2020 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

Prepared for:

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LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	Above Mean Sea Level
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
DI	Deionized
DMP	Data Management Plan
DO	Dissolved Oxygen
EI	Environmental Indicator
ET	Evapotranspiration
EVCGWA	East Valley Controlled Groundwater Area
HHS	Human Health Standard
IC	Institutional Controls
IM	Interim Measures
MCL	Maximum Contaminant Level
METG	Montana Environmental Trust Group
mg/L	milligrams/liter
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
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 2020. 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 2020 monitoring program was 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 overall objective of the 2020 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. As outlined in the 2020 Corrective Action Monitoring Plan (CAMP), the 2020 monitoring program included semiannual streamflow and water quality sampling at ten sites on or tributary to Prickly Pear Creek, seasonal groundwater level monitoring at 186 monitoring wells, semiannual groundwater quality sampling at 83 monitoring wells, and semiannual water quality monitoring at 20 residential/public water supply wells. Supplemental monitoring in addition to that stipulated in the CAMP was conducted in early spring at two Prickly Pear Creek tributary sites, and in late fall at six additional monitoring wells. All water quality samples were analyzed for an extended suite of parameters including general chemistry constituents and trace metals, including the primary constituents of concern (COCs) arsenic and selenium. All 2020 data was reviewed and validated for data quality, and entered into the East Helena Project electronic database.

Residential and water supply well monitoring in 2020 showed no drinking water standard exceedances for selenium at any of the sampled wells, and arsenic drinking water standard exceedances at three wells. Concentrations of arsenic in the three wells exhibiting arsenic exceedances were similar to previously observed values, and these wells are located south (upgradient) of the former smelter, or to the west in an area of known naturally occurring groundwater arsenic.

Groundwater levels and surface water flows at project monitoring sites decreased in 2020 as a result of lower precipitation, snowpack, and associated runoff and recharge during the year compared with the above average 2018 and 2019 precipitation totals. Groundwater elevations on the former smelter declined in 2020 to near minimum observed levels at many locations, with overall water level decreases of up to 10 feet observed in response to remedial measures. The water level declines on the former plant site have resulted in approximately 50 to 70% reductions in saturated thickness in the former Acid Plant, West Selenium, and North Plant Arsenic source areas and corresponding reductions in groundwater contaminant flux migrating from the source areas. In general, groundwater contaminant concentrations have continued to decline in response to the recently completed interim remedial measures with arsenic concentrations in the Acid Plant, North Plant Arsenic, and Slag Pile source areas and selenium concentrations in the West Selenium and Slag Pile source areas at or near the minimum values observed as of October 2020. Downgradient (north) of the former smelter, arsenic and selenium concentrations were generally stable or decreasing in 2020 in response to the completed interim

remedial measures. Arsenic concentrations at some wells along the west margin of the downgradient arsenic plume have recently increased and remained elevated in 2020 above historic values due to a westward shift in the plume caused by elimination of a large irrigation ditch to the west, and associated loss of groundwater recharge in this area. The leading edge of the selenium plume to the north, as defined by the estimated location of the 0.050 mg/L human health standard (HHS) groundwater isocontour, has retracted approximately 1400 feet over the last five years.

Plume geometry and stability metrics, including average plume concentrations, plume areas and plume centroid locations show the downgradient arsenic and selenium plumes to be largely stable. Compared with plume conditions in 2010 (prior to interim measures (IM) implementation), the downgradient arsenic and selenium plume metrics for 2020 showed similar overall plume areas and modest reductions in average plume concentrations. Plume metrics on the former smelter site show that the plumes continue to decrease in size and concentration in the groundwater contaminant source areas, with the average arsenic and selenium concentrations both decreasing by approximately 50% between 2010 and 2020.

Groundwater monitoring in the Corrective Action Management Unit (CAMU) landfill area monitoring wells showed consistent groundwater quality in 2020 compared to previous years. Most CAMU area wells continue to show stable concentrations of arsenic (0.007 to 0.017 mg/L) consistent with naturally occurring background arsenic concentrations in this area. Monitoring well MW-6, which has shown elevated arsenic concentrations in the past, decreased from 0.072 mg/L in 2017 to 0.040 mg/L in 2020. Selenium concentrations at all CAMU area wells have consistently been less than the 0.05 mg/L drinking water standard. All other metals were near or less than analytical detection limits in all 2020 CAMU well samples, including parameters that have been documented at elevated concentrations in plant site soils and/or groundwater such as antimony (<0.003 mg/L), cadmium (<0.001 mg/L), zinc (<0.01 mg/L), and thallium (<0.001 mg/L).

While not considered primary COCs, zinc and cadmium are currently present at elevated concentrations in selected site monitoring wells, although concentrations generally remain much lower than those observed when the smelter was operating. The ongoing localized occurrence of elevated zinc and cadmium concentrations may be due to fluctuating groundwater levels caused by annual variations in precipitation patterns, and/or associated changes in groundwater pH or redox conditions. Currently, drinking water standards are exceeded at four wells for zinc and six wells for cadmium on the plant site. Despite the elevated zinc and cadmium groundwater concentrations in certain areas of the former smelter, no off-site migration at concentrations above the groundwater HHS of 2.0 mg/L is currently indicated for zinc. Exceedances for cadmium (HHS of 0.005 mg/L) are limited to one well north of the plant site on the American Chemet facility property (DH-64 at 0.024 mg/L). Downgradient well EH-100 showed a cadmium concentration equivalent to the HHS in October 2020. No residential well concentrations currently exceed the cadmium or zinc drinking water standards. Future groundwater monitoring will continue to include collection and evaluation of zinc and cadmium data, to assess any changes in concentration distributions and trends.

2020 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

DRAFT FOR REVIEW

1.0 INTRODUCTION

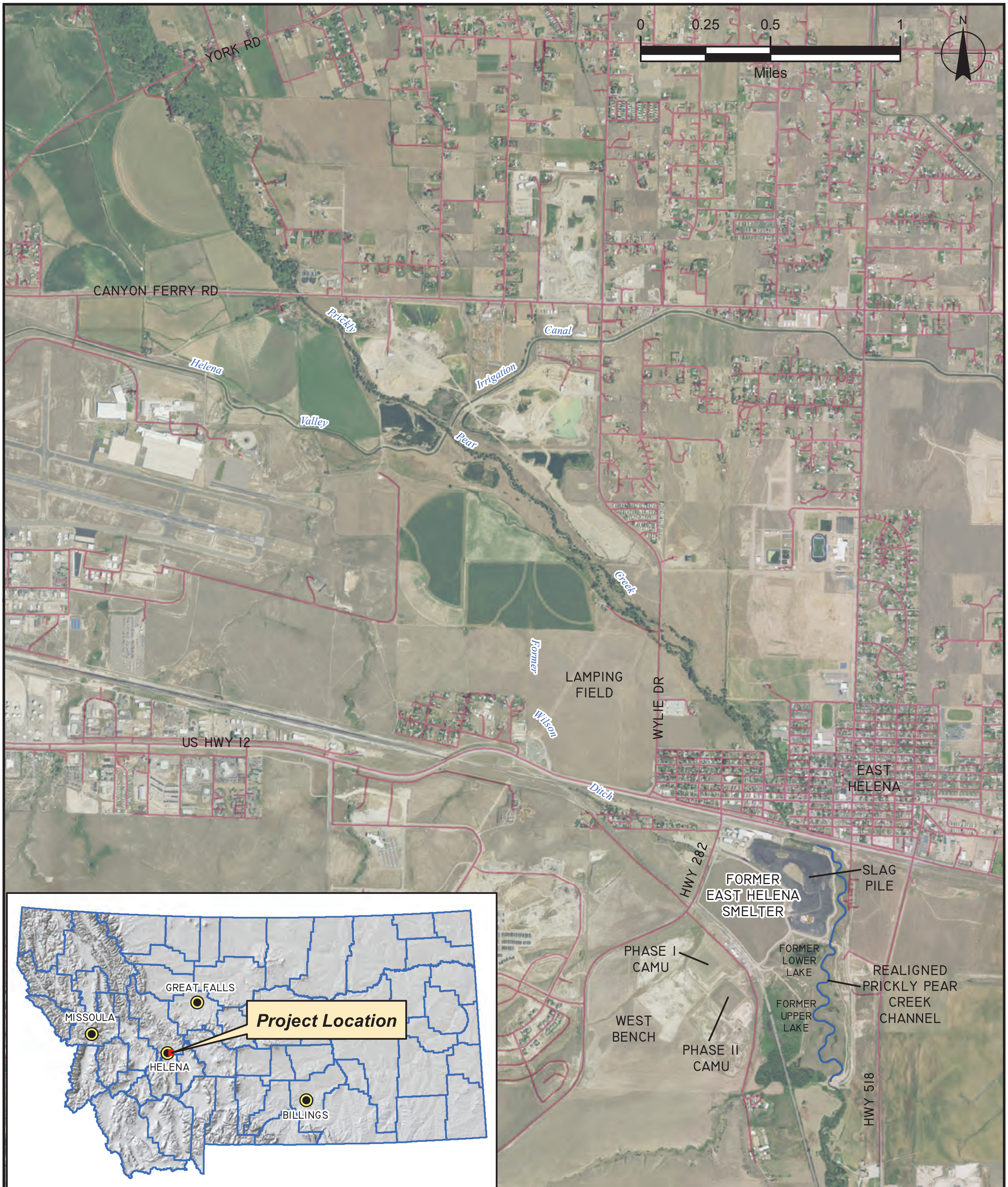
This report presents a summary of water resources monitoring (WRM) activities conducted in 2020 for the former East Helena Smelter remediation project. For purposes of this WRM report, the project area includes the former East Helena smelter site or Facility[1], and the surrounding area encompassing 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 2020 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 2020 as outlined in the 2020 Corrective Action Monitoring Plan (CAMP). Information provided in this report will support the 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 been eliminated and the Prickly Pear Creek channel and

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



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2020 WATER RESOURCES MONITORING REPORT
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PROJECT LOCATION AND FEATURES

FIGURE
1-1

Path: V:\10022\GIS\2020 WRM Report\Fig1-1_Location_and_Features.mxd 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), GSI (2014), and CH2M (2018).

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; METG, 2020). 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 has completed the CMS for the East Helena Facility, under 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 involved the completion of several site investigations designed to delineate groundwater contaminant source areas and aid in selection of groundwater 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 thus the mass of contaminants available for leaching. Components of the SPHC include: 1) dewatering of former Upper Lake immediately south of the Facility, previously a major source of recharge to the Facility groundwater system; 2) 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 3) 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.

In addition to these IMs, a number of institutional controls (ICs) have been implemented by the Custodial Trust and other entities to further mitigate potential exposures to contaminated soil and groundwater. These ICs include a well abandonment program to encourage abandonment of private wells located in areas potentially impacted by the groundwater contaminant plumes; deeded land-use restrictions on Trust-owned property; administration of the East Valley Controlled Groundwater Area (EVCGWA) to control and restrict groundwater appropriations within and adjacent to the groundwater contaminant plumes; a prohibition on new well installation within the COEH boundaries; and implementation of the COEH Lead Education and Abatement Program Soil Ordinance to regulate earthwork in areas of potential soil contamination.

Additional information on the completed IMs and the ICs is available in the CMS Report (CH2M, 2018; METG, 2020). Evaluation of 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 2020 were conducted in accordance with the 2020 CAMP (Hydrometrics, 2020a). As described in the CAMP, the overall objective of the 2020 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 - 2019, the 2020 program focused on performance monitoring appropriate to the CMS phase of a RCRA Corrective Action remediation project including the following objectives:

(1) Assessment of sitewide groundwater level trends and groundwater flow directions;
(2) Assessment of groundwater quality trends for key constituents (arsenic, selenium, chloride, and sulfate) at specific wells located in both Facility source areas and downgradient areas;
(3) Assessment of arsenic and selenium plume geometry and stability;
(4) Evaluation of residential/public water supply well water quality in the area of former smelter site impacts;
(5) Evaluation of surface water flow and quality trends, from upstream of the Facility through the Prickly Pear Creek realignment area, and downstream to Canyon Ferry Road;
(6) Continued evaluation of groundwater chemistry in CAMU area wells; and
(7) Updated assessment of additional smelter-related groundwater constituents (zinc and cadmium) that have persisted at elevated concentrations in selected on-Site wells, and have recently shown increasing concentration trends at some locations (Hydrometrics, 2020b).

Assessment of groundwater level trends, groundwater quality trends, and arsenic and selenium plume geometry and stability (objectives (1), (2), and (3) above) are addressed through a remedy performance monitoring data evaluation program, as outlined in the 2020 CAMP (Hydrometrics, 2020a). This data evaluation program forms the basis of the discussion of 2020 monitoring results for groundwater levels, groundwater quality trends, and plume geometry/stability in Section 3.3 of this WRM report.

This document presents a summary of the 2020 groundwater and surface water monitoring activities and resulting data. The scope of monitoring activities is presented in Section 2 and monitoring results are discussed in Section 3.

2.0 2020 MONITORING SCOPE

The 2020 monitoring program included semiannual monitoring at an extensive network of groundwater and surface water locations spanning the project area. The sampling protocol is detailed in the 2020 CAMP (Hydrometrics, 2020a), 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 2020 monitoring is described below.

2.1 SURFACE WATER MONITORING

The 2020 surface water monitoring program delineated in the CAMP included semiannual surface water elevation or stage measurements, streamflow measurements and water quality sampling in June and October. The semiannual monitoring schedule included ten monitoring sites, (Table 2-1, Figure 2-1) with eight sites located on Prickly Pear Creek and two sites (Trib-1B and Trib-1D) located on a spring-fed tributary drainage flowing from the southwest through the former Upper and Lower Lake areas on the south end of the Facility to Prickly Pear Creek (Figure 2-1). Surface water elevations were measured in June and October at all ten 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. Streamflow and water quality monitoring was conducted at eight of the ten surface water sites during high flow (June) and low flow (October) conditions (Table 2-1).

In addition to the semiannual CAMP surface water monitoring, a supplemental surface water sampling event was conducted in May 2020 at the spring-fed tributary sites Trib-1B and Trib-1D (Table 2-1, Figure 2-1). These tributary sites have shown highly variable flows and water quality results during past monitoring, particularly during the spring season. Elevated metals concentrations throughout the tributary drainage have been documented through past sampling, resulting in removal of approximately 350 cubic yards of metals-impacted soils in the vicinity of Trib-1B in November 2018. The supplemental May 2020 monitoring was conducted to better define water quality trends at the tributary locations in response to the 2018 soil removal.

All 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 2020 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 2020 validated database is included in Appendix A. Surface water monitoring results for 2020 are discussed in Section 3.1.

Table 2-1. 2020 Surface Water Monitoring Locations and Schedule
2020 Water Resources Monitoring Report - East Helena Facility

Site ID	Northing	Easting	Description	June/October Water Elevation	June/October Flow and 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
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
Trib-1B*	858476.2701	1360181.888	Tributary drainage south of Facility, upstream of site Trib-1D	X	X
Trib-1D*	859392.30	1361402.33	Tributary drainage immediately upstream of Prickly Pear Creek confluence	X	X

Site locations shown on Figure 2-1.

Sites listed in upstream to downstream order.

*In addition to the June and October 2020 CAMP-related monitoring, supplemental monitoring was conducted at the two tributary locations in May 2020.

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 2/11/2021 4:15:10 PM	2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**2020 SURFACE WATER MONITORING LOCATIONS**	FIGURE **2-1**

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Table 2-2. 2020 Surface Water Sample Analytical Parameter List

2020 Water Resources Monitoring Report - East Helena Facility

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 2020 GROUNDWATER MONITORING

The 2020 groundwater monitoring program included groundwater level and water quality monitoring at an extensive 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, to about 1600 feet 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 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 2020 water level monitoring schedule is included in Table 2-3 with results presented in Section 3.3.

2.2.2 Groundwater Quality Monitoring

The 2020 CAMP groundwater monitoring program included groundwater quality sampling at 28 monitoring wells in June and 83 wells in October. A supplemental monitoring event at 6 monitoring wells was conducted in November 2020, to collect additional groundwater data in the south plant area and the vicinity of the slag pile prior to planned slag recovery operations, scheduled to begin in 2021. Monitoring wells sampled for groundwater quality in 2020 are summarized in Table 2-3 and shown on Exhibit 1. 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 18 residential/public water supply wells (Table 2-4, Exhibit 1). Note that two of the residential wells scheduled for sampling in 2021 were not sampled due to an inoperative dedicated pump at one well, and an owner request at the other well (Table 2-4). 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 semiannual sampling event.

Table 2-3. 2020 Monitoring Well Sampling Schedule

2020 Water Resources Monitoring Report - East Helena Facility

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring		
				June / October	June	October	November*
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	
Amchem Injection	861628.3080	1360331.4230	NA			X	
ASIW-1	859803.7500	1362064.5200	3915.99	X			
ASIW-2	860471.8300	1363184.5870	3909.13	X			
Dartman	864632.3180	1360118.0550	3863.03		X	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	3923.91	X			
DH-14	859527.8759	1361225.1135	3916.06	X			X
DH-15	861541.0629	1360256.9955	3889.82	X		X	
DH-17	860997.4140	1359668.6307	3917.56	X	X	X	
DH-18	860535.2929	1359814.8334	3924.93	X			
DH-2	859910.4322	1358532.4429	3936.91	X			
DH-20	858989.3710	1360128.4527	3927.09	X			X
DH-22	859690.0706	1359816.2344	3948.63	X			
DH-23	860270.2165	1360217.4896	3931.82	X			
DH-24	861412.6262	1359442.0091	3899.59	X			
DH-27	859923.8461	1360046.4609	3946.21	X			
DH-3	858002.5720	1359985.2180	3947.48	X			
DH-30	859935.1871	1360099.5558	3943.239	X			
DH-36	860631.4997	1359936.3381	3920.66	X			
DH-4	859526.8209	1361217.1986	3917.26	X			X
DH-42	859587.2008	1359938.7981	3942.63	X		X	
DH-47	859460.0231	1360402.0232	3926.818	X			
DH-48	861493.5490	1358990.7080	3905.96	X			
DH-5	859641.3787	1360792.8184	3921.18	X			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			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	3929.53	X			
DH-58	860620.3468	1360149.7987	3919.331	X	X	X	
DH-59	859632.0757	1360058.6049	3937.44	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	3926.84	X			
DH-62	860406.7352	1359291.4704	3926.95	X			
DH-63	861507.1600	1359149.8337	3905.37	X			
DH-64	861382.7472	1359476.2570	3904.02	X	X	X	
DH-65	861207.1996	1360879.4052	3945.85	X			
DH-66	861005.1400	1359333.4093	3919.28	X	X	X	

Table 2-3. 2020 Monitoring Well Sampling Schedule

2020 Water Resources Monitoring Report - East Helena Facility

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring		
				June / October	June	October	November*
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	3934.49	X		X	
DH-7	861281.5224	1361580.6838	3898.66	X			
DH-70	859738.6045	1360346.8143	3933.91	X			X
DH-71	859876.6862	1359640.5437	3944.88	X			
DH-72	859627.5477	1360069.2019	3939.67	X			
DH-73	860573.7778	1360394.4012	3918.08	X			
DH-74	860942.4611	1360679.4656	4006.44	X			
DH-75	860942.0961	1360685.1136	4006.54	X			
DH-76	860173.6276	1360887.0582	3994.28	X			
DH-77	860292.4800	1359639.2500	3932.203	X	X	X	
DH-78	860848.9600	1359368.2200	3921.117	X			
DH-79	860422.2150	1359937.1910	3928.802	X	X	X	
DH-8	860693.1656	1359404.7242	3923.38	X		X	
DH-80	859665.4470	1360005.8920	3942.358	X	X	X	
DH-82	861377.1610	1359161.9690	3908.18	X			
DH-83	860783.4290	1359388.4600	3922.139	X			
DH-9	860570.6829	1360370.6073	3918.08	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	
EH-115	862717.8146	1357963.0351	3883.29	X	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	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	

Table 2-3. 2020 Monitoring Well Sampling Schedule

2020 Water Resources Monitoring Report - East Helena Facility

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring		
				June / October	June	October	November*
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	
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	

Table 2-3. 2020 Monitoring Well Sampling Schedule

2020 Water Resources Monitoring Report - East Helena Facility

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring		
				June / October	June	October	November*
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	X	X	
EH-69	863791.1154	1360852.6083	3869.10	X	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	3959.01	X		X	
PBTW-1	861055.8909	1359662.6777	3914.59	X			
PBTW-2	861165.7887	1359622.4268	3906.73	X			
PPCRPZ-02	858388.3477	1360904.9182	3919.76	X			
PRB-1	861019.3720	1359488.1840	3918.37	X			
PRB-2	861114.8098	1359753.5985	3905.34	X			
PRB-3	860983.8120	1359418.5272	3919.19	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	3925.11	X	X	X	
SDMW-2	860448.2571	1359851.2283	3928.09	X			
SDMW-3	860203.9396	1359859.3573	3935.142	X			
SDMW-4	860218.1176	1360144.9397	3936.10	X			
SDMW-5	860446.6991	1359750.3085	3929.86	X	X	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			

Table 2-3. 2020 Monitoring Well Sampling Schedule

2020 Water Resources Monitoring Report - East Helena Facility

Well ID	Northing	Easting	MP Elevation	Water Levels	Water Quality Monitoring		
				June / October	June	October	November*
TW-1	860392.8781	1359940.7995	3930.10	X			
TW-2	860351.2000	1359895.9000	3931.435	X			
ULM-PZ-1	857498.2490	1360521.7270	3924.401	X			
ULTP-1	858779.0631	1360264.2920	3919.63	X			
ULTP-2	858262.1761	1360427.4600	3921.23	X			
			Total # Wells Per Event	**186**	**28**	**83**	**6**

*Non-CAMP supplemental monitoring event conducted to provide additional groundwater data in the south plant area and the vicinity of the slag pile prior to planned slag recovery operations.

All monitoring locations shown on Exhibit 1.

NA - Not Available

Table 2-4. 2020 Residential/Public Water Supply Well Sampling Sites and Schedule

2020 Water Resources Monitoring Report - East Helena Facility

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(1)	X(1)
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(2)	X(2)
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.

(1) Well scheduled for sampling but not sampled in 2020 due to inoperative dedicated pump.

(2) Well scheduled for sampling but not sampled in 2020 at the request of well owner.

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 2020 CAMP has been entered into the project database and validated for data quality and usability. The validated database is included in Appendix A. Groundwater monitoring results for residential wells are presented in Section 3.2, and monitoring well results are presented in Section 3.3.

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 DMP (Hydrometrics, 2011), and the 2020 CAMP (Hydrometrics, 2020a). 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 verify the effectiveness of the decontamination procedure), and field duplicate samples, all collected at a frequency of 5% (1 per 20 field samples) for both monitoring wells and residential wells. Field QC samples for surface water included DI blanks and field duplicate samples, both collected at a frequency of 5% (1 per 20 samples).

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 2020 WRM program has been reviewed and validated in accordance with these procedures and entered into the East Helena Project water quality database. The 2020 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 2020 data set, 99.6% of the surface water results, 99% of the monitoring well results, and 100% of the residential well results were accepted without any qualifiers applied; for the fall 2020 data set, 99.3% of the surface water results, 99% of the monitoring well results, and 99.1% of the residential well results were accepted without any qualifiers applied. One dissolved iron result obtained during the spring 2020 residential well sampling event was rejected based on (1) significant inconsistency with historical data, and (2) disagreement with the total iron concentration reported for the same sample (dissolved iron ≈ 10x total iron); all other WRM data collected during 2020 was categorized as usable following the validation process.

Table 2-5. 2020 Groundwater Sample Analytical Parameter List

2020 Water Resources Monitoring Report - East Helena Facility

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 (June 2019 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.

3.0 2020 WATER RESOURCES MONITORING RESULTS

3.1 SURFACE WATER MONITORING RESULTS

The 2020 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 June and October 2020. The streamflow and stream stage data is in Table 3-1 with site locations shown on Figure 2-1. Prickly Pear Creek flows measured in 2020 (Table 3-1) were significantly lower than those measured in 2019. Measured flows for June 2019 were 212 to 241 cubic feet per second (cfs) (Hydrometrics, 2020b), while the June 2020 measured flows ranged from 83 to 96 cfs; similarly, October 2019 flows (56 to 64 cfs) were substantially higher than October 2020 flows (13 to 23 cfs).

Figure 3-1 shows continuous streamflow data for 2010 through 2020 from a USGS gaging station on Prickly Pear Creek approximately five miles upstream of the Facility. As shown on the hydrograph, 2020 Prickly Pear Creek flows at the gaging station were similar to the overall median flow rates for the period of record, with a maximum flow of 183 cfs occurring on June 18th. The total precipitation measured in 2020 at the Helena Regional Airport station (9.87 inches) was the lowest total since 2015, well below the long-term average of 11.33 inches and 40% lower than the 2019 total of 16.50 inches; precipitation throughout the summer months of 2020 (July, August, September) was well below average, while totals in June and October 2020 were above average[2]. Snowpack in 2020 (measured as snow-water equivalents at a SNOTEL station in Tizer Basin, near the headwaters of Prickly Pear Creek) was also significantly lower than in 2018 and 2019, particularly in the later season under maximum snowpack conditions (approximately mid-April); approximate snow-water equivalents in mid-April at this site were 13 inches in 2018, 10.5 inches in 2019, and 8 inches in 2020[3]. Annual variability in precipitation and associated Prickly Pear Creek streamflow has a direct impact on the plant site and downgradient groundwater conditions.

Similar to past years, the 2020 data indicates that Prickly Pear Creek flow adjacent to the Facility (PPC-3A, -4A, -5A, and -7) was relatively consistent from upstream to downstream in both June and October (Table 3-1). The 2020 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. Flow rates and trends at sites PPC-4A and PPC-5A, located on the realigned segment of the creek, are similar to those measured in previous years indicating that the realignment project, completed as part

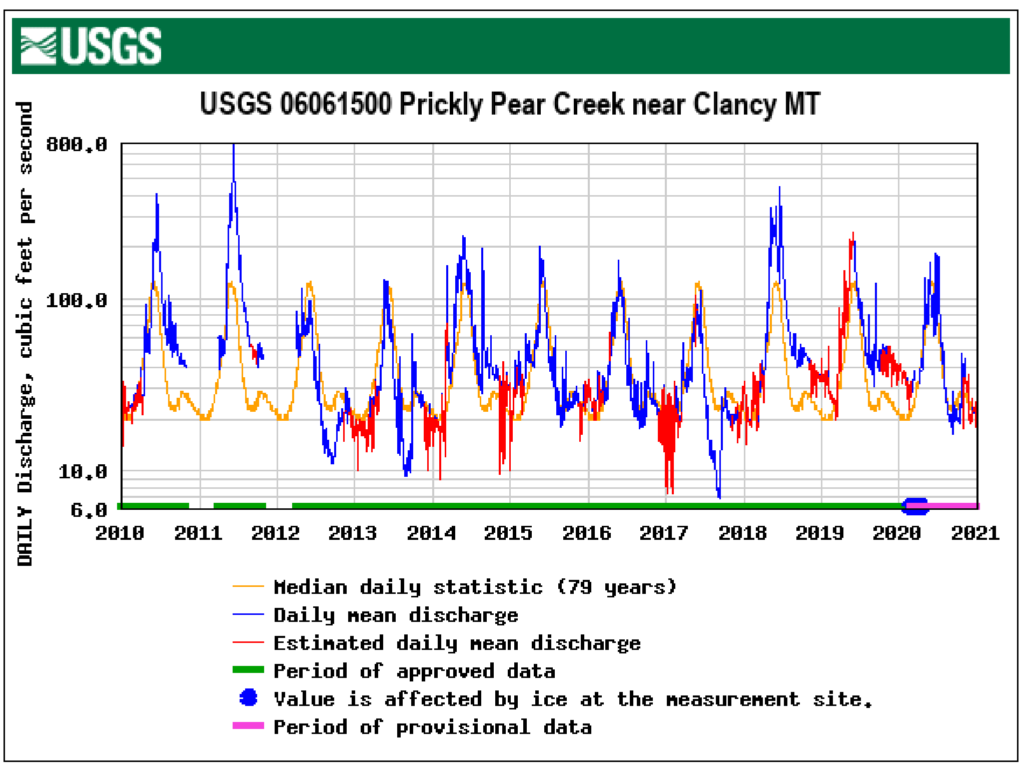
[2] https://wrcc.dri.edu/WRCCWrappers.py?sodxtrmts+244055+por+por+pcpn+none+msum+5+01+F
[3] https://www.nrcs.usda.gov/Internet/WCIS/AWS_PLOTS/siteCharts/POR/WTEQ/MT/Tizer%20Basin.html

TABLE 3-1. 2020 PRICKLY PEAR CREEK STREAMFLOW AND STAGE MEASUREMENTS

Monitoring Site	Location	Stream Stage - ft AMSL		Stream Flow - cfs	
		6/11/2020	10/7/2020	6/11/2020	10/7/2020
PPC-3A	PPC Upstream of Facility	3927.60	3926.77	86	23
PPC-4A	PPC Adjacent to Facility	3910.35	3909.84	95	22
Trib-1B	Tributary drainage south of Facility	3914.21	Dry	0.002 E	Dry
Trib-1D	Tributary site at PPC Confluence	3905.05	3904.94	0.033 E	0.005 E
PPC-5A	PPC Adjacent to Facility	3902.78	3902.08	89	22
PPC-7	PPC Downstream Facility Boundary	3882.58	3881.65	96	23
PPC-8	PPC at West Gail Street in East Helena	3868.24	3867.78	nm	nm
PPC-36A	PPC 0.7 miles downstream of Facility	3854.99	3854.65	83	22
PPC-9A	PPC 1.0 mile downstream of smelter	3845.56	3845.42	nm	nm
SG-16	PPC 2.9 miles downstream of Facility	3766.44	3766.01	83	13

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 2020 CAMP
E - Flow estimated

FIGURE 3-1. 2010 THROUGH 2020 PRICKLY PEAR CREEK FLOWS UPSTREAM OF THE FORMER SMELTER



of the SPHC IM, has maintained the historic condition of no significant flow gains or losses adjacent to the Facility. Downstream of the Facility, the 2020 flow data shows streamflow decreases in a downstream direction, indicating leakage from the creek to groundwater; this result is consistent with historic observations. Although irrigation diversion flows were not measured in 2020, previous comprehensive synoptic flow data accounting for irrigation diversions has shown net 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, 2018).

3.1.2 Semiannual Surface Water Quality Results

The 2020 semiannual surface water quality data is summarized in Table 3-2 with the complete dataset in Appendix A. The seasonal data shows Prickly Pear Creek water to be a calcium-bicarbonate type water with alkaline pH and total dissolved solids (TDS) concentrations ranging from 109 to 216 milligrams per liter (mg/L) seasonally. As observed during past monitoring, seasonal concentrations of major ions (calcium, magnesium, sodium, potassium, sulfate) in 2020 were very consistent from upstream of the smelter site (site PPC-3A) to downstream site SG-16 near Canyon Ferry Road, with October low flow concentrations about twice the June high flow concentrations. The tributary sites show higher TDS (329 to 408 mg/L) and major ion concentrations than Prickly Pear Creek, with Trib-1B showing a calcium-bicarbonate signature and Trib-1D showing a calcium-sulfate signature.

Total recoverable trace metal concentrations are also relatively low and consistent throughout the sampled reach of Prickly Pear Creek (Table 3-2, Appendix A). A number of trace metals including selenium and thallium were below the laboratory reporting limits in all 2020 samples. Several other trace metals were only detected in one of the 2020 Prickly Pear Creek surface water samples: antimony at site PPC-7 in October (0.0028 mg/L) and mercury at site SG-16 in October (0.000006 mg/L). Water quality criterion exceedances (DEQ-7 surface water standards; MDEQ, 2019) in 2020 Prickly Pear Creek samples were limited to total recoverable lead, which exceeded the hardness-dependent chronic aquatic life criteria in all six June samples (Table 3-2). The water quality exceedances occurred both upstream and downstream of the Facility, indicating that upstream contaminant sources are producing these exceedances. The occurrence of elevated metals concentrations well upstream of the Facility has been noted in numerous studies, including the watershed total maximum daily load (TMDL) document (USEPA, 2004b). Overall, the 2020 Prickly Pear Creek water quality monitoring results are consistent with past sampling results dating back more than 20 years.

Sampling results from tributary drainage sites Trib-1B and Trib-1D show a number of water quality exceedances, particularly at upstream site Trib-1B. Water quality at Trib-1B exceeded the aquatic criteria for arsenic, cadmium, copper, lead, and zinc and the human health surface water standard for mercury in May and June; Trib-1B was dry in October 2020 and no sample was collected. Three exceedances were recorded in 2020 at site Trib-1D, located immediately upstream of the confluence with Prickly Pear Creek: arsenic and iron in May, and arsenic in June (Table 3-2). Elevated metals concentrations throughout the tributary drainage have been documented through past sampling, resulting in removal of approximately 350 cubic yards of metals-impacted soils in the vicinity of Trib-1B in November 2018.

Table 3-2. 2020 Surface Water Quality Monitoring Results
2020 Water Resources Monitoring Report - East Helena Facility

Monitoring Site	Prickly Pear Creek						Tributary Drainage			
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	SG-16	TRIB-1B		TRIB-1D	
Sample Date	6/11/20	6/11/20	6/11/20	6/11/20	6/11/20	6/11/20	5/21/20	6/11/20	5/21/20	6/11/20
Field Parameters										
pH (s.u.)	7.63	7.59	7.45	7.28	7.29	6.99	6.76	6.78	7.40	7.72
SC (μmhos/cm)	189	191	191	187	188	221	531	532	603	507
Flow (cfs)	86	95	89	96	83	83	0.04 E	0.002 E	0.134 E	0.033 E
Laboratory Analyses										
Total Dissolved Solids	118	116	109	112	114	118	347	335	406	329
Calcium	22	22	22	22	21	25	62	64	72	52
Magnesium	5	5	5	5	5	6	15	15	19	17
Sodium	8	8	8	8	8	10	26	25	27	24
Potassium	2	2	2	2	2	2	5	4	6	3
Chloride	3	3	3	3	3	4	11	7	11	7
Sulfate	27	26	26	26	26	28	81	54	144	130
Trace Metals (Total Recoverable)										
Antimony	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0016	0.0008	0.0009	0.0010
Arsenic	0.004	0.004	0.005	0.005	0.004	0.009	0.013	0.019	0.012	0.011
Cadmium	0.00021	0.00017	0.00020	0.00019	0.00021	0.00019	0.01350	0.02320	0.00028	0.00015
Copper	0.004	0.003	0.004	0.004	0.004	0.004	0.025	0.025	0.003	<0.002
Iron	0.47	0.41	0.39	0.50	0.45	0.39	0.58	0.83	1.47	0.69
Lead	0.0052	0.0045	0.0047	0.0051	0.0053	0.0052	0.0117	0.0189	0.0023	0.0022
Manganese	0.05	0.05	0.05	0.05	0.05	0.05	0.26	2.02	2.07	0.44
Mercury	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.000104	0.000144	0.000016	<0.000005
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	0.050	0.047	0.049	0.057	0.052	0.044	0.592	1.05	0.018	0.008

Monitoring Site	Prickly Pear Creek						Tributary Drainage	
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	SG-16	TRIB-1B	TRIB-1D
Sample Date	10/7/20	10/7/20	10/7/20	10/7/20	10/7/20	10/7/20	10/7/20	10/7/20
Field Parameters								
pH (s.u.)	8.15	8.20	8.09	8.15	8.03	7.71		7.64
SC (μmhos/cm)	325	324	327	326	327	329		627
Flow (cfs)	23	22	22	23	22	13		0.005 E
Laboratory Analyses								
Total Dissolved Solids	210	216	209	214	211	210		408
Calcium	37	38	38	38	39	36		76
Magnesium	9	9	9	9	9	8	**Site**	21
Sodium	16	17	16	16	16	16	**Dry**	27
Potassium	3	3	3	3	3	3	**No**	5
Chloride	6	6	6	6	6	7	**Sample**	10
Sulfate	53	54	55	54	55	55		160
Trace Metals (Total Recoverable)								
Antimony	<0.0005	<0.0005	<0.0005	0.0028	<0.0005	<0.0005		0.0005
Arsenic	0.004	0.005	0.005	0.005	0.005	0.005		0.003
Cadmium	0.00012	0.00012	0.00012	0.00013	0.00012	0.00014		0.00031
Copper	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002
Iron	0.12	0.16	0.16	0.18	0.16	0.13		0.05
Lead	0.0015	0.0017	0.0020	0.0028	0.0018	0.0019		0.0004
Manganese	0.03	0.04	0.04	0.04	0.04	0.02		0.03
Mercury	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.000006		0.000005
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Zinc	0.045	0.042	0.043	0.043	0.045	0.042		0.027

All concentrations in mg/L unless otherwise noted.
Concentration exceeds applicable surface water quality standard.
Prickly Pear Creek sites listed in upstream to downstream order.
E-Estimated
Complete 2020 database in Appendix A.

Table 3-3 includes a comparison of the 2020 concentrations in the tributary drainage compared to 2017-2018 (pre-soil removal) concentrations, as well as 2019 concentrations. As shown in Table 3-3, average 2020 concentrations of numerous constituents show considerable reductions from 2017-2018 pre-soil removal averages, with overall decreases at Trib-1B of 48% for sulfate, 51% for cadmium, 41% for lead, and 72% for zinc. At Trib-1D, percent decreases in average concentrations for cadmium, lead, and zinc have been even larger (80% to 91%), with decreasing average concentrations also observed for arsenic, copper, and iron. Conversely, average manganese concentrations have increased at both locations from 2017-2018 through 2020, and iron concentrations have increased slightly at Trib-1B (Table 3-3). Seasonally variable manganese and iron concentrations may reflect fluctuations in redox conditions, with higher concentrations present when conditions are more reducing. The tributary sites will be included in the 2021 monitoring program to further assess post-soil removal concentrations.

3.2 RESIDENTIAL / PUBLIC WATER SUPPLY SAMPLING RESULTS

Table 3-4 includes a statistical summary of the 2020 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 copper at a few residential wells, the total and dissolved metals concentrations are virtually identical. Slightly elevated concentrations of copper at well R3 (0.362 mg/L total copper) and zinc at well R17 (0.15 mg/L total zinc) were observed during the June 2020 monitoring event; concentrations subsequently decreased to more typical values in October 2020, including 0.059 mg/L copper at R3 and 0.01 mg/L zinc at R17 (Appendix A). Variable copper and zinc concentrations at residential wells are occasionally observed due to the presence of copper and zinc in domestic water system plumbing and piping.

As shown in the table, no water supply wells exhibited HHS exceedances for selenium in 2020, while three of the eighteen wells sampled showed HHS exceedances for arsenic, consistent with previous results for these wells. The three wells with arsenic exceedances in 2020 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 2020 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 3-4).

3.3 GROUNDWATER MONITORING RESULTS AND DATA ANALYSIS

This section presents a summary of 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, 2020a). 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) includes

TABLE 3-3. TRIBUTARY DRAINAGE CONCENTRATION COMPARISON 2017 - 2020

2020 Water Resources Monitoring Report - East Helena Facility

	Sulfate	Arsenic	pH	Cadmium	Copper	Iron	Lead	Manganese	Zinc
	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Trib-1B									
4/17/2017	160	0.004	7.02	0.0710	0.021	0.35	0.0366	0.48	5.3600001
5/5/2017	NM	NM	6.68	NM	NM	NM	NM	NM	3.9400001
6/19/2017	140	0.022	8.31	0.0186	0.024	0.91	0.0332	0.32	0.959
5/25/2018	87	0.007	6.25	0.0239	0.022	0.18	0.008	0.20	1.38
2017/18 Average	**129**	**0.011**	**7.07**	**0.038**	**0.022**	**0.48**	**0.0259**	**0.33**	**2.91**
6/7/2019	76	0.010	6.88	0.0310	0.026	0.48	0.0202	1.34	1.4299999
10/17/2019	91	0.005	7.87	0.0128	0.015	0.32	0.0157	0.07	0.739
2019 Average	**84**	**0.007**	**7.38**	**0.022**	**0.021**	**0.40**	**0.0179**	**0.71**	**1.08**
5/21/2020	81	0.013	6.76	0.0135	0.025	0.58	0.0117	0.26	0.592
6/11/2020	54	0.019	6.78	0.0232	0.025	0.83	0.0189	2.02	1.05
2020 Average	**68**	**0.016**	**6.77**	**0.018**	**0.025**	**0.71**	**0.0153**	**1.14**	**0.82**
% Reduction	**48%**	**-45%**	**4%**	**51%**	**-12%**	**-47%**	**41%**	**-243%**	**72%**
Trib-1D									
4/17/2017	210	0.017	8.09	0.00259	0.008	3.57	0.0228	1.14	0.240
6/19/2017	250	0.011	8.49	0.00079	0.011	1.11	0.0120	0.21	0.041
10/2/2017	260	0.020	9.20	0.00014	0.004	0.22	0.0031	0.02	0.008
5/25/2018	134	0.011	7.60	0.00875	0.015	1.22	0.0061	0.39	0.894
7/19/2018	209	0.021	9.72	0.0002	0.003	0.19	0.0012	0.03	0.011
10/12/2018	276	0.007	8.70	0.00021	0.002	0.47	0.0032	0.63	0.019
2017/18 Average	**223**	**0.015**	**8.63**	**0.00211**	**0.0072**	**1.13**	**0.0081**	**0.40**	**0.202**
6/7/2019	167	0.011	9.13	0.00026	0.003	0.84	0.0019	0.35	0.019
10/17/2019	184	0.005	8.84	0.00014	0.002	0.60	0.0020	1.69	0.023
2019 Average	**176**	**0.008**	**8.99**	**0.00020**	**0.0025**	**0.72**	**0.0020**	**1.02**	**0.021**
5/21/2020	144	0.012	7.40	0.00028	0.003	1.47	0.0023	2.07	0.018
6/11/2020	130	0.011	7.72	0.00015	<0.002	0.69	0.0022	0.44	0.008
10/7/2020	160	0.003	7.64	0.00031	<0.002	0.05	0.0004	0.03	0.027
2020 Average	**145**	**0.008667**	**7.59**	**0.00025**	**0.0023**	**0.74**	**0.0016**	**0.85**	**0.018**
% Reduction	**35%**	**40%**	**12%**	**88%**	**67%**	**35%**	**80%**	**-110%**	**91%**

NM - Not Measured

Metals analyses are total recoverable fraction.

% Reduction shown as percent change from 2017/18 average to 2020 average

Table 3-4. Summary of 2020 Residential/Public Water Supply Well Arsenic and Selenium Data

2020 Water Resources Monitoring Report - East Helena Facility

Map Key (see Exhibit 1)	Use	# of Samples	Dissolved Arsenic (mg/L)				Dissolved Selenium (mg/L)			
			Concentration			HHS Exceedances	Concentration			HHS Exceedances
			Min	Max	Mean		Min	Max	Mean	
R1	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R2	Irrigation	2	<0.002	<0.002	<0.002	0	0.001	0.001	0.001	0
R3	Drinking	2	<0.002	<0.002	<0.002	0	<0.001	0.005	0.003	0
R4	Irrigation	2	<0.002	<0.002	<0.002	0	0.002	0.002	0.002	0
R5	Drinking/Irrigation	3	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R6	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0.002	0.003	0.0025	0
R7	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0.001	0.001	0.001	0
R8	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R9	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R10	Irrigation	NS(1)	--	--	--	0	--	--	--	0
R11	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	0.041	0.046	0.0435	0
R12	Drinking/Irrigation	2	<0.002	<0.002	<0.002	0	<0.001	0.001	0.001	0
R13	Drinking/Irrigation	2	0.013	0.015	0.014	2	<0.001	<0.001	<0.001	0
R14	Irrigation	3	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R15	Drinking/Irrigation	2	0.015	0.016	0.0155	2	0.002	0.002	0.002	0
R16	Drinking/Irrigation	NS(2)	--	--	--	0	--	--	--	0
R17	Drinking/Irrigation	2	0.016	0.017	0.0165	2	0.002	0.002	0.002	0
R18	Public Water Supply	2	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R19	Public Water Supply	2	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	0
R20	Public Water Supply	2	<0.002	<0.002	<0.002	0	<0.001	<0.001	<0.001	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
NS(1) = no samples collected in 2020 due to inoperative dedicated pump
NS(2) = no samples collected in 2020 at owner's request

discussions of recommended remedy evaluation strategies. Based on these guidance documents, and goals and objectives specific to the East Helena Project (Section 1), the 2020 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.

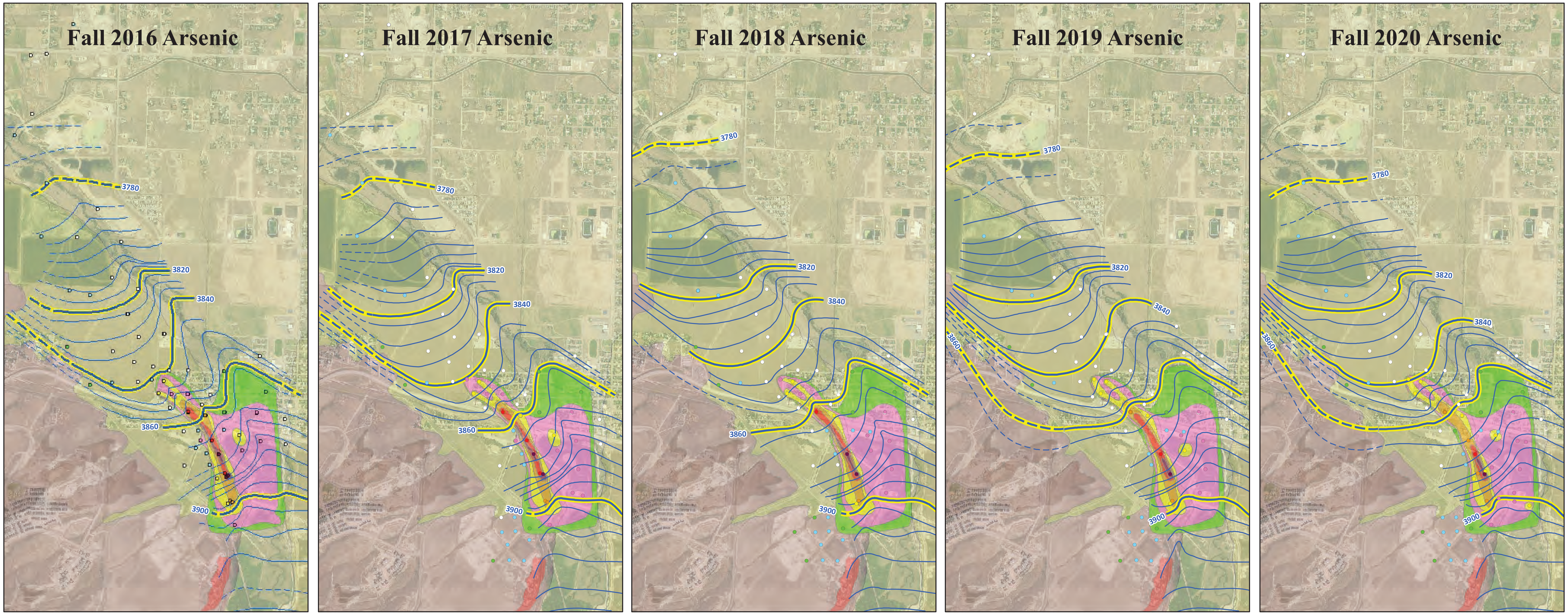
Following is a summary of 2020 groundwater conditions in the Project area, followed by discussions of the two performance monitoring components.

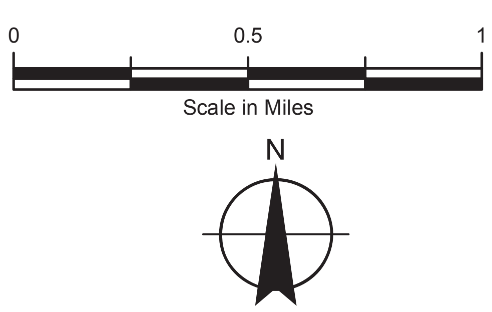
3.3.1 General Groundwater Conditions

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 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 largely restricted to the upper alluvial aquifer.

As previously noted, the primary groundwater 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 2020 arsenic and selenium groundwater plumes, as well as the 2016 through 2020 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 (i.e., during smelter operations) 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, the primary post-smelter closure 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,





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		

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2016-2020 GROUNDWATER ARSENIC PLUMES AND POTENTIOMETRIC CONTOURS
EAST HELENA FACILITY

FIGURE
3-2

Hydrometrics, Inc.
Consulting Scientists and Engineers

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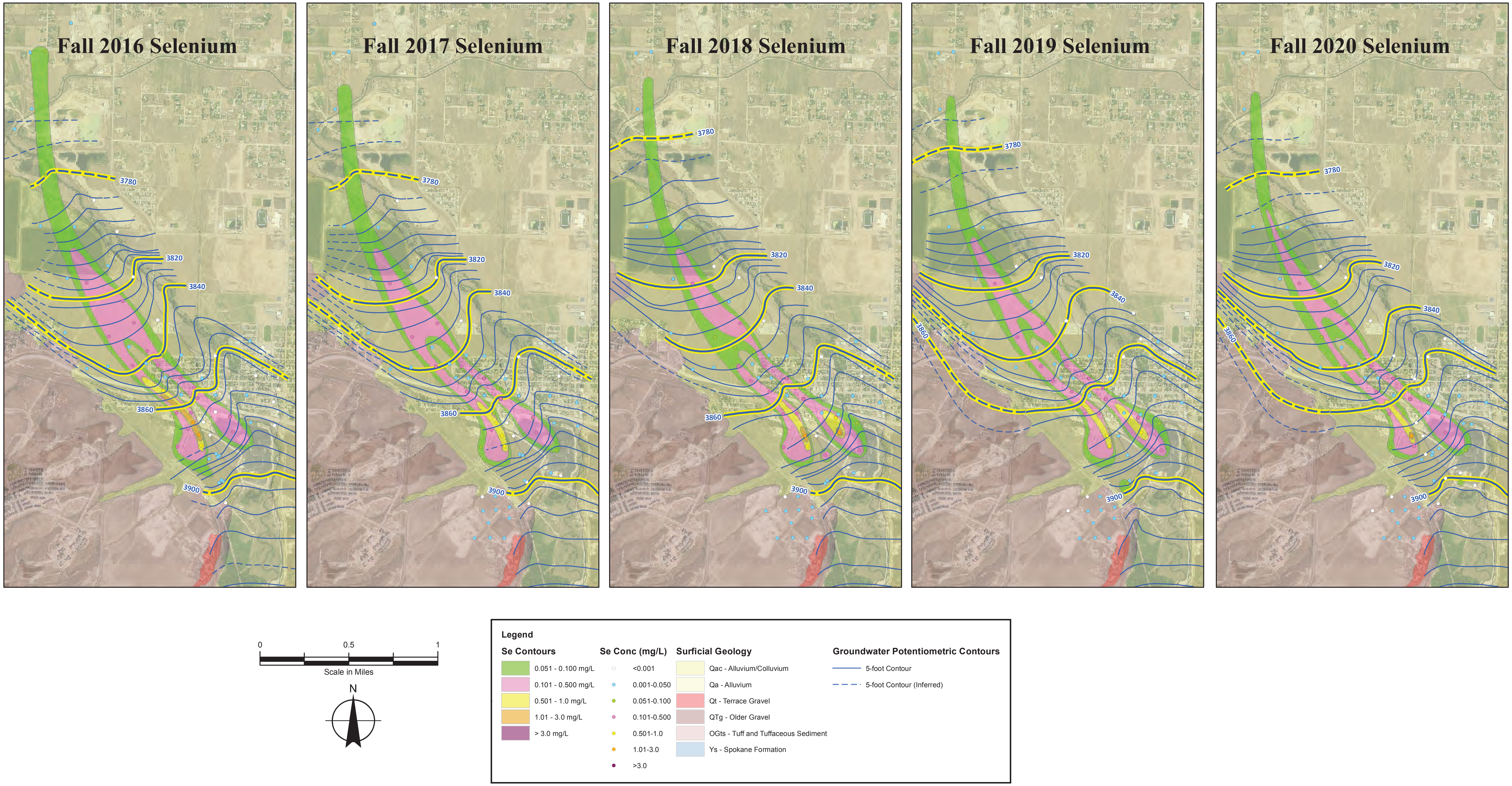

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EAST HELENA FACILITY

2016-2020 GROUNDWATER SELENIUM PLUMES AND POTENTIOMETRIC CONTOURS
EAST HELENA FACILITY

FIGURE
3-3

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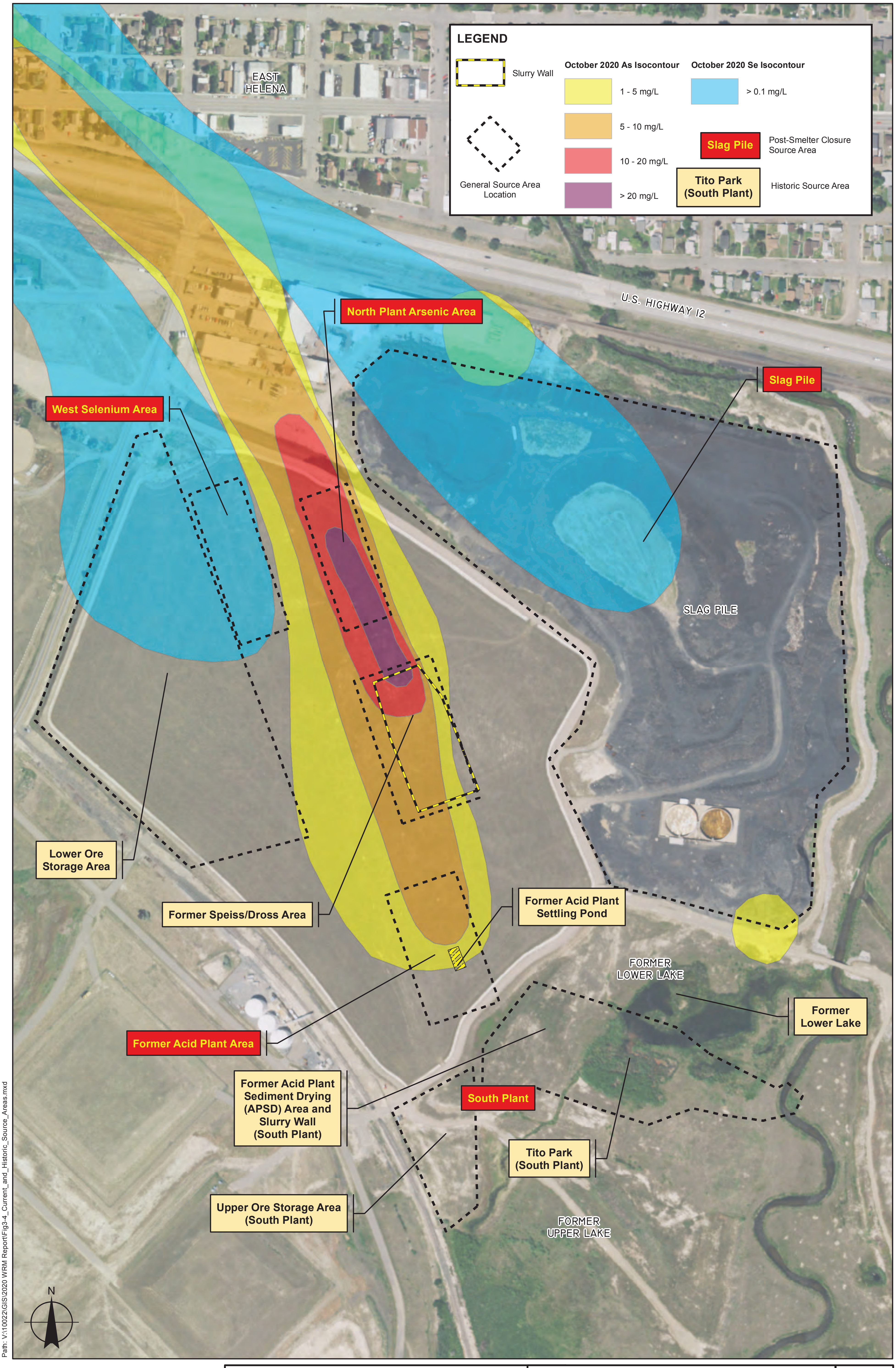

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2020 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

HISTORIC AND POST-SMELTER CLOSURE GROUNDWATER CONTAMINANT SOURCE AREAS

FIGURE 3-4

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 further 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 COEH, with a more diffuse (lower concentration) plume extending north of 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 in the 15 to 40 mg/L range immediately north of the wall in the North Plant Arsenic 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.

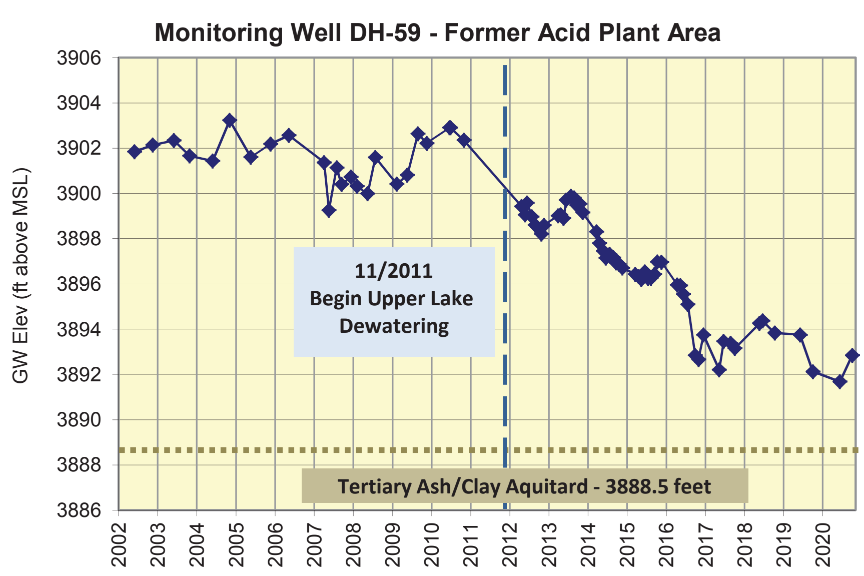
The selenium plume (Figure 3-3) extends offsite significantly further than the arsenic plume, due to a lower rate of geochemical attenuation (adsorption or coprecipitation) and the associated relatively conservative transport behavior of selenium, with the 0.05 mg/L (HHS) selenium plume extending approximately two 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).

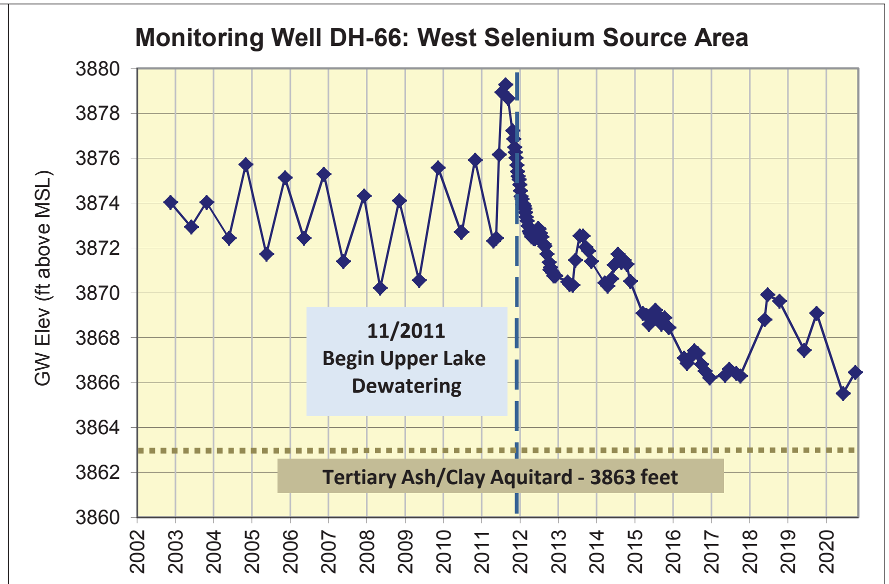
3.3.2 Groundwater Level and Concentration Trends

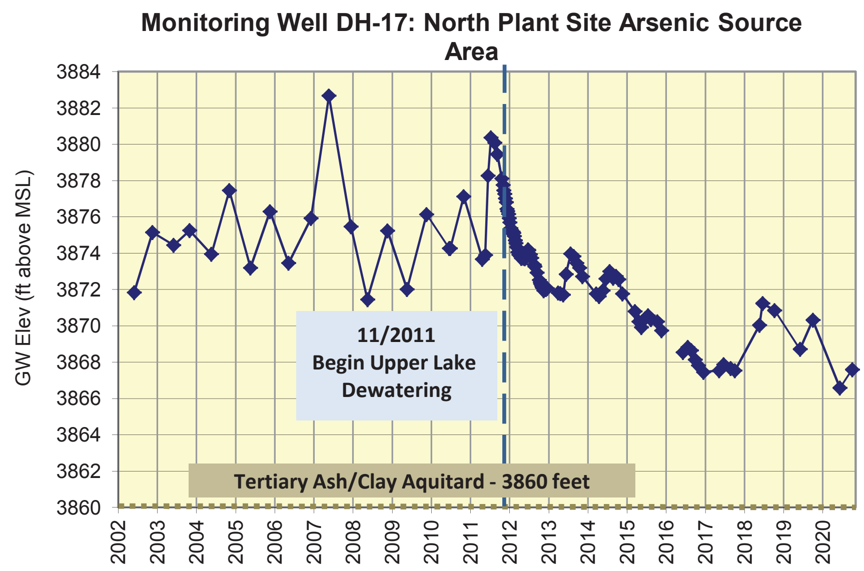
3.3.2.1 Groundwater Level Trends

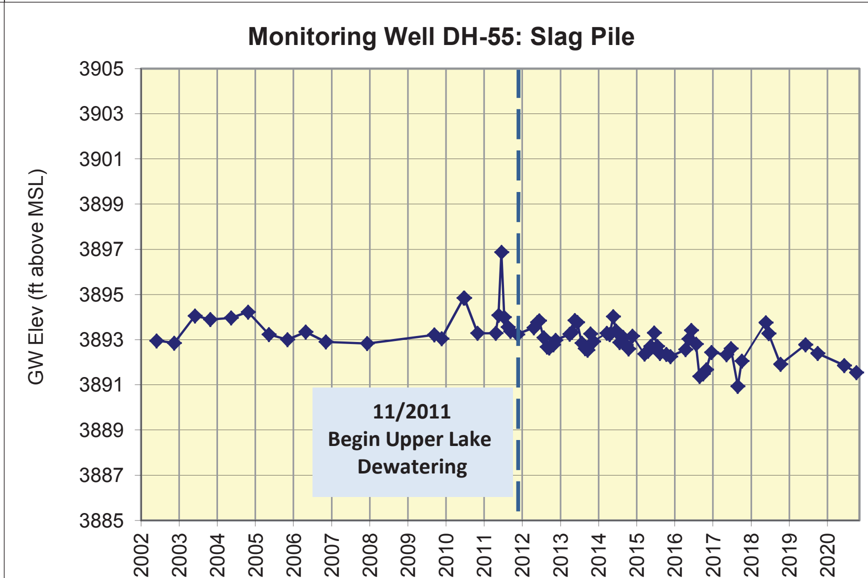
Groundwater level trends on the Facility are of particular interest since reducing groundwater levels is a large component of the corrective measures program. As previously noted, the main objective of the SPHC IM is to reduce groundwater levels on the Facility, thereby reducing groundwater interaction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

Appendix B includes the 2020 manual groundwater level measurements from the project area (in addition to the manual measurements, approximately 30 of the project area monitoring wells are instrumented for continuous water level recording). Figure 3-5 includes groundwater 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 SPHC IM and other IM-related activities. Groundwater levels in the Acid Plant Area, illustrated by well DH-59, have declined by about 8 to 10 feet from typical pre-2012 levels, prior to SPHC IM initiation, through 2020. Similarly, the hydrograph for well DH-66 shows that water levels in the West Selenium Source Area have declined about 8 to 9 feet from 2012 through 2020, and in the North plant site Arsenic Source Area (well DH-17), water levels declined about 9 feet through 2020 (Figure 3-5). All three of these locations (DH-59, DH-66, and DH-17) also show the transitory effects of elevated 2018 and 2019 precipitation and snowpack (Section 3.1.1) on groundwater levels, illustrated by the temporary increase in water levels observed in 2018 and 2019, followed by a decrease to near-minimum values in 2020 (Figure 3-5).









2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**GROUNDWATER LEVEL HYDROGRAPHS FROM FACILITY SOURCE AREA MONITORING WELLS**	**FIGURE 3-5**

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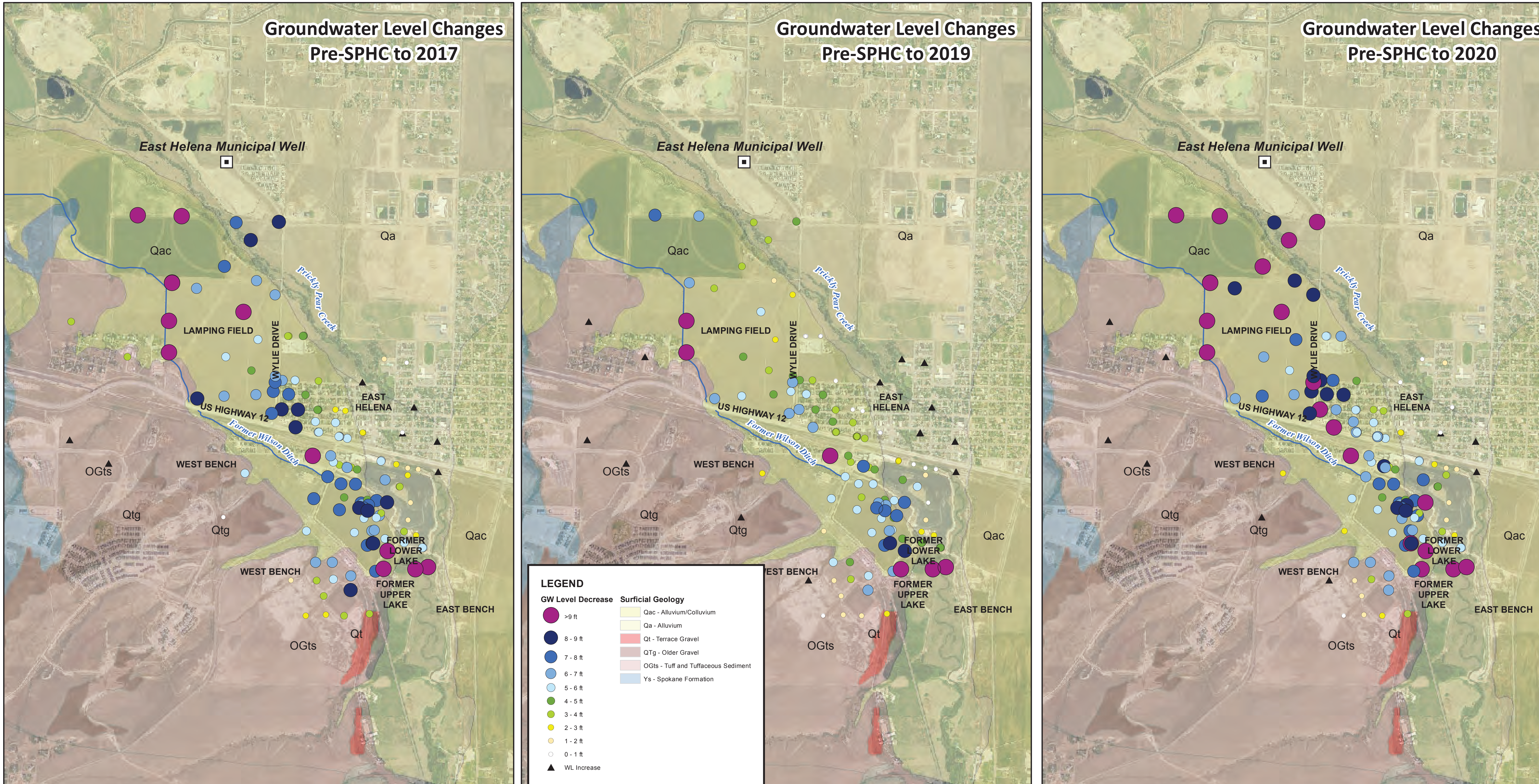
In contrast to the Acid Plant, West Selenium, and North Plant Arsenic source area water level declines, water levels beneath the slag pile (well DH-55), have shown little or no change in response to the SPHC IM. Groundwater levels in the eastern portion of the Facility (i.e., beneath the slag pile), are controlled by the relatively constant Prickly Pear Creek stage while water levels at the other locations were historically heavily influenced by the former Upper Lake, which was drained as part of the SPHC IM.

The IM-induced groundwater level declines between 2012 and 2020 have resulted in the desaturation of some of the most contaminated Facility soils, thereby reducing groundwater interactions with and contaminant leaching from these soils. The Figure 3-5 hydrographs include the elevation of the Tertiary ash/clay layer representing the base of the plume-bearing upper alluvial groundwater system at each location. In the former Acid Plant area, groundwater elevations have decreased from about 3901 feet AMSL to about 3893 feet as of October 2020 with the ash/clay layer at about 3889 feet. This represents a decrease in saturated thickness from 12 feet to 4 feet in this source area. The reduced saturated thickness, and relatively consistent hydraulic gradient over that time, represents an approximate 66% 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 70% and 55%, 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.

Figure 3-6 summarizes groundwater elevation changes throughout the project area since inception of the CM/IM program in 2011. The figure shows water level changes since the inception of the CM/IM program compared to the 2017, 2019, and 2020 data sets, to demonstrate not only the effects of the IM program, but also the short-term effects of the exceptionally high precipitation experienced in 2018 and 2019, and the lower precipitation observed in 2020. Groundwater levels throughout much of the study area have declined since 2011 with the largest declines (>9 feet) as of 2020 occurring in the south plant area, the western portion of East Helena, the north and west portions of Lamping Field, and the area north of Lamping Field. As noted in previous WRM reports, groundwater level declines in the south plant area are due mainly to elimination of former Upper and Lower Lake as part of the SPHC IM, and in the western portion of Lamping Field in response to decommissioning of Wilson Ditch, formerly a significant seasonal source of groundwater recharge (Figure 3-6). Water level fluctuations in the northernmost wells are a function of both precipitation/recharge patterns and other non-project related land use practices such as groundwater pumping and irrigation practices (Hydrometrics, 2018). In addition to desaturating remaining contaminated soils, the larger declines in the south plant area have also decreased the hydraulic gradient, and thus the groundwater flux and associated contaminant load, leaving the plant site. The larger declines along the west side of Lamping Field are responsible for the slight westward shift observed in the selenium plume since 2012.

Also apparent in Figure 3-6 is the increase in groundwater levels from 2017 to 2019, and the subsequent decrease in 2020, on both the plant site and even more so downgradient (to the north).



NOTE: Groundwater level changes calculated as the difference between 2002 -2010 average elevations (pre-SPHC) and 2017/2019/2020 average elevations.

0 0.25 0.5 0.75
Scale In Miles

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2020 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

PROJECT AREA
GROUNDWATER LEVEL CHANGES
2017, 2019, AND 2020

FIGURE
3-6

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The variations in plant site water levels are believed to be due primarily to the relatively high 2018 and 2019 precipitation and the relatively low 2020 precipitation, while the northernmost water levels are influenced by seasonal precipitation patterns as well as the other non-project related land use practices noted above. Figure 3-6 also shows the relatively small water level declines (1 to 3 feet) recorded in the eastern portion of the plant site beneath the slag pile, and similar small declines or slight water level increases north of the plant site in East Helena. This last observation exemplifies the influence of Prickly Pear Creek on the local groundwater flow and plume migration patterns with groundwater quality impacts from the former smelter primarily restricted to areas west of the creek. Overall water level increases over time have also been observed at most of the wells to the west, completed in Tertiary sediments.

3.3.2.2 Groundwater Concentration Trends

Remediation phase performance trend evaluation currently focuses on the primary COCs at the Facility (arsenic and selenium), as well as the indicator geochemical parameters sulfate and chloride, and groundwater levels. Monitoring wells included in the concentration trend analysis are located in three primary areas of interest: (1) the Facility source areas, including the Acid Plant area, slag pile area, 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 3-5 and are shown on Figure 3-7. 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 2011-2020).

The complete set of arsenic and selenium trend plots for the trend analysis wells are shown on Figures 3-8 and 3-9 with additional constituent graphs (chloride and sulfate) 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 shown on Figures 3-8 and 3-9 and presented in Appendix C, arsenic and selenium concentration trends are summarized below.

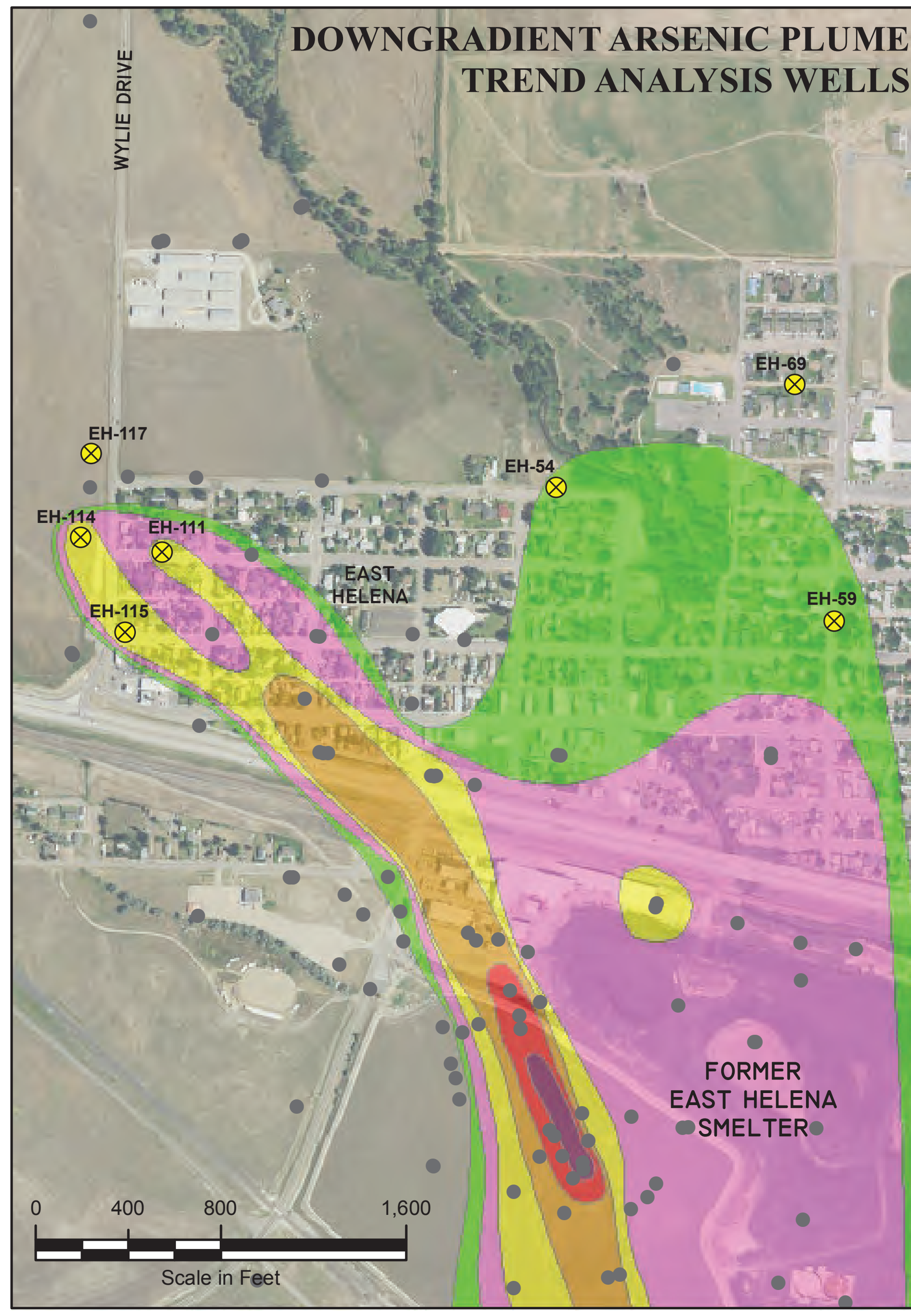
Acid Plant Area

In the Acid Plant area, arsenic concentrations have decreased at well DH-42 during both the 2002 to 2011 RFI phase and 2012 to 2020 IM/CM phase (Figure 3-8). This well was dry during the scheduled October 2020 monitoring event; however, since 2012, arsenic at DH-42 decreased from 3.89 mg/L in June 2012 to 2.07 mg/L in October 2019. Selenium trends at DH-42 have been more variable (Figure 3-8), but overall concentrations have been lower during the IM/CM period (0.016 to 0.094 mg/L) compared with the RFI period (0.067 to 0.221 mg/L). 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 subsequently decreased slowly to its lowest level on record, 8.51 mg/L, in October

Table 3-5. 2020 Concentration Trend Analysis Monitoring Wells

2020 Water Resources Monitoring Report - East Helena Facility

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



2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**2020 PERFORMANCE EVALUATION TREND ANALYSIS MONITORING WELLS**	**FIGURE** 3-7

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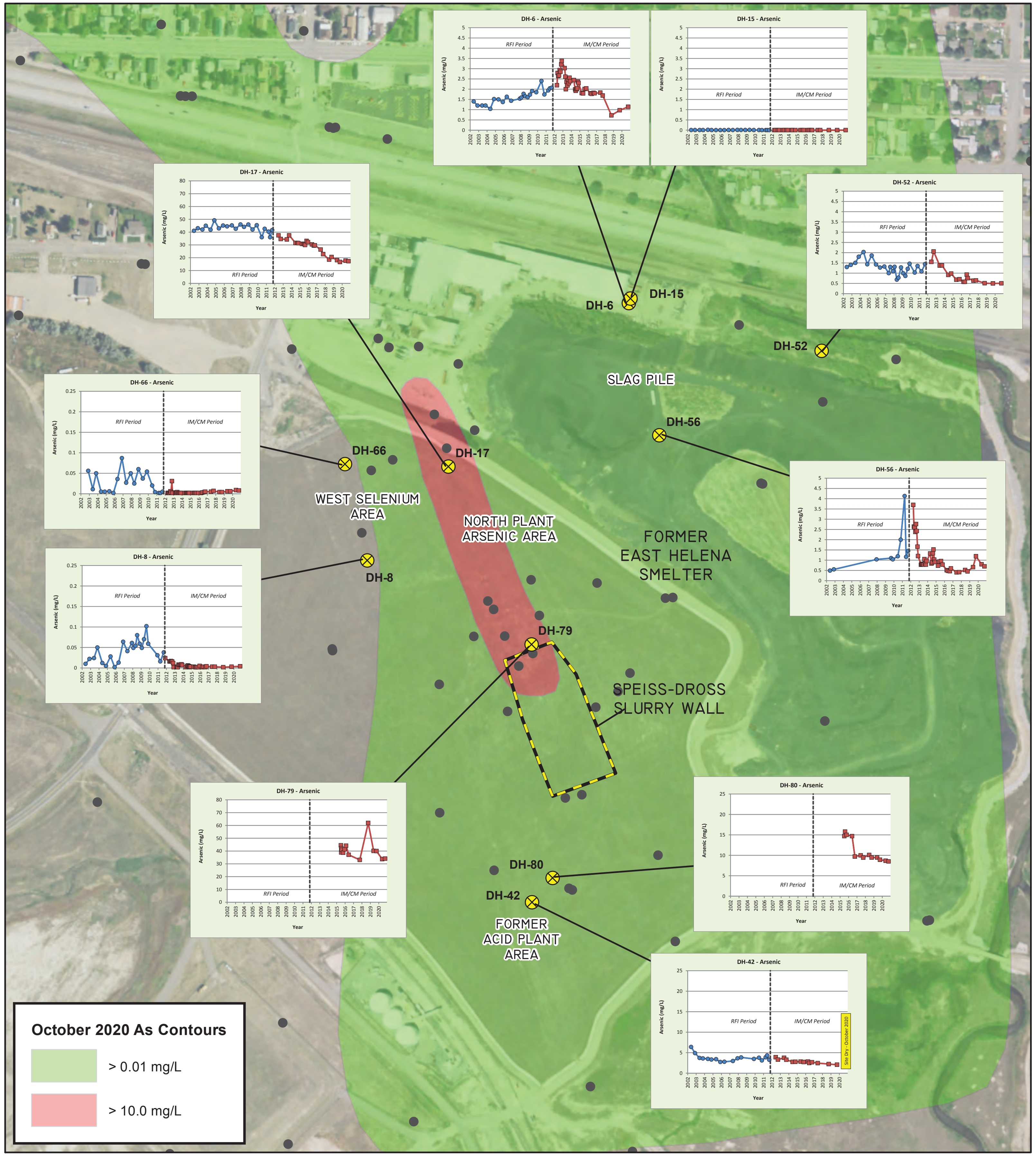
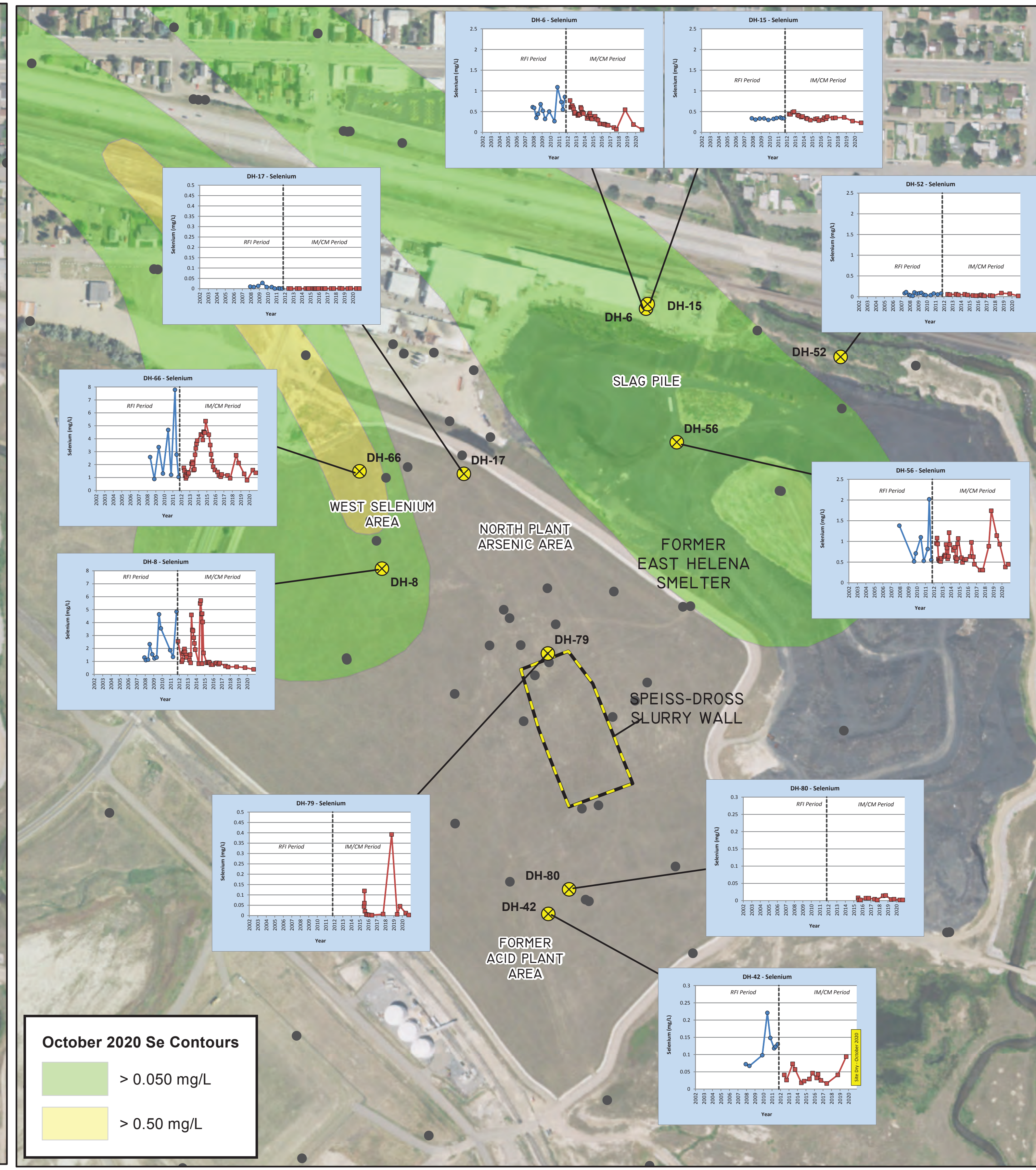


PLANT SITE SOURCE AREA ARSENIC TRENDS



PLANT SITE SOURCE AREA SELENIUM TRENDS

N

0 200 400

Feet

NOTE: Arsenic trend graphs have green background; selenium trend graphs have blue background

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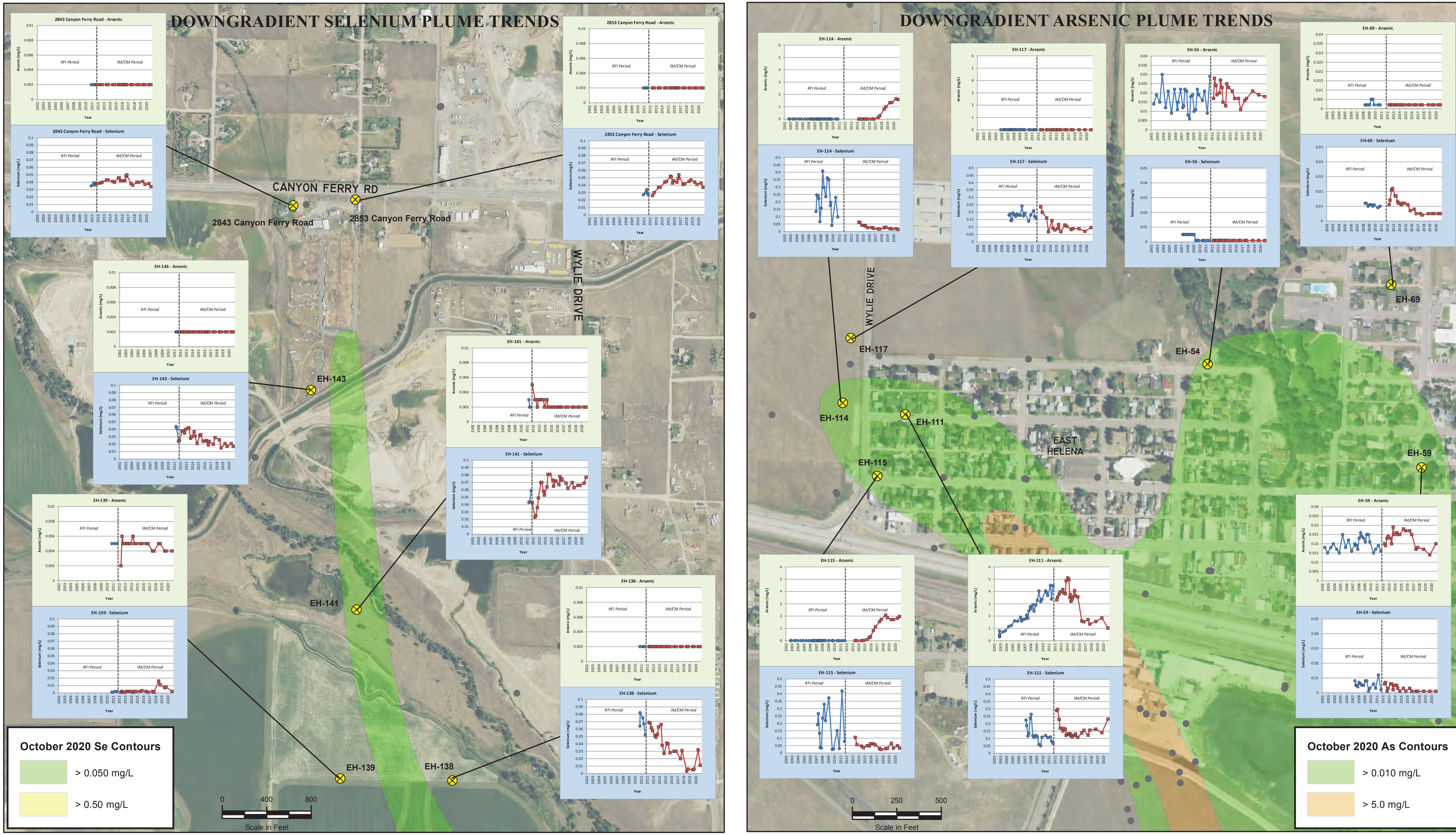
2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2020 PERFORMANCE EVALUATION TRENDS PLANT SITE AREA	FIGURE 3-8



NOTE: Arsenic trend graphs have green background; selenium trend graphs have blue background

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2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2020 PERFORMANCE EVALUATION TRENDS DOWNGRADIENT SELENIUM AND ARSENIC PLUME AREAS	FIGURE 3-9

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2020 (Figure 3-8). The selenium concentration at DH-80 increased slightly from 0.002 to 0.015 mg/L in 2018, presumably in response to short-term increase in groundwater levels and possible associated changes in geochemical conditions, before decreasing again to 0.003 mg/L in 2019 and 0.002 mg/L in 2020. Sulfate concentrations at well DH-80 also reached the minimum value observed to date in 2020 (Appendix C).

Slag Pile Area

Concentration trend plots for slag pile area wells DH-6, DH-15, DH-52, and DH-56 are included in Figure 3-8 and Appendix C. Arsenic concentrations at all four wells were either stable or increased during the RFI phase, and have decreased during the 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 1.14 mg/L in October 2020, and DH-56 decreased from 3.7 to 0.698 mg/L arsenic from 2012 to 2020 (66% and 81% reductions, respectively) (Figure 3-8). The arsenic concentration at DH-56 showed a temporary increase from 2017 to 2019 (0.416 to 1.19 mg/L), followed by a subsequent decrease to 0.698 mg/L in 2020, most likely due to the above average precipitation recorded in 2018 and 2019.

Selenium concentrations at slag pile wells DH-6 and DH-56 decreased in 2019 and 2020 after showing notable increases in 2018 (Figure 3-8). At DH-6, the 2018 selenium peak concentration of 0.545 mg/L has decreased to 0.068 mg/L in 2020, while the 2018 peak at DH-56 (1.74 mg/L) has decreased to 0.445 mg/L; the 2020 selenium concentrations are near-minimum values for DH-6 and DH-56. Similar trends also occurred for indicator parameters chloride and sulfate at these two wells (Appendix C), indicative of a slag pile source. Similar to arsenic at well DH-80 described above, the increase is believed to be attributable to the above average precipitation in 2018 and 2019, with saturation of the slag pile base and/or increased infiltration through the slag pile being potential leaching and transport mechanisms. Both DH-6 and DH-56 showed groundwater level increases of about 3 to 5 feet in 2018 and 2019, relative to 2017, with a subsequent decrease in 2020 to elevations similar to 2017. It should be noted that the slag pile is scheduled to be regraded and capped in the near future, to reduce infiltration through the pile.

West Selenium Area

Concentration trend plots for West Selenium Area wells DH-66 and DH-8 are shown on Figure 3-8 and 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. Concentrations increased slightly in 2020 to 0.008-0.009 mg/L arsenic at DH-66 and 0.004 mg/L at DH-8. Selenium concentrations at wells DH-8 and DH-66 were highly variable historically, ranging from 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 (Figure 3-8). Selenium concentrations at DH-66 did spike in June 2018 (2.72 mg/L) but have since decreased to a range of 0.786 mg/L (the minimum recorded concentration at this well) to 1.57 mg/L in 2019 and 2020. The groundwater level in well DH-66 peaked at about 3870 feet in early July 2018, the highest level recorded since 2014, which may be related to the 2018 spike in selenium concentration. The October 2020 selenium concentration at DH-8, 0.382 mg/L, was also the minimum concentration recorded at that well.

North Plant Source Area

Arsenic and selenium trend plots for North Plant Area wells DH-17 and DH-79 are shown on Figure 3-8. Arsenic concentrations at DH-17 remained near historic minimum concentrations (17.3 to 17.7 mg/L), approximately one-third the RFI phase concentrations of 40 to 50 mg/L. Arsenic concentrations at well DH-79, located immediately north (downgradient) of the Speiss/Dross slurry wall, decreased to 33.7 to 34.1 mg/L in 2020 after spiking to 62 mg/L in 2018 and decreasing to about 40 mg/L in 2019. Selenium concentrations remained low at DH-17 in 2020 (<0.001 mg/L) while concentrations at DH-79 decreased to 0.003 to 0.012 mg/L after spiking to 0.39 mg/L in October 2018 (Figure 3-8). Similar to some other plant source area wells, the 2018 concentration spikes at well DH-79 may have been related to short-term water level increases at this well observed during 2018. Sulfate and chloride concentrations have been stable at wells DH-17 and DH-79 in the IM/CM period, after decreasing throughout the RFI period (Appendix C).

Downgradient Concentration Trends

Arsenic and selenium 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, are shown on Figure 3-9 with additional plots (chloride and sulfate) in Appendix C. Well EH-111, which has historically represented the furthest downgradient extent of arsenic concentrations greater than 1 mg/L (with maximum concentrations in the 5 mg/L range), has shown a significant decrease from 2015 through 2020. The October 2020 arsenic concentration at EH-111 (1.03 mg/L) is approximately 80% lower than the peak concentration of 5.1 mg/L in February 2014. Selenium concentration ranges at EH-111 in the RFI period (0.050 to 0.263 mg/L) are slightly lower than IM/CM period concentrations (0.170 to 0.296 mg/L), although no consistent trend in selenium concentration is apparent. Sulfate concentrations at EH-111 have increased during the IM/CM period, while chloride has decreased and stabilized (Appendix C). The overall water quality trends at EH-111 suggest a potential increasing influence from the slag pile (a high sulfate source) in the IM/CM period, evidence of a westward plume shift in this area.

Water quality trends at wells EH-114 and EH-115 (south and west of EH-111; Figure 3-9) also 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 significantly at both wells and selenium concentrations have decreased to near or below the 0.05 mg/L maximum contaminant level (MCL) (Figure 3-9), while sulfate concentrations have increased (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. The arsenic concentrations at both of these wells are currently between 1.5 and 2.0 mg/L; concentrations at EH-115 appear to have stabilized over the last several years.

In the eastern, lower concentration portion of the arsenic plume, arsenic concentrations are currently between 0.018 and 0.020 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, with selenium concentrations at all three wells currently 0.005 mg/L or less.

Trend analysis 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 3-9). 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, with the available data indicating the following:

- Arsenic: concentrations in the downgradient area are consistently low, ranging from <0.002 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 0.011 to 0.016 mg/L in 2018, due to the slight westward plume shift. The concentration has since decreased to 0.002 mg/L as of October 2020.
  - At well EH-138, located along the east side of the plume between the plume and East Helena municipal well #3, the selenium concentration has decreased from a range of 0.052 to 0.082 mg/L in 2010-2011 (immediately after well installation), to 0.011 mg/L in October 2020; the overall decreasing trend has been interrupted by occasional temporary concentration increases such as those in 2014 and 2020 (Figure 3-9; Appendix C).
  - At the other wells defining the downgradient selenium plume (2843 and 2853 Canyon Ferry Road wells, EH-141, EH-143), selenium concentrations have generally shown slight to moderate decreasing trends over the last 5 to 8 years (Figure 3-9), accompanied by similar trends in the indicator parameters chloride and sulfate (Appendix C). The October 2020 selenium concentration at 2843 Canyon Ferry Road (0.034 mg/L) was the lowest recorded to date at this well, and the October 2020 selenium concentration at 2853 Canyon Ferry Road of 0.037 mg/L is the lowest observed since 2013, and represents a decrease of about 30% from the 2016 maximum of 0.054 mg/L. As of October 2020, the selenium concentration exceeded the 0.05 mg/L groundwater standard in only one downgradient trend analysis well, EH-141 at 0.077 mg/L.

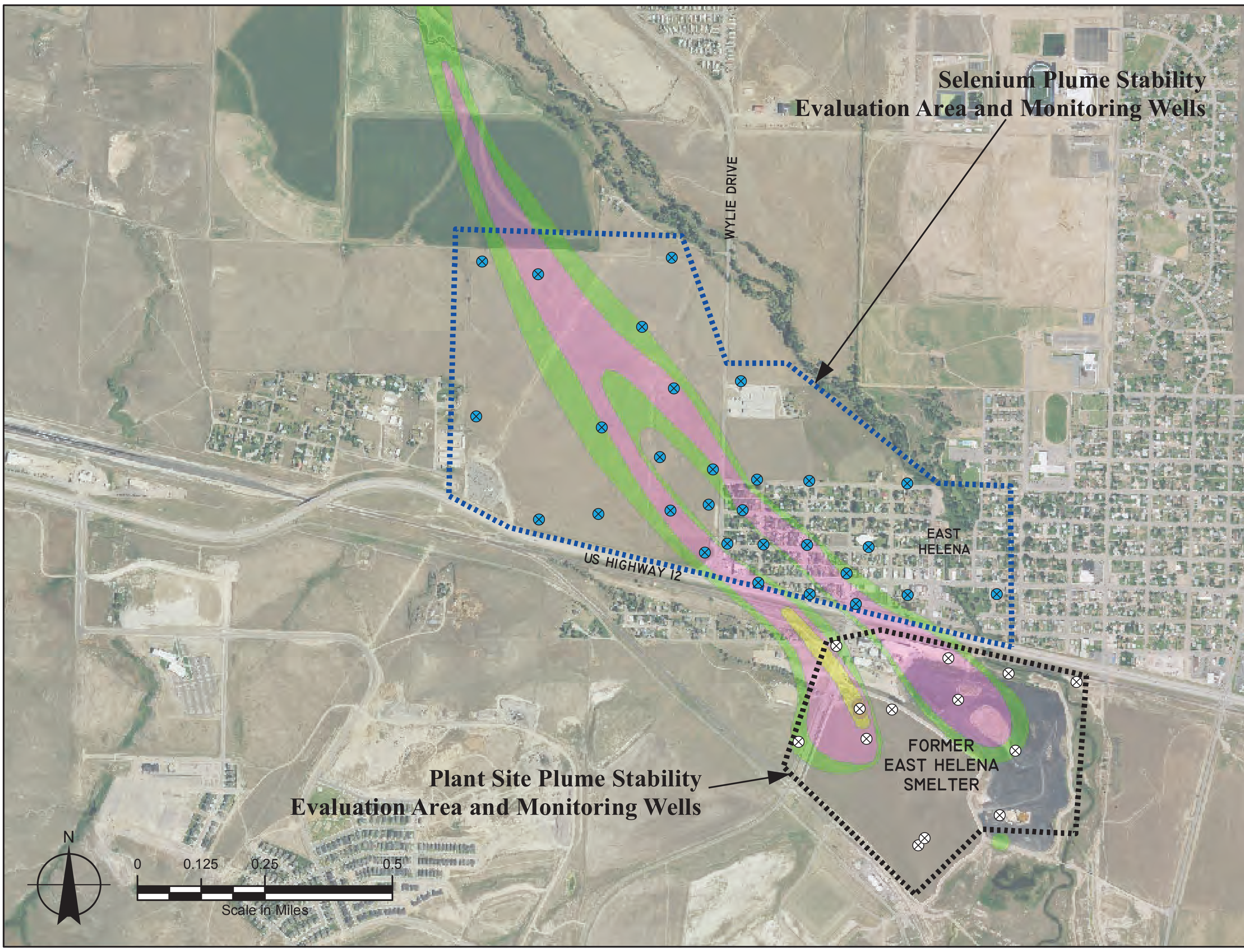
Overall, arsenic and selenium concentrations show decreasing trends at most source area and downgradient wells during the IM/CM period (post-2011). The short-term increases noted at some source area wells in 2018 are believed to be due to well above average precipitation rates in 2018 and associated groundwater level changes, with concentrations at most of those wells decreasing in 2019 and 2020. The slight to moderate decreasing selenium concentration trends exhibited at downgradient wells are due to a slight westward shift in the plume as well as an overall decrease in downgradient selenium groundwater loads and concentrations. Based on these trends, the downgradient extent of the selenium plume in 2020 has receded by approximately 1400 feet compared with 2016 (see Figure 3-3).

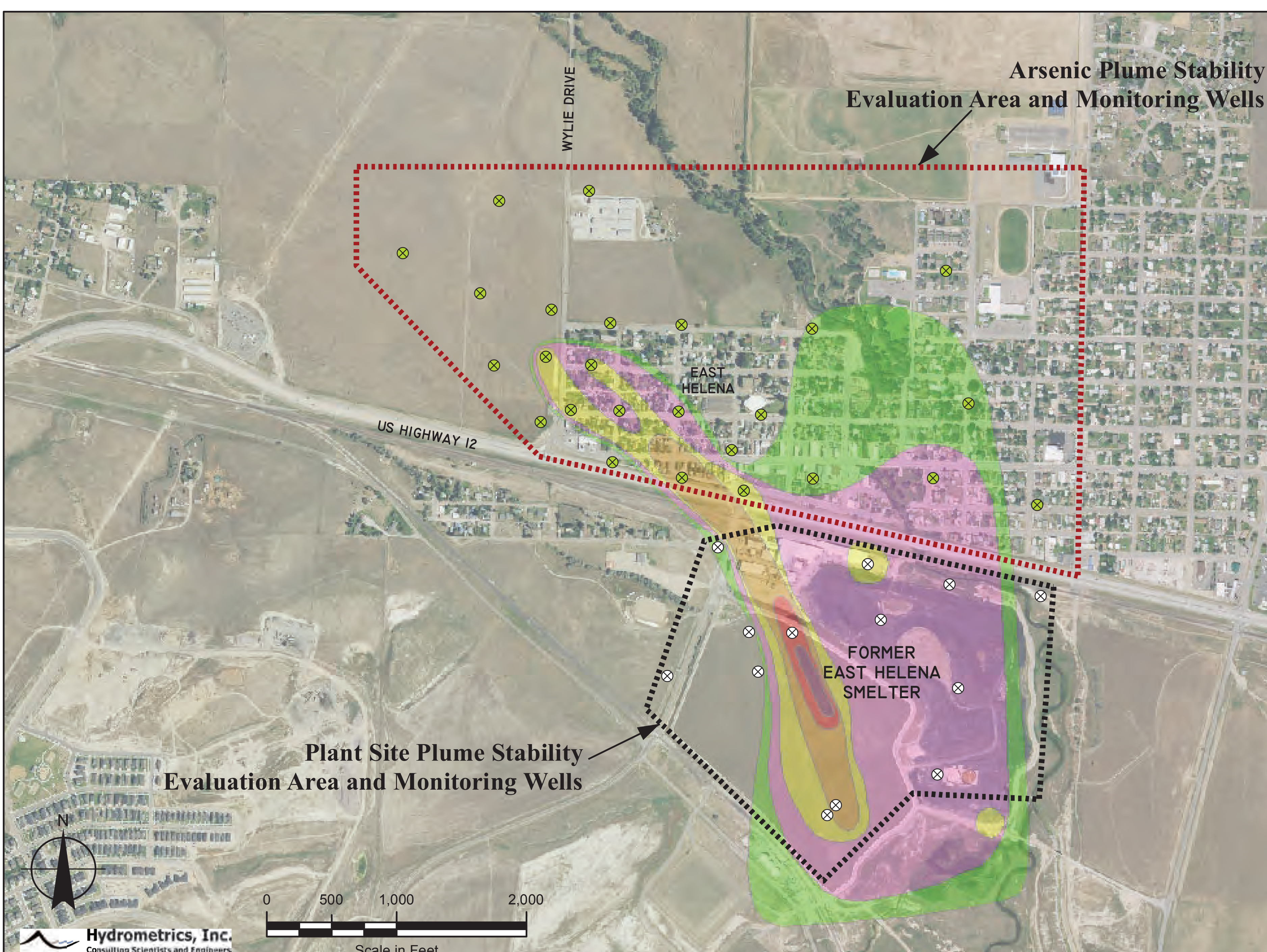
3.3.3 Contaminant Plume Stability

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 on the former plant site and 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. As in previous years, for the purposes of remediation phase performance evaluation monitoring described in the 2020 CAMP, arsenic and selenium plume areas on the former smelter site ("plant site plume stability"), and in the near downgradient areas in the COEH 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 3-10.
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 3-10 and summarized in Table 3-6. 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.





2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**2020 PLUME STABILITY EVALUATION AREAS AND MONITORING WELLS**	**FIGURE** **3-10**

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Table 3-6. 2020 Plume Stability Analysis Monitoring Wells
2020 Water Resources Monitoring Report - East Helena Facility

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

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

**Well DH-7 is not sampled; data from nearby well EH-58 (700' north) is used to approximate the concentration at DH-7 for plume stability calculations.

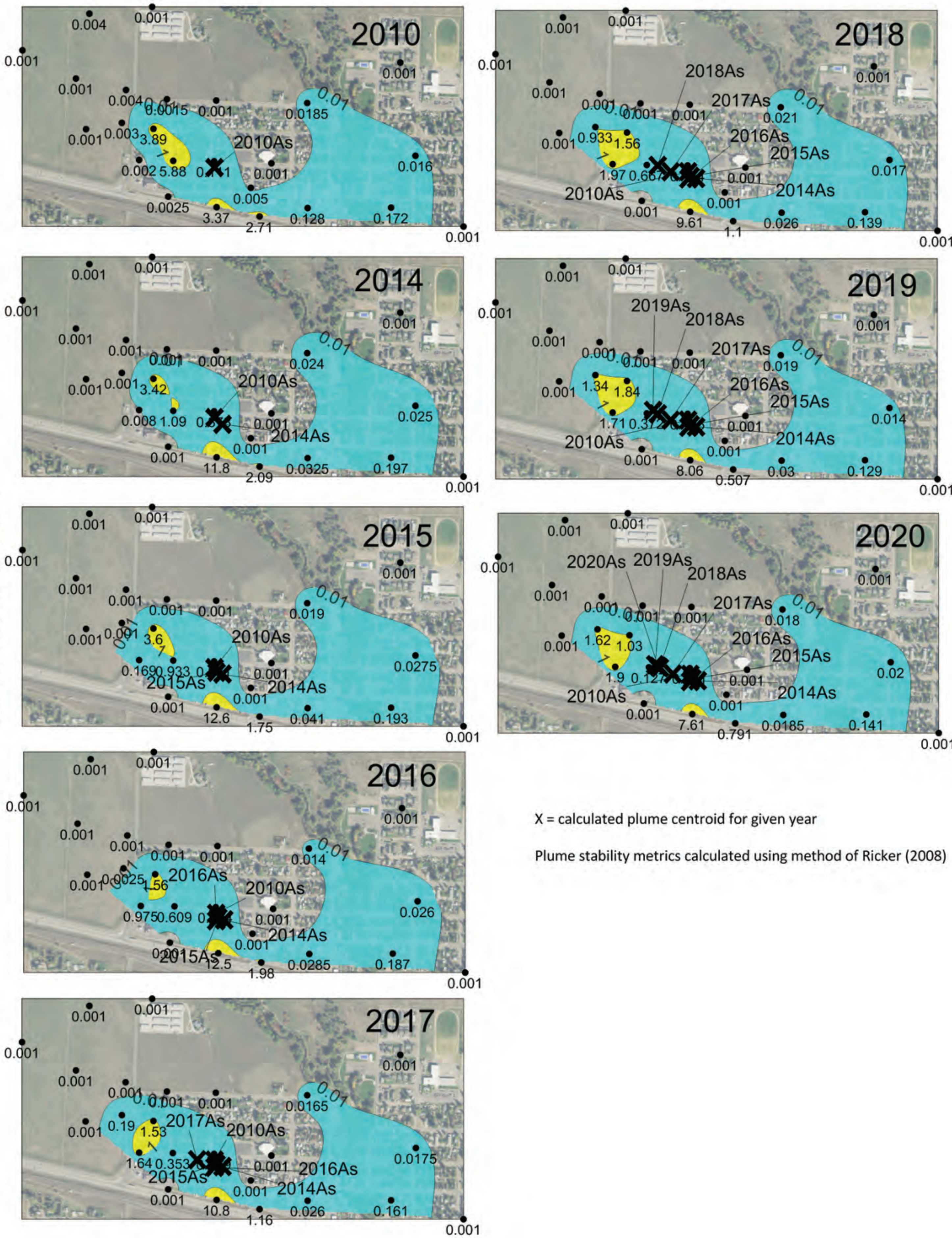
Calculated values are then compared over time to determine any trends in total plume area or average plume concentration. In addition, Ricker (2008) notes that for shrinking plumes, the plume centroid of concentration (or mass) should recede toward the source over time; if the plume is transient (migrating 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 3-6, off-site arsenic and selenium plume stability metrics have been calculated for monitoring years 2010 (representing conditions prior to implementation of IMs), and 2014 through 2020 (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), and 2016 through 2020 (during IM implementation).

3.3.3.1 Arsenic Plume Stability Results

The arsenic plume stability analysis results are summarized on Figure 3-11, 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 each year evaluated. The overall plume area with arsenic concentrations above the 0.01 mg/L groundwater standard is virtually unchanged from 2010 to 2020 (66 acres) with relatively minor variability during intervening years. Average arsenic concentrations within the 0.01 mg/L contour have slightly declined from 0.203 mg/L in 2010 to 0.173 mg/L in 2020; the overall range of average concentrations observed since 2010 is relatively narrow (0.167 to 0.211 mg/L), and the overall trend is essentially flat. The locations of the calculated plume centroids show a distinctive westward shift from 2010 through 2020 (Figure 3-11).

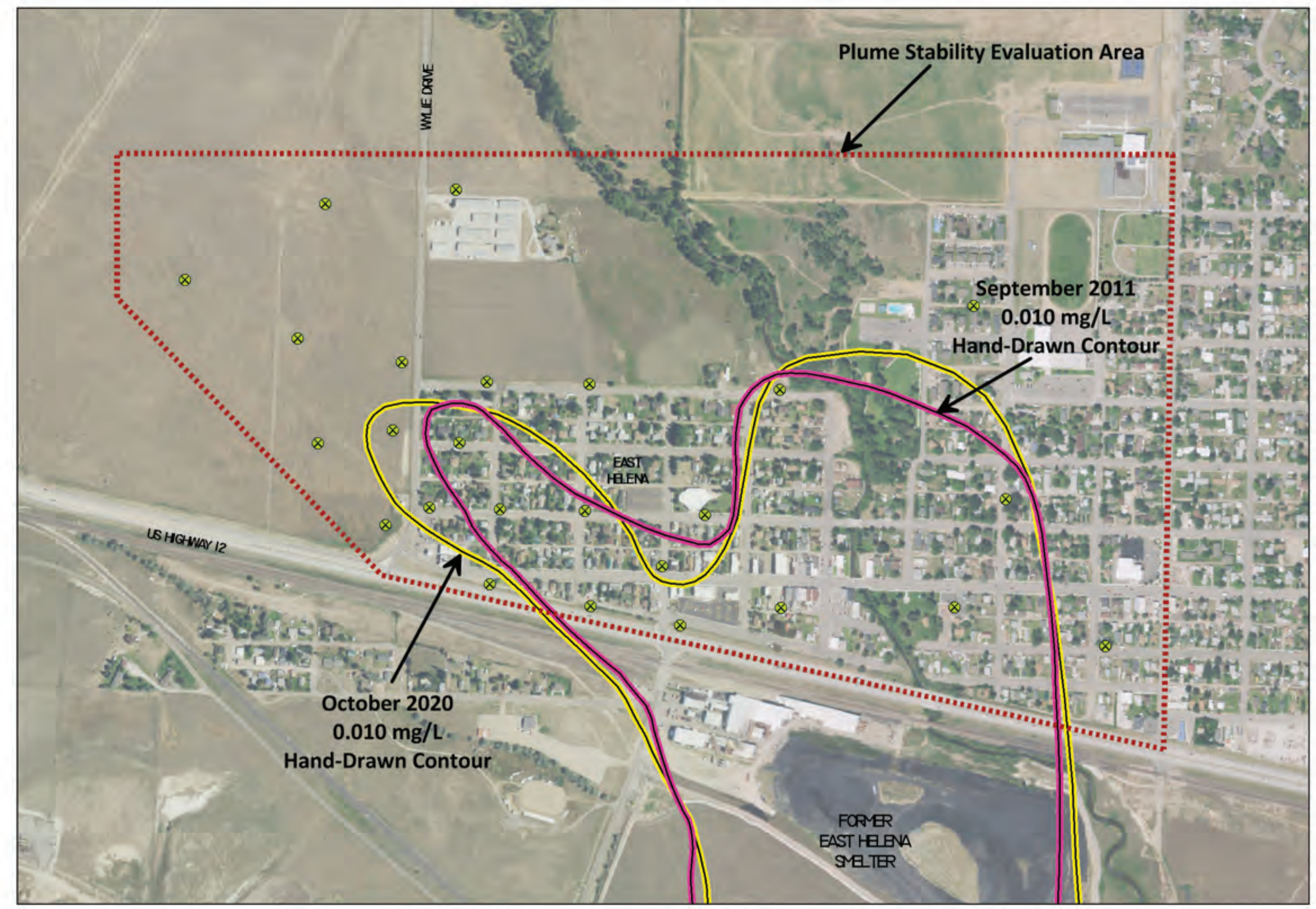
Overall, the arsenic plume stability metrics suggest that the arsenic plume is relatively stable with a slight westward shift in the plume centroid over time attributable to the decommissioning of Wilson Ditch and associated loss of a recharge source west of the plumes (Section 3.3.2.1). The relatively stable downgradient plume area and concentrations is not unexpected. As noted in previous studies (Hydrometrics, 2016), although the plant site arsenic concentrations have decreased significantly since inception of the IM/CM program in 2010 (see Section 3.3.3.3), downgradient concentrations are not expected to decrease significantly in the near future due to the release of adsorbed arsenic from the downgradient soils. By decreasing the plant site concentrations and arsenic loading to downgradient soils however, the completed IMs are intended to prevent future advancement of the downgradient arsenic plume. The arsenic plume stability results are generally consistent with observations based on preparation of hand-drawn arsenic isocontour maps. The fall 2011 and fall 2020 0.01 mg/L hand-drawn arsenic contours shown on Figure 3-11 illustrate the stability in overall plume area, along with the recent shift to the west in the higher concentration western portion of the arsenic plume.



X = calculated plume centroid for given year

Plume stability metrics calculated using method of Ricker (2008)

Year	Planar Area (acres)	Average Arsenic Concentration (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
2019	66	0.203
2020	**66**	**0.173**



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2020 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

ARSENIC PLUME STABILITY EVALUATION RESULTS

FIGURE

3-11

3.3.3.2 Selenium Plume Stability Results

Selenium plume stability analysis results are summarized on Figure 3-12. 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 a relatively narrow range of 79 acres in 2017, 74 acres in 2018, 82 acres in 2019, and 79 acres in 2020. Average selenium concentrations showed an overall decrease from 2010 (0.112 mg/L) to 2020 (0.086 mg/L). 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 subsequent years (Figure 3-12). Also apparent in Figure 3-12, particularly in the 2017 through 2020 computer generated plume map, is the apparent fragmentation of the plume between the Facility and Lamping Field. This is attributable to the significant concentration decreases observed in the upgradient West Selenium source area since 2015 (Section 3.3.3.3).

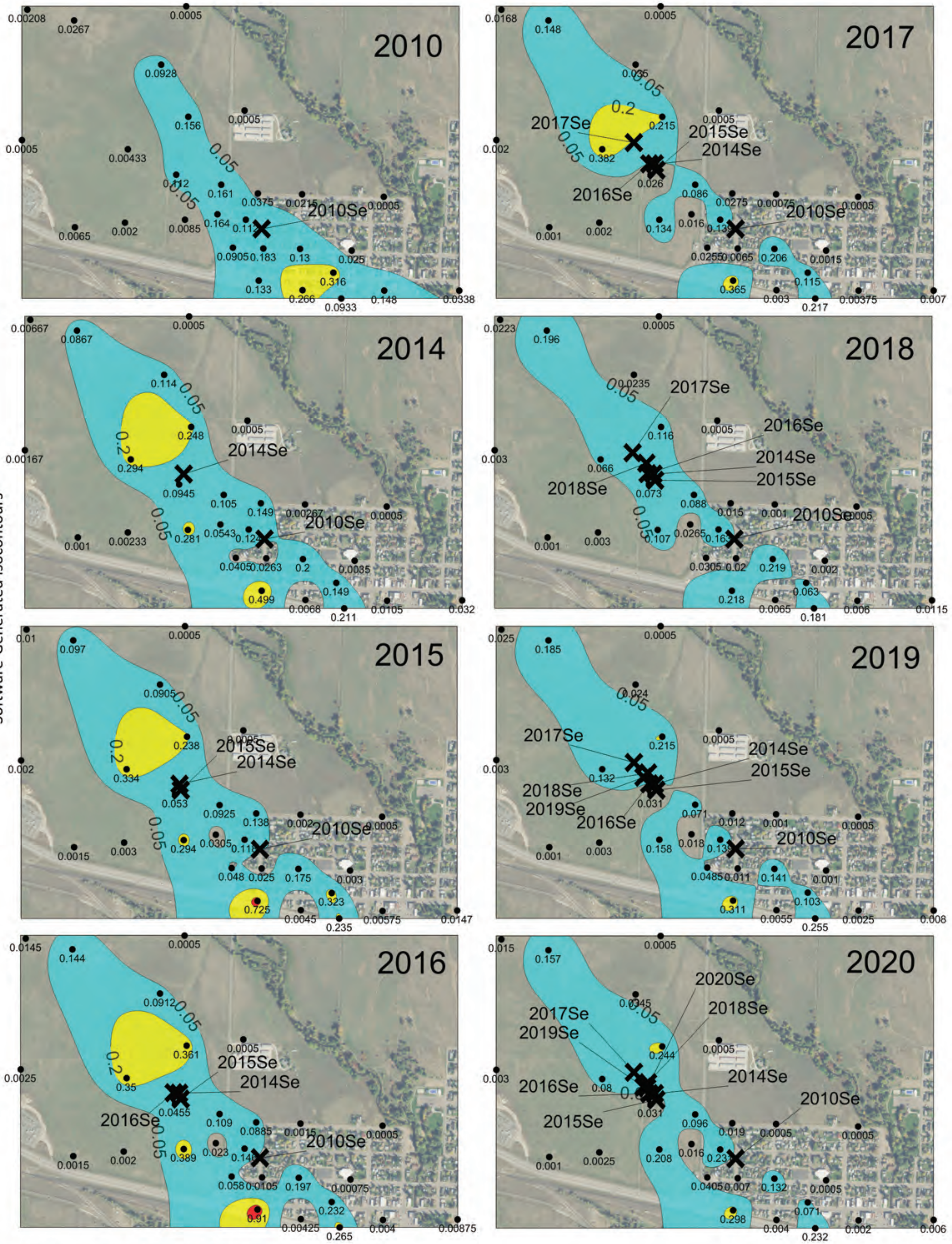
Overall, the downgradient selenium plume metrics shown in Figure 3-12 suggest the plume is receding. The southward migration of the plume centroid since 2017, and retraction of the downgradient plume extent of approximately 1400 feet from 2016 to 2020 (Section 3.3.2.2) both indicate a receding plume. The increase in average concentrations from 2010 to 2016, before decreasing from 2017 to 2020, is consistent with the temporary concentration increases noted at upgradient West Selenium Source well DH-66 (Section 3.3.2.2) through 2014, which is believed to be attributable to remediation construction activities in the area at that time.

3.3.3.3 Plant Site Arsenic and Selenium Plume Stability Results

Plume stability metrics for pre-IM (2010) and post-IM (2016 through 2020) conditions were also calculated for arsenic and selenium, based on data from 13 Facility wells (Table 3-6; Figure 3-13). Plume stability results show a 2010 to 2020 reduction in overall selenium plume area from 67 to 33 acres, and a reduction in the arsenic plume area of 82 to 72 acres. Average concentrations have decreased by approximately 50%, from 0.45 to 0.22 mg/L for selenium, and 2.25 to 1.04 mg/L for arsenic from 2010 to 2020. 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 plume centroid shows little change from 2010 to 2020, while the selenium plume centroid showed a notable eastward shift in 2018-2019, and a shift back to the west in 2020 (Figure 3-13). The recent eastward shift in the selenium plume centroid is due to a greater influence from the slag pile source area as the West Selenium source area concentrations continue to decrease. The slag pile is scheduled to be regraded and partially capped in the near future to address that source.

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. As noted in Section 3.3.2.1, the saturated thickness of the contaminated shallow aquifer has also decreased on the plant site, resulting in decreased mass flux of arsenic and selenium migrating off-site. In time, these trends should result in decreases in the downgradient selenium plume concentrations and extent. For arsenic, the decreasing source area concentrations should eventually translate to decreasing downgradient concentrations, although that process is expected to take much longer for arsenic than

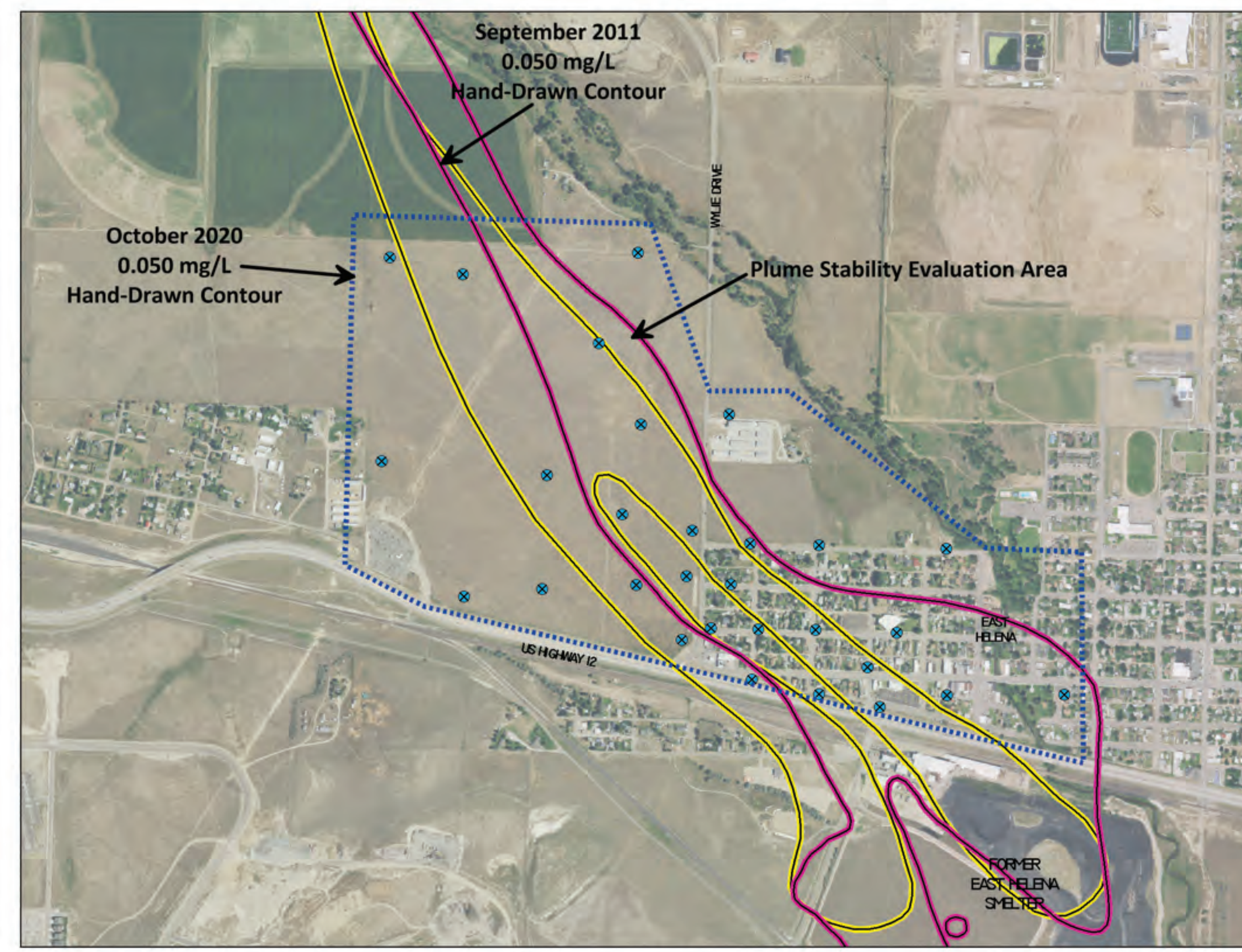
Software-Generated Isocontours



Year	Planar Area (acres)	Average Selenium Concentration (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
2019	82	0.088
2020	**79**	**0.086**

X = calculated plume centroid for given year

Plume stability metrics calculated using method of Ricker (2008)



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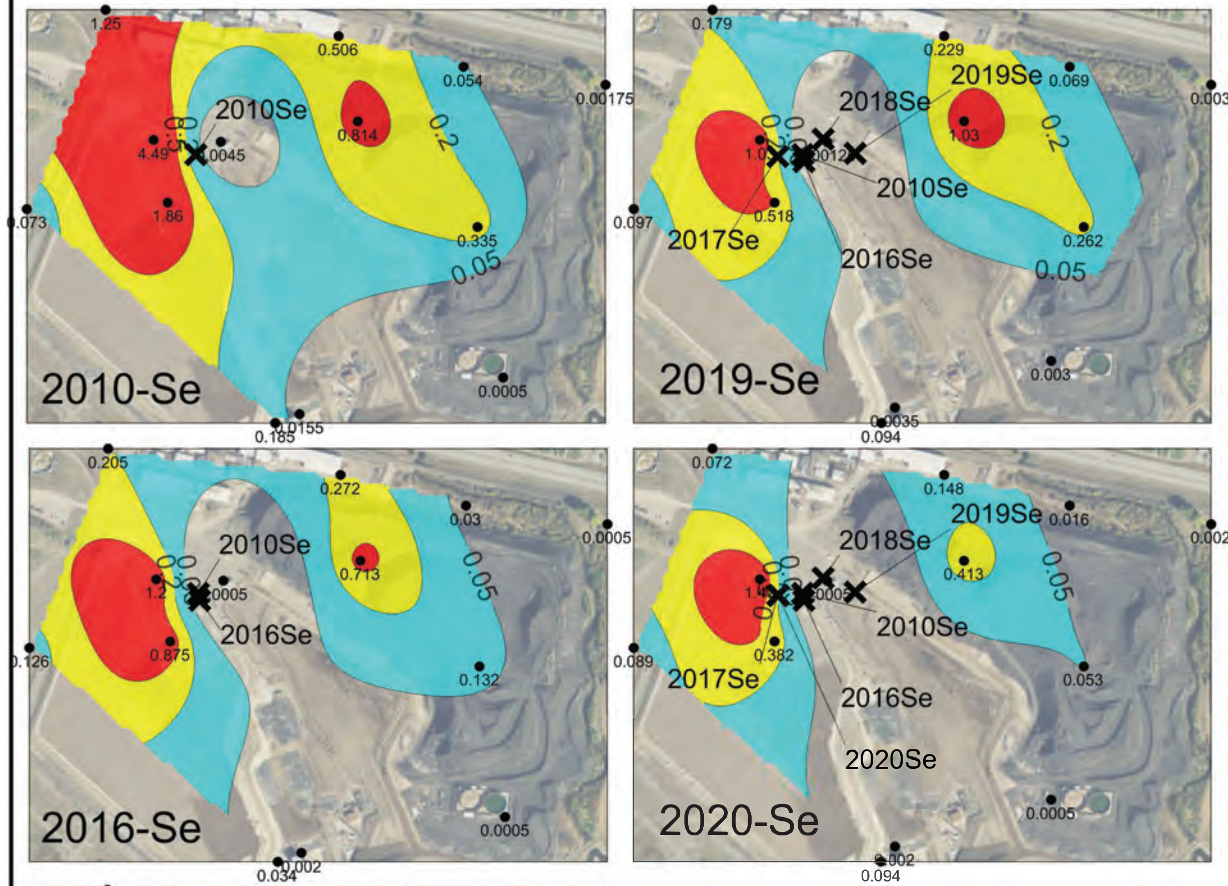
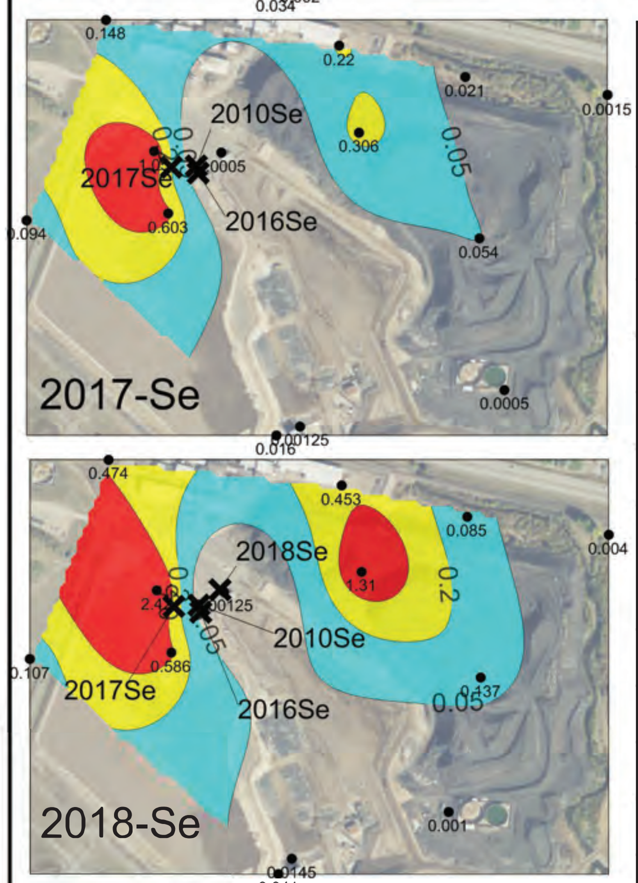
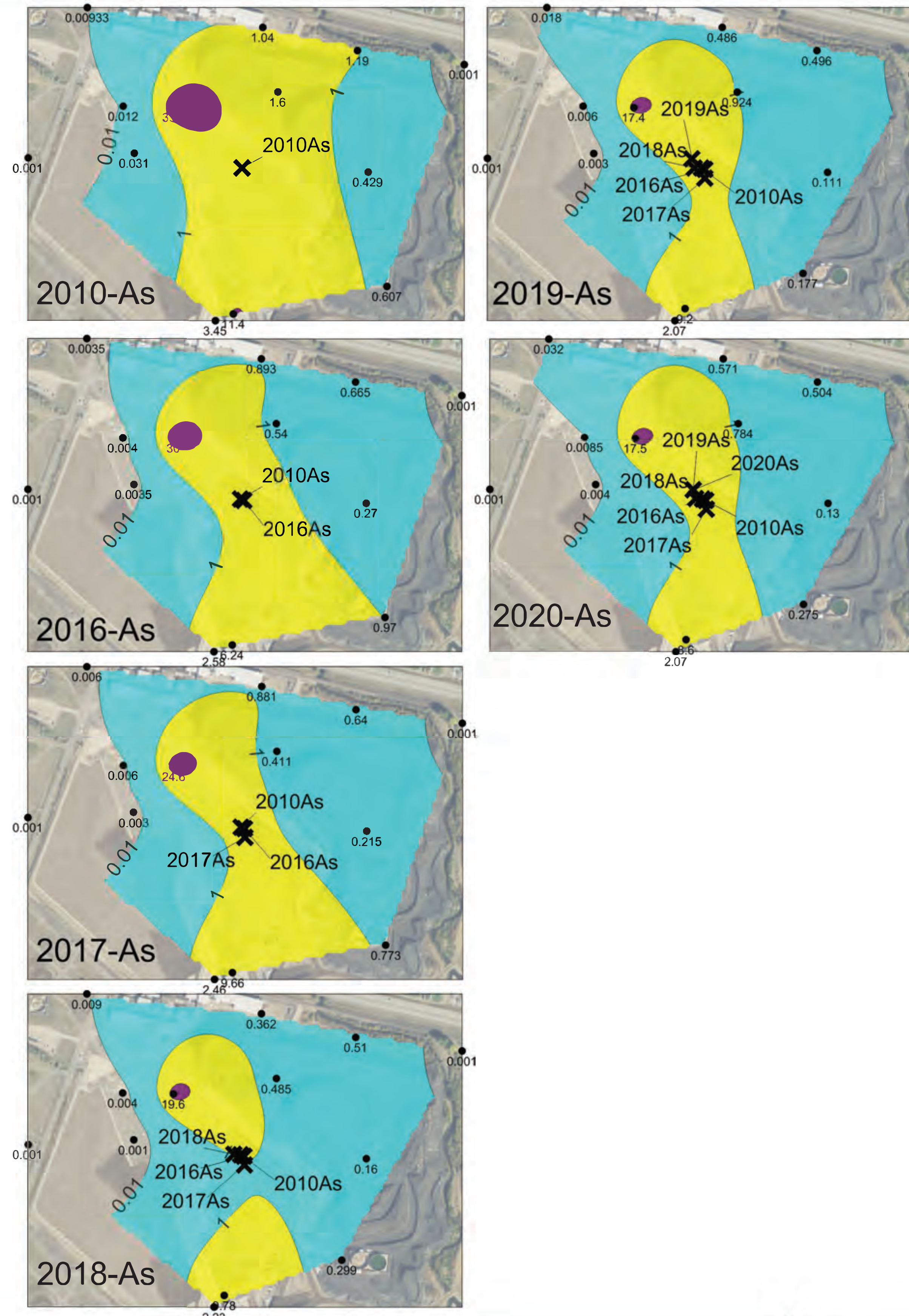
2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	SELENIUM PLUME STABILITY EVALUATION RESULTS	FIGURE 3-12







Software-generated contours are shown on each plot

X = calculated plume centroid for given year

Plume stability metrics calculated using method of Ricker (2008)

Year	Parameter	Planar Area (acres)	Average Concentration (mg/L)
2010	Selenium	67	0.45
2016		48	0.27
2017		35	0.23
2018		52	0.34
2019		51	0.24
2020		33	0.22
Year	**Parameter**	**Planar Area (acres)**	**Average Concentration (mg/L)**
2010	Arsenic	82	2.25
2016		77	1.29
2017		77	1.19
2018		69	0.94
2019		71	1.02
2020		72	1.04

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2020 WATER RESOURCES
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EAST HELENA FACILITY

PLANT SITE PLUME STABILITY EVALUATION RESULTS

FIGURE

3-13

for selenium due to the greater attenuation affinity and slower migration rate for arsenic. In the meantime, the decrease in source area concentrations will aid in stabilizing the arsenic plume and preventing further downgradient expansion.

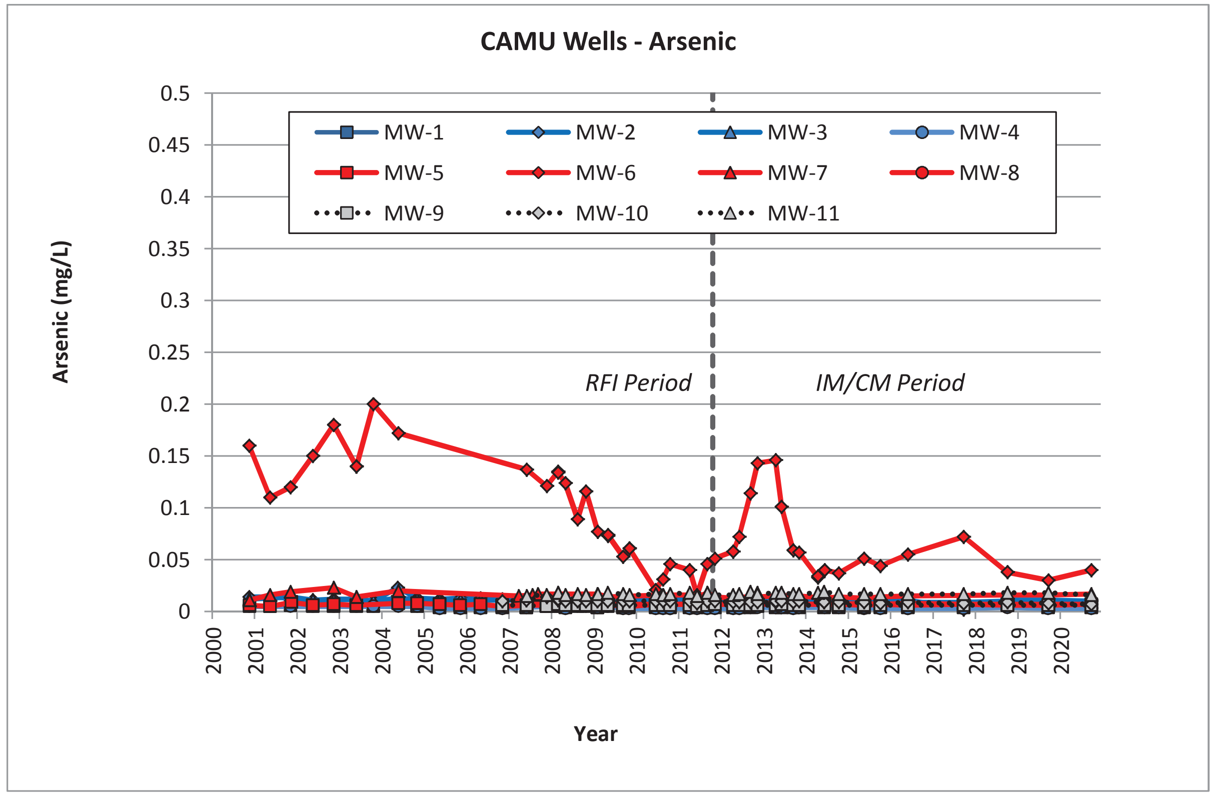
3.3.4 CAMU Area Monitoring Results

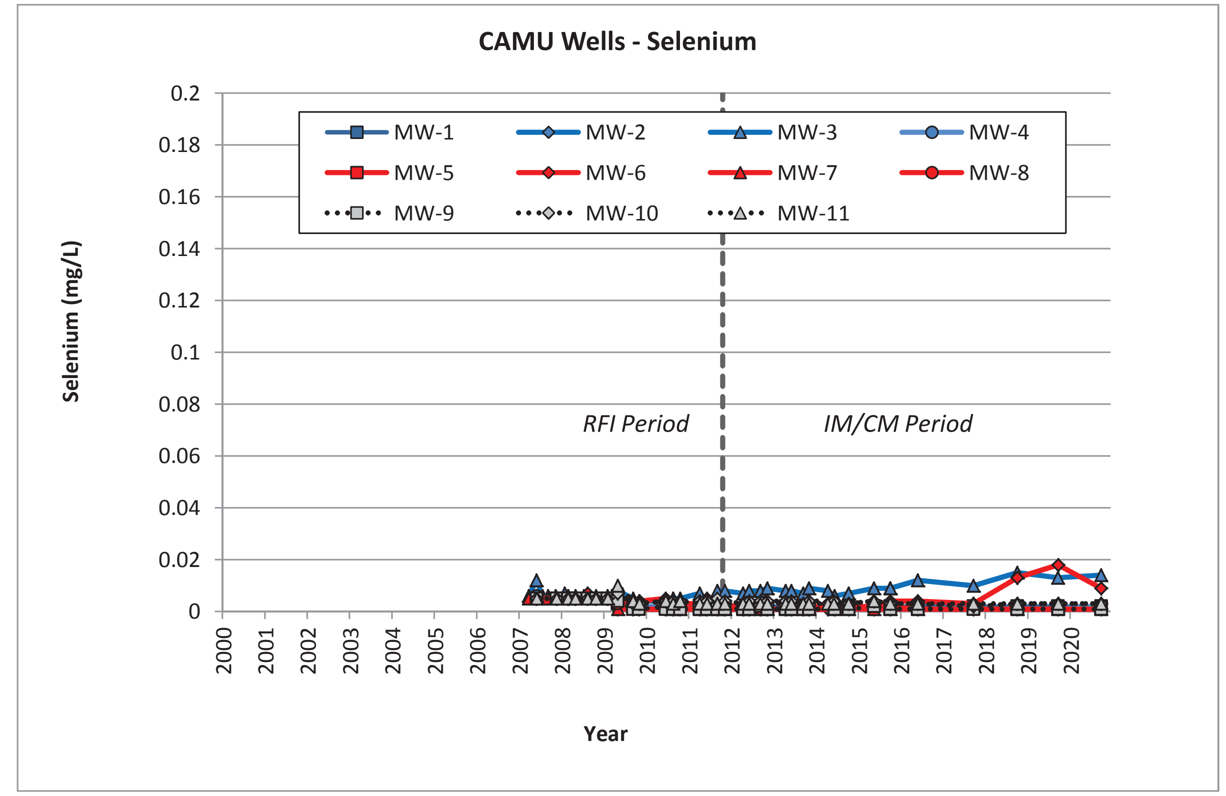
An additional objective of the 2020 monitoring program was to continue to evaluate groundwater quality in the vicinity of the two RCRA landfills, the CAMUs, located immediately southwest of the Facility (Figure 1-1). The CAMU groundwater monitoring network includes 11 monitoring wells ranging from 40 to 72 feet deep. All 11 wells were sampled in October 2020 to document current groundwater quality. Trend plots for arsenic, selenium, chloride, and sulfate at the CAMU wells through October 2020 are shown on Figure 3-14.

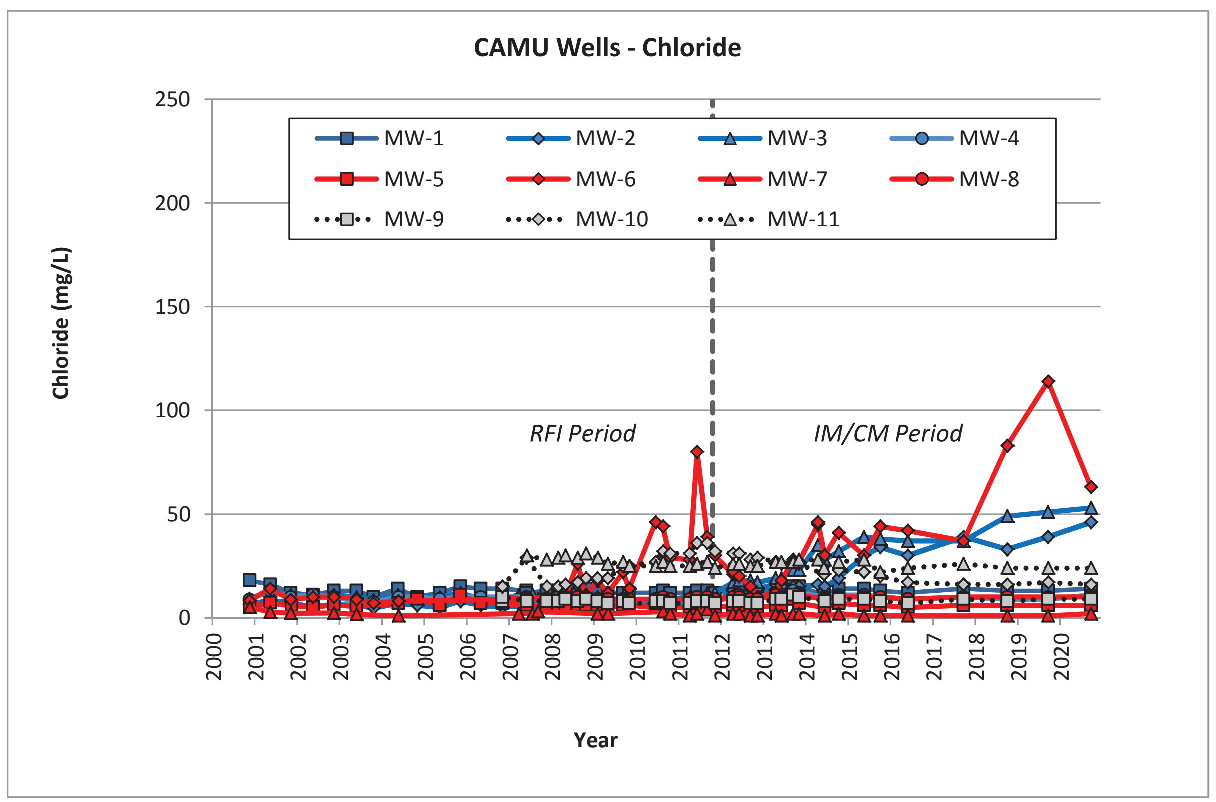
Overall, the 2020 CAMU monitoring results are consistent with previous monitoring results. For example, CAMU wells MW-2, MW-3, MW-7, MW-10, and MW-11 (Exhibit 1) yielded arsenic concentrations ranging from 0.007 to 0.017 mg/L (compared with the groundwater HHS of 0.01 mg/L). These results are consistent with previous observations and 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 3-14), suggesting some plant site influence. From October 2017 to October 2020, however, the arsenic concentration at MW-6 decreased from 0.072 to 0.040 mg/L. Selenium concentrations at all CAMU monitoring wells were well below the 0.05 mg/L HHS in October 2020, ranging from <0.001 to 0.014 mg/L. Although selenium concentrations at wells MW-3 and MW-6 have increased since about 2015-2017, concentrations have stabilized in the last several years. Since 2018, selenium concentrations at MW-6 were reported at 0.013 (2018), 0.018 (2019), and 0.009 (2020) mg/L; over the same three years at MW-3, selenium concentrations were 0.015, 0.013, and 0.014 mg/L.

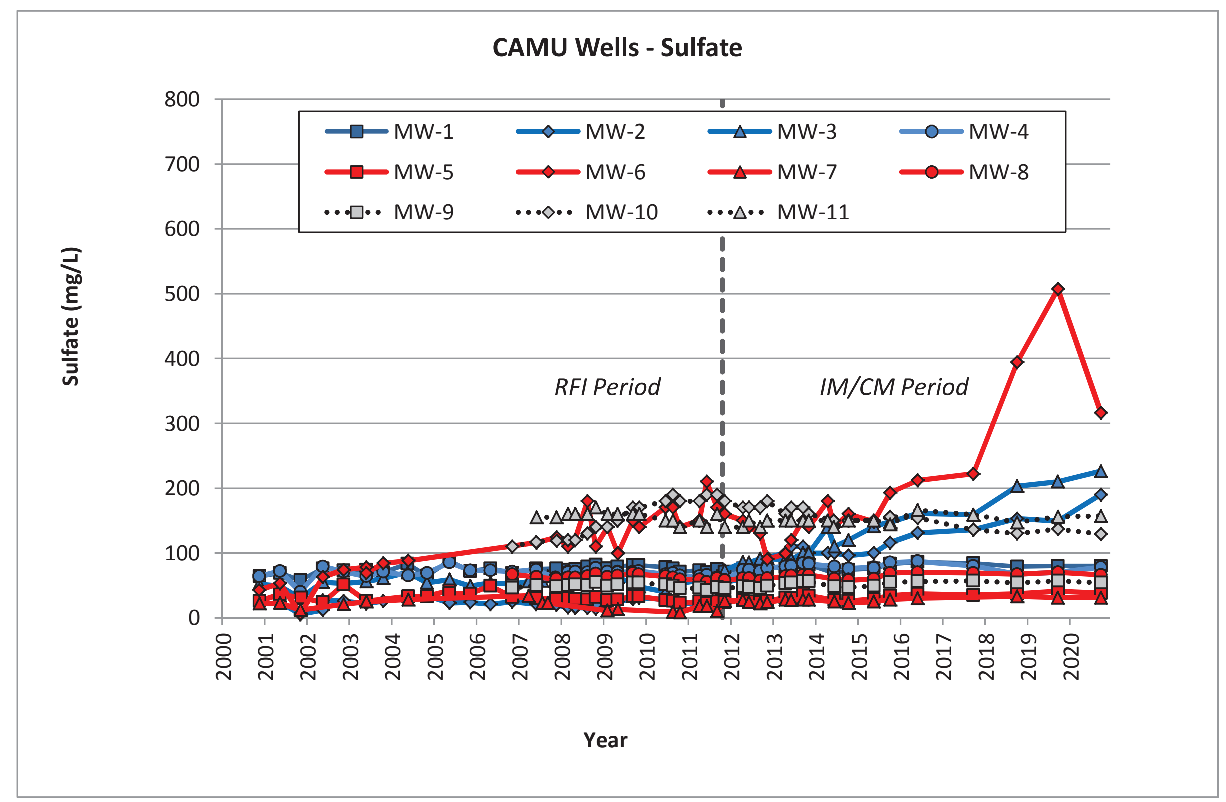
Manganese concentrations have recently decreased slightly at well MW-6, from a range of 2.3 to 5.7 mg/L prior to 2018, to a range of 0.7 to 1.1 mg/L since 2018. The lower manganese concentration at MW-6 could indicate more oxidizing groundwater conditions, which could also lead to the observed increase in selenium (more mobile under oxidizing conditions) and the decrease in arsenic (less mobile under oxidizing conditions) during the 2018-2020 period. All other metals were near or less than analytical detection limits in all 2020 CAMU well samples, including parameters that have been documented at elevated concentrations in plant site soils and/or groundwater such as antimony (all <0.003 mg/L), cadmium (all <0.001 mg/L), zinc (all <0.01 mg/L), and thallium (all <0.001 mg/L) (Appendix A).

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 (see Exhibit 1) indicate an influence from plant site groundwater, with concentrations increasing significantly at all three wells beginning in about 2014 (Figure 3-14). The 2018-2019 increases in particular correspond with the increase in groundwater levels resulting from the above average precipitation experienced those years (Section 3.3.2.1), causing westward migration of plant site groundwater. Concentrations of sulfate and chloride both decreased substantially









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***Well locations shown on Exhibit 1**

2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	CAMU AREA GROUNDWATER QUALITY TRENDS	FIGURE 3-14

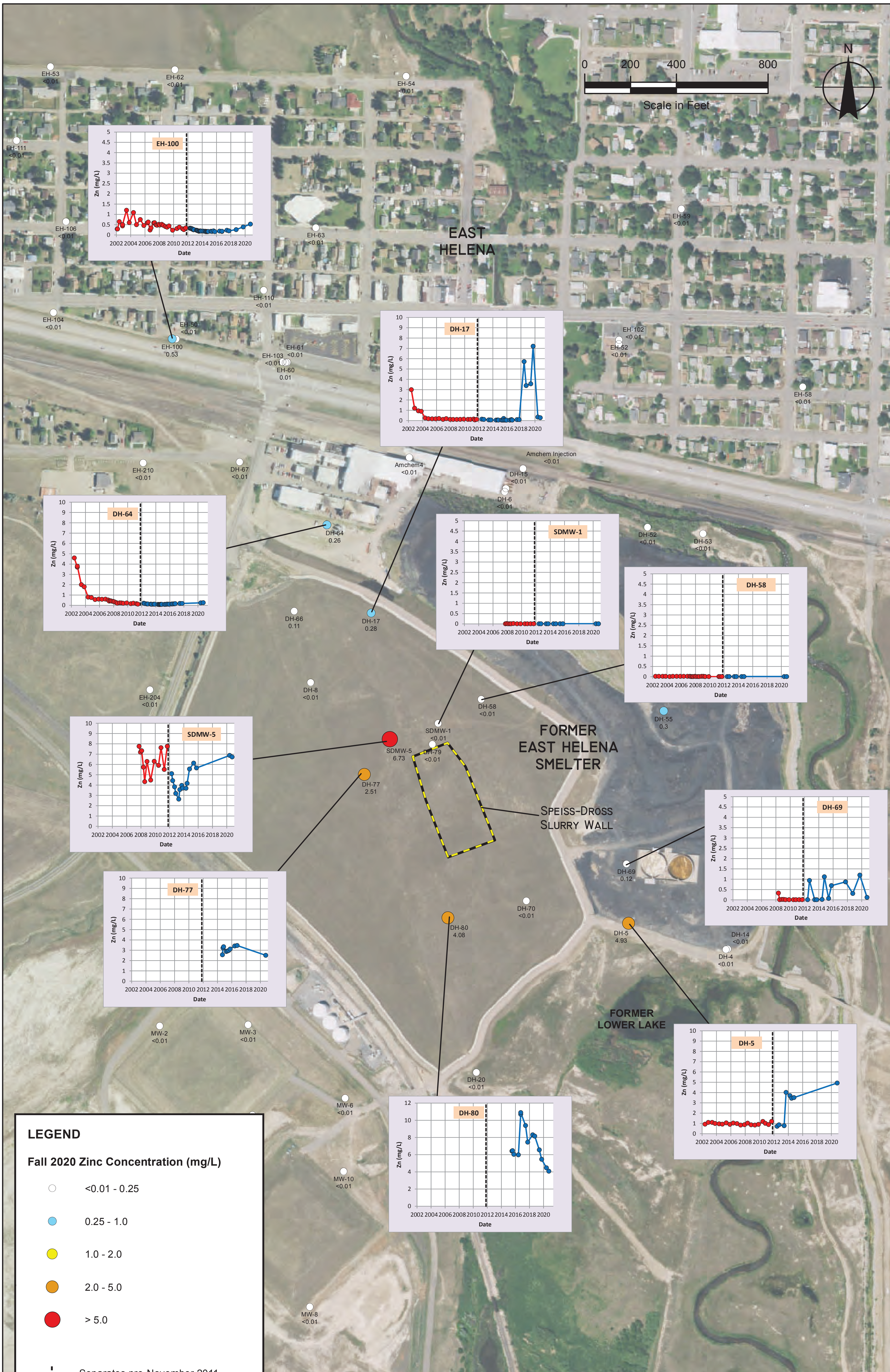
from 2019 to 2020 at well MW-6, however, from 507 to 316 mg/L for sulfate and from 114 to 63 mg/L for chloride. Current (October 2020) concentrations at wells MW-2 and MW-3 are 190 to 226 mg/L sulfate and 46 to 53 mg/L chloride. The plant site influence on chloride and sulfate concentrations at these wells also corresponds with the relatively elevated (although decreasing) arsenic concentrations at well MW-6 and the slight increases in selenium concentrations at MW-3 and MW-6.

3.3.5 Zinc and Cadmium Concentrations and Trends

Although arsenic and selenium are the primary groundwater COCs for the former East Helena Smelter Site, the WRM program parameter suite includes a number of other parameters that have been detected at elevated concentrations in Facility groundwater in the past, or that may be associated with metal smelting operations (Table 2-5). As discussed in the 2019 WRM Report (Hydrometrics, 2020b) and previous reports, both zinc and cadmium have persisted at elevated groundwater concentrations in certain areas of the former smelter, with concentrations of both constituents showing increasing trends in recent years at some wells. Semiannual sampling of five wells (DH-58, DH-64, DH-77, SDMW-1, and SDMW-5) was added to the 2020 CAMP monitoring scope, to provide additional information on the current distribution of zinc and cadmium in site groundwater, as well as updated concentration trends for both zinc and cadmium through 2020.

As noted in the 2019 WRM Report (Hydrometrics, 2020b), groundwater zinc concentrations beneath process areas during the operational period of the smelter occasionally reached concentrations above 50 mg/L, with a few samples over 100 mg/L. These concentrations largely occurred in wells within and around the former Acid Plant, and were associated with releases from the process water circuit and contaminated Acid Plant sludges, and with low groundwater pH values (pH<5.0). Downgradient of the Acid Plant, groundwater showed maximum concentrations above 30 mg/L prior to the 2001 smelter shutdown. Following the smelter shutdown, however, zinc concentrations decreased, and although isolated areas of higher concentrations have remained, maximum observed concentrations are much lower than during the operational period. The 2020 data in Appendix A show elevated zinc concentrations above the 2.0 mg/L groundwater HHS at four monitoring wells (DH-5, DH-77, DH-80, and SDMW-5), and lower concentrations from 0.1 to 0.6 mg/L at six wells (DH-17, DH-55, DH-64, DH-66, DH-69, and EH-100); all of the remaining 2020 groundwater samples from both on and off-site monitoring wells and residential wells (with the exception of one sample from the residential well discussed in Section 3.2) had zinc concentrations from <0.01 to 0.02 mg/L.

Figure 3-15 shows October 2020 zinc concentrations along with updated temporal trends from 2002 (plant shutdown) through 2020 for a selected set of wells. As shown on Figure 3-15, zinc concentrations at monitoring well DH-17, located in the North Plant Arsenic Source Area, showed an abrupt increase from typical values less than 0.1 mg/L to 5.72 mg/L in June 2018, and again in October 2019 to 7.21 mg/L. Zinc concentrations returned to much lower concentrations (0.28 to 0.34 mg/L) at DH-17 in 2020. A recent slight increase in zinc concentration at downgradient well EH-100 from about 0.2 to 0.5 mg/L has occurred over the same period, likely influenced by the short-term increase at DH-17. At well DH-80 in the former Acid Plant area, the October 2020 zinc concentration of 4.08 mg/L is the minimum recorded to date at this well, continuing a decreasing trend from the 2016 maximum of about



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ZINC CONCENTRATIONS AND TRENDS IN PLANT SITE GROUNDWATER

FIGURE 3-15

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11 mg/L. Zinc concentrations near the south end of the slag pile increased at well DH-5 in 2014 from about 1 to 4 mg/L, and remain elevated (4.93 mg/L) as of October 2020; at slag pile well DH-69, zinc concentrations have been variable during the IM/CM period, decreasing from 1.2 to 0.12 mg/L from October 2019 to October 2020, for example. Wells DH-77 (2.51 mg/L zinc in October 2020) and SDMW-5 (6.73 mg/L zinc), downgradient of the former Acid Plant area and adjacent to the Speiss-Dross area, have consistently exhibited zinc concentrations above 2 mg/L and as high as nearly 8 mg/L (Figure 3-15).

As noted in the 2019 WRM report (Hydrometrics, 2020b), zinc concentrations above the HHS of 2.0 mg/L occurred frequently at well DH-17 prior to 2003, with concentrations as high as 8.2 mg/L in the late 1980s, but decreased significantly after the 2001 smelter shutdown. The increased zinc concentrations at DH-17 in 2018 and 2019 are likely attributable to the higher groundwater levels during those years, and/or varying geochemical conditions related to the increased groundwater recharge. Groundwater levels at DH-17 decreased again in 2020 (Figure 3-5 and Section 3.3.2.1), and zinc concentrations also decreased as shown on Figure 3-15. Variations in zinc and cadmium concentrations across the plant site are closely related to historic source areas and to local pH and redox conditions. The mobility of zinc and cadmium in groundwater is sensitive to even small changes in pH, with increased solubility and decreased adsorption occurring as pH decreases. While both zinc and cadmium exist in only one oxidation state under normal environmental conditions (Zn^{2+} and Cd^{2+}), changing redox conditions nevertheless impact their mobility through (1) affecting the formation and dissolution of iron and manganese oxides, which adsorb metals including zinc and cadmium, and (2) creating sulfate reducing conditions, which can lead to precipitation as stable zinc or cadmium sulfide. Many of the current elevated zinc concentrations observed in plant site wells are associated with lower pH conditions, including DH-80 (pH 4.5 to 5.9 in 2020), SDMW-5 (pH 5.5 to 6.3), and DH-77 (6.6). At well DH-69, the decrease from 1.2 to 0.12 mg/L zinc from October 2019 to October 2020 was accompanied by a redox potential decrease of nearly 100 mV and a decrease in sulfate concentration from 317 to 250 mg/L, which could indicate the onset of sulfate reducing conditions and the precipitation of zinc sulfide.

Similar to zinc, cadmium concentrations in Facility groundwater were historically elevated in the former Acid Plant area, due to process water releases, contaminated sediments, and low pH values, with concentrations often above 10 mg/L and periodically above 20 mg/L in area monitoring wells. Downgradient migration of cadmium, however, was more limited than that of zinc. For example, well EH-100 (maximum zinc concentration of 1.2 mg/L) has a maximum cadmium concentration of 0.006 mg/L. As with zinc, following the 2001 smelter shutdown cadmium concentrations decreased, with isolated areas of higher concentrations remaining at present. The 2020 groundwater monitoring data in Appendix A show elevated cadmium concentrations above 1.0 mg/L at three wells (DH-77, DH-80, SDMW-1), concentrations above 0.1 mg/L at two additional wells (DH-66 and SDMW-5), and concentrations above 0.01 mg/L at two wells (DH-5 and DH-64). Cadmium at well EH-100 was 0.005 mg/L in 2020. All of the remaining 2020 groundwater samples from both on and off-site monitoring wells and residential wells had nondetect cadmium concentrations (<0.001 mg/L). The detectable cadmium concentrations all exceeded the 0.005 mg/L groundwater HHS, except at EH-100 (equivalent to the HHS).

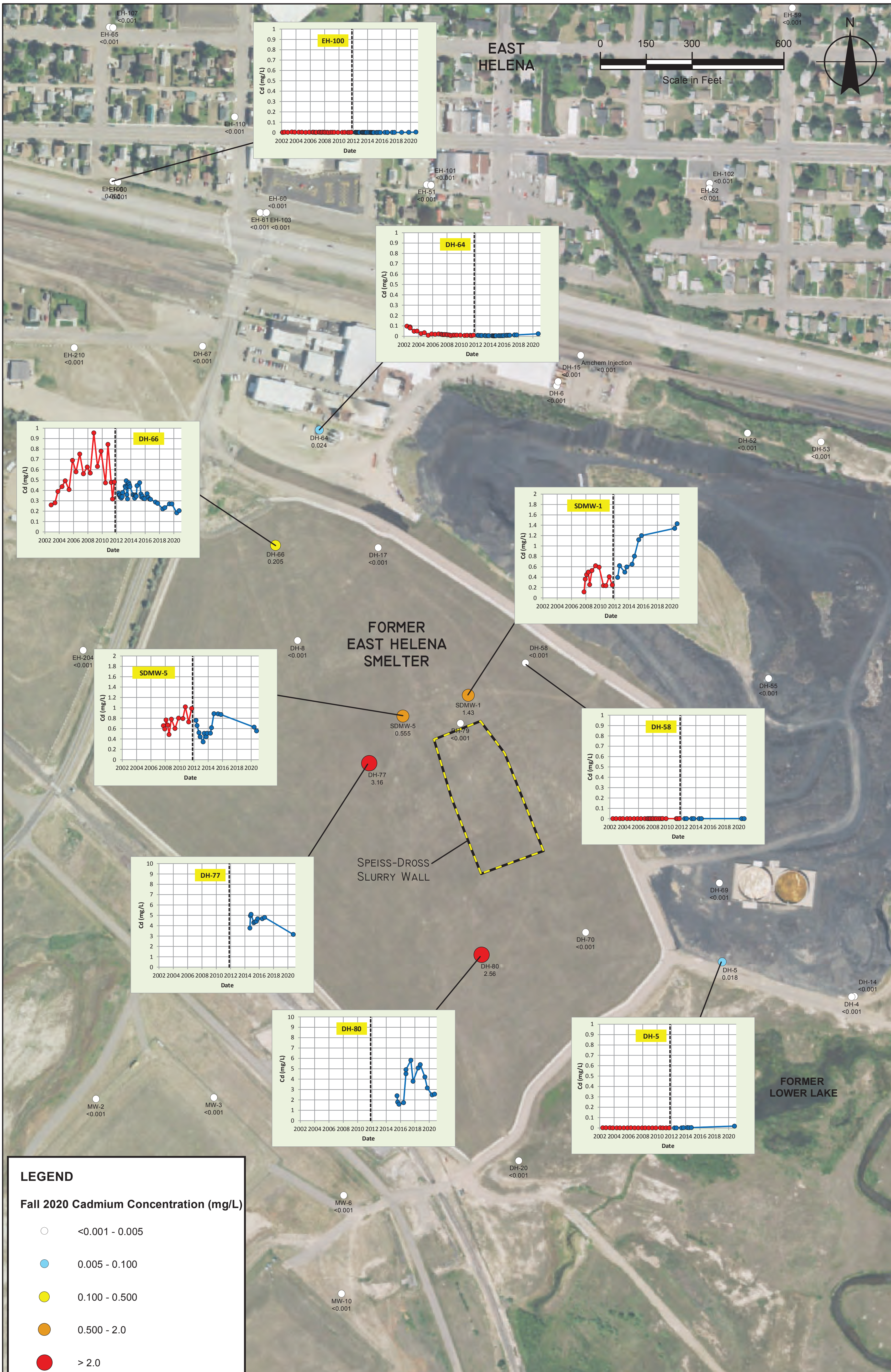
Figure 3-16 presents updated cadmium concentration trends through October 2020 for selected wells, and the most recent cadmium concentration observed at each well. The highest cadmium concentrations in Facility groundwater occur in and downgradient of the former Acid Plant area at wells DH-80 and DH-77 (2.56 to 3.16 mg/L), with slightly lower concentrations in the Speiss-Dross area at wells SDMW-1 and SDMW-5 (0.555 to 1.43 mg/L) (Figure 3-16). This area is generally coincident with the area of elevated zinc concentrations, although cadmium concentrations have remained relatively low at well DH-17 (<0.001 mg/L in October 2020), and at the south end of the slag pile (DH-69 at <0.001 mg/L and DH-5 at 0.018 mg/L) where higher zinc concentrations have been observed (Figure 3-15). Cadmium concentration trends on the plant site indicate decreasing trends over the last several years at wells DH-66, DH-77, and DH-80, relatively stable concentrations at SDMW-5, and an increasing trend at well SDMW-1 (Figure 3-16).

Along with zinc (and other groundwater contaminants), cadmium concentrations and migration patterns in groundwater beneath the former plant site are a combined function of historic plant processes and source areas, changes in plant site water levels, and/or pH and redox conditions, as described previously. Elevated zinc and cadmium concentrations largely co-occur with elevated concentrations of the primary groundwater COCs arsenic and selenium. Despite the persistent elevated zinc and cadmium groundwater concentrations in certain areas of the former smelter, no off-site migration at concentrations above the groundwater HHS of 2.0 mg/L is currently indicated for zinc, and exceedances for cadmium (HHS of 0.005 mg/L) are limited to one well north of the plant site on the American Chemet facility property (DH-64 at 0.024 mg/L). Off-site well EH-100 showed a cadmium concentration equivalent to the HHS in October 2020. Future groundwater monitoring will continue to include collection and evaluation of zinc and cadmium data, to assess any changes in concentration distributions and trends.

3.3.6 November 2020 Supplemental Monitoring Results

In addition to the semiannual 2020 CAMP groundwater monitoring conducted in June and October, six monitoring wells were sampled in November 2020 to obtain current groundwater quality data at selected locations in the south plant area and in the vicinity of the slag pile, prior to planned slag recovery operations that are scheduled to begin in 2021 (Section 2.2.2). Wells sampled in November 2020 included DH-4, DH-5, DH-14, DH-20, DH-53, and DH-70 (Exhibit 1).

The November 2020 groundwater monitoring results are presented in the monitoring well data summary table in Appendix A. These results were also used along with the October 2020 CAMP groundwater monitoring data to develop the arsenic and selenium plume maps shown in Figures 3-2 and 3-3, and on the figures in Appendix D. Overall, the groundwater quality results for the wells sampled in November 2020 were comparable to other plant site and slag pile area wells. Field-measured pH values ranged from 6.66 to 7.46, and field-measured conductivity ranged from 420 to



2020 WATER RESOURCES MONITORING REPORT
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CADMIUM CONCENTRATIONS AND TRENDS IN PLANT SITE GROUNDWATER

FIGURE 3-16

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1040 μmhos/cm (Appendix A). Most wells showed relatively reducing conditions, with DO concentrations less than 0.4 mg/L and mostly negative ORP values as low as -303 mV at well DH-14. Well DH-5 had an anomalously elevated DO concentration of 8.16 mg/L, suggesting a possible close connection with surface water (Prickly Pear Creek or the wetland located in the former Lower Lake area; see Exhibit 1).

Arsenic concentrations ranged from <0.002 mg/L at well DH-14 to 1.44 mg/L at DH-4; these paired wells are located at the southeastern corner of the slag pile, with the shallower well (DH-4) showing elevated concentrations of iron (17.4 mg/L) and manganese (6.41 mg/L) along with the much higher arsenic concentrations. Selenium concentrations were relatively low, with <0.001 mg/L reported at all wells except DH-53 (0.026 mg/L) and DH-5 (0.100 mg/L). Higher potassium concentrations characteristic of slag impacts to water quality were observed at wells DH-5 (39 mg/L) and DH-53 (40 mg/L).

The November 2020 sample from DH-5, completed in slag at the south end of the slag pile, also showed unusually high concentrations of several trace metals that are detected in a limited number of other site wells, but at significantly lower concentrations. For example, the antimony concentration at DH-5 (0.117 mg/L) was twice the next highest antimony concentration reported in 2020 (0.050 mg/L at DH-6). Similarly, the DH-5 copper concentration (0.145 mg/L) contrasted with 0.013 mg/L at DH-6, and the lead concentration at DH-5 (0.148 mg/L) was one of only two detectable lead concentrations reported in 2020, with the other value of 0.005 mg/L reported at well DH-8 (Appendix A). The zinc concentration at DH-5 (4.93 mg/L) was also one of the higher concentrations observed in 2020 (see Section 3.3.5). The specific characteristics and composition of the slag in which DH-5 is completed presumably influence the groundwater quality at this well.

The proposed slag recovery operation starting in 2021 will require an associated groundwater monitoring plan to evaluate potential groundwater quality impacts from recovery activities. Data from the wells sampled in November 2020 and from other monitoring wells within, upgradient, and downgradient of the slag pile will be reviewed to develop the monitoring schedule, including sampling locations, frequency, and analytes.

4.0 REFERENCES

CH2M, 2018. Former ASARCO East Helena Facility Corrective Measures Study Report. Public Review Draft. Prepared for Montana Environmental Trust Group, LLC, Trustee of the Montana Environmental Custodial Trust. March 2018.

GSI Water Solutions, Inc. (GSI), 2014. *Phase II RCRA Facility Investigation*, *East Helena Facility*. April 29.

Hydrometrics, Inc. 1999. Current Conditions/Release Assessment, East Helena Facility. September 1998; Revised January 1999.

Hydrometrics, Inc., 2010. Phase II RCRA Facility Investigation Site Characterization Work Plan. May 2010.

Hydrometrics, Inc., 2011. Data Management Plan for Environmental Data Collection Activities, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. Revised August 2011.

Hydrometrics, Inc., 2015a. Quality Assurance Project Plan for Environmental Data Collection Activities, East Helena Facility (Draft). Prepared for Montana Environmental Trust Group, LLC. Revised August 2011.

Hydrometrics, Inc., 2015b. 2014 Supplemental Contaminant Source Area Investigation at the Former East Helena Smelter. Prepared for Montana Environmental Trust Group, LLC. February 2015.

Hydrometrics, Inc., 2016. 2015 Supplemental Contaminant Source Area Investigation at the Former East Helena Smelter. Prepared for Montana Environmental Trust Group, LLC. March 2016.

Hydrometrics, Inc., 2017. 2015/2016 Water Resources Monitoring Report, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. December 2017.

Hydrometrics, Inc., 2018. 2017 Water Resources Monitoring Report, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. December 2018.

Hydrometrics, Inc., 2020a. 2020 Groundwater and Surface Water Corrective Action Monitoring Plan, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. May 2020.

Hydrometrics, Inc., 2020b. 2019 Water Resources Monitoring Report, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. August 2020.

MDEQ, 2019. Circular DEQ-7, Montana Numeric Water Quality Standards. Prepared by: Water Quality Planning Bureau, Water Quality Standards Section, Helena, Montana. June 2019.

METG, 2020. Transmittal of Former ASARCO East Helena Facility, Corrective Measures Study Report Addendum. Letter from Cindy Brooks (METG) to Betsy Burns (USEPA). October 8, 2020.

Ricker, J.A., 2008. A Practical Method to Evaluate Ground Water Contaminant Plume Stability. *Ground Water Monitoring & Remediation* 28(4): 85-94. Fall 2008.

US District Court, 2012. First Modification to the 1998 Consent Decree. Civil Action No. CV 98-3-H-CCL. Case 6:98-cv-00003-CCL. Document 38. Filed January 17, 2012.

USEPA, 2004a. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action. EPA 530-R-04-030. April 2004.

USEPA, 2004b. Water Quality Restoration Plan and Total Maximum Daily Loads for the Lake Helena Watershed Planning Area: V1 Watershed Characterization and Water Quality Status Review. December 30, 2004.

USEPA, 2013. Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions. OSWER 9355.0-129. Office of Superfund Remediation and Technology Innovation. November 2013.

USEPA, 2014a. Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well. OSWER 9283.1-44. August 2014.

USEPA, 2014b. Groundwater Remedy Completion Strategy – Moving Forward with the End in Mind. OSWER Directive 9200.2-144. Office of Solid Waste and Emergency Response. May 2014.

APPENDIX A

2020 SURFACE WATER AND GROUNDWATER DATABASE

APPENDIX A1

2020 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	6/18/2020	31.47	7.01	618	5.03	53	274	3.7	10.2	7.3	625	130	10 U	426
2843 Canyon Ferry Rd	10/16/2020	29.62	7.25	630	5.62	34	255	7.0	10.0	7.4	585	130	10 UJ	414
2853 Canyon Ferry Rd	6/18/2020	32.72	6.95	668	4.93	62	283	4.0	10.0	7.3	663	140	10 U	443
2853 Canyon Ferry Rd	10/16/2020		7.10	666	5.14	59	280	1.9	10.0	7.4	619	130	10 UJ	435
Amchem Injection	10/15/2020		7.50	357	2.50	96	293	7.2	40.4	7.3	323	110	10 UJ	236
Amchem4	10/15/2020		7.32	338	3.11	180	399	4.8	12.8	7.2	325	110	10 UJ	241
Dartman Well	6/17/2020		6.67	359	1.71	39	261		8.8	7.1	335	97	10 U	220
Dartman Well	10/15/2020		6.94	333	1.57	28	250	5.4	8.8	7.2	321	94	10 UJ	204
DH-6	10/15/2020	20.42	7.70	876	1.34	78	298	1.2	10.3	7.5	865	140	10 UJ	572
DH-8	10/15/2020	52.11	7.30	3718	4.58	43	262	0.7	12.4	7.3	3490	310	11 J	3310
DH-15	10/15/2020	20.38	7.13	1395	0.04	67	287	0.6	10.6	7.0	1350	140	10 UJ	1100
DH-17	6/11/2020	50.72	6.91	1471	0.03	-16	203	4.0	12.9	7.1	1480	270	10 U	1010
DH-17	10/15/2020	50.20	6.92	1439	0.13	-24	195	2.3	12.2	7.1	1420	270	10 UJ	1020
DH-42		October 2020 - No Sample - Insufficient Water												
DH-52	10/14/2020	8.07	7.29	687	0.19	-1	219	1.4	11.4	7.4	683	130	10 U	461
DH-52 (Dup)	10/14/2020	8.07	7.29	687	0.19	-1	219	1.4	11.4	7.5	683	130	10 U	460
DH-55	10/15/2020	81.31	7.22	1797	0.63	80	302	0.8	9.0	7.3	1730	150	10 UJ	1320
DH-56	6/10/2020	85.23	7.99	3011	2.08	47	268	55.2	10.6	8.0	3000	200	241	2090
DH-56	10/15/2020	85.15	7.74	3030	2.43	47	268	10.7	10.4	7.9	2960	210	36 J	2120
DH-58	6/11/2020	45.12	6.49	1138	0.38	232	451	1.8	13.1	6.9	1160	250	10 U	773
DH-58	10/14/2020	44.84	6.82	1115	0.24	47	266	0.4	12.5	6.8	1100	230	10 U	784
DH-64	6/10/2020	39.51	6.70	1402	0.07	21	240	1.4	11.9	6.9	1420	230	13	999
DH-64	10/15/2020	38.77	6.96	1601	0.10	9	229	1.5	11.6	6.8	1540	220	13	1200
DH-66	6/11/2020	53.70	6.61	2605	4.13	213	432	8.9	12.6	6.8	2660	210	236	2130
DH-66	10/15/2020	52.99	6.97	2658	3.00	66	285	5.8	12.2	6.8	2510	210	19 J	2170
DH-67	10/9/2020	36.73	6.84	1168	0.98	69	289	2.9	11.6	6.5	1170	140	10 U	878
DH-69	10/14/2020	36.15	6.93	915	0.12	-137	83	32.1	11.2	6.8	873	200	84	594
DH-77		June 2020 - No Sample - Insufficient Water												
DH-77	10/16/2020	54.06	6.63	845	10.63	125	347	500 J-	9.7	5.8	827	36	1540	642
DH-79	6/11/2020	55.64	7.64 J	1868 J	2.14 J	-76 J	139 J	366 J	17.6 J	7.8	1920	320	155	1300 J-
DH-79	10/16/2020	55.39	7.68	1815	1.02	-80	138	13.9	14.3	7.8	1790	330	176 J	1250
DH-80	6/11/2020	49.74	4.51	769	0.20	215	434	13.5	13.1	4.8	779	2 U	18	531
DH-80	10/15/2020	50.05	5.92 J	726	0.22	148	367	32.4	12.2	4.5	712	2 U	74 J	509
DH-80 (Dup)	10/15/2020	50.05	5.9 J	725	0.21	149	368	30.5	12.2	4.5	706	2 U	185 J	509
EH-50	10/14/2020	30.98	6.90	1439	0.96	66	285	1.8	11.8	6.5	1440	160	10 U	1050
EH-51	10/13/2020	17.78	7.05	370	5.99	49	270	0.6	10.2	7.1	374	94	10 U	210
EH-52	10/13/2020	8.15	6.97	360	2.43	60	278	0.4	13.7	6.9	362	110	10 U	215
EH-53	10/9/2020	32.30	7.07	550	9.33	67	287	0.8	11.5	7.1	563	150	10 U	357
EH-54	10/9/2020	9.25	7.07	291	3.59	63	281	2.5	12.6	7.0	298	90	10 U	190
EH-57A		October 2020 - No Sample - Insufficient Water												
EH-58	10/8/2020	13.81	7.04	393	2.19	48	268	0.2	11.4	6.9	395	110	10 U	266
EH-58 (Dup)	10/8/2020	13.81	7.04	393	2.21	48	268	0.2	11.4	6.9	397	110	10 U	257
EH-59	10/13/2020	8.34	6.96	358	2.09	-20	199	1.1	12.6	7.0	357	130	10 U	202
EH-60	10/14/2020	26.63	6.73	1912	5.00	84	304	6.0	11.5	6.4	1970	160	10 U	1420
EH-61	10/14/2020	28.24	7.32	1974	0.02	46	266	0.8	11.2	7.0	1950	170	10 U	1500
EH-62	10/9/2020	29.51	7.18	369	6.24	64	285	0.2	10.5	7.1	377	110	10 U	231
EH-63	10/13/2020	23.63	7.51	362	7.07	81	301	2.0	10.5	7.3	353	100	12	224
EH-63 (Dup)	10/13/2020	23.63	7.49	361	7.07	80	300	2.0	10.5	7.1	355	100	15	229
EH-65	10/13/2020	29.05	6.71	1486	1.41	52	272	1.8	11.7	6.5	1450	160	10 U	1050
EH-66	10/5/2020	33.72	7.20	289	7.94	170	391	19.4	9.9	7.2	312	89	39	205
EH-68	6/10/2020	10.42	6.44	435	7.57	260	483	3.8	7.5	6.9	449	130	15	273
EH-68	10/8/2020	11.97	7.08	382	2.13	58	276	0.9	14.1	6.8	379	140	13	258
EH-69	6/10/2020	22.35	6.77	407	3.44	212	433	4.9	10.2	7.0	418	110	27	254
EH-69	10/8/2020	20.56	7.10	440	6.15	61	282	9.9	11.0	7.0	438	120	81	291
EH-70	10/6/2020	38.88	6.89	829	6.89	61	281	2.0	10.9	7.2	806	130	10 U	556

			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-100	10/14/2020	31.51	7.02	1887	0.03	57	276	0.3	12.1	6.6	1850	170	10 U	1430
EH-101	10/13/2020	18.10	7.08	333	5.35	50	271	0.4	9.7	7.1	333	86	10 U	182
EH-102	10/13/2020	9.61	7.14	420	1.83	51	272	0.5	10.0	7.0	420	100	10 U	264
EH-103	10/14/2020	28.84	7.33	1794	0.08	66	285	1.6	11.7	7.0	1770	160	10 U	1420
EH-104	10/13/2020	38.89	6.85	1443	5.91	46	266	0.5	11.3	6.8	1410	220	10 U	1060
EH-106	10/13/2020	32.38	6.72	1245	1.64	55	275	10.5	11.9	6.6	1230	170	13	901
EH-107	10/13/2020	25.96	6.92	1201	0.10	35	254	1.3	12.2	6.9	1180	160	10 U	835
EH-110	10/13/2020	24.08	7.24	814	1.94	41	260	0.5	12.1	7.2	809	160	10 U	502
EH-111	10/13/2020	33.57	6.71	1976	0.32	46	265	1.9	11.7	6.6	1920	130	12	1540
EH-114	6/10/2020	38.50	6.45	1538	0.32	190	410	3.6	11.5	6.6	1560	160	19	1120
EH-114	10/8/2020	36.81	7.09	1579	0.42	59	279	5.1	11.3	6.6	1530	160	19	1190
EH-115	6/10/2020	40.70	6.35	1324	0.53	189	408	1.2	12.1	6.6	1350	170	13	939
EH-115	10/14/2020	39.19	6.76	1349	0.36	91	311	1.2	11.8	6.5	1330	170	18	995
EH-117	10/7/2020	32.34		1421	4.58	227	447	4.0	10.9	6.7	1340	150	11	1020
EH-118	10/8/2020	40.36	7.05	1340	3.19	70	290	9.7	11.2	6.8	1300	220	47	1010
EH-119	10/6/2020	37.06	6.56	1340	0.74	47	267	2.8	11.3	6.9	1300	190	10 U	960
EH-120	6/10/2020	36.02	6.60	1574	0.27	199	419	1.1	11.5	6.8	1610	150	10	1240
EH-120	10/6/2020	34.56	6.67	1487	0.62	154	374	1.2	11.8	6.9	1430	150	10 U	1120
EH-121	10/5/2020	33.54	7.07	269	5.15	178	398	0.6	10.2	7.1	294	80	10 U	188
EH-123	6/9/2020	47.36	7.14	608	5.82	148	367	5.1	12.2	7.4	712	160	10 U	414
EH-123	10/5/2020	46.25	7.29	566	5.56	185	404	4.2	12.6	7.3	605	160	10 U	411
EH-124	10/7/2020	40.17	7.13	900	5.99	142	361	1.9	11.4	7.4	867	200	10 U	599
EH-125	10/6/2020	39.47	6.93	501	4.72	178	398	5.3	10.9	7.2	488	100	15	323
EH-126	10/6/2020	58.51	7.06	1264	4.51	129	349	2.8	11.8	7.3	1220	200	11	944
EH-129	6/9/2020	63.76	7.43	505	5.92	182	401	3.9	12.5	7.6	629	150	10	347
EH-129	10/6/2020	59.23	7.30	625	6.27	167	386	3.4	12.3	7.6	608	160	13	423
EH-130	6/9/2020	52.58	6.71	317	4.28	222	443	4.8	10.4	7.2	330	85	10 U	199
EH-130 (Dup)	6/9/2020	52.58	6.71	317	4.27	222	443	4.8	10.4	7.2	332	87	10 U	194
EH-130	10/5/2020	48.99	6.36	301	3.91	180	401	4.6	10.4	7.2	301	84	13	202
EH-132	10/6/2020	61.92	7.27	680	5.04	175	393	5.5	13.7	7.5	660	140	14	473
EH-134	6/9/2020	62.94	7.43	454	6.96	138	357	13.4	13.0	7.6	466	140	25	310
EH-134	10/6/2020	59.16	7.40	461	7.10	162	381	1.6	12.8	7.7	451	140	10 U	314
EH-135	10/5/2020	33.85	7.10	264	4.75	160	382	1.7	9.4	7.1	289	81	10 U	186
EH-138	6/9/2020	52.95	6.96	587	6.99	163	384	3.5	10.1	7.3	678	120	10 U	393
EH-138	10/5/2020	46.88	7.24	415	6.49	126	346	1.0	10.4	7.3	451	110	17	296
EH-139		June 2020 - No Sample - Insufficient Water												
EH-139	10/5/2020	52.52	7.35	583	8.01	124	343	3.5	12.2	7.4	624	200	10 U	425
EH-141	6/10/2020	37.90	7.21	783	5.38	190	410	1.4	11.1	7.4	803	160	10	548
EH-141	10/6/2020	32.73	7.25	848	5.22	115	335	0.8	11.4	7.4	825	170	10 U	585
EH-143	6/9/2020	37.67	7.06	476	5.70	190	411	3.1	10.2	7.4	548	110	10 U	309
EH-143	10/5/2020	34.96	7.30	407	5.73	155	375	1.6	10.4	7.3	452	110	15	300
EH-143 (Dup)	10/5/2020	34.96	7.30	408	5.73	154	375	1.6	10.4	7.3	454	110	10 U	301
EH-204	6/10/2020	56.30	7.08	1864	2.75	174	394	2.7	11.5	7.2	1910	260	22	1410
EH-204	10/9/2020	56.51	7.33	1837	3.19	62	282	2.8	11.5	7.2	1850	260	10 U	1460
EH-206	10/6/2020	49.53	7.49	667	6.09	194	413	2.8	12.8	7.6	645	210	10 U	423
EH-210	6/10/2020	38.83	7.15	957	7.87	168	387	3.1	12.3	7.4	972	130	17	674
EH-210	10/9/2020	38.41	7.42	957	8.20	63	282	2.6	12.3	7.3	970	140	10 U	708

			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
MW-1	10/8/2020	52.35	7.40	439	9.72	52	271	17.1	11.7	7.5	434	120	45	323
MW-2	10/8/2020	40.91	7.13	951	0.14	24	245	0.4	11.1	7.1	927	230	10 U	699
MW-3	10/8/2020	36.28	7.07	1010	0.56	43	263	0.3	10.9	7.1	985	240	10 U	737
MW-4	10/8/2020	48.88	7.42	507	9.81	51	271	56.0	11.3	7.5	499	170	97	358
MW-5	10/9/2020	54.01	7.77	372	9.21	82	301	8.4	11.8	7.8	377	140	36	244
MW-6	10/9/2020	32.76	7.24	1235	0.46	53	274	2.0	10.6	7.1	1240	260	10 U	908
MW-7	10/9/2020	55.34	7.86	247	10.08	63	283	8.8	10.7	7.7	257	88	19	189
MW-8	10/9/2020	53.15	7.49	468	7.47	65	285	7.3	11.3	7.5	480	160	12	325
MW-9	10/9/2020	52.16	7.60	435	9.19	64	284	8.8	10.9	7.6	447	160	32	291
MW-10	10/8/2020	45.31	7.37	732	5.25	50	269	2.5	11.7	7.4	719	240	10 U	513
MW-11	10/8/2020	62.80	7.73	632	9.52	51	269	2.6	12.7	7.7	622	110	10 U	467
SDMW-1	6/11/2020	52.82	6.85	1517	0.05	60	279	4.4	12.7	7.1	1540	250	10 U	1080
SDMW-1 (Dup)	6/11/2020	52.82	6.85	1517	0.05	60	279	4.4	12.8	7.1	1530	250	10 U	1080
SDMW-1	10/15/2020	52.34	6.69	1464	0.10	40	259	13.7	12.3	7.0	1410	250	27 J	1050
SDMW-5	6/11/2020	55.20	5.50	774	0.63	93	311	8.9	13.3	5.8	784	48	11	501
SDMW-5	10/15/2020	55.21	6.30	740	0.26	57	276	2.7	12.4	5.8	737	49	18 J	476

November 2020 Supplemental Monitoring Event														
DH-4	11/6/2020	14.01	7.14	801	0.14	-176	44	1.1	11.3	7.0	790	230	34	532
DH-5	11/6/2020	17.45	7.46	916	8.16	23	239	38.6	15.9	7.8	951	270	36	723
DH-14	11/6/2020	14.00	6.66	786	0.37	-303	-83	73.0	11.0	6.7	804	250	57	574
DH-20	11/6/2020	18.40	7.10	775	0.29	-167	53	0.9	11.7	7.0	770	270	16	547
DH-53	11/6/2020	10.58	7.17	420	0.16	178	397	2.5	12.1	7.3	434	130	10 U	289
DH-70	11/6/2020	34.00	7.08	1040	0.17	-161	59	9.0	11.3	7.0	1040	240	43	805

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
J = QC criterion exceeded (estimated value with bias direction not indicated)
J- = QC criterion exceeded (estimated value with potential low bias)
J+ = QC criterion exceeded (estimated value with potential high bias)
R = value rejected during validation

		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	6/18/2020	69	16	31	4	160	15	168	0.7	0.003 U	0.002 U	0.001 U	0.001 U	0.06	0.005 U	0.01 U	0.001 U	0.038	0.001 U	0.01 U
2843 Canyon Ferry Rd	10/16/2020	71	16	29	4	160	14	157	0.61	0.003 U	0.002 U	0.001 U	0.001 U	0.06	0.005 U	0.01 U	0.001 U	0.034	0.001 U	0.01 U
2853 Canyon Ferry Rd	6/18/2020	76	17	30	4	170	16	186	0.73	0.003 U	0.002 U	0.001 U	0.001 U	0.08	0.005 U	0.01 U	0.001 U	0.043	0.001 U	0.01 U
2853 Canyon Ferry Rd	10/16/2020	77	17	30	4	160	15	175	0.62	0.003 U	0.002 U	0.001 U	0.001 U	0.03	0.005 U	0.01 U	0.001 U	0.037	0.001 U	0.01 U
Amchem Injection	10/15/2020	37	9	16	4	140	5	49	0.23	0.003 U	0.007	0.001 U	0.005	0.04	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
Amchem4	10/15/2020	38	9	16	4	140	5	49	0.23	0.003 U	0.007	0.001 U	0.001	0.03	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
Dartman Well	6/17/2020	37	8	15	3	120	4	68	0.08	0.003 U	0.002 U	0.001 U	0.001 U	0.21	0.005 U	0.02	0.001 U	0.001 U	0.001 U	0.01 U
Dartman Well	10/15/2020	38	8	15	3	110	4	64	0.08	0.003 U	0.002 U	0.001 U	0.001 U	0.21	0.005 U	0.02	0.001 U	0.001 U	0.001 U	0.01 U
DH-6	10/15/2020	23	3	111	81	170	10	247	0.16	0.05	1.14	0.001 U	0.013	0.02 U	0.005 U	0.01 U	0.001 U	0.068	0.001 U	0.01 U
DH-8	10/15/2020	638	140	130	17	380	321	1590	23.8	0.003 U	0.004	0.001 U	0.002	0.02 U	0.005	0.01 U	0.001 U	0.382	0.002	0.01 U
DH-15	10/15/2020	163	33	125	6	180	14	599	0.7	0.003 U	0.002 U	0.001 U	0.004	0.02 U	0.005 U	0.01	0.001 U	0.229	0.001 U	0.01 U
DH-17	6/11/2020	98	23	175	26	330	22	399	2.2	0.003 U	17.7	0.001 U	0.001 U	0.47	0.005 U	2.53	0.001 U	0.001 U	0.001 U	0.34
DH-17	10/15/2020	100	23	174	28	330	24	438	2.4	0.003 U	17.3	0.001 U	0.001 U	0.53	0.005 U	2.85	0.001 U	0.001 U	0.001 U	0.28
DH-42		October 2020 - No Sample - Insufficient Water																		
DH-52	10/14/2020	44	7	56	62	160	7	186	0.11	0.029	0.504	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.016	0.001 U	0.01 U
DH-52 (Dup)	10/14/2020	44	7	57	62	160	7	186	0.11	0.029	0.502	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.016	0.001 U	0.01 U
DH-55	10/15/2020	100	16	187	152	180	18	697	0.5	0.026	0.13	0.001 U	0.003	0.02 U	0.005 U	0.21	0.001 U	0.053	0.01	0.3
DH-56	6/10/2020	52	9	377	338	250	19	1100	0.82	0.028	0.799	0.001 U	0.002	0.03	0.005 U	0.01 U	0.001 U	0.381	0.001 U	0.01 U
DH-56	10/15/2020	64	11	387	345	250	24	1300	1.2	0.027	0.698	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.445	0.001 U	0.01 U
DH-58	6/11/2020	96	14	125	21	300	13	280	1	0.04	0.717	0.001 U	0.003	0.02 U	0.005 U	2.07	0.001 U	0.006	0.001 U	0.01 U
DH-58	10/14/2020	104	15	122	21	280	16	333	1.1	0.035	0.651	0.001 U	0.003	0.02 U	0.005 U	2.18	0.001 U	0.004	0.001 U	0.01 U
DH-64	6/10/2020	107	26	160	18	280	18	460	1.8	0.003 U	7.31	0.023	0.001 U	0.79	0.005 U	4.48	0.001 U	0.001 U	0.001 U	0.24
DH-64	10/15/2020	151	34	168	20	270	23	618	1.9	0.003 U	6.76	0.024	0.001 U	0.97	0.005 U	5.58	0.001 U	0.001 U	0.001 U	0.26
DH-66	6/11/2020	325	88	89	9	250	223	912	18	0.003 U	0.009 J+	0.184	0.003	0.02 U	0.005 U	0.01	0.001 U	1.57	0.001 U	0.11
DH-66	10/15/2020	394	108	87	10	260	257	1050	20.3	0.003 U	0.008	0.205	0.003	0.02 U	0.005 U	0.01 U	0.001	1.36	0.001 U	0.11
DH-67	10/9/2020	123	39	81	6	170	34	412	2	0.003 U	0.032	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.072	0.001 U	0.01 U
DH-69	10/14/2020	84	13	80	8	240	11	250	0.18	0.003 U	0.275	0.001 U	0.001 U	20.4	0.005 U	6.61	0.001 U	0.001 U	0.001 U	0.12
DH-77		June 2020 - No Sample - Insufficient Water																		
DH-77	10/16/2020	76	24	42	8	44	16	340	0.7	0.003 U	3.94	3.16	0.009	0.25	0.005 U	9.28	0.001 U	0.004	0.001	2.51
DH-79	6/11/2020	37	14	347	17	390	28	495	1.7	0.003 U	33.7	0.001 U	0.002	0.21	0.005 U	2.04	0.001 U	0.012	0.001 U	0.01 U
DH-79	10/16/2020	36	13	347	17	400	32	520	1.6	0.003 U	34.1	0.001 U	0.001 U	0.22	0.005 U	2.2	0.001 U	0.003	0.001 U	0.01 U
DH-80	6/11/2020	61	16	37	8	2 U	12	308	0.26	0.003 U	8.68	2.48	0.003	6.34	0.005 U	3.02	0.001 U	0.002	0.209	4.47
DH-80	10/15/2020	64	16	36	7	2 U	13	320	0.28	0.003 U	8.51	2.56	0.001 U	5.59	0.005 U	2.92	0.001 U	0.002	0.181	4.08
DH-80 (Dup)	10/15/2020	64	16	36	7	2 U	13	323	0.27	0.003 U	8.57	2.57	0.001 U	5.61	0.005 U	2.93	0.001 U	0.002	0.176	4.08
EH-50	10/14/2020	87	26	205	7	200	53	488	1.3	0.003 U	7.04	0.001 U	0.002	0.02 U	0.005 U	0.02	0.001 U	0.006	0.001 U	0.01 U
EH-51	10/13/2020	30	6	26	20	110	9	68	0.05 U	0.003 U	0.034	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-52	10/13/2020	33	7	19	19	130	7	57	0.05 U	0.014	0.282	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.004	0.001 U	0.01 U
EH-53	10/9/2020	37	11	67	4	180	16	98	0.13	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.019	0.001 U	0.01 U
EH-54	10/9/2020	35	7	13	3	110	6	48	0.05 U	0.003 U	0.018	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-57A		October 2020 - No Sample - Insufficient Water																		
EH-58	10/8/2020	45	10	18	4	140	10	70	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-58 (Dup)	10/8/2020	43	10	18	3	140	10	70	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-59	10/13/2020	41	9	16	10	150	6	50	0.05 U	0.006	0.02	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-60	10/14/2020	144	43	235	13	200	157	676	1.5	0.003 U	2.37	0.001 U	0.002	0.02 U	0.005 U	5.36	0.001 U	0.001 U	0.001 U	0.01
EH-61	10/14/2020	160	27	267	16	210	30	958	1.1	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.74	0.001 U	0.364	0.001 U	0.01 U
EH-62	10/9/2020	44	10	17	4	130	9	60	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-63	10/13/2020	41	9	18	4	120	14	51	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-63 (Dup)	10/13/2020	41	9	18	4	120	15	52	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-65	10/13/2020	108	27	178	9	200	82	432	0.8	0.003 U	0.199	0.001 U	0.001 U	0.02 U	0.005 U	0.35	0.001 U	0.124	0.001 U	0.01 U
EH-66	10/5/2020	35	8	14	3	110	7	52	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-68	6/10/2020	52	12	17	3	160	7.5	68	0.05 U	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-68	10/8/2020	47	11	17	3	170	7	46	0.05 U	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-69	6/10/2020	39	8	30	4	130	8.7	76	0.06	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.005	0.001 U	0.01 U
EH-69	10/8/2020	46	10	31	4	150	11	79	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.005	0.001 U	0.01 U
EH-70	10/6/2020	64	20	79	4	160	24	230	0.83	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.052	0.001 U	0.01 U

		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-100	10/14/2020	117	40	256	13	200	24	809	1.8	0.003 U	8.18	0.005	0.004	0.02 U	0.005 U	17.7	0.001 U	0.002	0.001 U	0.53
EH-101	10/13/2020	30	6	22	16	100	8	63	0.05 U	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-102	10/13/2020	32	7	43	7	120	10	90	0.06	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.008	0.001 U	0.01 U
EH-103	10/14/2020	188	36	193	11	190	26	777	1.9	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.19	0.001 U	0.33	0.001 U	0.01 U
EH-104	10/13/2020	163	41	102	6	270	83	412	2.5	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.298	0.001 U	0.01 U
EH-106	10/13/2020	108	24	135	6	200	57	404	1.5	0.003 U	0.127	0.001 U	0.001 U	0.02 U	0.005 U	0.01	0.001 U	0.007	0.001 U	0.01 U
EH-107	10/13/2020	99	21	126	5	200	44	366	0.5	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.07	0.001 U	0.139	0.001 U	0.01 U
EH-110	10/13/2020	35	7	129	6	190	32	184	0.19	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.071	0.001 U	0.01 U
EH-111	10/13/2020	160	41	225	11	160	37	878	2.1	0.003 U	1.03	0.001 U	0.001	0.02 U	0.005 U	8.44	0.001 U	0.231	0.001 U	0.01 U
EH-114	6/10/2020	109	29	196	8	200	31	540	2.1	0.003 U	1.64	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.018	0.001 U	0.01 U
EH-114	10/8/2020	121	32	198	8	200	35	601	1.9	0.003 U	1.59	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.014	0.001 U	0.01 U
EH-115	6/10/2020	98	27	159	7	210	30	430	1.8	0.003 U	1.83	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.049	0.001 U	0.01 U
EH-115	10/14/2020	104	28	151	6	210	34	466	1.7	0.003 U	1.97	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.032	0.001 U	0.01 U
EH-117	10/7/2020	110	27	165	6	180	36	492	1.8	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.096	0.001 U	0.01 U
EH-118	10/8/2020	146	44	94	7	260	68	392	1.9	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.208	0.001 U	0.01 U
EH-119	10/6/2020	113	33	137	6	230	33	445	1.85	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.031	0.001 U	0.01 U
EH-120	6/10/2020	180	38	129	6	190	26	610	1.5	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.27	0.001 U	0.01 U
EH-120	10/6/2020	158	36	112	6	190	28	583	1.38	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.218	0.001 U	0.01 U
EH-121	10/5/2020	32	7	14	3	97	7	52	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-123	6/9/2020	59	15	41	7	190	24	100	0.19	0.003 U	0.006	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-123	10/5/2020	62	16	39	7	200	26	105	0.2	0.003 U	0.006	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-124	10/7/2020	97	27	48	6	240	51	171	0.82	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.08	0.001 U	0.01 U
EH-125	10/6/2020	45	12	40	3	130	14	111	0.22	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.017	0.001 U	0.01 U
EH-126	10/6/2020	137	53	71	5	250	34	402	1.98	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.157	0.001 U	0.01 U
EH-129	6/9/2020	50	15	29	6	180	13	82	0.21	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.015	0.001 U	0.01 U
EH-129	10/6/2020	61	19	32	6	200	19	117	0.5	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.038	0.001 U	0.01 U
EH-130	6/9/2020	34	8	17	3	100	7.8	53	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-130 (Dup)	6/9/2020	33	8	17	3	110	7.9	53	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-130	10/5/2020	31	8	15	2	100	7	52	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-132	10/6/2020	68	21	36	9	170	26	150	0.66	0.003 U	0.019	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-134	6/9/2020	47	13	24	6	160	11	68	0.11	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-134	10/6/2020	48	14	23	6	170	11	69	0.12	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-135	10/5/2020	33	7	13	2	99	5	51	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-138	6/9/2020	54	14	45	3	140	14	140	0.56	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.032	0.001 U	0.01 U
EH-138	10/5/2020	39	11	37	3	140	11	89	0.18	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.011	0.001 U	0.01 U
EH-139		June 2020 - No Sample - Insufficient Water																		
EH-139	10/5/2020	57	24	35	9	240	13	103	0.1	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-141	6/10/2020	85	22	46	7	190	20	190	1.04	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.069	0.001 U	0.01 U
EH-141	10/6/2020	94	25	46	7	210	22	220	1.08	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.077	0.001 U	0.01 U
EH-143	6/9/2020	50	12	30	4	130	9.9	100	0.3	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.021	0.001 U	0.01 U
EH-143	10/5/2020	47	12	29	3	140	10	96	0.28	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.017	0.001 U	0.01 U
EH-143 (Dup)	10/5/2020	48	12	29	3	130	10	95	0.28	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.017	0.001 U	0.01 U
EH-204	6/10/2020	258	59	81	12	310	85	620	4.2	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.092	0.001 U	0.01 U
EH-204	10/9/2020	279	62	76	11	320	89	627	3.6	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.086	0.001 U	0.01 U
EH-206	10/6/2020	81	20	19	10	260	54	43	0.08	0.003 U	0.026	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-210	6/10/2020	113	24	47	10	160	35	270	4.02	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.106	0.001 U	0.01 U
EH-210	10/9/2020	124	26	46	9	170	37	282	3.73	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.104	0.001 U	0.01 U

		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)**
MW-1	10/8/2020	49	10	26	5	140	14	80	0.13	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-2	10/8/2020	135	29	27	7	280	46	217	0.29	0.003 U	0.010	0.001 U	0.001 U	0.02 U	0.005 U	0.5	0.001 U	0.001 U	0.001 U	0.01 U
MW-3	10/8/2020	140	31	29	7	290	53	226	0.36	0.003 U	0.009	0.001 U	0.001 U	0.02 U	0.005 U	0.04	0.001 U	0.014	0.001 U	0.01 U
MW-4	10/8/2020	57	12	32	6	200	11	78	0.08	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-5	10/9/2020	40	8	26	4	170	6	38	0.06	0.003 U	0.007	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
MW-6	10/9/2020	188	40	33	7	320	63	316	0.4	0.003 U	0.04	0.001 U	0.001 U	0.02 U	0.005 U	1.11	0.001 U	0.009	0.001 U	0.01 U
MW-7	10/9/2020	21	6	20	5	110	2	31	0.05 U	0.003 U	0.017	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
MW-8	10/9/2020	58	11	24	6	190	10	66	0.07	0.003 U	0.007	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
MW-9	10/9/2020	50	10	27	5	190	9	54	0.06	0.003 U	0.006	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
MW-10	10/8/2020	90	21	37	7	300	16	129	0.11	0.003 U	0.007	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
MW-11	10/8/2020	50	11	61	10	140	24	157	0.21	0.003 U	0.016	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
SDMW-1	6/11/2020	117	21	169	34	300	27	426	2.6	0.014	2.75	1.34	0.001 U	0.04	0.005 U	4.1	0.001 U	0.006	0.001 U	0.01 U
SDMW-1 (Dup)	6/11/2020	118	22	167	34	310	27	436	2.7	0.014	2.76	1.35	0.001 U	0.04	0.005 U	4.13	0.001 U	0.006	0.001 U	0.01 U
SDMW-1	10/15/2020	127	22	167	32	300	28	486	2.4	0.015	2.87	1.43	0.001 U	0.03	0.005 U	3.88	0.001 U	0.005	0.001 U	0.01 U
SDMW-5	6/11/2020	38	11	57	24	58	11	252	0.46	0.003 U	8.66	0.628	0.001 U	11.6	0.005 U	4.04	0.001 U	0.001	0.042	6.88
SDMW-5	10/15/2020	38	11	54	23	59	13	277	0.49	0.003 U	8.83	0.555	0.001 U	11.3	0.005 U	4.03	0.001 U	0.001 U	0.037	6.73

		November 2020 Supplemental Monitoring Event																		
DH-4	11/6/2020	80	14	58	9	280	10	171	0.09	0.003 U	1.44	0.001 U	0.001 U	17.4	0.005 U	6.41	0.001 U	0.001 U	0.001 U	0.01 U
DH-5	11/6/2020	162	15	6	39	330	1 U	269	0.09	0.117	0.212	0.018	0.145	0.02 U	0.148	0.16	0.001 U	0.100	0.060	4.93
DH-14	11/6/2020	109	25	26	6	310	20	174	2.9	0.003 U	0.002 U	0.001 U	0.001 U	0.09	0.005 U	0.61	0.001 U	0.001 U	0.001 U	0.01 U
DH-20	11/6/2020	100	22	29	7	330	11	153	0.07	0.003 U	0.131	0.001 U	0.001 U	7.8	0.005 U	6.3	0.001 U	0.001 U	0.001 U	0.01 U
DH-53	11/6/2020	33	6	24	40	150	6	80	0.05 U	0.013	0.236	0.001 U	0.002	0.02 U	0.005 U	1.72	0.001 U	0.026	0.001 U	0.01 U
DH-70	11/6/2020	127	26	60	6	290	12	334	0.20	0.003 U	0.517	0.001 U	0.001 U	15.8	0.005 U	9.68	0.001 U	0.001 U	0.001 U	0.01 U

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
J = QC criterion exceeded (estimated value with low/high bias not indicated)
J- = QC criterion exceeded (estimated value with potential low bias)
J+ = QC criterion exceeded (estimated value with potential high bias)
R = value rejected during validation

APPENDIX A2

2020 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	6/11/2020	7.29	188	9.90	10.8	83	8.0	201	60	114	10 U	21	5	8	2
PPC-36A	10/7/2020	8.03	327	9.66	10.0	22	8.2	327	100	211	10 U	39	9	16	3
PPC-36A (Dup)	10/7/2020	8.00	327	9.64	10.0	22	8.2	327	99	210	10 U	36	8	16	3
PPC-3A	6/11/2020	7.63	189	9.41	13.5	86	8.0	204	60	118	10 U	22	5	8	2
PPC-3A (Dup)	6/11/2020	7.66	188	9.42	13.5	86	8.0	204	61	110	10 U	22	5	9	2
PPC-3A	10/7/2020	8.15	325	9.06	12.8	23	8.1	324	100	210	10 U	37	9	16	3
PPC-4A	6/11/2020	7.59	191	9.74	13.0	95	8.0	205	59	116	10 U	22	5	8	2
PPC-4A	10/7/2020	8.20	324	9.24	12.5	22	8.2	315	98	216	10 U	38	9	17	3
PPC-5A	6/11/2020	7.45	191	9.87	12.2	89	8.0	203	59	109	10 U	22	5	8	2
PPC-5A	10/7/2020	8.09	327	9.58	11.5	22	8.1	325	98	209	10 U	38	9	16	3
PPC-7	6/11/2020	7.28	187	9.92	11.7	96	8.0	205	61	112	10 U	22	5	8	2
PPC-7	10/7/2020	8.15	326	9.67	10.9	23	8.2	325	98	214	10 U	38	9	16	3
SG-16	6/11/2020	6.99	221	10.00	11.0	83	8.2	239	74	118	10 U	25	6	10	2
SG-16	10/7/2020	7.71	329	9.71	9.8	13	8.2	330	100	210	10 U	36	8	16	3
Trib-1B	5/21/2020	6.76	531	1.79	10.4	0.04 E	7.2	548	190	347	10 U	62	15	26	5
Trib-1B	6/11/2020	6.78	532	0.94	12.0	0.002 E	7.0	547	210	335	10 U	64	15	25	4
Trib-1D	5/21/2020	7.40	603	6.69	12.9	0.134 E	7.7	619	160	406	10 U	72	19	27	6
Trib-1D	6/11/2020	7.72	507	7.53	20.3	0.033 E	8.0	525	99	329	10 U	52	17	24	3
Trib-1D	10/7/2020	7.64	627	4.97	11.7	0.005 E	7.7	594	140	408	10 U	76	21	27	5

NOTES: All concentrations in mg/L except as indicated
(TR) = total recoverable
U = value below reporting limit
J = QC criterion exceeded (estimated value)
E = Estimated

Station ID	Sample Date	HCO3	Cl	SO4	Sb (TR)	As (TR)	Cd (TR)	Cu (TR)	Fe (TR)	Pb (TR)	Mn (TR)	Hg (TR) (μg/L)	Se (TR)	Tl (TR)	Zn (TR)
PPC-36A	6/11/2020	72	3	26	0.0005 U	0.004	0.00021	0.004	0.45	0.0053	0.05	0.005 U	0.001 U	0.0002 U	0.052
PPC-36A	10/7/2020	120	6	55	0.0005 U	0.005	0.00012	0.002 U	0.16	0.0018	0.04	0.005 U	0.001 U	0.0002 U	0.045
PPC-36A (Dup)	10/7/2020	120	6	55	0.0005 U	0.005	0.00012	0.002 U	0.15	0.0018	0.04	0.005 U	0.001 U	0.0002 U	0.042
PPC-3A	6/11/2020	73	3	27	0.0005 U	0.004	0.00021	0.004	0.47	0.0052	0.05	0.005 U	0.001 U	0.0002 U	0.050
PPC-3A (Dup)	6/11/2020	74	3	26	0.0005 U	0.005	0.00022	0.004	0.50	0.0052	0.05	0.005 U	0.001 U	0.0002 U	0.051
PPC-3A	10/7/2020	120	6	53	0.0005 U	0.004	0.00012	0.002 U	0.12	0.0015	0.03	0.005 U	0.001 U	0.0002 U	0.045
PPC-4A	6/11/2020	72	3	26	0.0005 U	0.004	0.00017	0.003	0.41	0.0045	0.05	0.005 U	0.001 U	0.0002 U	0.047
PPC-4A	10/7/2020	120	6	54	0.0005 U	0.005	0.00012	0.002 U	0.16	0.0017	0.04	0.005 U	0.001 U	0.0002 U	0.042
PPC-5A	6/11/2020	72	3	26	0.0005 U	0.005	0.00020	0.004	0.39	0.0047	0.05	0.005 U	0.001 U	0.0002 U	0.049
PPC-5A	10/7/2020	120	6	55	0.0005 U	0.005	0.00012	0.002 U	0.16	0.0020	0.04	0.005 U	0.001 U	0.0002 U	0.043
PPC-7	6/11/2020	74	3	26	0.0005 U	0.005	0.00019	0.004	0.50	0.0051	0.05	0.005 U	0.001 U	0.0002 U	0.057
PPC-7	10/7/2020	120	6	54	0.0028	0.005	0.00013	0.002 U	0.18	0.0028	0.04	0.005 U	0.001 U	0.0002 U	0.043
SG-16	6/11/2020	89	4	28	0.0005 U	0.009	0.00019	0.004	0.39	0.0052	0.05	0.005 U	0.001 U	0.0002 U	0.044
SG-16	10/7/2020	120	7	55	0.0005 U	0.005	0.00014	0.002 U	0.13	0.0019	0.02	0.006	0.001 U	0.0002 U	0.042
Trib-1B	5/21/2020	230	11	81	0.0016	0.013	0.01350	0.025	0.58	0.0117	0.26	0.104	0.001 U	0.0004	0.592
Trib-1B	6/11/2020	250	7	54	0.0008	0.019	0.02320	0.025	0.83	0.0189	2.02	0.144	0.001 U	0.0006	1.05
Trib-1D	5/21/2020	200	11	144	0.0009	0.012	0.00028	0.003	1.47	0.0023	2.07	0.016	0.001 U	0.0002U	0.018
Trib-1D	6/11/2020	120	7	130	0.0010	0.011	0.00015	0.002 U	0.69	0.0022	0.44	0.005 U	0.001 U	0.0002 U	0.008
Trib-1D	10/7/2020	170	10	160	0.0005	0.003	0.00031	0.002 U	0.05	0.0004	0.03	0.005	0.001 U	0.0002 U	0.027

NOTES: All concentrations in mg/L except as indicated

(TR) = total recoverable

U = value below reporting limit

J = QC criterion exceeded (estimated value)

E = Estimated

APPENDIX A3

2020 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	6/17/2020		6.61	341	6.17	118	340	0.66	9.0	7.0	320	85	10 U	207	34	8	14	3	100	7	53	0.05 U
R1	10/19/2020		6.82	284	4.17	176	399	0.66	7.9	7.0	291	83	10 U	174	31	7	12	2	100	5	49	0.05 U
R2	6/17/2020		6.70	355	3.69	125	346	2.38	9.8	7.1	332	88	10 U	215	35	8	15	3	110	7	55	0.05 U
R2	9/9/2020		6.52	330	3.77	169	390	0.97	9.4	7.2	329	89	10 U	230	37	8	15	3	110	8	64	0.05 U
R3	6/17/2020		6.46	433	2.95	195	416	0.23	10.5	6.8	408	100	10 U	242	40	8	21	14	120	10	71	0.05 U
R3	10/20/2020		6.67	389	1.68	172	390	0.37	14.5	6.8	368	120	10 U	221	38	8	20	14	140	8	61	0.05 U
R4	6/22/2020		6.62	373	3.76	102	324	1.45	9.8	7.3	376	94	10 U	241	33	7	28	3	110	8	76	0.19
R4	10/21/2020		6.80	363	1.10	201	422	1.01	9.7	7.2	352	94	10 U	226	34	8	27	3	110	8	70	0.15
R5	6/18/2020		6.68	298	5.31	105	326	2.13	9.2	7.1	303	81	10 U	192	32	7	14	3	99	7	49	0.05 U
R5	10/19/2020		6.94	301	7.51	169	391	1.18	8.7	7.1	305	80	10 U	178	33	8	14	3	97	7	56	0.05 U
R5 (Dup)	10/19/2020		6.95	301	7.54	169	391	1.15	8.7	7.2	305	80	10 U	186	33	8	14	3	97	7	56	0.05 U
R6	6/22/2020		6.86	442	4.21	152	373	0.59	9.7	7.3	449	110	10 U	307	50	11	17	5	130	7	102	0.24
R6	10/21/2020		7.09	435	4.21	211	432	0.26	9.5	7.1	424	110	10 U	299	52	11	17	5	130	7	99	0.22
R7	6/18/2020		6.88	290	4.76	131	352	1.33	10.6	7.3	305	90	10 U	188	31	7	16	3	110	5	44	0.05 U
R7	10/16/2020	30.81	7.19	302	5.00	124	344	1.15	10.8	7.4	306	87	10 U	185	33	8	16	3	110	6	51	0.05 U
R8	6/18/2020	33.86	6.82	283	3.16	111	332	0.6	10.6	7.3	288	85	10 U	169	31	7	14	3	100	6	41	0.05 U
R8	10/16/2020		7.12	300	3.75	89	309	0.33	10.8	7.2	298	85	10 U	182	32	7	14	3	100	7	51	0.05 U
R9	6/18/2020	36.17	6.79	276	1.92	111	330	0.59	13.0	7.3	281	85	10 U	176	30	7	14	3	100	5	39	0.05 U
R9	10/16/2020	34.28	7.12	289	2.72	120	339	0.26	12.8	7.3	286	83	10 U	174	30	7	13	3	100	5	47	0.05 U
R10	June 2020 - No Sample - Inoperative Pump																					
R10	October 2020 - No Sample - Inoperative Pump																					
R11	6/24/2020		6.65	798	1.84	163	383	1.56	11.7	7.0	815	130	10 U	576	99	21	25	6	150	23	237	2.96
R11	10/20/2020		6.90	817	1.99	183	403	1.18	11.6	7.0	766	120	10 U	580	102	23	26	6	150	24	243	2.96
R12	6/22/2020	22.78	6.91	346	5.54	205	426	0.36	10.5	7.7	344	91	10 U	213	38	8	15	3	110	7	67	0.05 U
R12	10/20/2020	18.13	7.18	343	6.63	208	428	0.38	10.2	7.4	326	94	10 U	203	38	9	15	3	110	7	62	0.05 U
R13	6/22/2020	19.31	6.88	633	5.41	147	369	0.7	9.0	7.3	634	270	10 U	383	72	15	33	7	330	15	43	0.12
R13	10/21/2020	20.11	7.17	609	5.52	193	415	0.7	8.8	7.3	587	260	10 U	376	76	16	32	7	310	14	52	0.10
R14	6/17/2020	14.37	6.66	351	5.78	144	367	0.65	8.1	7.1	329	87	10 U	214	36	8	14	3	110	7	56	0.05 U
R14 (Dup)	6/17/2020	14.37	6.66	351	5.76	144	367	0.39	8.1	7.1	329	87	10 U	207	35	8	14	3	110	7	54	0.05 U
R14	10/19/2020	15.25	6.86	307	3.64	186	408	1.69	8.1	7.1	309	120	10 U	179	34	8	13	3	140	6	49	0.05 U
R15	6/22/2020		7.41	721	8.44	195	415	0.34	11.9	7.7	726	190	10 U	486	72	19	39	14	230	29	122	0.26
R15	10/20/2020		7.55	688	8.76	247	467	0.18	11.6	7.6	664	190	10 U	464	71	19	38	14	230	27	112	0.23
R16	June 2020 - No Sample - Owner Request																					
R16	October 2020 - No Sample - Owner Request																					
R17	6/22/2020	84.37	7.42	508	9.64	149	368	0.26	12.4	7.8	525	130	10 U	363	45	12	33	12	160	18	95	0.18
R17	10/20/2020	84.07	7.66	497	10.19	221	441	0.23	12.1	7.8	488	130	10 U	346	47	13	33	12	160	17	88	0.16
R18	6/24/2020		6.65	284	5.51	213	432	0.27	11.8	7.4	292	93	10 U	182	30	7	12	3	110	6	38	0.05 U
R18	10/22/2020		6.90	287	4.26	218	438	0.31	10.7	7.3	280	89	10 U	170	33	7	13	3	110	6	43	0.05 U
R19	6/24/2020		6.57	295	6.68	180	401	0.73	10.3	7.3	306	87	10 U	191	33	7	12	3	110	8	45	0.05 U
R19	10/22/2020		7.09	308	8.12	199	420	0.56	10.0	7.2	292	86	10 U	180	35	8	13	3	100	8	48	0.05 U
R20	6/24/2020		6.55	298	6.12	188	411	0.3	8.1	7.4	310	87	10 U	195	32	7	13	2	110	6	52	0.05 U
R20	10/22/2020		7.19	292	5.41	202	421	0.24	12.5	7.2	286	97	10 U	173	33	7	13	3	120	7	39	0.05 U

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
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	6/17/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.009	0.009	0.03	0.04 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R1	10/19/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.007	0.007	0.05	0.11	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R2	6/17/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.004	0.02 U	0.27 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R2	9/9/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.002	0.04	0.09	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R3	6/17/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.081	0.362	0.02 U	0.02 UJ	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.005	0.005	0.001 U	0.001 U	0.01	0.01 U
R3	10/20/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.052	0.059	0.02 U	0.06	0.005 U	0.005 U	0.02	0.02	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02	0.02
R4	6/22/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.03	0.14	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R4	10/21/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.09	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R5	6/18/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.001	0.17 R	0.02 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01
R5	10/19/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.002	0.02 U	0.09	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02	0.02
R5 (Dup)	10/19/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.09	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02	0.02
R6	6/22/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.003	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.003	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R6	10/21/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.004	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R7	6/18/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.013	0.014	0.02 U	0.10 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R7	10/16/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.01	0.011	0.02 U	0.06	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R8	6/18/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.002	0.02 U	0.07 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R8	10/16/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R9	6/18/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.002	0.04	0.24 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R9	10/16/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.16	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R10	June 2020 - No Sample - Inoperative Pump																						
R10	October 2020 - No Sample - Inoperative Pump																						
R11	6/24/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.043	0.02 U	0.15	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.046	0.047	0.001 U	0.001 U	0.02	0.02
R11	10/20/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.002	0.02 U	0.09	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.041	0.041	0.001 U	0.001 U	0.02	0.02
R12	6/22/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.004	0.004	0.02 U	0.04	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R12	10/20/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.019	0.018	0.02 U	0.02	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R13	6/22/2020	0.003 U	0.003 U	0.015	0.014	0.001 U	0.001 U	0.011	0.015	0.02 U	0.04	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01
R13	10/21/2020	0.003 U	0.003 U	0.013	0.013	0.001 U	0.001 U	0.015	0.022	0.03	0.04	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01
R14	6/17/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.34 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R14 (Dup)	6/17/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.18 J	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01
R14	10/19/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.003	0.02 U	1.39	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R15	6/22/2020	0.003 U	0.003 U	0.016	0.016	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R15	10/20/2020	0.003 U	0.003 U	0.015	0.015	0.001 U	0.001 U	0.001	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R16	June 2020 - No Sample - Owner Request																						
R16	October 2020 - No Sample - Owner Request																						
R17	6/22/2020	0.003 U	0.003 U	0.017	0.017	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.14	0.15
R17	10/20/2020	0.003 U	0.003 U	0.016	0.017	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01	0.01
R18	6/24/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.006	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.02
R18	10/22/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R19	6/24/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02	0.02
R19	10/22/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R20	6/24/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01 U
R20	10/22/2020	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02	0.02

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

APPENDIX B

2020 GROUNDWATER ELEVATION DATA

2020 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-20**	**Oct-20**	**Jun-20**	**Oct-20**
ASIW-1	3915.99	18.82	19.51	3897.17	3896.48
ASIW-2	3909.13	35.79	32.70	3873.34	3876.43
DH-1	3910.89	44.53	44.22	3866.36	3866.67
DH-2	3936.91	61.01	61.78	3875.90	3875.13
DH-3	3947.48	31.24	31.97	3916.24	3915.51
DH-4	3917.26	14.69	15.05	3902.57	3902.21
DH-5	3921.18	18.05	DRY	3903.13	DRY
DH-6	3889.85	20.60	20.18	3869.25	3869.67
DH-7	3898.66	16.00	16.32	3882.66	3882.34
DH-8	3923.38	52.22	52.02	3871.16	3871.36
DH-9	3918.08	DRY	DRY	DRY	DRY
DH-10A	3886.97	8.99	10.11	3877.98	3876.86
DH-13	3923.91	52.70	52.15	3871.21	3871.76
DH-14	3916.06	13.65	14.00	3902.41	3902.06
DH-15	3889.82	20.57	20.17	3869.25	3869.65
DH-17	3917.56	50.98	49.97	3866.58	3867.59
DH-18	3924.93	50.20	50.00	3874.73	3874.93
DH-20	3927.09	18.22	18.90	3908.87	3908.19
DH-22	3948.63	DRY	DRY	DRY	DRY
DH-23	3931.82	DRY	DRY	DRY	DRY
DH-24	3899.59	DRY	37.59	DRY	3862.00
DH-27	3946.21	55.86	56.05	3890.35	3890.16
DH-30	3943.24	51.88	52.04	3891.36	3891.20
DH-36	3920.66	45.98	45.93	3874.68	3874.73
DH-42	3942.63	49.48	49.70	3893.15	3892.93
DH-47	3926.82	21.57	22.04	3905.25	3904.78
DH-48	3905.96	35.76	35.78	3870.20	3870.18
DH-50	3904.76	36.35	36.38	3868.41	3868.38
DH-51	3904.34	36.26	36.32	3868.08	3868.02
DH-52	3889.18	6.93	7.93	3882.25	3881.25
DH-53	3892.87	9.41	10.58	3883.46	3882.29
DH-54	3890.27	28.22	27.19	3862.05	3863.08
DH-55	3972.76	80.89	81.21	3891.87	3891.55
DH-56	3958.17	85.35	84.88	3872.82	3873.29
DH-57	3929.53	45.26	45.20	3884.27	3884.33
DH-58	3919.33	45.21	44.68	3874.12	3874.65
DH-59	3937.44	45.77	44.61	3891.67	3892.83
DH-5A	3921.92	18.71	18.93	3903.21	3902.99
DH-61	3926.84	DRY	DRY	DRY	DRY
DH-62	3926.95	56.66	56.87	3870.29	3870.08
DH-63	3905.37	41.52	41.47	3863.85	3863.90
DH-64	3904.02	39.58	38.62	3864.44	3865.40

2020 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-20**	**Oct-20**	**Jun-20**	**Oct-20**
DH-65	3945.85	63.41	64.33	3882.44	3881.52
DH-66	3919.28	53.77	52.83	3865.51	3866.45
DH-67	3899.77	37.69	36.68	3862.08	3863.09
DH-68	3943.28	44.58	44.74	3898.70	3898.54
DH-69	3934.49	36.00	36.13	3898.49	3898.36
DH-70	3933.91	33.96	34.09	3899.95	3899.82
DH-71	3944.88	DRY	56.43	DRY	3888.45
DH-72	3939.67	44.16	44.36	3895.51	3895.31
DH-73	3918.08	40.80	40.48	3877.28	3877.60
DH-74	4006.44	124.86	125.40	3881.58	3881.04
DH-75	4006.54	125.29	125.80	3881.25	3880.74
DH-76	3994.28	99.11	99.20	3895.17	3895.08
DH-77	3932.20	54.09	54.05	3878.11	3878.15
DH-78	3921.12	53.68	53.26	3867.44	3867.86
DH-79	3928.80	55.78	55.28	3873.02	3873.52
DH-80	3942.36	49.83	50.04	3892.53	3892.32
DH-82	3908.18	44.85	43.83	3863.33	3864.35
DH-83	3922.14	53.06	52.75	3869.08	3869.39
East-PZ-1	3911.93	23.96	23.97	3887.97	3887.96
East-PZ-2	3924.58	24.50	24.48	3900.08	3900.10
East-PZ-4	3935.66	20.26	20.52	3915.40	3915.14
East-PZ-6	3943.83	23.91	24.12	3919.92	3919.71
East-PZ-7	3928.83	18.31	18.60	3910.52	3910.23
EH-50	3889.39	31.95	30.78	3857.44	3858.61
EH-51	3880.09	17.13	17.15	3862.96	3862.94
EH-52	3880.50	7.56	7.93	3872.94	3872.57
EH-53	3872.82	35.10	32.17	3837.72	3840.65
EH-54	3869.66	8.92	8.85	3860.74	3860.81
EH-57	3885.05	DRY	DRY	DRY	DRY
EH-57A	3885.45	DRY	42.40	DRY	3843.05
EH-58	3888.15	14.05	13.72	3874.10	3874.43
EH-59	3876.57	8.40	8.34	3868.17	3868.23
EH-60	3888.46	27.56	26.40	3860.90	3862.06
EH-61	3889.77	29.15	28.06	3860.62	3861.71
EH-62	3875.07	29.98	29.18	3845.09	3845.89
EH-63	3878.32	23.82	22.86	3854.50	3855.46
EH-64	3882.67	30.39	29.25	3852.28	3853.42
EH-65	3879.96	29.97	28.44	3849.99	3851.52
EH-66	3869.48	33.14	33.00	3836.34	3836.48
EH-67	3869.46	29.89	30.55	3839.57	3838.91
EH-68	3867.60	9.49	10.72	3858.11	3856.88
EH-69	3869.10	22.44	20.39	3846.66	3848.71

2020 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-20**	**Oct-20**	**Jun-20**	**Oct-20**
EH-70	3863.48	40.96	38.72	3822.52	3824.76
EH-100	3889.83	32.46	31.27	3857.37	3858.56
EH-101	3879.95	17.49	17.48	3862.46	3862.47
EH-102	3880.45	9.30	9.36	3871.15	3871.09
EH-103	3890.54	29.72	28.62	3860.82	3861.92
EH-104	3887.83	40.36	38.75	3847.47	3849.08
EH-106	3882.07	33.58	32.28	3848.49	3849.79
EH-107	3880.15	26.62	25.49	3853.53	3854.66
EH-109	3885.67	29.64	28.44	3856.03	3857.23
EH-110	3884.05	25.06	23.91	3858.99	3860.14
EH-111	3876.50	35.34	33.40	3841.16	3843.10
EH-112	3875.78	35.50	31.89	3840.28	3843.89
EH-113	3871.34	34.13	31.18	3837.21	3840.16
EH-114	3878.07	38.48	36.75	3839.59	3841.32
EH-115	3883.29	40.74	39.05	3842.55	3844.24
EH-116	3874.52	36.51	34.56	3838.01	3839.96
EH-117	3871.33	34.50	32.21	3836.83	3839.12
EH-118	3879.95	41.19	40.35	3838.76	3839.60
EH-119	3873.75	38.57	37.03	3835.18	3836.72
EH-120	3865.78	36.15	34.42	3829.63	3831.36
EH-121	3869.49	33.35	33.32	3836.14	3836.17
EH-122	3868.08	28.81	29.65	3839.27	3838.43
EH-123	3885.71	47.42	46.28	3838.29	3839.43
EH-124	3874.46	41.57	40.18	3832.89	3834.28
EH-125	3863.22	41.51	39.29	3821.71	3823.93
EH-126	3870.00	62.60	58.48	3807.40	3811.52
EH-127	3860.75	34.36	35.03	3826.39	3825.72
EH-128	3892.17	DRY	DRY	DRY	DRY
EH-129	3870.21	63.85	59.16	3806.36	3811.05
EH-130	3858.55	52.62	48.89	3805.93	3809.66
EH-131	3834.44	40.62	36.44	3793.82	3798.00
EH-132	3893.90	62.84	61.92	3831.06	3831.98
EH-133	3884.36	59.31	58.55	3825.05	3825.81
EH-134	3870.21	63.05	59.12	3807.16	3811.09
EH-135	3852.25	35.26	33.68	3816.99	3818.57
EH-136	3838.59	36.65	34.23	3801.94	3804.36
EH-137	3839.66	43.63	40.94	3796.03	3798.72
EH-138	3839.70	53.02	46.92	3786.68	3792.78
EH-139	3839.78	57.12	52.60	3782.66	3787.18
EH-140	3812.08	30.70	25.38	3781.38	3786.70
EH-141	3813.32	38.17	32.75	3775.15	3780.57
EH-142	3804.68	37.25	33.10	3767.43	3771.58

2020 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

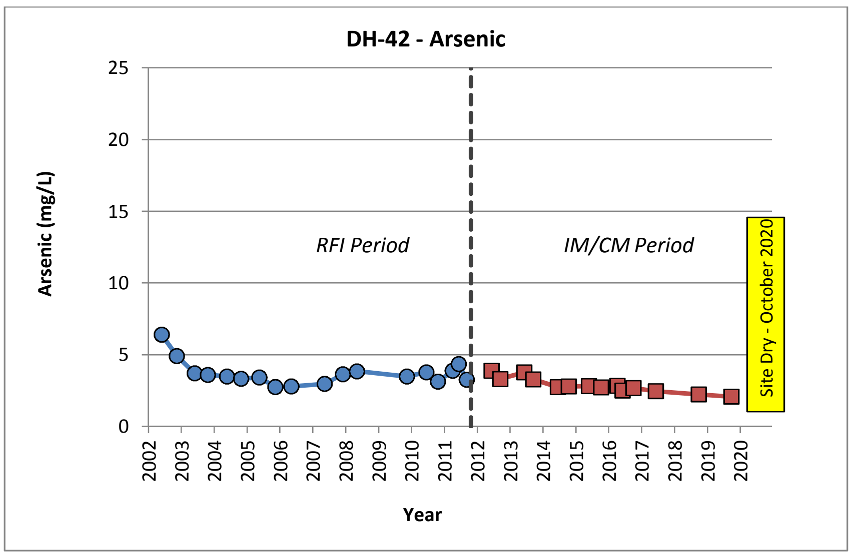
		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-20**	**Oct-20**	**Jun-20**	**Oct-20**
EH-143	3803.37	37.79	33.87	3765.58	3769.50
EH-144D	3778.86	25.27	22.56	3753.59	3756.30
EH-144M	3778.95	27.97	25.32	3750.98	3753.63
EH-144S	3778.70	29.41	26.91	3749.29	3751.79
EH-145D	3789.60	33.05	30.07	3756.55	3759.53
EH-145S	3790.09	33.99	31.04	3756.10	3759.05
EH-200	3953.33	28.39	27.96	3924.94	3925.37
EH-201	3973.48	86.78	85.77	3886.70	3887.71
EH-202	3930.56	65.23	65.57	3865.33	3864.99
EH-203	4003.92	103.16	103.21	3900.76	3900.71
EH-204	3925.69	56.32	56.55	3869.37	3869.14
EH-205	3900.66	36.41	35.87	3864.25	3864.79
EH-206	3898.10	49.68	49.53	3848.42	3848.57
EH-208	3910.58	53.77	54.90	3856.81	3855.68
EH-209	3898.34	38.94	40.22	3859.40	3858.12
EH-210	3901.19	38.80	38.41	3862.39	3862.78
EH-211	3905.75	49.96	No Access	3855.79	No Access
EH-212	3905.90	50.06	No Access	3855.84	No Access
EHMW-3	3825.45	47.21	42.38	3778.24	3783.07
EHTW-3	3827.66	50.02	44.88	3777.64	3782.78
IW-01	3888.28	66.75	66.21	3821.53	3822.07
IW-02	3871.08	52.04	51.73	3819.04	3819.35
MW-1	3953.05	52.50	52.76	3900.55	3900.29
MW-2	3945.97	40.33	41.00	3905.64	3904.97
MW-3	3940.95	35.55	36.34	3905.40	3904.61
MW-4	3947.06	48.94	49.22	3898.12	3897.84
MW-5	3956.18	53.92	54.12	3902.26	3902.06
MW-6	3938.14	32.36	32.82	3905.78	3905.32
MW-7	3963.67	55.62	55.48	3908.05	3908.19
MW-8	3958.65	53.01	53.36	3905.64	3905.29
MW-9	3959.01	52.22	52.27	3906.79	3906.74
MW-10	3946.28	45.06	45.54	3901.22	3900.74
MW-11	3973.33	63.19	63.13	3910.14	3910.20
PBTW-1	3914.59	48.25	47.26	3866.34	3867.33
PBTW-2	3906.73	40.92	39.90	3865.81	3866.83
PPCRPZ-02	3919.76	7.52	8.25	3912.24	3911.51
PRB-1	3918.37	52.41	51.40	3865.96	3866.97
PRB-2	3905.34	38.75	37.86	3866.59	3867.48
PRB-3	3919.19	53.32	52.33	3865.87	3866.86
PZ-36A	3858.96	15.20	18.24	3843.76	3840.72
PZ-36B	3858.75	DRY	DRY	DRY	DRY
PZ-36C	3859.60	DRY	DRY	DRY	DRY

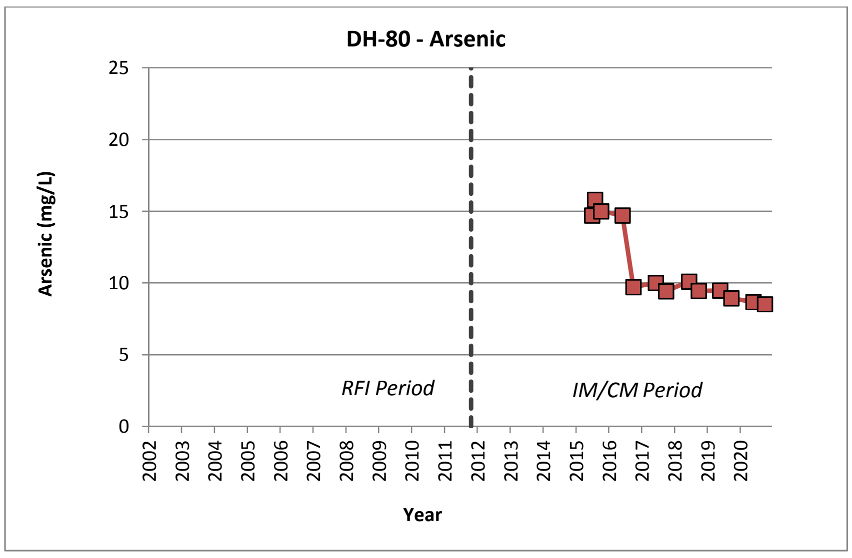
2020 PROJECT-WIDE MONTHLY GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

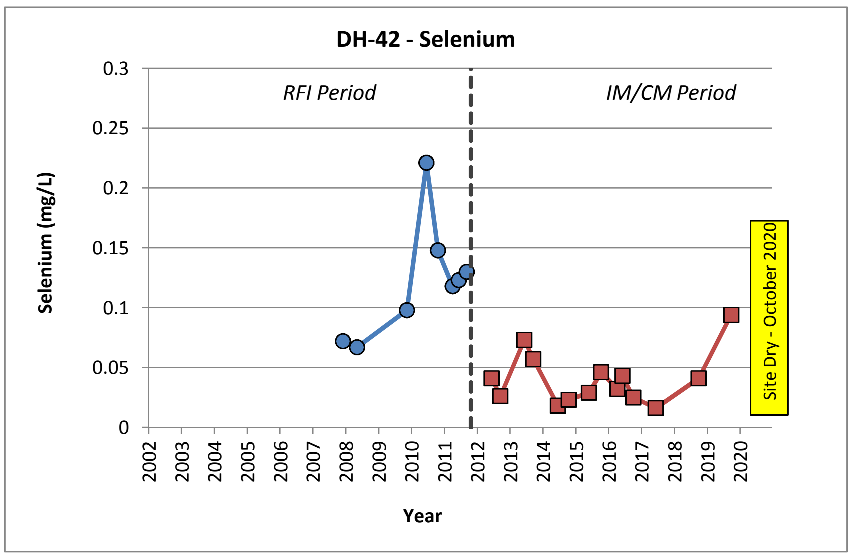
		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-20**	**Oct-20**	**Jun-20**	**Oct-20**
PZ-9A	3850.70	DRY	DRY	DRY	DRY
PZ-9B	3849.43	19.10	16.30	3830.33	3833.13
SC-1	3890.42	34.61	33.77	3855.81	3856.65
SDMW-1	3925.11	52.75	52.18	3872.36	3872.93
SDMW-2	3928.09	54.85	54.49	3873.24	3873.60
SDMW-3	3935.14	53.44	53.43	3881.70	3881.71
SDMW-4	3936.10	51.70	51.62	3884.40	3884.48
SDMW-5	3929.86	55.32	55.10	3874.54	3874.76
SP-3	3905.91	DRY	DRY	DRY	DRY
SP-4	3908.16	DRY	DRY	DRY	DRY
SP-5	3903.52	27.77	DRY	3875.75	DRY
TW-1	3930.10	52.42	52.08	3877.68	3878.02
TW-2	3931.44	54.22	53.96	3877.22	3877.48
ULM-PZ-1	3924.40	5.60	6.24	3918.80	3918.16
ULTP-1	3919.63	No Access	6.28	No Access	3913.35
ULTP-2	3921.23	6.59	7.96	3914.64	3913.27

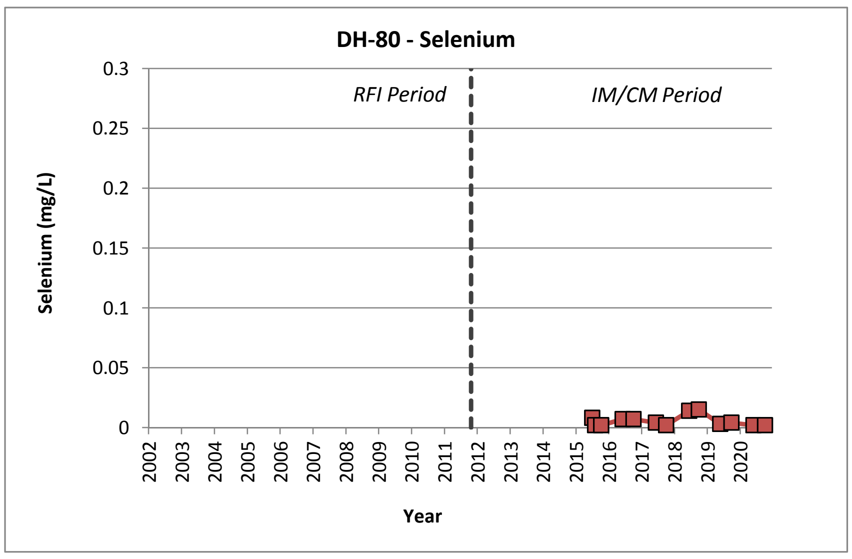
APPENDIX C

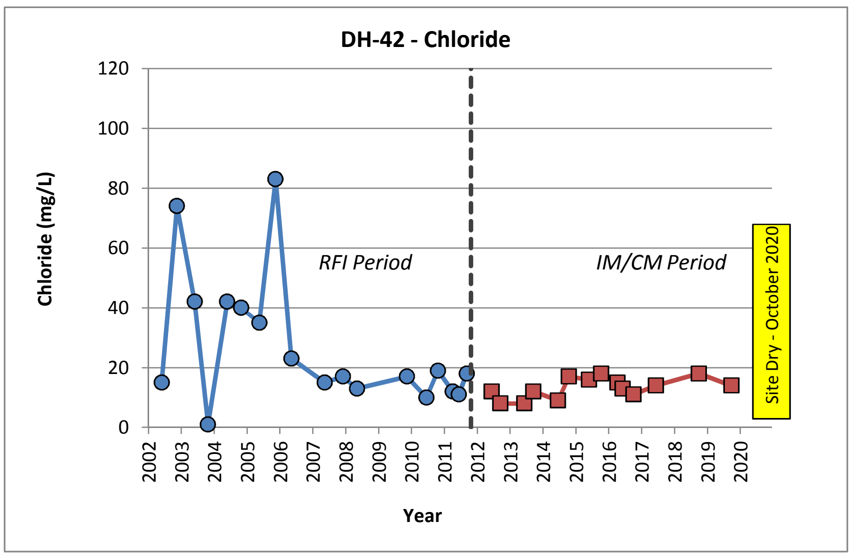
SITE-WIDE GROUNDWATER CONCENTRATION TREND GRAPHS

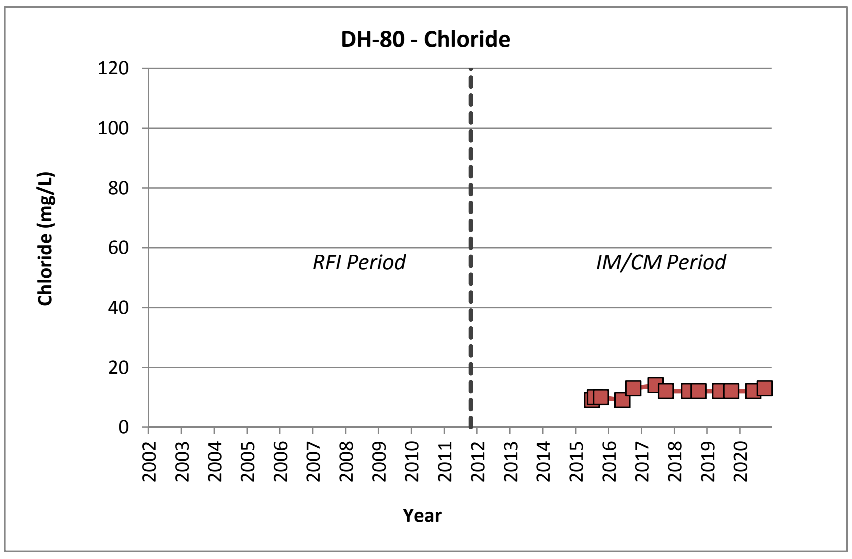


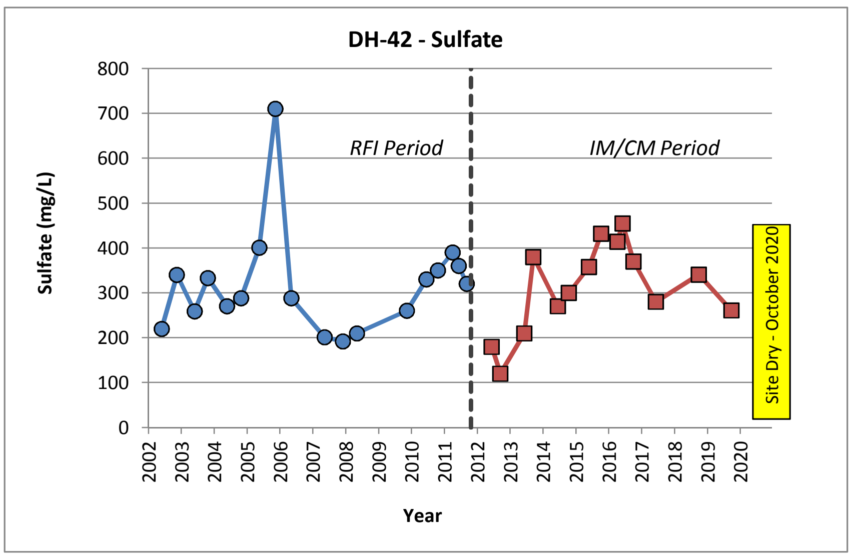


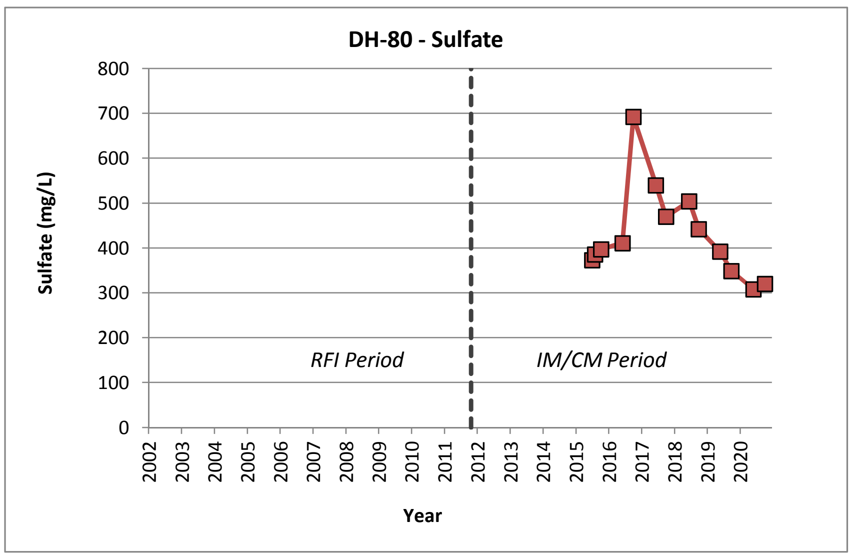






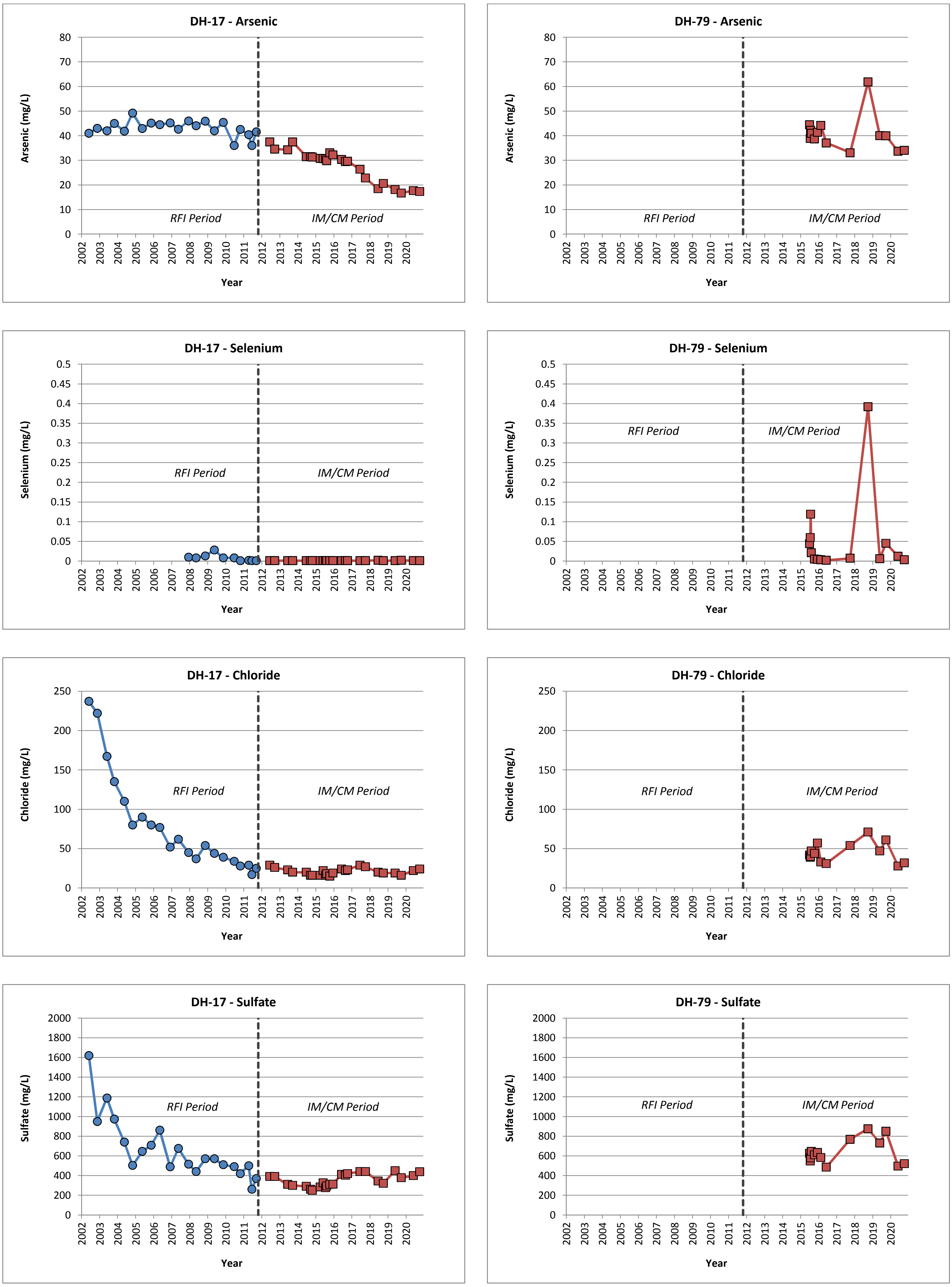




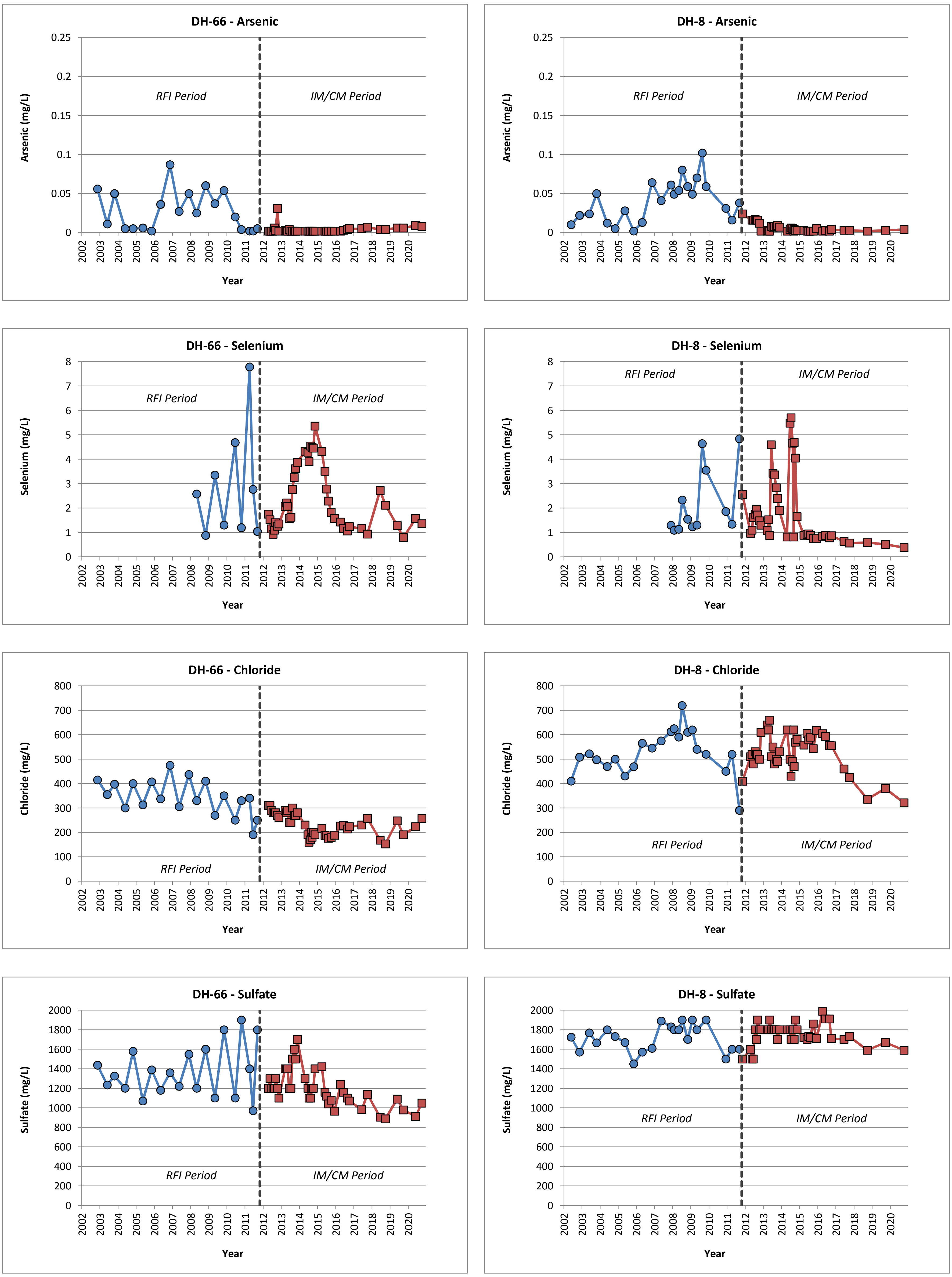


Hydrometrics, Inc.	2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**FORMER ACID PLANT AREA GROUNDWATER QUALITY TRENDS**	FIGURE **C-1**

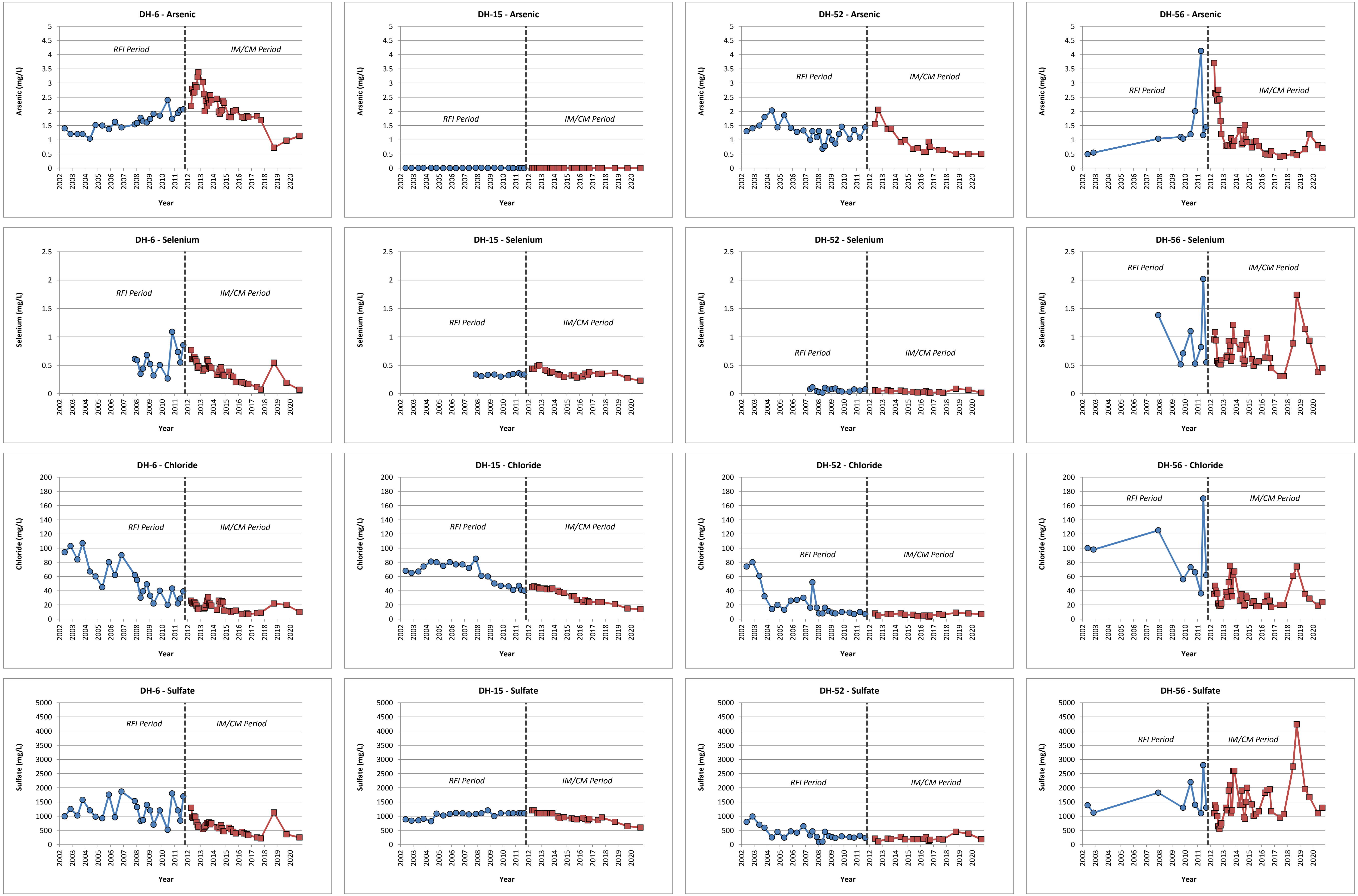
K:\project\10022\Annual Monitoring Reports\2020 WRM Report\Appendices\Appendix C\AsSeClSO4_TrendData_2020Report.xlsx\AP Graphs 2020



Hydrometrics, Inc.	2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	NORTH PLANT ARSENIC AREA GROUNDWATER QUALITY TRENDS	FIGURE C-2

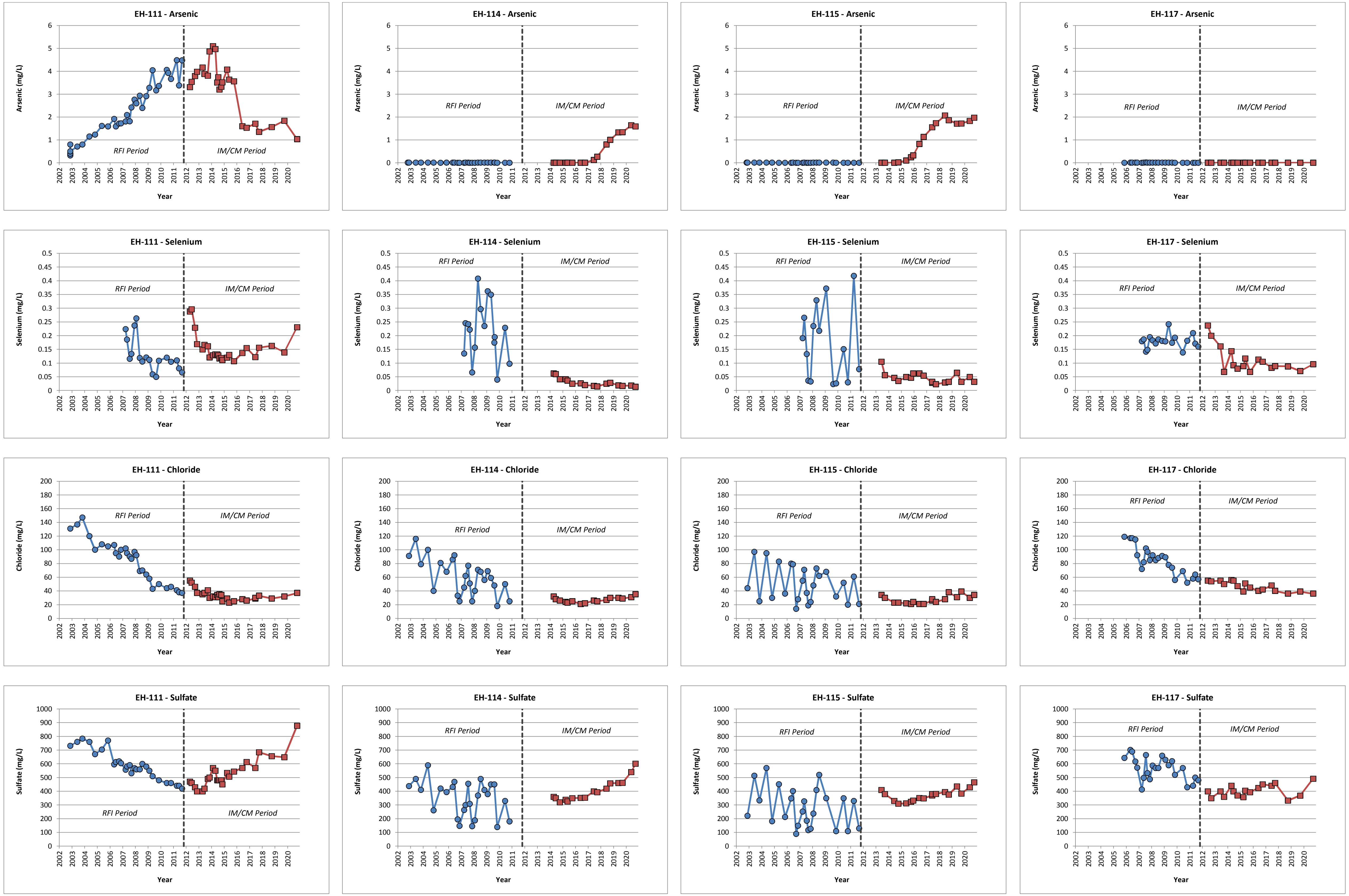


Hydrometrics, Inc.	2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**WEST SELENIUM AREA GROUNDWATER QUALITY TRENDS**	FIGURE **C-3**

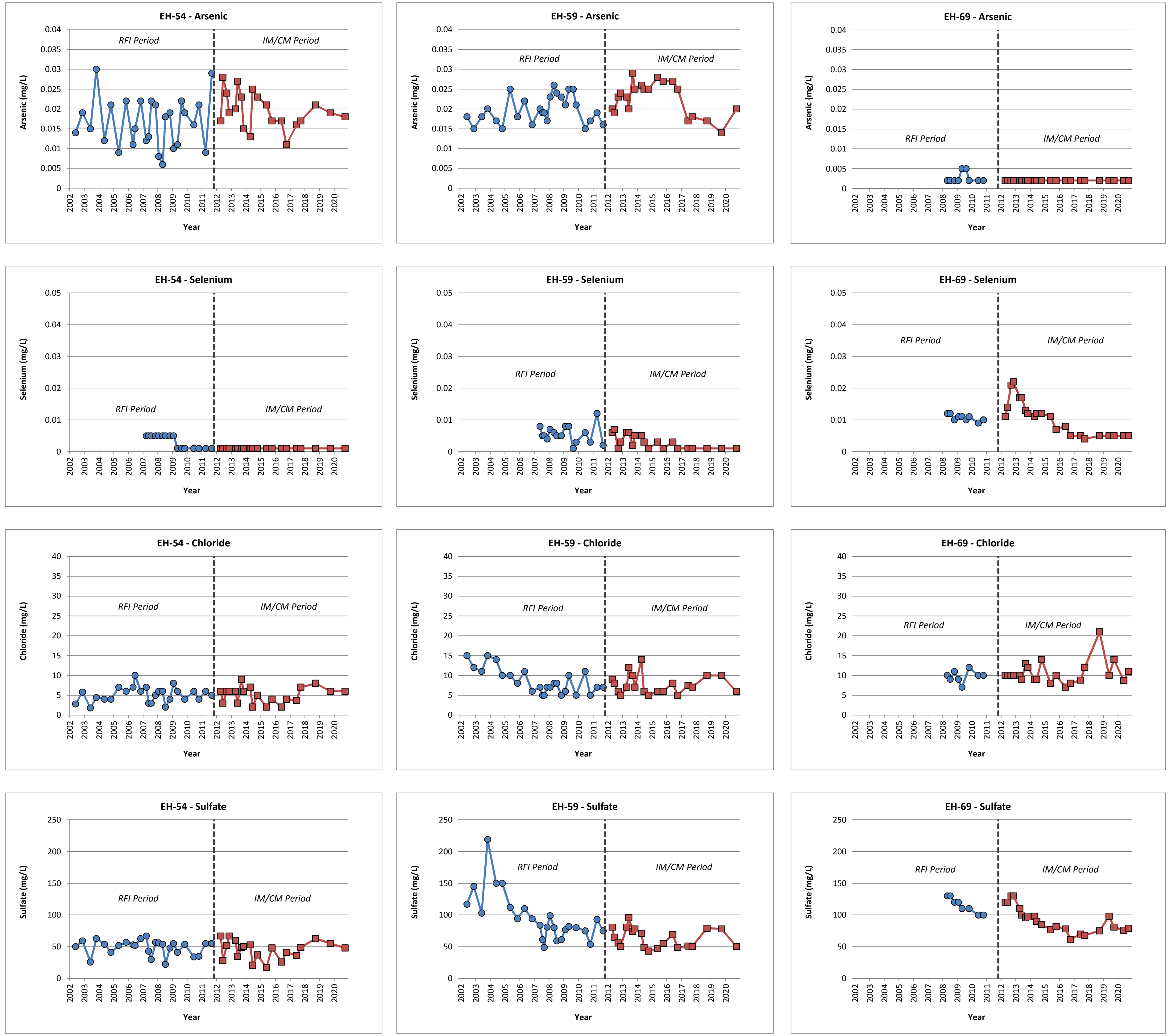


2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	SLAG PILE AREA GROUNDWATER QUALITY TRENDS	FIGURE C-4

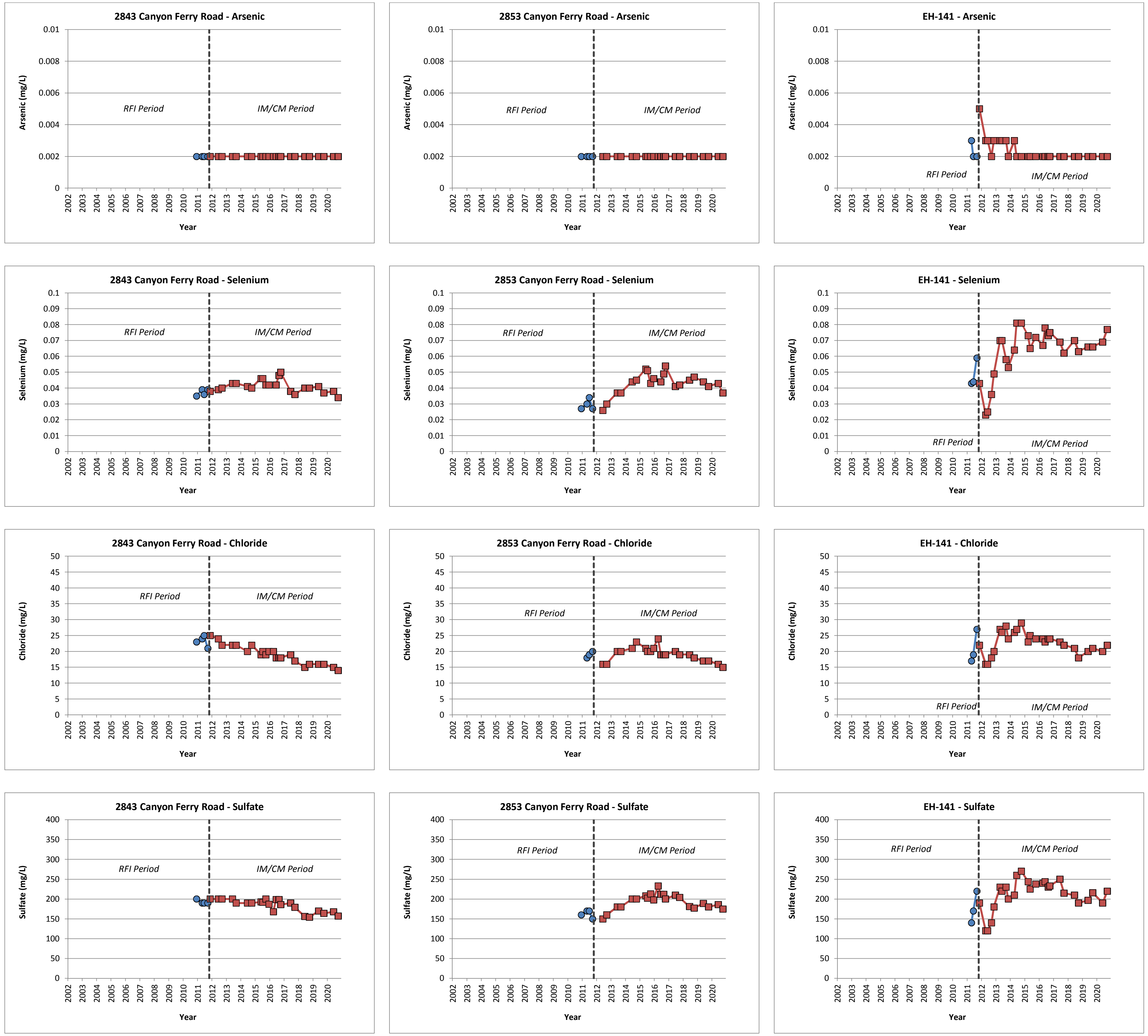
K:\project\10022\Annual Monitoring Reports\2020 WRM Report\Appendices\Appendix C\AsSeClSO4_TrendData_2020Report.xlsx\Slag Pile Graphs 2020



2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (WEST) GROUNDWATER QUALITY TRENDS	FIGURE C-5



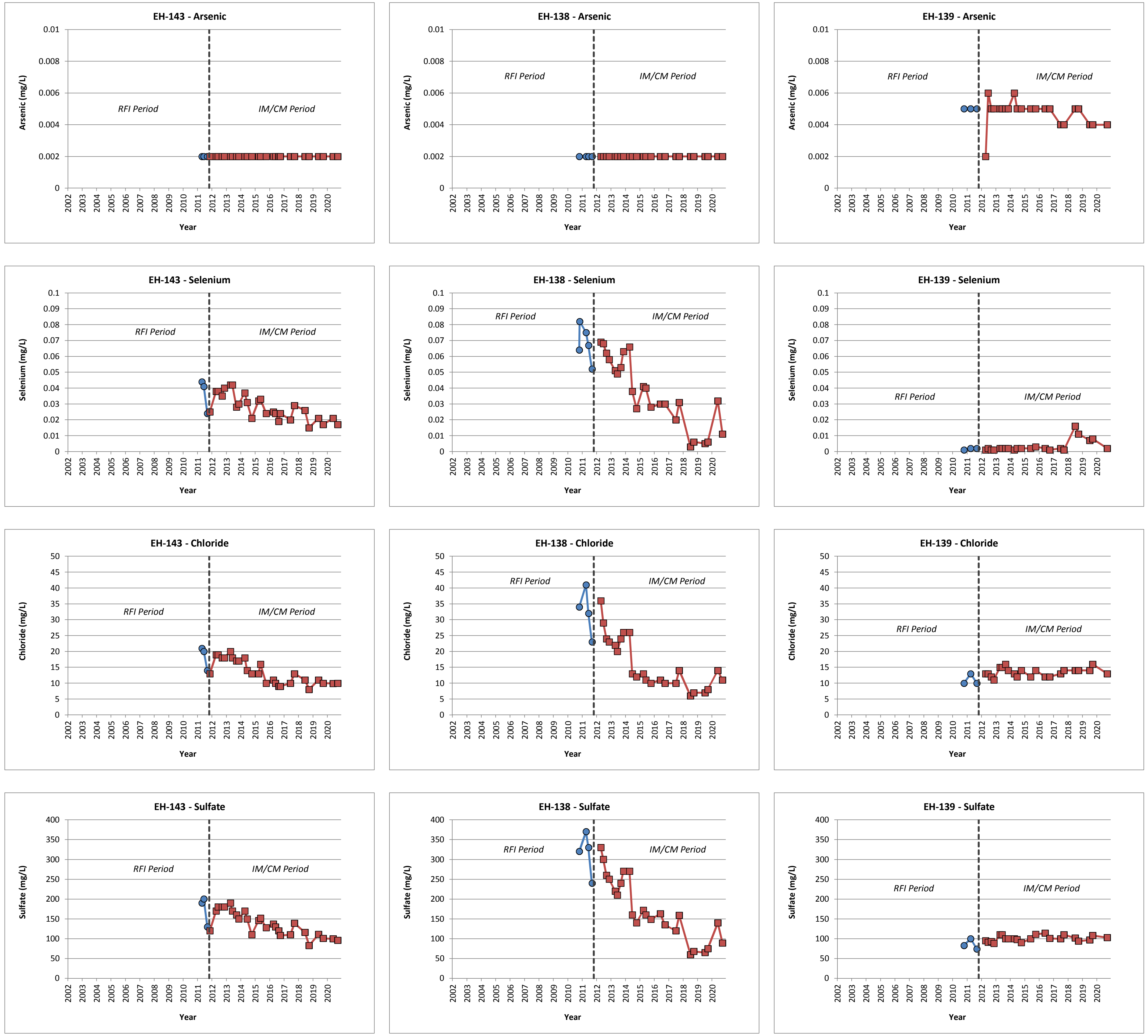
2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (EAST) GROUNDWATER QUALITY TRENDS	FIGURE C-5



2020 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS

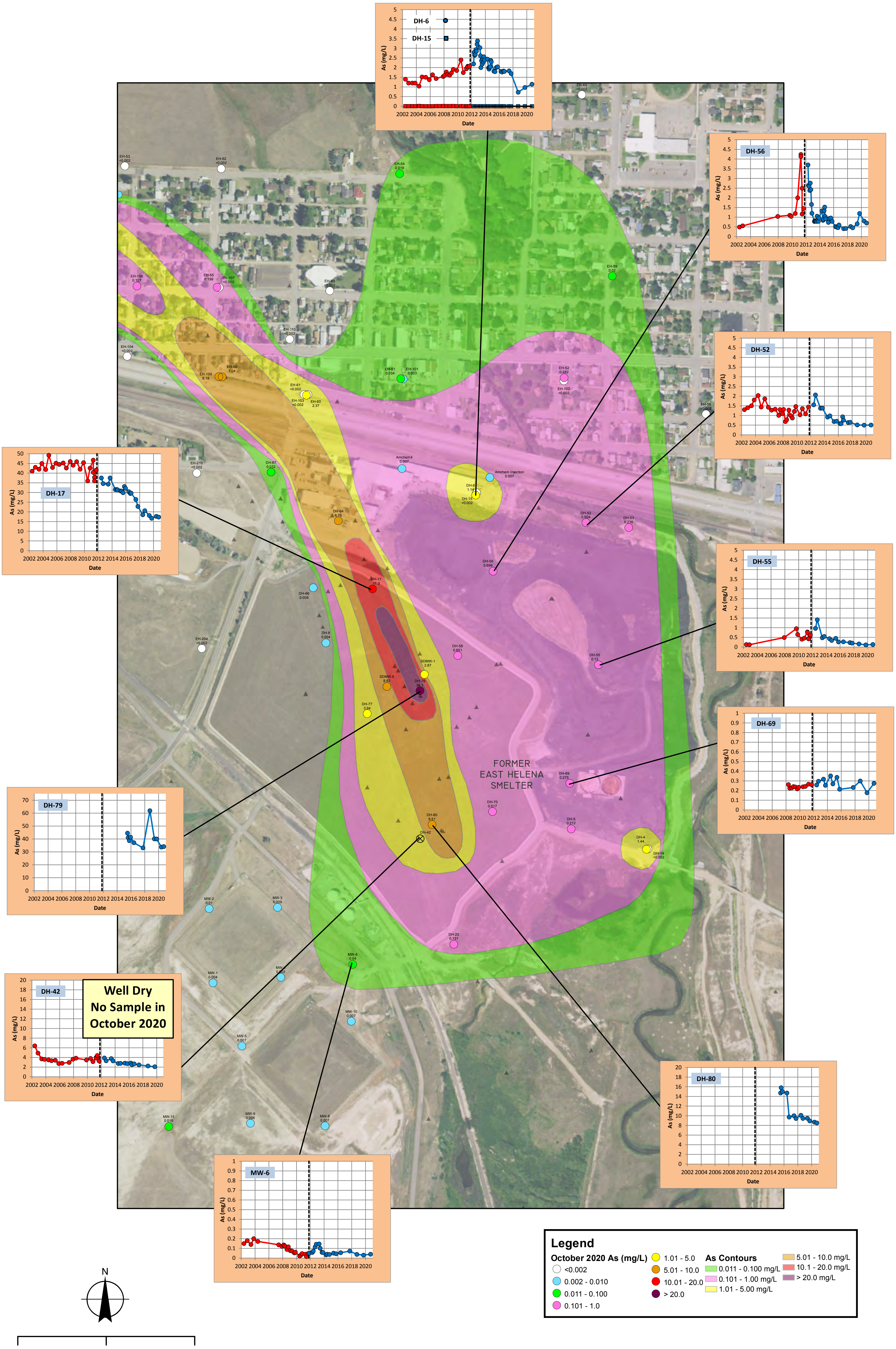
FIGURE
C-6



2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS**	FIGURE **C-6**

APPENDIX D

ARSENIC AND SELENIUM
TREND PLOT MAPS



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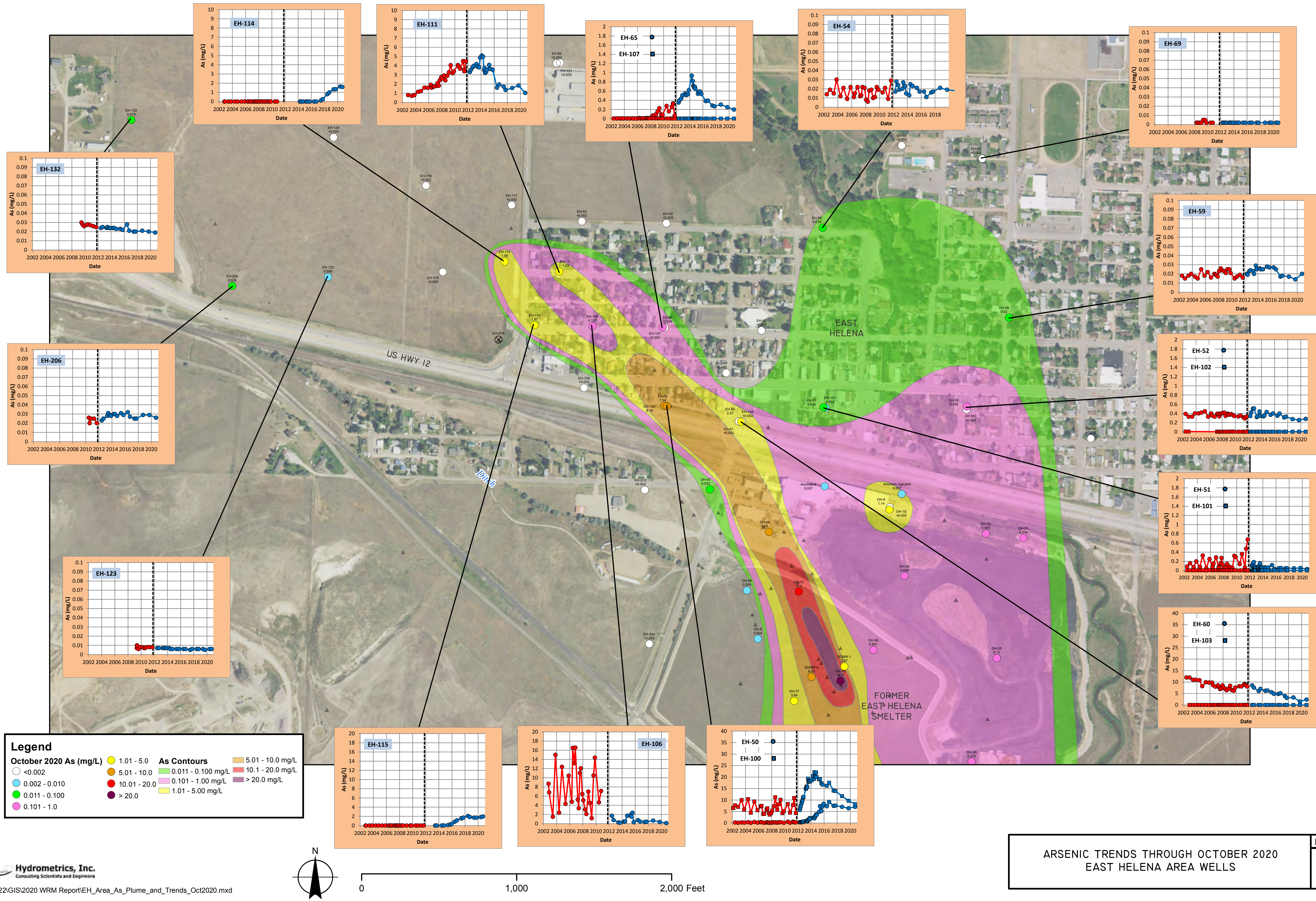
V:\10022\GIS\2020 WRM Report\Plant_Area_As_Plume_and_Trends_Oct2020.mxd

ARSENIC TRENDS THROUGH OCTOBER 2020
PLANT AREA WELLS

FIGURE
D-1



ARSENIC TRENDS THROUGH OCTOBER 2020
EAST HELENA AREA WELLS

FIGURE
D-2

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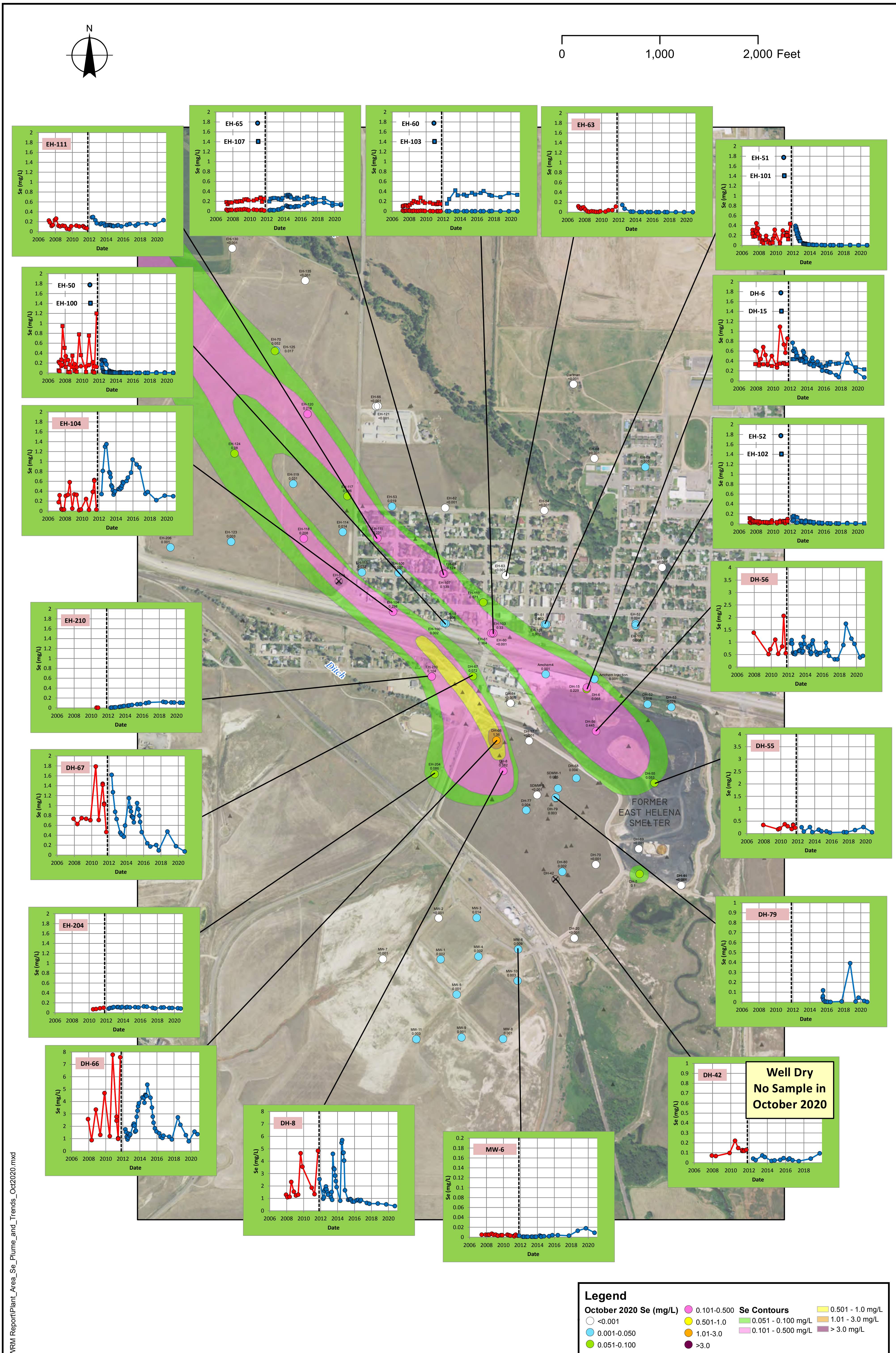

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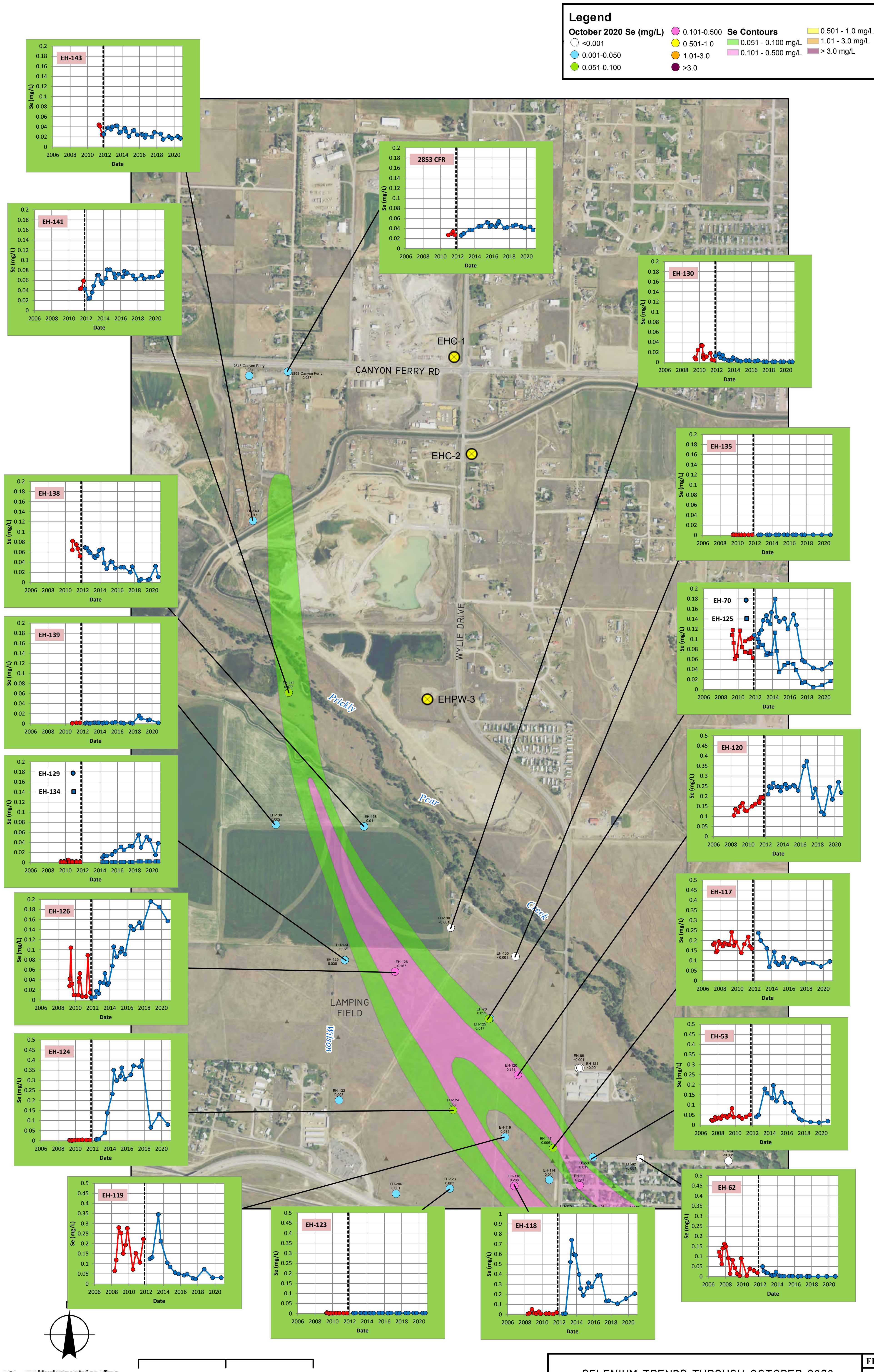
SELENIUM TRENDS THROUGH OCTOBER 2020
PLANT AREA WELLS

FIGURE
D-3



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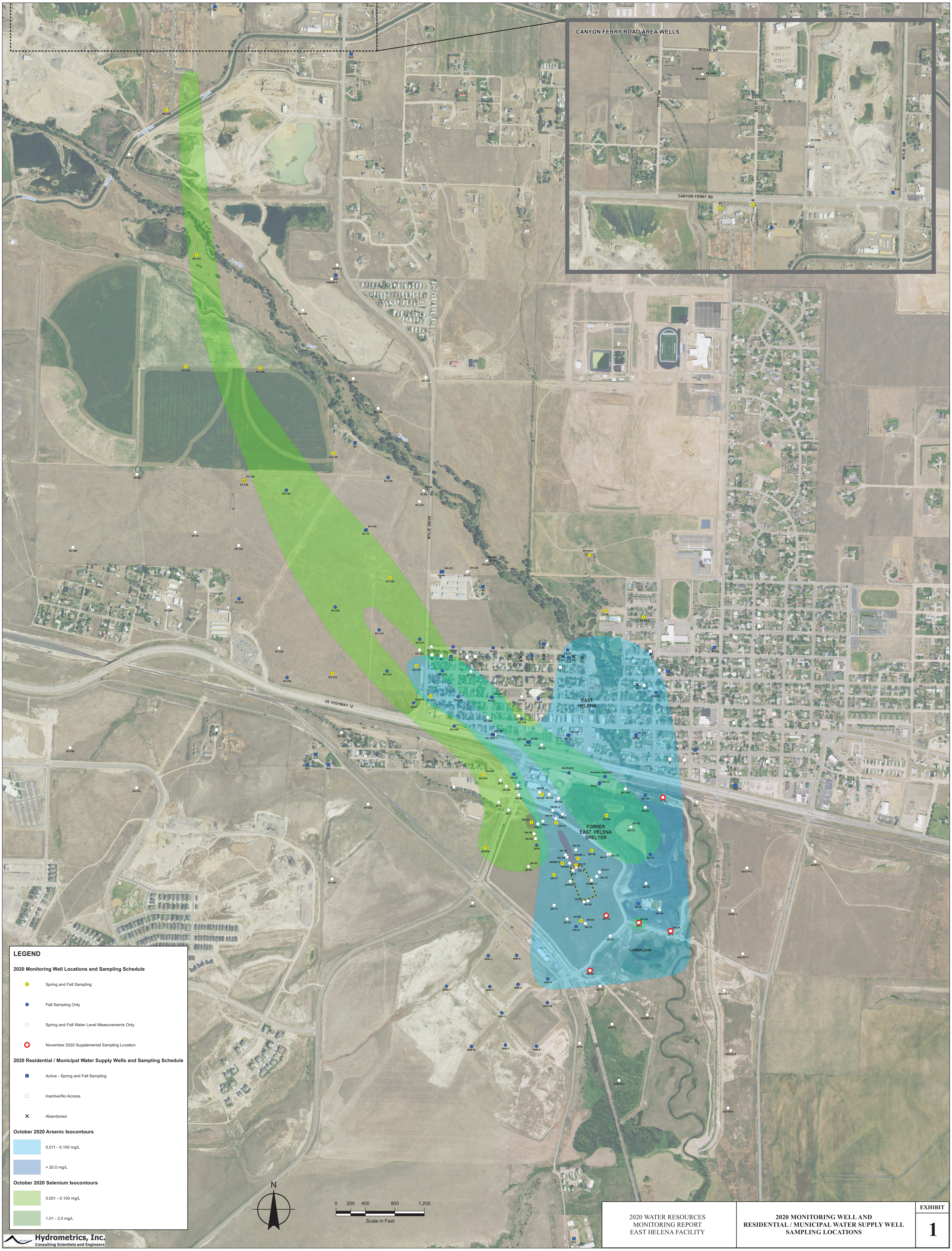
SELENIUM TRENDS THROUGH OCTOBER 2020
DOWNGRADIENT AREA

FIGURE
D-4

EXHIBITS



2020 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY

2020 MONITORING WELL AND RESIDENTIAL / MUNICIPAL WATER SUPPLY WELL SAMPLING LOCATIONS

EXHIBIT 1