10/16/2018	187	43	34	7	290	83	394	0.51	<0.003	0.038	<0.001	0.001	<0.02	<0.005	1.06	<0.001	0.013	<0.001	<0.01
MW-7	10/15/2018	21	6	21	5	110	1	33	<0.05	<0.003	0.016	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
MW-8	10/15/2018	56	11	24	7	190	10	67	0.07	<0.003	0.007	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
MW-9	10/15/2018	49	10	26	6	180	8	54	0.07	<0.003	0.006	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.001	<0.001	<0.01
MW-10	10/15/2018	93	23	38	7	300	16	130	0.12	<0.003	0.009	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01
MW-11	10/15/2018	50	12	60	11	140	24	147	0.22	<0.003	0.018	<0.001	<0.001	<0.02	<0.005	<0.01	<0.001	0.003	<0.001	<0.01

NOTES: All concentrations in mg/L except as indicated.
J = QC criterion exceeded (estimated value)

APPENDIX A2

2018 RESIDENTIAL WELL WATER QUALITY DATABASE

Station ID	Sample Date	Field pH (s.u.)	Field SC (µmhos/cm)	Diss O2 (mg/L)	Water Temp (°C)	Flow (cfs)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Dissolved Solids	Total Suspended Solids	Ca (TR)	Mg (TR)	Na (TR)	K (TR)
PPC-36A	7/19/2018	7.61	260	9.44	13	112	8.2	271	77	186	11	31	7	10	3
PPC-36A	10/12/2018	7.25	329	11.64	5.1	51	8.1	342	90	224	<10	39	9	14	3
PPC-36A (Dup)	10/12/2018	7.26	329	11.60	5.1	51	8.1	342	90	226	<10	37	8	13	3
PPC-3A	7/19/2018	8.00	260	9.52	14.8	118	8.2	271	77	185	<10	31	7	10	3
PPC-3A (Dup)	7/19/2018	7.99	260	9.53	14.8	118	8.2	271	77	186	<10	32	7	10	3
PPC-3A	10/12/2018	7.52	325	11.11	6.5	49	8	337	89	211	<10	40	9	14	3
PPC-4A	7/19/2018	8.01	243	9.53	14.4	115	8.2	271	77	182	<10	32	7	11	3
PPC-4A	10/12/2018	7.34	325	11.51	6.2	51	8.1	338	90	215	<10	39	9	14	3
PPC-5A	6/28/2018	7.33	182	9.52	11.9	284	7.6	188	55	132	19	21	5	7	2
PPC-5A	7/19/2018	7.93	261	9.60	13.9	112	8.2	270	77	183	10	30	7	10	3
PPC-5A	10/12/2018	7.53	328	11.40	6.1	50	8.1	339	90	220	<10	37	8	13	3
PPC-7	7/19/2018	7.94	260	9.47	13.6	111	8.2	271	77	183	10	31	7	10	3
PPC-7	10/12/2018	7.35	328	11.30	5.8	52	8.1	340	89	218	<10	36	8	13	3
SG-16	7/19/2018	7.62	261	9.67	13.3	93	8.2	272	77	187	<10	31	7	11	3
SG-16	10/12/2018	6.73	327	11.72	4.8	43	8.1	345	90	224	<10	38	8	13	3
Trib-1	5/25/2018	6.68	513	4.11	14.2		7.5	518	170	342	<10	64	15	25	5
Trib-1B	5/25/2018	6.25	403	1.04	14.6	0.07 J	7	425	110	288	<10	52	11	17	4
Trib-1C	5/25/2018	7.36	450	7.37	16.5	0.68	7.6	456	93	316	<10	59	12	14	4
Trib-1D	5/25/2018	7.6	485	7.79	17	0.5 J-	8	491	100	342	<10	65	14	15	4
Trib-1D	7/19/2018	9.72	551	11.79	25.3	0.0097	9.8	563	63	404	<10	62	16	24	2
Trib-1D	10/12/2018	8.36	770	13.22	9.3	0.038	8.7	792	96	573	<10	105	22	25	5

NOTES: All concentrations in mg/L except as indicated

NM = not measured

(TR) = total recoverable

J = QC criterion exceeded (estimated value)

J- = QC criterion exceeded (estimated value with potential low bias)

Station ID	Sample Date	HCO3	Cl	SO4	Br	Sb (TR)	As (TR)	Cd (TR)	Cu (TR)	Fe (TR)	Pb (TR)	Mn (TR	Hg (TR)	Se (TR)	Tl (TR)	Zn (TR)
PPC-36A	7/19/2018	93	6	43	NM	0.0007	0.005	0.00035	0.005	0.48	0.0059	0.08 J	<0.000005	<0.001	<0.0002	0.081
PPC-36A	10/12/2018	110	7	61	<0.05	<0.0005	0.004	0.00042	0.003	0.23	0.002	0.06	<0.000005	<0.001	<0.0002	0.149
PPC-36A (Dup)	10/12/2018	110	7	60	<0.05	<0.0005	0.004	0.00045	0.003	0.22	0.0019	0.06	<0.000005	<0.001	<0.0002	0.144
PPC-3A	7/19/2018	93	6	43	NM	<0.0005	0.005	0.0003	0.004	0.45	0.0039	0.09 J	<0.000005	<0.001	<0.0002	0.08
PPC-3A (Dup)	7/19/2018	93	6	42	NM	<0.0005	0.005	0.00025	0.004	0.41	0.0041	0.07 J	<0.000005	<0.001	<0.0002	0.078
PPC-3A	10/12/2018	110	7	61	<0.05	<0.0005	0.004	0.00039	<0.002	0.2	0.0014	0.05	<0.000005	<0.001	<0.0002	0.141
PPC-4A	7/19/2018	93	6	43	NM	<0.0005	0.006	0.0004	0.007	0.65	0.0045	0.08 J	<0.000005	<0.001	<0.0002	0.087
PPC-4A	10/12/2018	110	7	60	<0.05	<0.0005	0.004	0.00044	0.002	0.22	0.0017	0.05	<0.000005	<0.001	<0.0002	0.146
PPC-5A	6/28/2018	66	3	24	NM	<0.0005	0.007	0.00039	0.007	0.95	0.0111	0.12	0.000009	<0.001	<0.0002	0.091
PPC-5A	7/19/2018	93	6	43	NM	<0.0005	0.005	0.00027	0.004	0.47	0.0047	0.08 J	<0.000005	<0.001	<0.0002	0.079
PPC-5A	10/12/2018	110	7	59	<0.05	<0.0005	0.004	0.00043	0.002	0.22	0.0016	0.06	<0.000005	<0.001	<0.0002	0.142
PPC-7	7/19/2018	93	6	43	NM	<0.0005	0.005	0.00027	0.005	0.47	0.0048	0.07 J	<0.000005	<0.001	<0.0002	0.078
PPC-7	10/12/2018	110	7	60	<0.05	<0.0005	0.004	0.00041	0.002	0.22	0.0016	0.06	<0.000005	<0.001	<0.0002	0.142
SG-16	7/19/2018	93	6	43	NM	<0.0005	0.005	0.0003	0.005	0.49	0.006	0.07 J	<0.000005	<0.001	<0.0002	0.078
SG-16	10/12/2018	110	7	60	<0.05	<0.0005	0.004	0.00042	0.003	0.23	0.0027	0.05	<0.000005	<0.001	<0.0002	0.143
Trib-1	5/25/2018	210	9	79	NM	0.0009	0.01	0.00085	0.002	0.78	0.0086	0.169	NM	<0.001	<0.0002	0.016
Trib-1B	5/25/2018	130	5	87	NM	0.0028	0.007	0.0239	0.022	0.18	0.008	0.197	NM	<0.001	0.0004	1.38
Trib-1C	5/25/2018	110	4	122	NM	0.0029	0.009	0.0265	0.023	0.26	0.008	0.254	NM	<0.001	0.0003	2.02
Trib-1D	5/25/2018	120	4	134	NM	0.0023	0.011	0.00875	0.015	1.22	0.0061	0.388	NM	<0.001	<0.0002	0.894
Trib-1D	7/19/2018	27	6	209	NM	0.0008	0.021	0.0002	0.003	0.19	0.0012	0.03 J	<0.000005	<0.001	<0.0002	0.011
Trib-1D	10/12/2018	110	8	276	<0.05	0.0005	0.007	0.00021	0.002	0.47	0.0032	0.63	0.000009	<0.001	<0.0002	0.019

NOTES: All concentrations in mg/L except as indicated

NM = not measured

(TR) = total recoverable

J = QC criterion exceeded (estimated value)

J- = QC criterion exceeded (estimated value with potential low bias)

APPENDIX A3

2018 SURFACE WATER QUALITY DATABASE

			Field Parameters							General Chemistry					Major Ions							
Map Key (see Exhibit 1)	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Chloride	Sulfate	Bromide
R1	6/21/2018		6.99	294	5.34	106	327	0.02	10.3	7.0	302	82	<10	187	33	7	14	3	99	7	46	<0.05
R1	10/15/2018		6.57	289	2.39	123	344	0.8	9.8	7.1	295	84	<10	187	33	7	13	3	100	6	44	<0.05
R2	6/21/2018		7.09	300	3.14	88	309	0.02	10.1	7.2	307	86	<10	196	34	7	15	3	100	6	47	<0.05
R3	6/20/2018		6.8	640	5.72	124	344	0.02	11.5	7.4	649	130	<10	414	68	13	33	16	160	36	122	<0.05
R3	10/11/2018		6.78	425	2.24	145	362	0.27	14.6	7.0	451	120	<10	272	43	9	23	15	150	9	85	<0.05
R4	6/21/2018		7.01	381	2.13	38	258	0.02	10.3	7.2	391	95	<10	256	37	8	29	3	120	7	77	0.15
R4	10/11/2018		6.96	369	2.19	28	249	0.7	10.1	7.1	394	95	<10	238	36	8	27	3	120	8	81	0.23
R5	6/19/2018		7.07	274	5.82	102	324	0.02	9	7.2	285	78	<10	180	32	7	13	2	94	6	46	<0.05
R5	10/11/2018		6.8	269	7.93	114	342	1.3	9	7.2	285	78	<10	167	30	7	13	2	95	6	50	<0.05
R6	6/19/2018		7.18	390	3.82	111	331	1.29	11.4	7.3	406	100	<10	283	47	10	16	4	120	6	81	0.11
R6	10/11/2018		6.87	434	4.49	93	314	0.59	9.3	7.2	464	110	<10	304	53	11	17	5	140	7	103	0.25
R7	6/19/2018	26.2	7.24	297	5.64	121	341	0.02	10.7	7.4	308	85	<10	198	33	7	16	3	100	5	50	<0.05
R7	10/16/2018	24.72	6.97	306	5.22	108	328	2.3	10.7	7.4	310	87	<10	197	33	7	15	3	110	5	50	<0.05
R8	6/19/2018	27.65	7.17	277	4.64	105	325	0.02	10.7	7.3	289	82	<10	183	31	7	14	3	100	5	45	<0.05
R8	10/16/2018	26.2	6.97	286	4.28	60	280	0.64	10.7	7.3	288	84	<10	179	31	7	14	3	100	5	45	<0.05
R8	10/16/2018	26.2	6.97	286	4.28	60	280	0.64	10.7	7.3	289	83	<10	181	31	7	14	3	100	5	45	<0.05
R9	6/19/2018	29.78	7.16	290	4.63	109	328	0.02	11.7	7.3	301	87	<10	194	33	7	14	3	110	6	44	<0.05
R9	6/19/2018	29.78	7.16	290	4.63	109	328	0.02	11.7	7.3	301	88	<10	190	33	7	14	3	110	6	45	<0.05
R9	10/11/2018	27.85	7.13	284	3.69	75	295	0.54	11.6	7.4	303	93	<10	182	33	7	14	3	110	6	44	<0.05
R10	6/20/2018		6.93	344	3.23	70	290	0.02	11.3	7.1	351	95	<10	218	37	8	16	3	120	8	53	<0.05
R11	6/19/2018		6.91	808	2.11	132	352	0.02	11.7	7.0	824	120	<10	602	107	23	26	6	150	25	250	2.75
R11	10/17/2018		6.6	805	1.74	106	326	1.4	11.7	7.0	822	120	<10	567	101	22	26	6	150	25	246	3.23
R12	6/20/2018	14.88	7.23	430	8.6	121	341	0.02	11	7.4	437	110	<10	280	49	11	20	3	140	6	85	0.08
R12	10/11/2018	16.94	7.09	415	9.08	144	365	0.44	10.6	7.4	440	110	<10	263	50	11	18	3	140	6	92	0.11
R13	6/20/2018	17.05	7.24	745	4.19	129	350	0.02	9.4	7.4	736	210	<10	490	74	15	60	7	250	15	144	0.06
R13	10/16/2018	19.6	6.97	716	2.73	107	329	0.53	9	7.4	724	270	<10	444	89	18	37	7	330	17	78	0.14
R14	6/21/2018	8.27	6.99	300	6.65	85	306	0.02	9.8	7	311	77	<10	200	34	7	14	3	93	10	49	<0.05
R14	10/15/2018	12.67	6.53	309	3.13	89	311	0.74	9.2	7.1	318	84	<10	198	35	8	13	3	100	7	51	<0.05
R15	6/20/2018		7.57	749	8.66	118	338	0.02	11.7	7.7	740	200	<10	510	76	20	40	15	240	29	116	0.2
R15	10/17/2018		7.41	713	8.23	103	323	0.44	11.6	7.7	704	190	<10	469	71	19	37	14	230	28	118	0.25
R16	10/17/2018		7.55	703	14.97	58	278	2.7	11.4	7.7	711	170	<10	463	66	18	41	14	210	30	128	0.26
R17	6/21/2018	85.11	7.75	497	10.42	109	329	NM	12.1	8	512	130	<10	365	47	13	33	12	160	16	82	0.13
R17	10/17/2018		7.56	510	9.45	90	309	0.29	12.1	7.7	503	130	<10	347	45	12	32	12	160	17	90	0.17
R18	6/21/2018		7.22	263	5.82	58	277	1.98	12	7.3	271	83	<10	173	29	7	13	3	100	5	35	<0.05
R18	10/17/2018		6.83	279	4.51	99	319	0.93	10.8	7.3	285	88	<10	182	31	7	13	3	110	6	44	<0.05
R19	6/21/2018		7.25	299	8.72	66	286	3.05	10.4	7.2	304	89	<10	197	34	7	14	3	110	7	40	<0.05
R19	10/17/2018		6.98	279	8.04	91	312	0.76	10.4	7.3	283	86	<10	179	31	7	12	3	100	6	45	<0.05
R20	6/21/2018		7.25	279	9.21	81	303	33.6	8.4	7.2	289	77	<10	187	32	7	14	3	94	6	47	<0.05
R20	10/17/2018		6.64	271	6.87	113	335	227	8.6	7.2	269	76	<10	175	29	6	13	2	92	6	48	<0.05

NOTES: All concentrations in mg/L except as indicated.
J = estimated value due to QC criterion exceedance
Locations shown on Exhibit 1

		Dissolved (D) and Total (T) Metals																							
Map Key (see Exhibit 1)	Sample Date	Sb (D)	Sb (T)	As (D)	As (T)	Cd (D)	Cd (T)	Cu (D)	Cu (T)	Fe (D)	Fe (T)	Pb (D)	Pb (T)	Mn (D)	Mn (T)	Hg (D)	Hg (T)	Se (D)	Se (T)	Tl (D)	Tl (T)	Zn (D)	Zn (T)
R1	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.009	0.009	0.04	0.16	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R1	10/15/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.009	0.01	0.02	0.06	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R2	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	0.004	<0.02	0.28	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	<0.01
R3	6/20/2018	0.003	0.003	<0.002	<0.002	<0.001	<0.001	0.033	0.033	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.006	0.006	<0.001	<0.001	<0.01	<0.01
R3	10/11/2018	0.004	0.004	<0.002	<0.002	<0.001	<0.001	0.039	0.037	<0.02	<0.02	<0.005	<0.005	0.01	0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	0.01
R4	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	0.08	0.22	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.003	0.003	<0.001	<0.001	<0.01	<0.01
R4	10/11/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	0.001	0.05	0.09	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.003	0.003	<0.001	<0.001	<0.01	<0.01
R5	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	0.003	0.03	1.62	<0.005	<0.005	<0.01	0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.01
R5	10/11/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	0.002	0.03	0.49	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.01
R6	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.005	0.006	0.18	0.18	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.04	0.05
R6	10/11/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.004	0.004	<0.02	0.05	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.003	0.002	<0.001	<0.001	0.01	0.01
R7	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.014	0.015	<0.02	0.17	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.01	<0.01
R7	10/16/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.011	0.011	0.05	0.12	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.01	<0.01
R8	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.002	0.002	<0.02	0.05	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R8	10/16/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.001	0.001	0.06	0.1	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R8	10/16/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.001	0.001	0.06	0.1	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R9	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.003	0.004	0.03	0.16	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R9	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.003	0.005	0.03	0.16	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R9	10/11/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.003	0.002	<0.02	0.05	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R10	6/20/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.001	0.002	0.03	0.08	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	<0.01
R11	6/19/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.004	0.005	<0.02	0.23	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.044	0.04	<0.001	<0.001	0.03	0.03
R11	10/17/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.003	0.004	<0.02	0.09	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.045	0.04	<0.001	<0.001	0.03	0.03
R12	6/20/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.015	0.017	<0.02	0.11	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.003	0.003	<0.001	<0.001	<0.01	<0.01
R12	10/11/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.013	0.023	<0.02	0.05	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.003	0.003	<0.001	<0.001	<0.01	<0.01
R13	6/20/2018	<0.003	<0.003	0.015	0.014	<0.001	<0.001	0.037 J	0.023 J	0.05	0.05	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.05	0.04
R13	10/16/2018	<0.003	<0.003	0.014	0.013	<0.001	<0.001	0.015	0.017	<0.02	0.04	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.02	0.02
R14	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.001	0.004	<0.02	2.61	<0.005	<0.005	<0.01	0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.02
R14	10/15/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.001	0.012	<0.02	0.55	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.02
R15	6/20/2018	<0.003	<0.003	0.016	0.015	<0.001	<0.001	0.001	0.001	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	<0.01
R15	10/17/2018	<0.003	<0.003	0.016	0.016	<0.001	<0.001	0.001	0.002	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	<0.01
R16	10/17/2018	<0.003	<0.003	0.016	0.018	<0.001	<0.001	<0.001	0.001	0.03	0.2	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.02	0.02
R17	6/21/2018	<0.003	<0.003	0.017	0.017	<0.001	<0.001	<0.001	<0.001	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	<0.01
R17	10/17/2018	<0.003	<0.003	0.017	0.017	<0.001	<0.001	<0.001	<0.001	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.01	<0.01
R18	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R18	10/17/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	0.002	<0.02	0.11	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R19	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R19	10/17/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.02	0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R20	6/21/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	<0.001	0.001	<0.02	<0.02	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01
R20	10/17/2018	<0.003	<0.003	<0.002	<0.002	<0.001	<0.001	0.001	0.001	<0.02	0.04	<0.005	<0.005	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.01

NOTES: All concentrations in mg/L except as indicated.
J = estimated value due to QC criterion exceedance
Locations shown on Exhibit 1

APPENDIX B

2018 GROUNDWATER ELEVATION DATA

2018 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water			Groundwater Elevation		
SiteID	MP Elevation	May-18	Jun-18	Oct-18	May-18	Jun-18	Oct-18
EH-100	3889.83	29.24	28.17	28.30	3860.59	3861.66	3861.53
EH-101	3879.95	13.81	13.22	15.48	3866.14	3866.73	3864.47
EH-102	3880.45	7.33	7.37	8.46	3873.12	3873.08	3871.99
EH-103	3890.54	26.33	25.19	25.66	3864.21	3865.35	3864.88
EH-104	3887.83	36.89	35.79	34.61	3850.94	3852.04	3853.22
EH-106	3882.07	30.57	29.27	28.84	3851.50	3852.80	3853.23
EH-107	3880.15	21.80	20.60	22.04	3858.35	3859.55	3858.11
EH-109	3885.67	26.37	25.26	25.36	3859.30	3860.41	3860.31
EH-110	3884.05	21.72	20.61	20.94	3862.33	3863.44	3863.11
EH-111	3876.50	31.01	29.25	28.42	3845.49	3847.25	3848.08
EH-112	3875.78	27.53	25.28	26.05	3848.25	3850.50	3849.73
EH-113	3871.34	27.12	24.83	25.29	3844.22	3846.51	3846.05
EH-114	3878.07	34.55	33.11	31.80	3843.52	3844.96	3846.27
EH-115	3883.29	37.08	35.76	34.30	3846.21	3847.53	3848.99
EH-116	3874.52	31.60	29.93	29.32	3842.92	3844.59	3845.20
EH-117	3871.33	28.35	26.33	26.46	3842.98	3845.00	3844.87
EH-118	3879.95	38.44	37.10	35.44	3841.51	3842.85	3844.51
EH-119	3873.75	35.15	33.73	32.29	3838.60	3840.02	3841.46
EH-120	3865.78	28.08	26.49	28.37	3837.70	3839.29	3837.41
EH-121	3869.49	23.44	23.00	27.83	3846.05	3846.49	3841.66
EH-122	3868.08	18.91	18.98	24.47	3849.17	3849.10	3843.61
EH-123	3885.71	45.29	44.28	42.28	3840.42	3841.43	3843.43
EH-124	3874.46	38.67	37.40	35.93	3835.79	3837.06	3838.53
EH-125	3863.22	31.83	29.77	32.33	3831.39	3833.45	3830.89
EH-126	3870.00	54.34	51.06	50.21	3815.66	3818.94	3819.79
EH-127	3860.75	23.37	22.43	28.05	3837.38	3838.32	3832.70
EH-128	3892.17	Dry	Dry	Dry			
EH-129	3870.21	55.92	52.59	51.00	3814.29	3817.62	3819.21
EH-130	3858.55	42.63	39.09	40.85	3815.92	3819.46	3817.70
EH-131	3834.44	31.01	26.48	28.44	3803.43	3807.96	3806.00
EH-132	3893.90	61.50	60.75	58.90	3832.40	3833.15	3835.00
EH-133	3884.36	58.48	57.57	54.79	3825.88	3826.79	3829.57
EH-134	3870.21	55.93	52.83	50.96	3814.28	3817.38	3819.25
EH-135	3852.25	23.53	21.32	26.11	3828.72	3830.93	3826.14
EH-136	3838.59	25.24	21.60	25.80	3813.35	3816.99	3812.79
EH-137	3839.66	34.35	29.81	31.94	3805.31	3809.85	3807.72
EH-138	3839.70	44.84	39.14	39.51	3794.86	3800.56	3800.19
EH-139	3839.78	52.28	46.33	44.40	3787.50	3793.45	3795.38
EH-140	3812.08	22.92	17.50	18.08	3789.16	3794.58	3794.00
EH-141	3813.32	31.47	25.15	25.93	3781.85	3788.17	3787.39
EH-142	3804.68	32.23	26.95	27.03	3772.45	3777.73	3777.65
EH-143	3803.37	33.32	28.32	27.85	3770.05	3775.05	3775.52
EH-144D	3778.86	23.24	19.74	17.47	3755.62	3759.12	3761.39
EH-144M	3778.95	26.27	22.89	19.95	3752.68	3756.06	3759.00
EH-144S	3778.70	27.85	24.65	21.48	3750.85	3754.05	3757.22
EH-145D	3789.60	31.15	27.07	24.60	3758.45	3762.53	3765.00
EH-145S	3790.09	32.21	28.13	25.01	3757.88	3761.96	3765.08
EH-206	3898.10	50.36	49.77	48.26	3847.74	3848.33	3849.84
EH-208	3910.58	57.73	57.35	56.31	3852.85	3853.23	3854.27

2018 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water			Groundwater Elevation		
SiteID	**MP Elevation**	**May-18**	**Jun-18**	**Oct-18**	**May-18**	**Jun-18**	**Oct-18**
EH-209	3898.34	43.60	42.81	41.97	3854.74	3855.53	3856.37
EH-50	3889.39	28.71	27.65	27.76	3860.68	3861.74	3861.63
EH-51	3880.09	13.54	12.85	15.17	3866.55	3867.24	3864.92
EH-52	3880.50	6.40	6.57	7.41	3874.10	3873.93	3873.09
EH-53	3872.82	27.16	24.78	25.92	3845.66	3848.04	3846.90
EH-54	3869.66	4.95	5.07	7.10	3864.71	3864.59	3862.56
EH-57	3885.05	Dry	Dry	Dry			
EH-57A	3885.45	40.39	39.12	37.53	3845.06	3846.33	3847.92
EH-58	3888.15	11.84	11.53	13.45	3876.31	3876.62	3874.70
EH-59	3876.57	6.74	6.60	7.44	3869.83	3869.97	3869.13
EH-60	3888.46	24.01	22.81	23.35	3864.45	3865.65	3865.11
EH-61	3889.77	25.76	24.64	25.05	3864.01	3865.13	3864.72
EH-62	3875.07	21.00	20.82	24.83	3854.07	3854.25	3850.24
EH-63	3878.32	17.77	17.02	20.00	3860.55	3861.30	3858.32
EH-64	3882.67	23.60	22.72	25.95	3859.07	3859.95	3856.72
EH-65	3879.96	23.66	22.61	25.02	3856.30	3857.35	3854.94
EH-66	3869.48	22.94	22.53	27.50	3846.54	3846.95	3841.98
EH-67	3869.46	19.22	19.42	25.28	3850.24	3850.04	3844.18
EH-68	3867.60	7.37	7.06	9.82	3860.23	3860.54	3857.78
EH-69	3869.10	18.59	17.20	17.44	3850.51	3851.90	3851.66
EH-70	3863.48	30.94	28.94	31.71	3832.54	3834.54	3831.77
EHMW-3	3825.45	40.42	34.92	34.94	3785.03	3790.53	3790.51
EHTW-3	3827.66	43.01	37.48	37.22	3784.65	3790.18	3790.44
PZ-36A	3858.96	4.07	6.54	Dry	3854.89	3852.42	
PZ-36B	3858.75	3.97	5.41	Dry	3854.78	3853.34	
PZ-36C	3859.60	5.30	5.47	13.90	3854.30	3854.13	3845.70
PZ-9A	3850.70	5.85	7.22	Dry	3844.85	3843.48	
PZ-9B	3849.43	4.62	6.02	13.23	3844.81	3843.41	3836.20
SC-1	3890.42	32.42	31.98	31.61	3858.00	3858.44	3858.81
ASIW-1	3915.99	17.52	17.70	18.73	3898.47	3898.29	3897.26
ASIW-2	3909.13	27.94	28.40	32.03	3881.19	3880.73	3877.10
DH-1	3910.89	42.39	42.40	42.73	3868.50	3868.49	3868.16
DH-10A	3886.97	5.27	5.49	8.38	3881.70	3881.48	3878.59
DH-13	3923.91	50.30	49.16	49.37	3873.61	3874.75	3874.54
DH-14	3916.06	13.09	13.23	13.92	3902.97	3902.83	3902.14
DH-15	3889.82	16.62	15.36	17.15	3873.20	3874.46	3872.67
DH-17	3917.56	47.52	46.33	46.71	3870.04	3871.23	3870.85
DH-18	3924.93	49.15	48.74	48.64	3875.78	3876.19	3876.29
DH-2	3936.91	60.30	59.66	60.09	3876.61	3877.25	3876.82
DH-20	3927.09	17.37	17.34	18.45	3909.72	3909.75	3908.64
DH-22	3948.63	Dry	Dry	Dry			
DH-23	3931.82	35.36	35.34	35.60	3896.46	3896.48	3896.22
DH-24	3899.59	35.21	33.93	34.42	3864.38	3865.66	3865.17
DH-27	3946.21	54.48	54.36	54.81	3891.73	3891.85	3891.40
DH-3	3947.48	29.75	30.05	31.34	3917.73	3917.43	3916.14
DH-30	3943.24	50.72	50.61	51.10	3892.52	3892.63	3892.14
DH-36	3920.66	45.98	45.41	45.78	3874.68	3875.25	3874.88
DH-4	3917.26	14.15	14.18	14.91	3903.11	3903.08	3902.35
DH-42	3942.63	48.25	48.12	48.64	3894.38	3894.51	3893.99
DH-47	3926.82	19.57	19.65	21.38	3907.25	3907.17	3905.44

2018 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

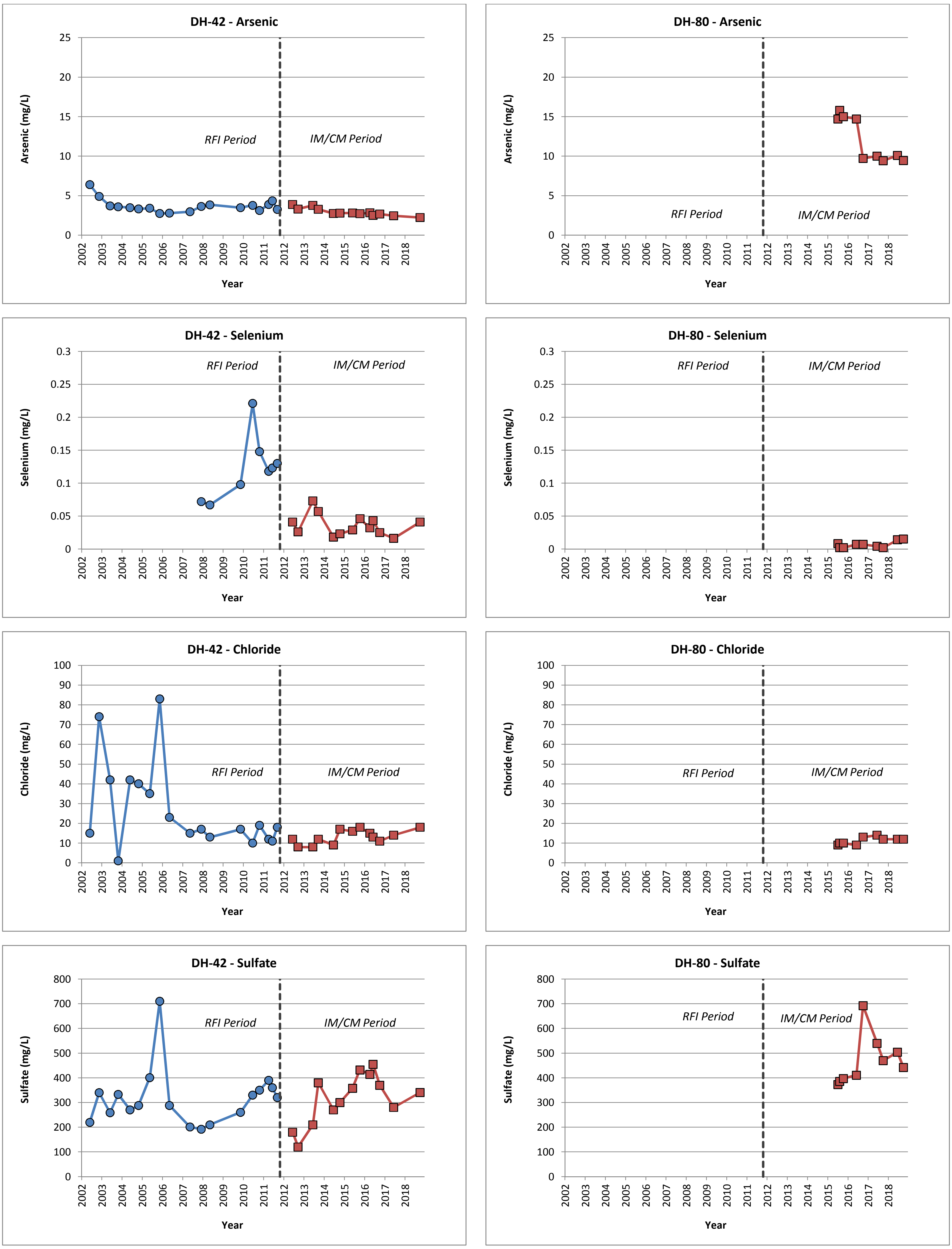
		Depth to Water			Groundwater Elevation		
SiteID	**MP Elevation**	**May-18**	**Jun-18**	**Oct-18**	**May-18**	**Jun-18**	**Oct-18**
DH-48	3905.96	35.22	35.73	Dry	3870.74	3870.23	
DH-5	3921.18	17.44	17.27	Dry	3903.74	3903.91	
DH-50	3904.76	Dry	35.14	35.72		3869.62	3869.04
DH-51	3904.34	35.29	34.01	34.68	3869.05	3870.33	3869.66
DH-52	3889.18	4.27	4.67	6.91	3884.91	3884.51	3882.27
DH-53	3892.87	7.17	7.68	9.64	3885.70	3885.19	3883.23
DH-54	3890.27	24.79	23.62	24.24	3865.48	3866.65	3866.03
DH-55	3972.76	79.00	79.48	80.84	3893.76	3893.28	3891.92
DH-56	3958.17	81.30	79.76	82.10	3876.87	3878.41	3876.07
DH-57	3929.53	42.79	42.13	45.31	3886.74	3887.40	3884.22
DH-58	3919.33	42.26	40.36	41.94	3877.07	3878.97	3877.39
DH-59	3937.44	43.19	43.07	43.61	3894.25	3894.37	3893.83
DH-5A	3921.92	18.10	17.96	18.95	3903.82	3903.96	3902.97
DH-6	3889.85	16.63	15.33	17.20	3873.22	3874.52	3872.65
DH-61	3926.84	Dry	Dry	Dry			
DH-62	3926.95	56.72	56.50	55.90	3870.23	3870.45	3871.05
DH-63	3905.37	39.05	37.90	38.33	3866.32	3867.47	3867.04
DH-64	3904.02	36.03	34.82	35.39	3867.99	3869.20	3868.63
DH-65	3945.85	60.09	60.32	63.14	3885.76	3885.53	3882.71
DH-66	3919.28	50.48	49.37	49.65	3868.80	3869.91	3869.63
DH-67	3899.77	34.27	33.14	33.58	3865.50	3866.63	3866.19
DH-68	3943.28	43.68	44.02	44.69	3899.60	3899.26	3898.59
DH-69	3934.40	35.11	35.35	36.06	3898.51	3898.60	3898.43
DH-7	3898.66	14.01	13.97	15.45	3884.65	3884.69	3883.21
DH-70	3933.91	33.33	33.40	33.97	3900.58	3900.51	3899.94
DH-71	3944.88	56.42	56.44	56.40	3888.46	3888.44	3888.48
DH-72	3939.67	42.93	42.77	43.41	3896.74	3896.90	3896.26
DH-73	3918.08	37.54	35.48	38.10	3880.54	3882.60	3879.98
DH-74	4001.49	115.89	115.48	123.51	3885.60	3886.01	3882.93
DH-75	4001.55	116.39	115.95	123.95	3885.16	3885.60	3882.59
DH-76	3994.28	97.87	98.31	99.13	3896.41	3895.97	3895.15
DH-77	3932.20	53.43	53.10	53.13	3878.77	3879.10	3879.07
DH-78	3921.12	51.68	50.60	50.67	3869.44	3870.52	3870.45
DH-79	3928.80	53.51	52.31	52.70	3875.29	3876.49	3876.10
DH-80	3942.36	48.61	48.46	48.98	3893.75	3893.90	3893.38
DH-82	3908.18	41.31	40.10	40.64	3866.87	3868.08	3867.54
DH-83	3922.14	51.68	51.02	58.78	3870.46	3871.12	3863.36
DH-8	3923.38	51.37	51.05	50.91	3872.01	3872.33	3872.47
DH-9	3918.08	33.72	33.72	33.78	3884.36	3884.36	3884.30
East-PZ-1	3911.93	21.00	20.99	22.55	3890.93	3890.94	3889.38
East-PZ-2	3924.58	22.34	22.33	23.83	3902.24	3902.25	3900.75
East-PZ-4	3935.66	18.63	19.01	20.30	3917.03	3916.65	3915.36
East-PZ-6	3943.83	22.42	22.83	24.04	3921.41	3921.00	3919.79
East-PZ-7	3928.83	16.93	17.28	18.41	3911.90	3911.55	3910.42
EH-200	3953.33	27.59	27.15	27.56	3925.74	3926.18	3925.77
EH-201	3973.48	96.22	96.07	95.01	3877.26	3877.41	3878.47
EH-202	3930.56	66.39	66.28	65.76	3864.17	3864.28	3864.80
EH-203	4003.92	105.94	105.70	105.23	3897.98	3898.22	3898.69
EH-204	3925.69	57.15	56.79	56.02	3868.54	3868.90	3869.67
EH-205	3900.66	34.36	34.32	35.42	3866.30	3866.34	3865.24

2018 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water			Groundwater Elevation		
SiteID	**MP Elevation**	**May-18**	**Jun-18**	**Oct-18**	**May-18**	**Jun-18**	**Oct-18**
EH-210	3901.19	37.13	37.22	36.96	3864.06	3863.97	3864.23
EH-211	3905.75	50.77	50.53	49.92	3854.98	3855.22	3855.83
EH-212	3905.90	50.84	50.63	49.99	3855.06	3855.27	3855.91
MW-1	3953.05	53.40	53.30	52.97	3899.65	3899.75	3900.08
MW-10	3946.28	43.91	44.01	44.78	3902.37	3902.27	3901.50
MW-11	3973.33	64.15	64.07	63.90	3909.18	3909.26	3909.43
MW-2	3945.97	38.85	38.76	40.18	3907.12	3907.21	3905.79
MW-3	3940.95	34.10	34.04	35.44	3906.85	3906.91	3905.51
MW-4	3947.06	49.74	49.43	49.04	3897.32	3897.63	3898.02
MW-5	3956.18	54.64	54.37	54.01	3901.54	3901.81	3902.17
MW-6	3938.14	30.73	30.61	32.03	3907.41	3907.53	3906.11
MW-7	3963.67	57.83	57.75	57.22	3905.84	3905.92	3906.45
MW-8	3958.65	51.82	52.03	52.74	3906.83	3906.62	3905.91
MW-9	3959.01	52.83	52.72	52.49	3906.18	3906.29	3906.52
PBTW-1	3914.59	44.77	43.54	44.61	3869.82	3871.05	3869.98
PBTW-2	3906.73	37.41	36.28	36.70	3869.32	3870.45	3870.03
PRB-1	3918.37	48.98	47.85	48.14	3869.39	3870.52	3870.23
PRB-2	3905.34	35.26	33.99	34.59	3870.08	3871.35	3870.75
PRB-3	3919.19	49.99	48.87	49.09	3869.20	3870.32	3870.10
SDMW-1	3925.11	50.20	48.84	49.44	3874.91	3876.27	3875.67
SDMW-2	3928.09	52.97	51.96	52.14	3875.12	3876.13	3875.95
SDMW-3	3935.14	52.59	52.32	52.45	3882.55	3882.82	3882.69
SDMW-4	3936.10	50.89	50.25	50.94	3885.21	3885.85	3885.16
SDMW-5	3929.86	53.95	53.26	53.35	3875.91	3876.60	3876.51
TW-1	3930.10	50.92	50.11	50.22	3879.18	3879.99	3879.88
TW-2	3931.44	52.88	52.15	51.59	3878.56	3879.29	3879.85
SP-3	3905.91	Dry	Dry	Dry			
SP-4	3908.16	Dry	Dry	Dry			
SP-5	3903.52	Dry	Dry	Dry			
ULM-PZ-1	3924.40	4.88	4.88	5.58	3919.52	3919.52	3918.82
PPCRPZ-02	3919.76	6.90	6.93	7.82	3912.86	3912.83	3911.94
ULTP-1	3919.63	4.11	NM	5.50	3915.52		3914.13
ULTP-2	3921.23	5.82	5.76	7.31	3915.41	3915.47	3913.92
PVC Piezo	?	NM	NM	NM	NM	NM	NM
IW-01	3888.28	66.53	65.94	63.93	3821.75	3822.34	3824.35
IW-02	3871.08	53.07	52.72	51.12	3818.01	3818.36	3819.96

APPENDIX C

SITE-WIDE GROUNDWATER CONCENTRATION TREND GRAPHS

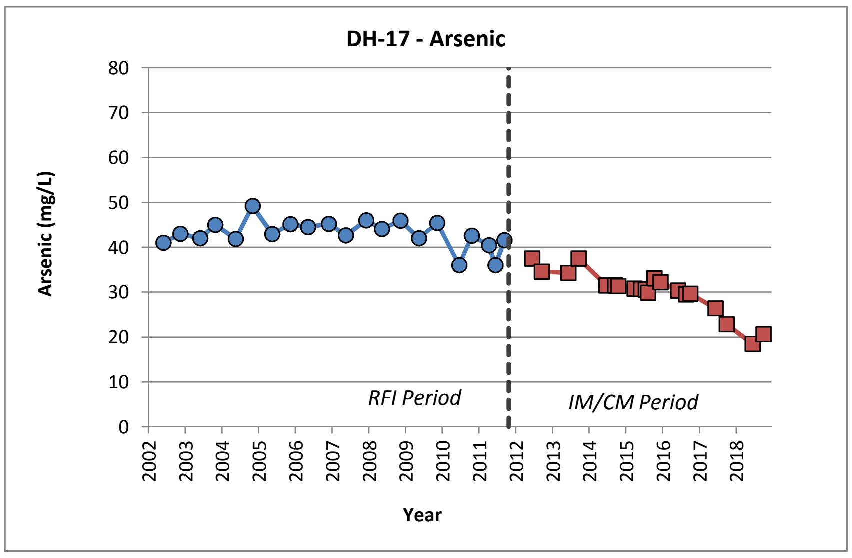


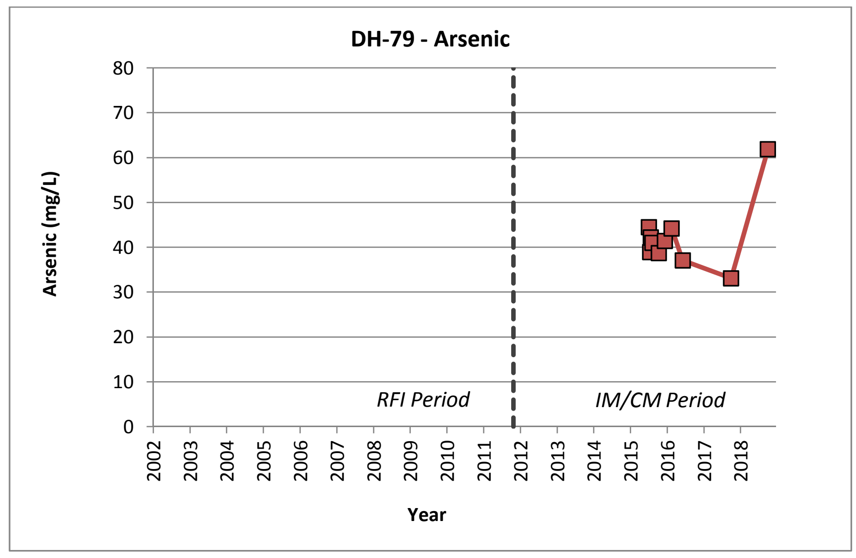
Hydrometrics, Inc.

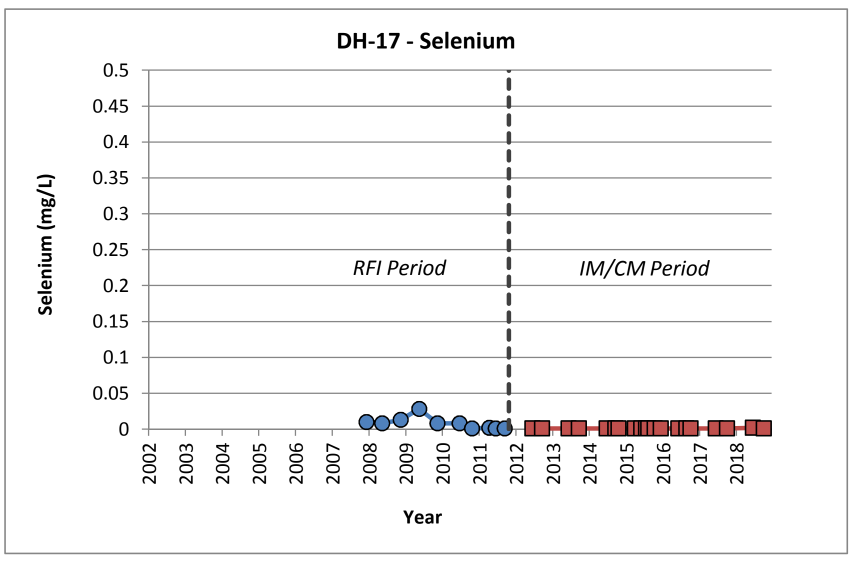
2018 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

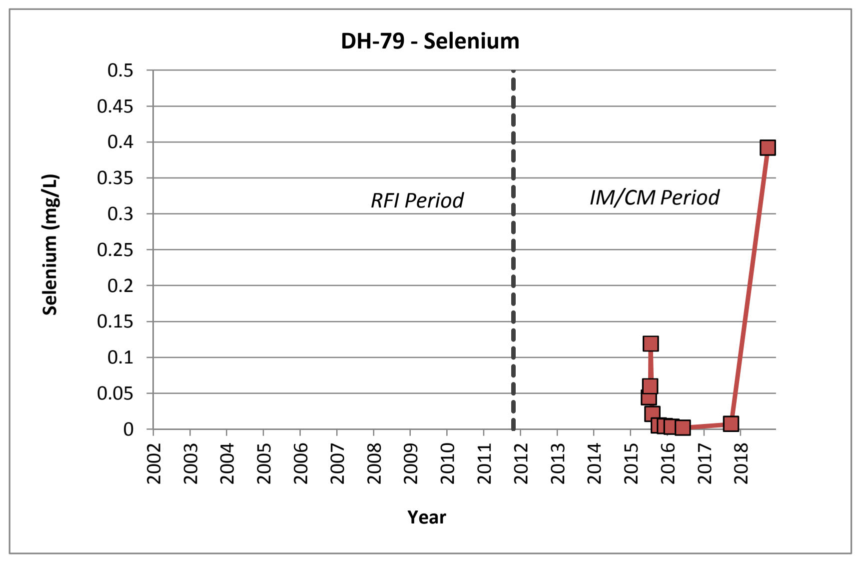
FORMER ACID PLANT AREA GROUNDWATER QUALITY TRENDS

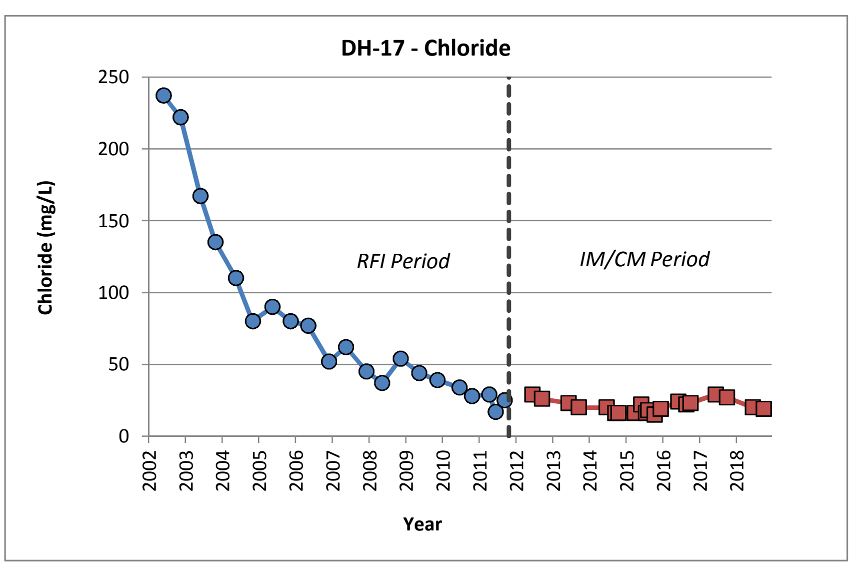
FIGURE
C-1

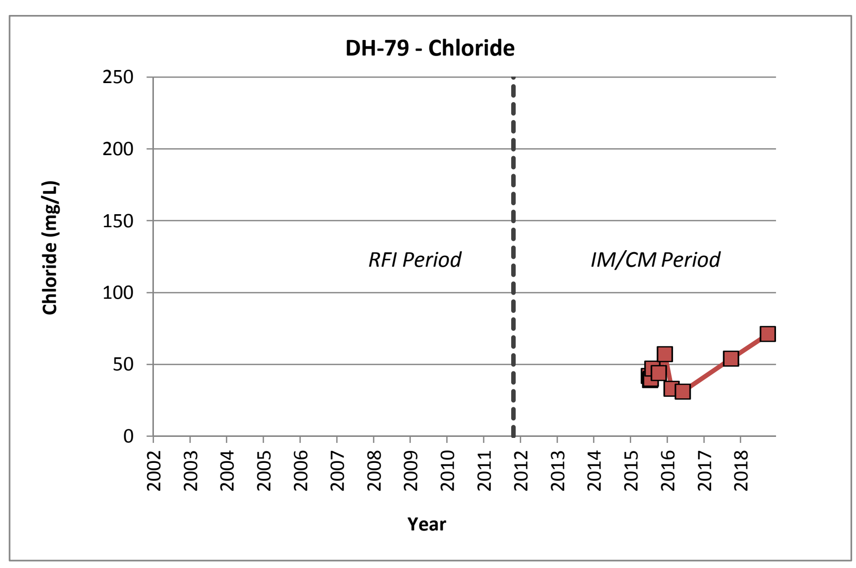


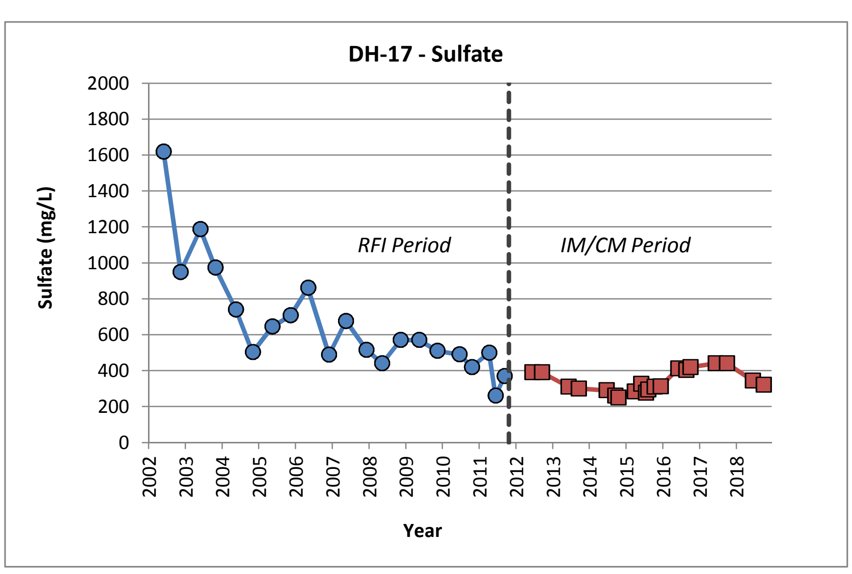


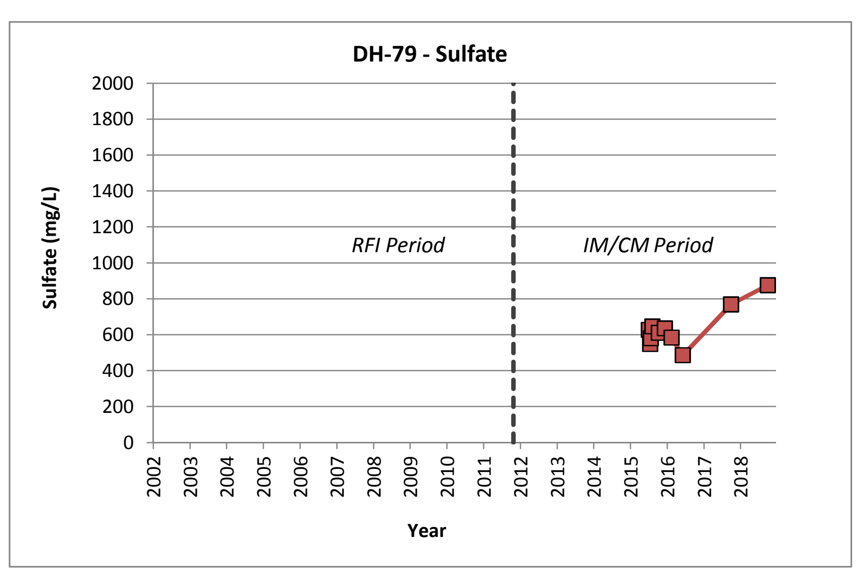






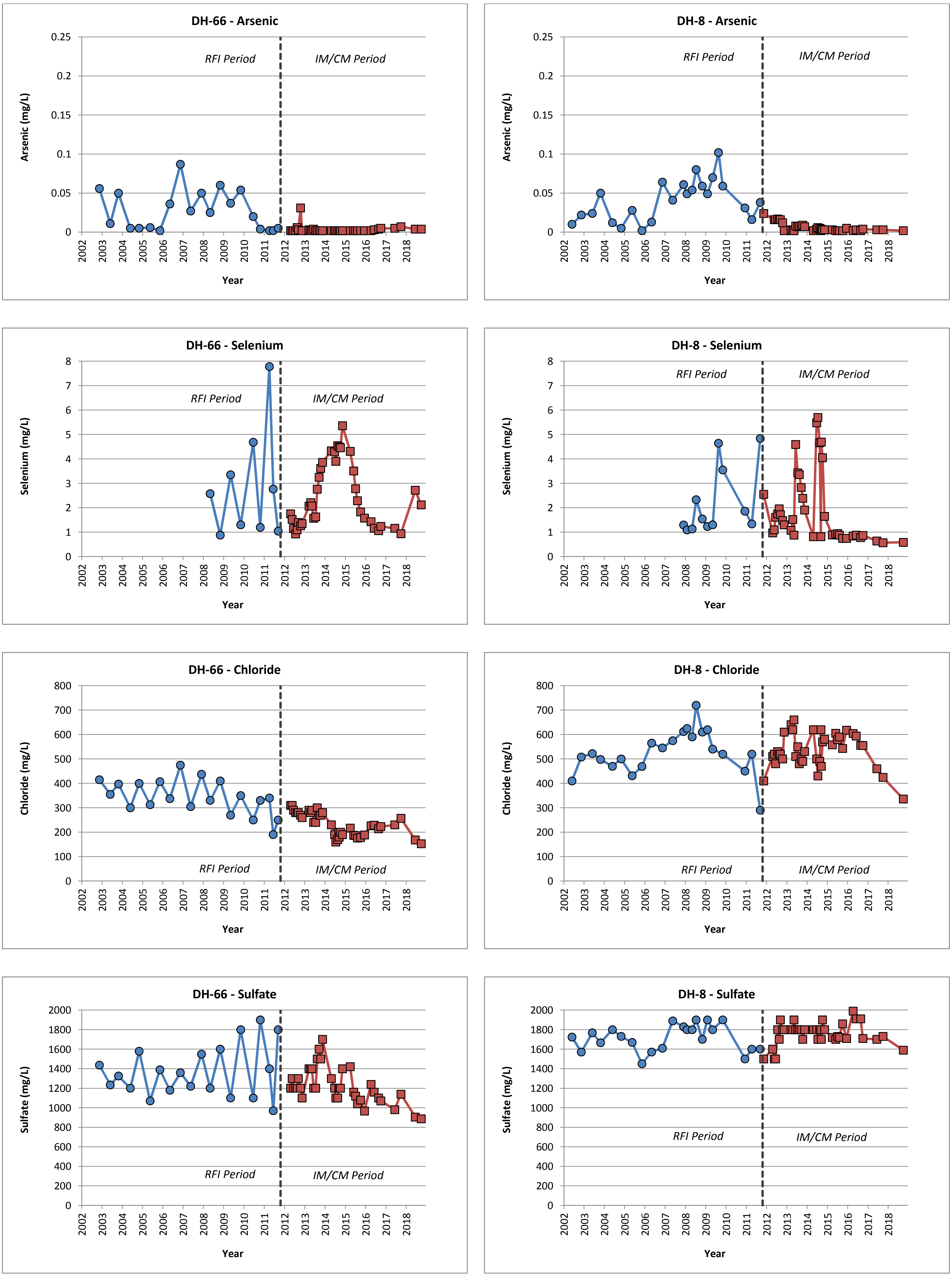






Hydrometrics, Inc.	2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**NORTH PLANT ARSENIC AREA GROUNDWATER QUALITY TRENDS**	FIGURE **C-2**

K:\project\10022\2018 WRM Report\Figures\AsSeClSO4_TrendData_2018Report.xlsx\North Plant As Graphs 2018



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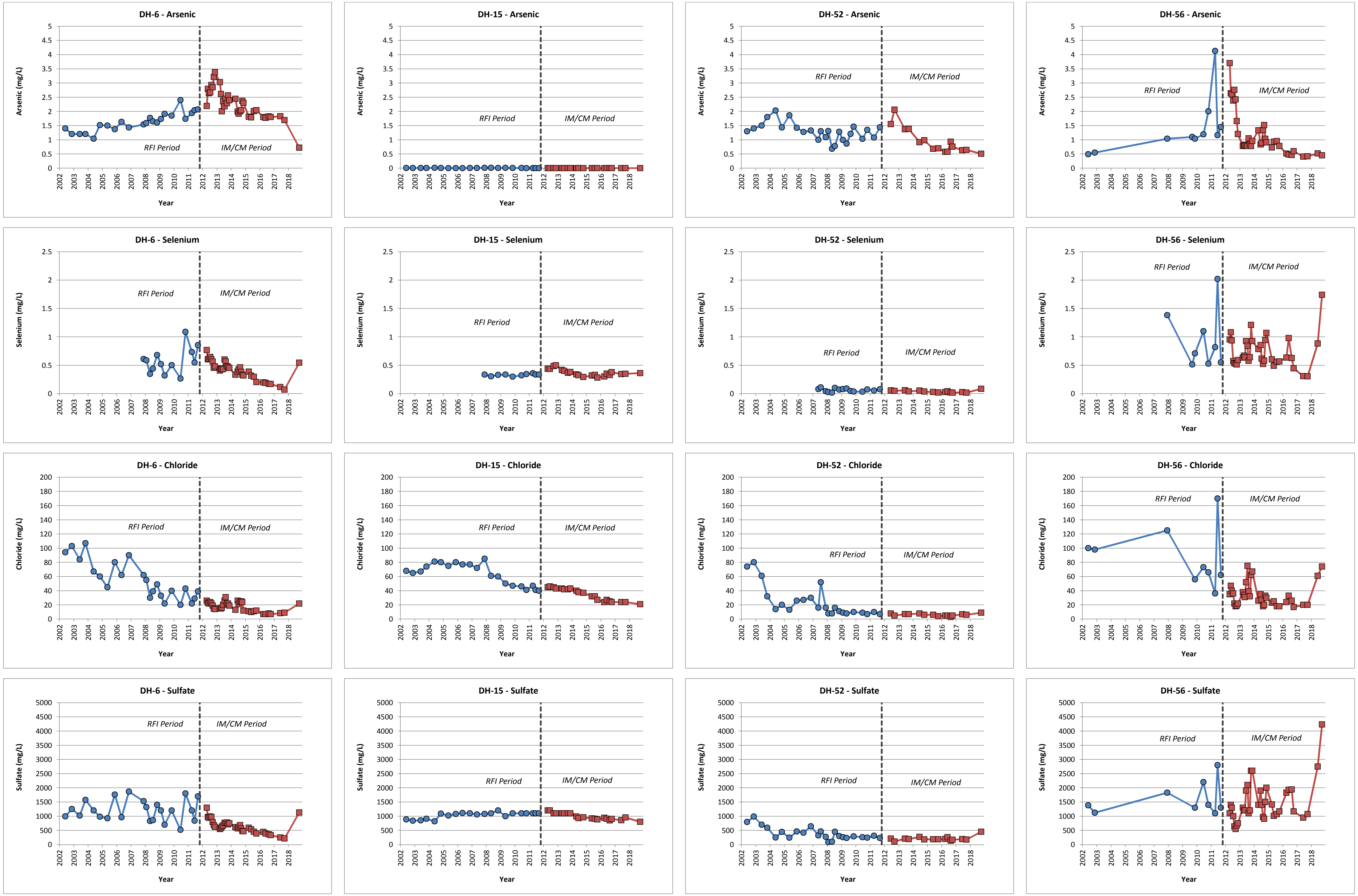
2018 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

WEST SELENIUM AREA GROUNDWATER QUALITY TRENDS

FIGURE
C-3

K:\project\10022\2018 WRM Report\Figures\AsSeClSO4_TrendData_2018Report.xlsx\West Se Graphs 2018



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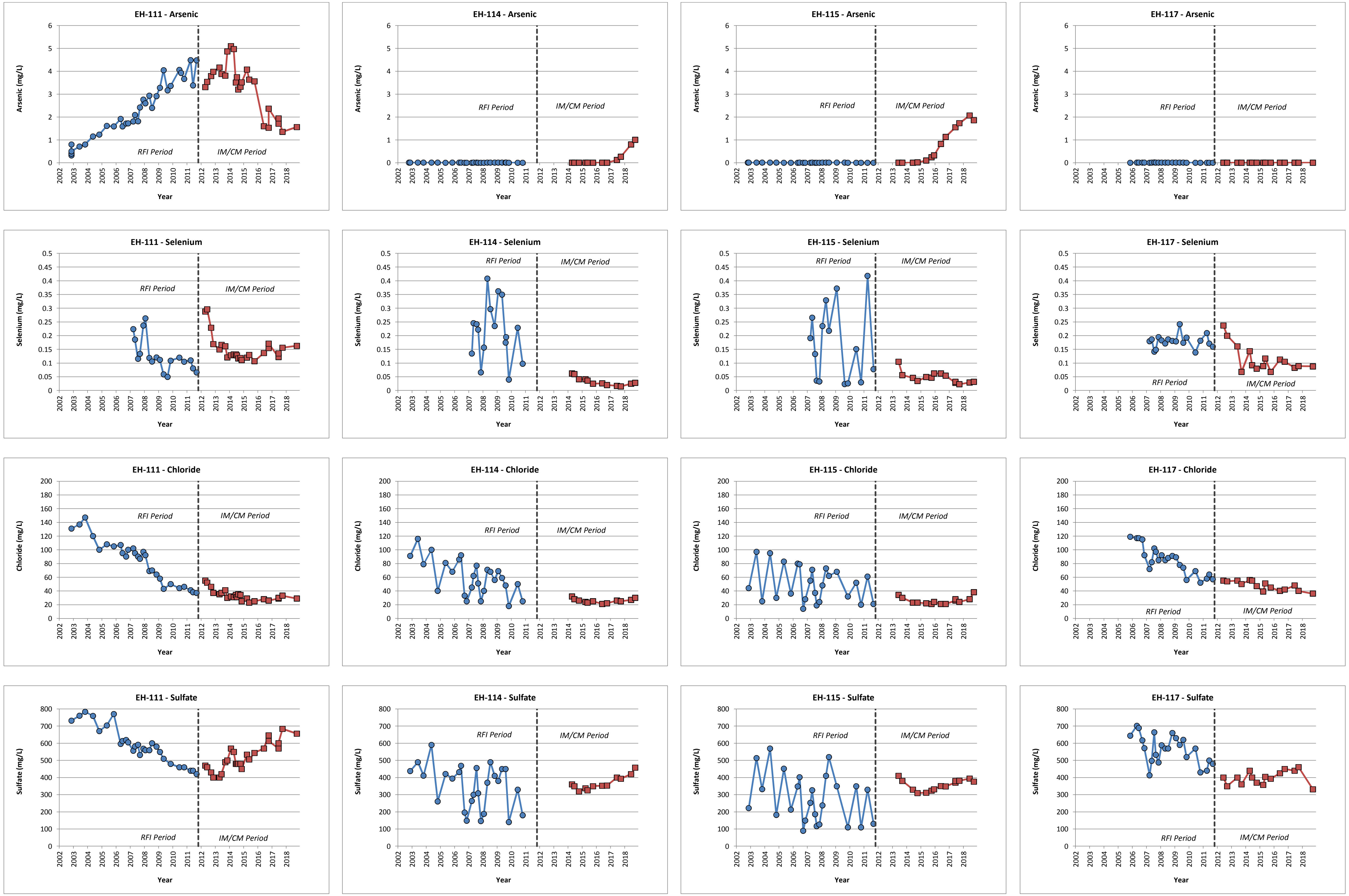
2018 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

SLAG PILE AREA
GROUNDWATER QUALITY TRENDS

FIGURE
C-4

K:\project\10022\2018 WRM Report\Figures\AsSeClSO4_TrendData_2018Report.xlsx\Slag Pile Graphs 2018

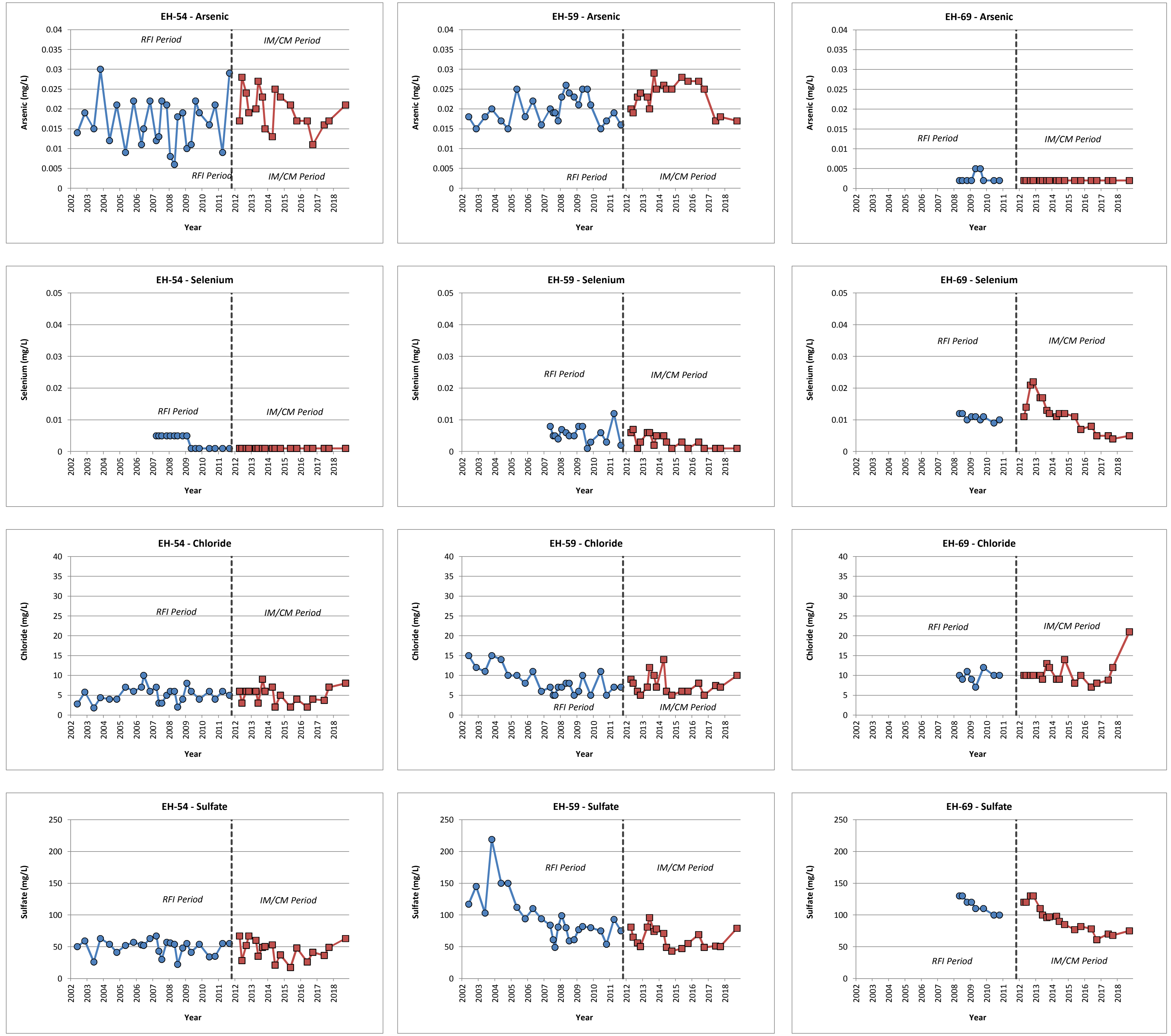


2018 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

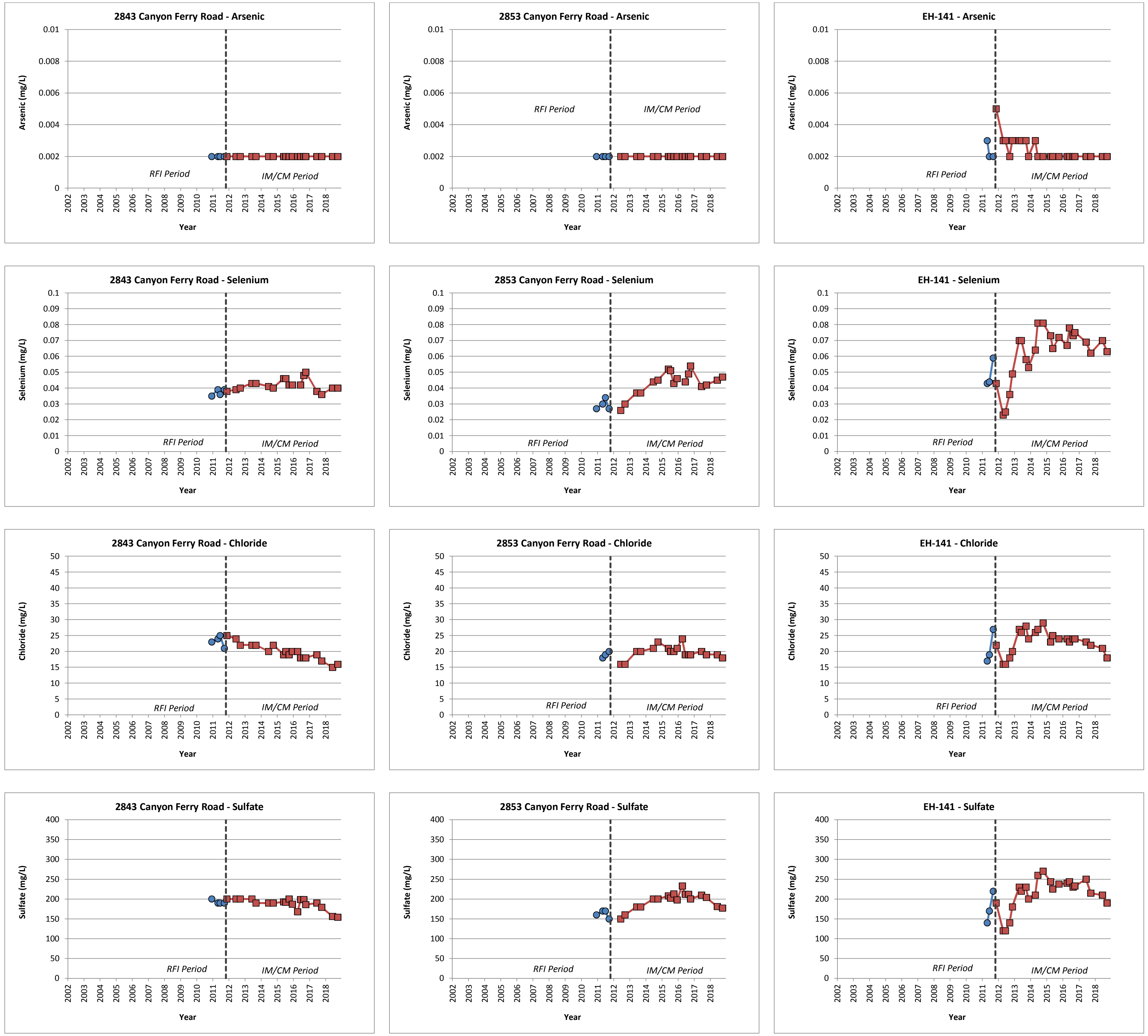
DOWNGRADIENT ARSENIC PLUME AREA (WEST) GROUNDWATER QUALITY TRENDS

FIGURE
C-5

K:\project\10022\2018 WRM Report\Figures\AsSeClSO4_TrendData_2018Report.xlsx\DG As Graphs 2018



2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (EAST) GROUNDWATER QUALITY TRENDS	FIGURE C-5

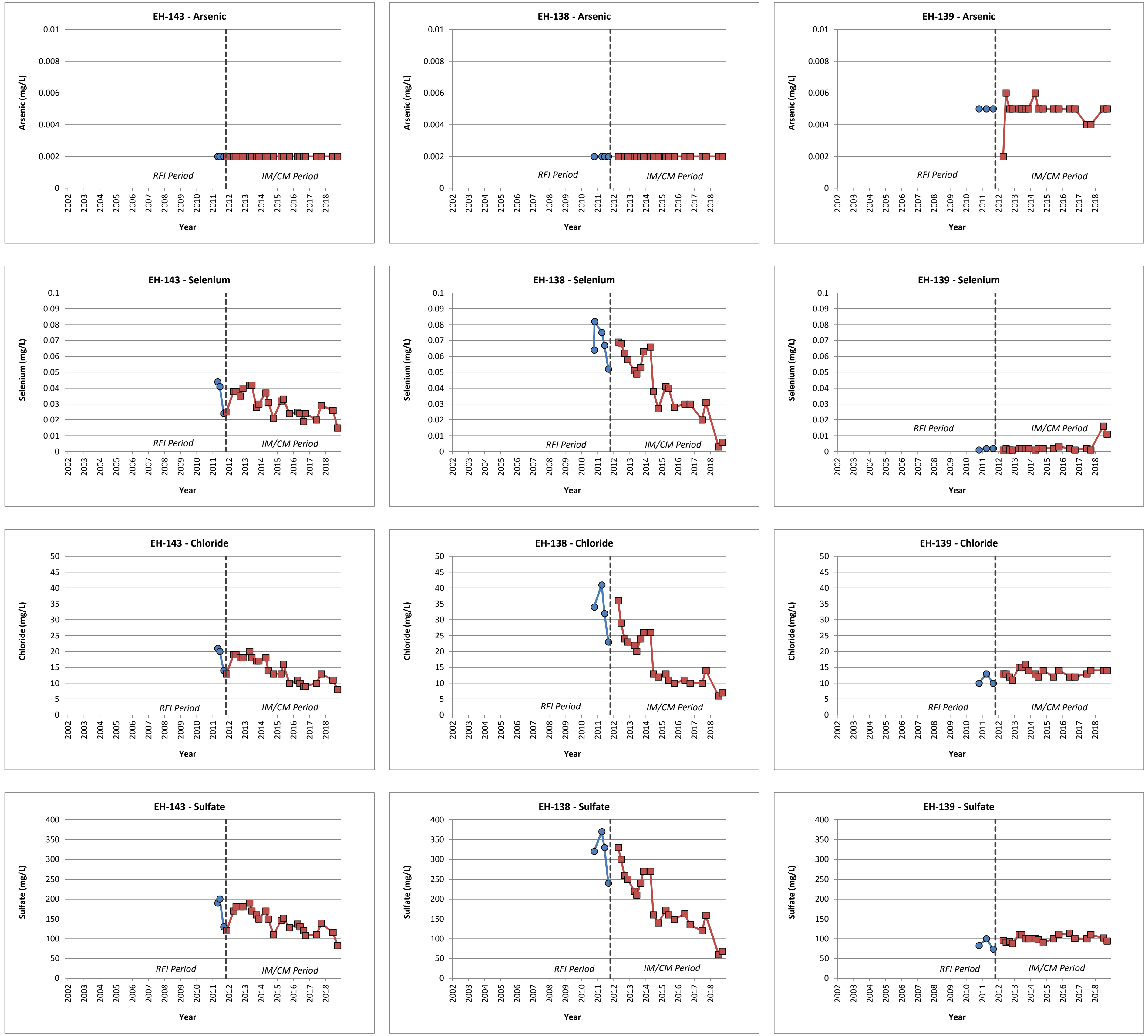


2018 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS

FIGURE
C-6

K:\project\10022\2018 WRM Report\Figures\AsSeClSO4_TrendData_2018Report.xlsx\DG Se Graphs 2018

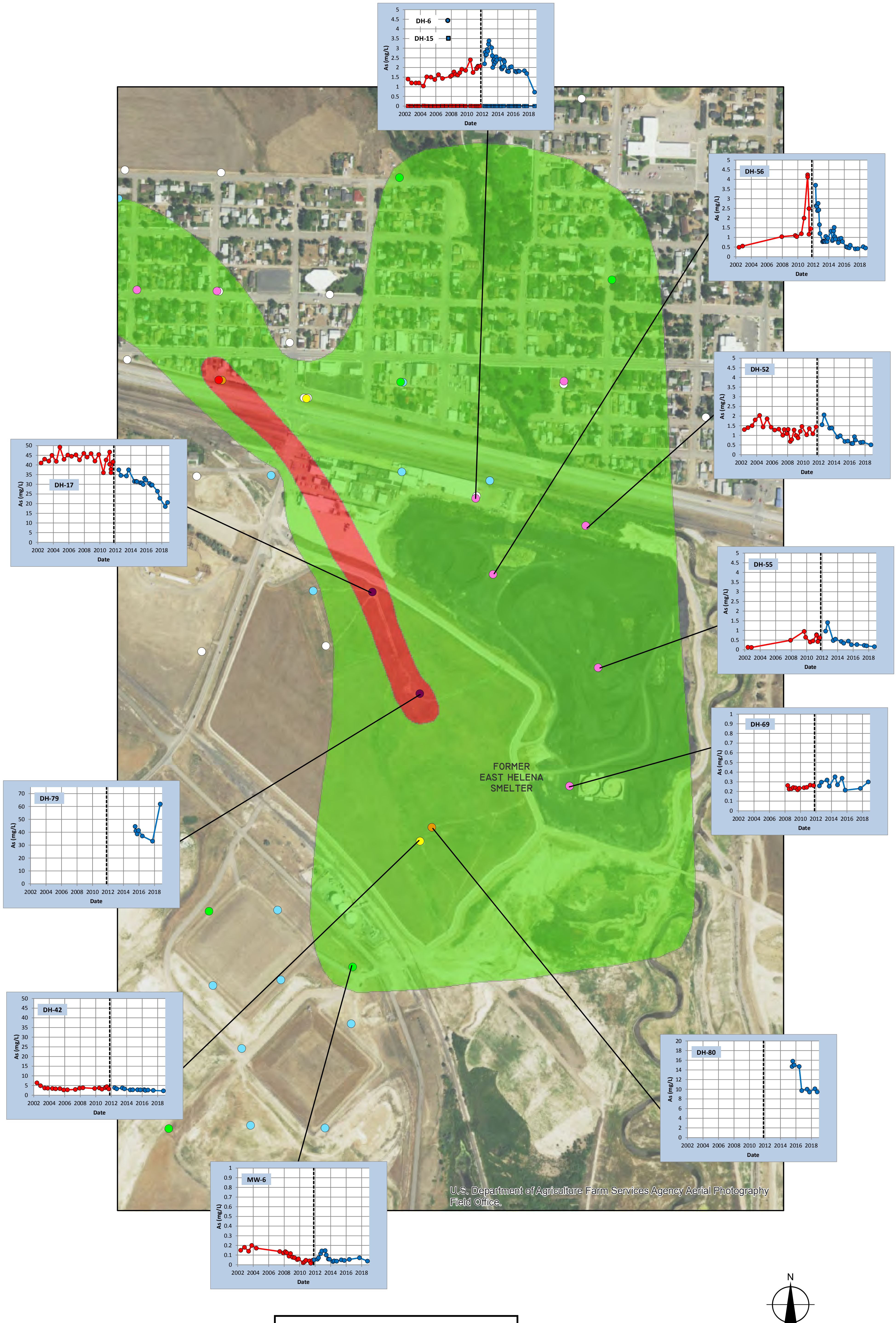


2018 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS	FIGURE C-6

K:\project\10022\2018 WRM Report\Figures\AsSeClSO4_TrendData_2018Report.xlsx\DG Se Graphs 2018

APPENDIX D

ARSENIC AND SELENIUM TREND PLOT MAPS



Legend

October 2018 As (mg/L)
- <0.002
- 0.002 - 0.010
- 0.011 - 0.100
- 0.101 - 1.0
- 1.01 - 5.0
- 5.01 - 10.0
- 10.01 - 20.0
- > 20.0

As Contours
- 0.011 - 0.100 mg/L
- 10.1 - 20.0 mg/L

0 250 500 1,000 Feet

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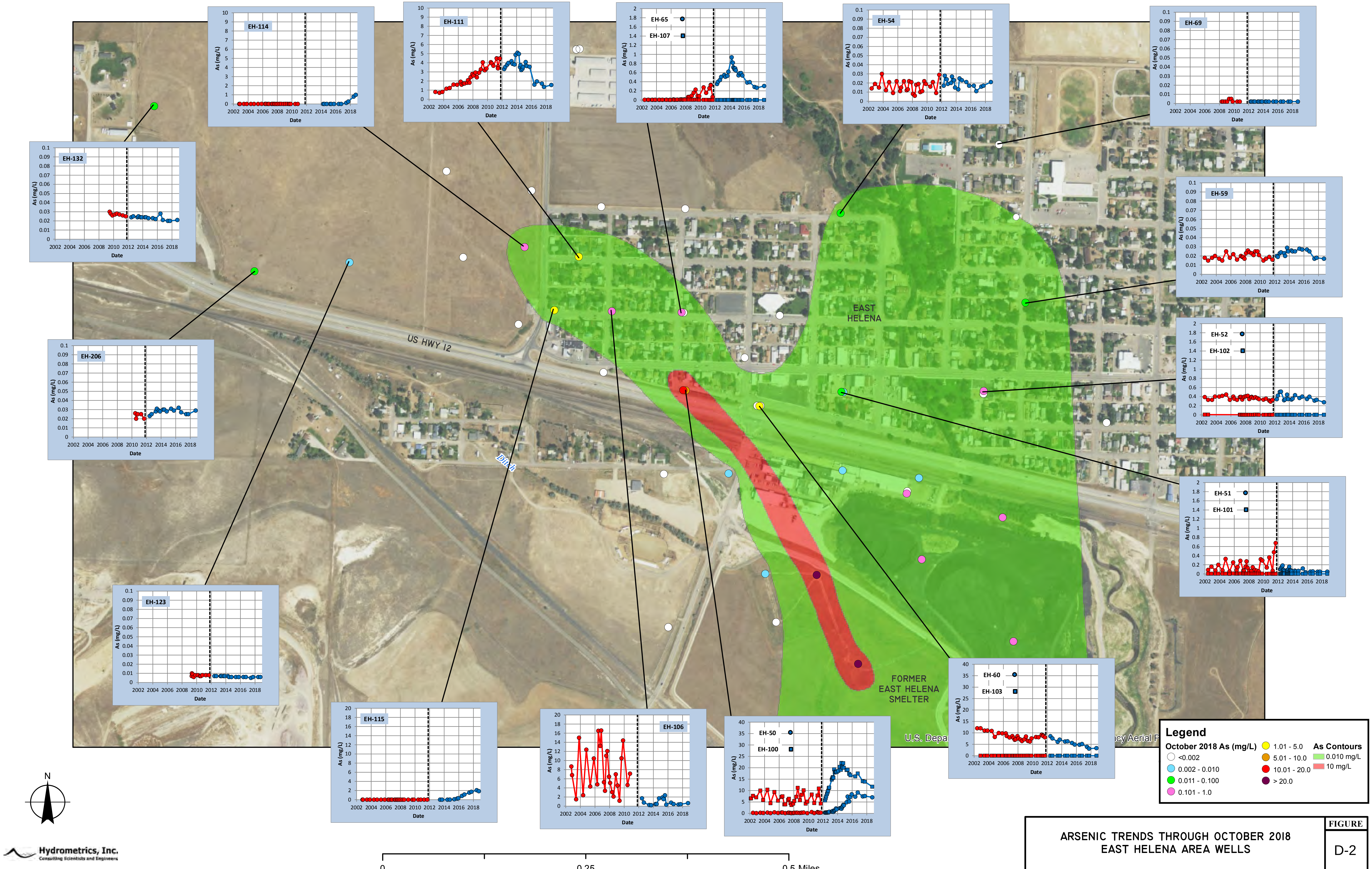
ARSENIC TRENDS THROUGH OCTOBER 2018
PLANT AREA WELLS

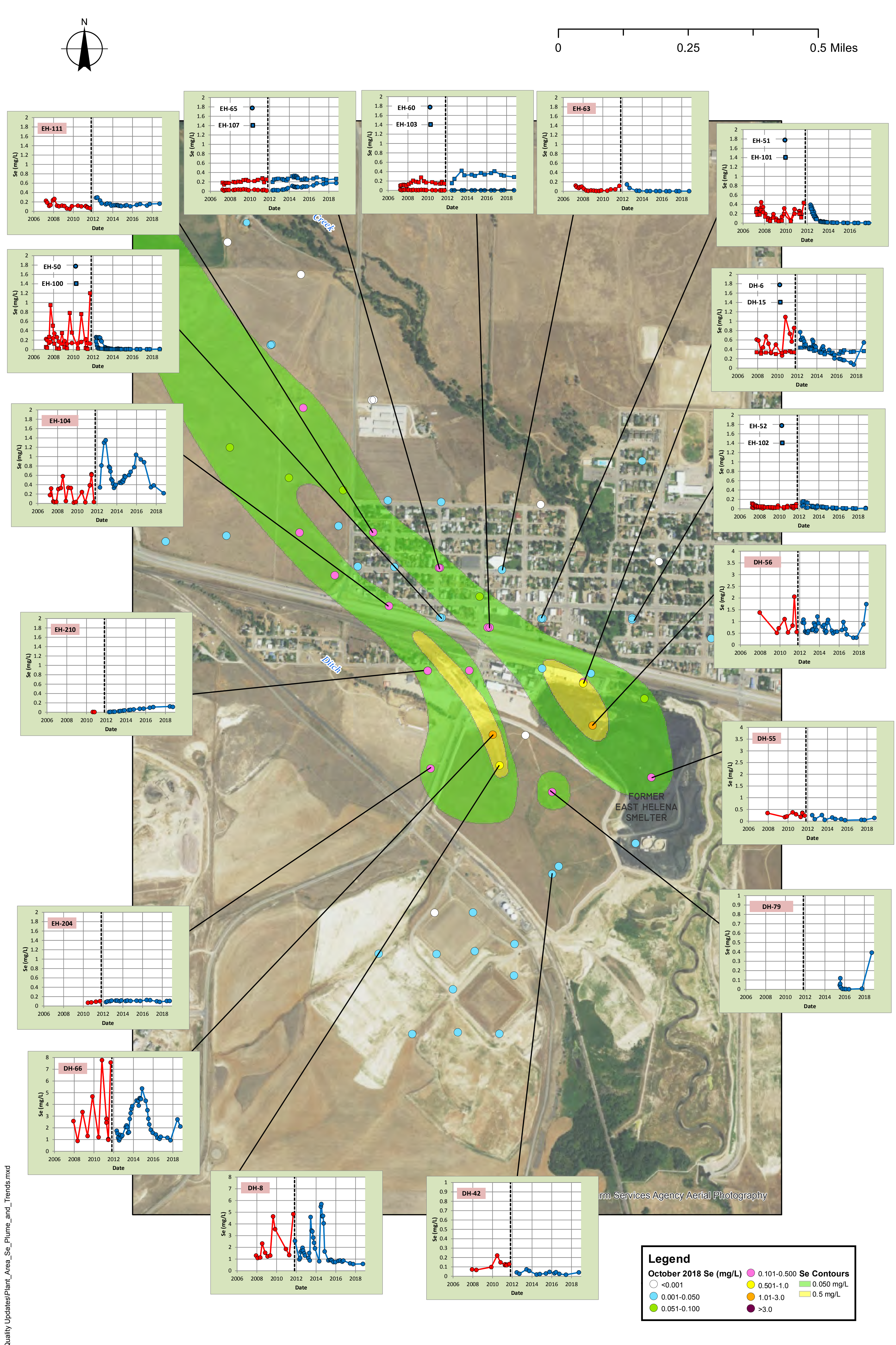
FIGURE
D-1



ARSENIC TRENDS THROUGH OCTOBER 2018
EAST HELENA AREA WELLS

FIGURE
D-2

V:\10022\GIS\Water Quality Updates\EH_Area_As_Plume_and_Trends.mxd



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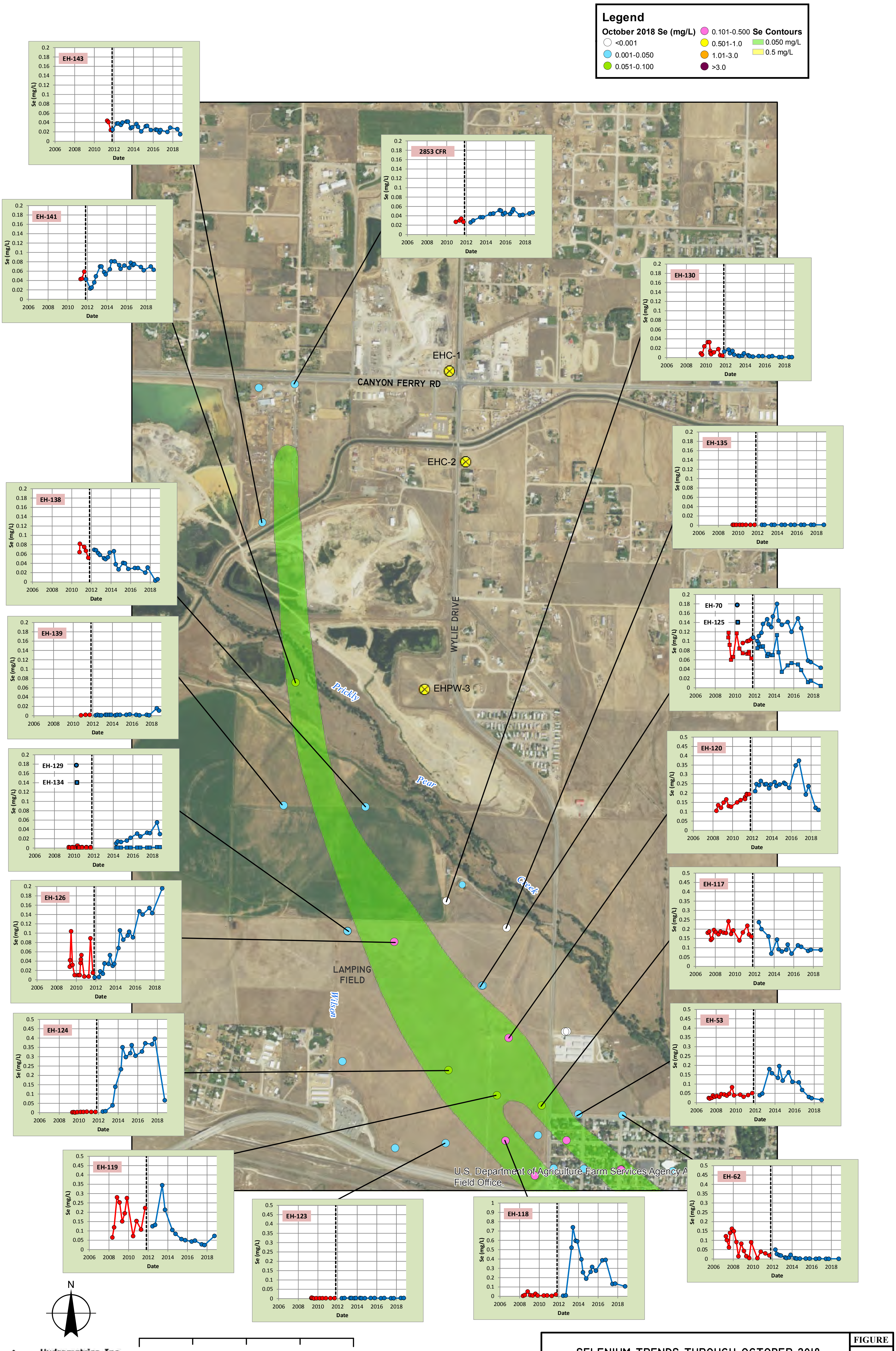
SELENIUM TRENDS THROUGH OCTOBER 2018
FACILITY AREA WELLS

FIGURE
D-3



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SELENIUM TRENDS THROUGH OCTOBER 2018
DOWNGRADIENT AREA

FIGURE
D-4

EXHIBITS

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2018 WATER RESOURCES MONITORING NETWORK EAST HELENA FACILITY	**2018 CAMP MONITORING WELL AND RESIDENTIAL / MUNICIPAL WATER SUPPLY WELL MONITORING NETWORK**	**EXHIBIT 1**