STORM WATER MONITORING PROGRAM 2019 ANNUAL REPORT

Hecla Greens Creek Mining Company

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1.0 Introduction

This Storm Water Report is submitted by Hecla Greens Creek Mining Company (HGCMC) pursuant to Parts 1.3, 1.6.2 and 1.8 of Alaska Pollutant Discharge Elimination System (APDES) Permit AK-0043206, effective 1 October 2015. APDES Permit AK-0043206 authorizes HGCMC to discharge from the Greens Creek Mine facility located on Admiralty Island at 11 locations (Table 1).

Table 1: Authorized Discharge Locations

Outfall	Receiving Water or Body	Latitude	Longitude
002	Hawk Inlet	58° 06’ 06” N	134° 46’ 30” W
003	Hawk Inlet	58° 07’ 32” N	134° 45’ 16” W
004	Wetlands	58° 09’ 01” N	134° 45’ 16” W
005.2	Zinc Creek	58° 05’ 28” N	134° 44’ 10” W
005.3	Greens Creek	58° 04’ 23” N	134° 43’ 25” W
005.4	Greens Creek	58° 04’ 21” N	134° 43’ 12” W
005.5	Greens Creek	58° 04’ 41” N	134° 39’ 07” W
006	Greens Creek	58° 04’ 43” N	134° 38’ 49” W
007	Greens Creek	58° 04’ 50” N	134° 38’ 27” W
008	Greens Creek	58° 04’ 52” N	134° 38’ 06” W
009	Greens Creek	58° 04’ 47” N	134° 37’ 47” W

Outfall 002 discharges treated wastewater contributed by mine contact water, storm water, mill process water, treated domestic wastewater, and intercepted groundwater at the mouth of Hawk Inlet. Monitoring associated with the APDES Outfall 002 diffuser is included in the Hawk Inlet Monitoring Program Annual Report.

This report includes results of monitoring associated with storm water outfalls 003, 004, 005.2, 005.3, 005.4, 005.5, 006, 007, 008, and 009. Outfall monitoring requirements (AK-0043206 Part 1.3) are summarized in Table 2. Outfall locations are shown in Figure 1.

Table 2: Storm Water Outfall Monitoring Requirements

Outfall	Location	Parameters[a]	Minimum Frequency[b]	Sample Type
003	Southern part of Hawk Inlet facilities area near the cannery buildings	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
004	Pit 7 (inactive rock quarry and topsoil storage) off of A-road at mile 1.9	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.2	Zinc Creek (east side of bridge) off of B-road at mile 3.0	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.3	Site E (inactive waste rock storage area) off of B-road at mile 4.7	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.4	Pit 6 (inactive rock quarry and top soil storage) off of B-road at mile 4.6	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.5	Culvert at B-road mile 7.8	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
006	Pond D (sediment pond from inactive waste rock storage area D) off of B-road at mile 8.0	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab
007	Pond C (sediment pond from inactive waste rock storage area C) off of B-road at mile 8.2	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab
008	960 laydown site (initial portal development waste rock)	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab
009	Site 1350 adit inactive waste rock storage area	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab

a. Flow shall be reported in gpm, lead and zinc shall be measured as total recoverable in µg/L, oil & grease and TSS shall be measured in mg/L, pH shall be measured in s.u., and hardness shall be measured as mg/L of $CaCO_3$.

b. The samples must be collected once during the spring runoff or snow-melt and once during the fall rainfall events. Sampling is only required when an outfall is discharging.

Section 1.6.2 of APDES Permit AK-0043206 requires monitoring of the receiving water directly upstream and downstream of where each storm water outfall enters the receiving water. The

upstream and downstream monitoring sites are summarized in Table 3 and locations are shown in Figures 2 through 9.

Receiving water monitoring is to be conducted semiannually (Table 2) and at the same time (within three hours) as each associated outfall. Samples are to be collected during the spring runoff or snow-melt and during the fall rainfall events. Because of the time required to visit all ten storm water outfalls and associated receiving water sites, it is likely that each semiannual monitoring event will occur over multiple days and potentially during separate storm events.

Storm event data and analytical water quality monitoring data for storm water and receiving water for the reporting period are presented in Section 2.0 of this report. An evaluation of the results for each outfall, including comparison of upstream and downstream monitoring, is presented in Section 3.0 pursuant to AK-0043206 Part 1.8. Section 4.0 of this report contains the required annual certification (AK-0043206 Appendix A, Part 1.12). Graphical presentations of the data at each monitoring station versus time are included in Attachment A. Attachment B is a tabulation of historical data for the outfalls and receiving waters. The data are also submitted as an electronic spreadsheet per AK-0043206 Part 1.8.

Table 3: Storm Water Outfall and Receiving Water Monitoring Sites

Location	Outfall	Site	Type	Site Description
Hawk Inlet	003	527SW	S	North Cannery Building @ Culvert Outfall
		529SW	RD	Hawk Inlet Float Plane Dock
Pit 7	004	520SW	S	"A" Road @ 1.8 Mile - Pit "7"
		532SW	RU	Upstream of Outfall 004
		524SW	RD	Downstream of Outfall 004
Zinc Creek Bridge	005.2	539SW	S	"B" Road @ 3.0 Mile - Zinc Creek Bridge
		371SW	RU	Zinc Creek - Above “B” Road
		368SW	RD	Zinc Creek - Below “B” Road
Site E	005.3	545SW	S	"B" Road @ 4.5 Mile - Waste Rock Area "E"
		595SW	RU	Greens Creek upstream of Outfalls 005.3 and 005.4
		591SW	RD	Greens Creek downstream of Outfalls 005.3 and 005.4
Pit 6	005.4	547SW	S	"B" Road @ 4.6 Mile - Pit "6"
		595SW	RU	Greens Creek upstream of Outfalls 005.3 and 005.4
		591SW	RD	Greens Creek downstream of Outfalls 005.3 and 005.4
7.8 Mile	005.5	560SW	S	"B" Road @ 7.8 Mile - Culvert Outfall
		6SW	RU	Greens Creek - Middle, Above Bruin Creek
		590SW	RD	Greens Creek - Lower
Pond D	006	562SW	S	Pond "D" Overflow - Waste Rock Area "D"
		6SW	RU	Greens Creek - Middle, Above Bruin Creek
		590SW	RD	Greens Creek - Lower
Pond C	007	565SW	S	Pond "C" Overflow - Waste Rock Area "C"
		1SW	RU	Greens Creek - Upper, At 920 Weir
		6SW	RD	Greens Creek - Middle, Above Bruin Creek
960 Waste Rock Pile	008	570SW	S	Waste Rock Area "960"
		1SW	RU	Greens Creek - Upper, At 920 Weir
		6SW	RD	Greens Creek - Middle, Above Bruin Creek
1350 Waste Stockpile	009	580SW	S	Site 1350 Inactive Waste Rock Storage Area – East Drainage
		48SW	RU	Greens Creek - Background Control Site
		1SW	RD	Greens Creek - Upper, At 920 Weir

* S = Storm water, RU = Receiving water upstream, RD = Receiving water downstream

2.0 Annual Monitoring Results

This section includes the results of storm water outfall and receiving waterbody monitoring pursuant to APDES Permit AK-0043206 Parts 1.3 and 1.6.2. Section 2.1 includes the date and duration (in hours) of the storm event sampled; rainfall measurements or estimates (in inches) of the storm event; the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event; and an estimate of the total volume (in gallons) of the discharge (AK-0043206 Part 1.3.7). Water quality data are included in Section 2.2.

2.1 Storm Event Data

Precipitation and duration data associated with the sampling events that occurred during the reporting period are summarized in Table 4. HGCMC maintains three meteorological stations at the site; one located at the mill site, one located at the tailings facility, and one located at the Hawk Inlet float plane dock. When possible, the meteorological station in closest proximity to the outfalls being sampled is used as the reference station for the precipitation and duration data.

The estimated total gallons of storm water discharged through the outfalls that were sampled during the reporting period are presented in Table 5. These discharge estimates were calculated using the rational method equation. Catchment areas were calculated based on high resolution LiDAR aerial imagery acquired in 2015.

2.2 Water Quality Data

Analytical results for the required monitoring parameters (Table 2) for each outfall and associated receiving water sites are presented in Table 6. Also provided are the method detection limit (MDL) and minimum level of quantification (ML) for total recoverable lead, total recoverable zinc, oil and grease, and total suspended solids. As required by Permit Part 1.3.6, if a value is less than the MDL it is reported as less than the numeric value of the MDL, and if a value is less than the ML it is reported as less than the numeric value of the ML.

The results in Table 6 are organized first by the permitted outfall, and then by the date of the sample or observation. The results for the storm water effluent (S) are grouped with the receiving

water upstream sites (RU) and downstream sites (RD), as appropriate for each sampling event. A discussion and evaluation of the results for each outfall and sampling event is provided in the following section.

Table 4: Storm Event Details

Date	3/18/2019	5/6/2019	8/27/2019	9/24/2019	10/6/2019
Outfalls Sampled	003, 005.3, 005.4	008, 009	008, 009	005.2, 005.3, 005.4	003
Outfalls Observed (not sampled)	004, 005.2	005.5, 006, 007	005.5, 006, 007	004, 005.5, 006, 007	004
Meteorological Station Reference	Hawk Inlet	Mill Site	Mill Site	Tailings	Hawk Inlet
SAMPLE EVENT					
Duration (hours)		20.25	18	19.5	11
Start Date		5/5/19	8/26/19	9/23/19	10/6/19
Start Time		16:45	14:30	17:15	0:15
Precipitation (inches)	Snow melt	0.47	0.61	0.942	0.86
Same Day Precip. (inches)	Snow melt	0.24	0.05	0.604	0.86
PRIOR EVENT					
Lapse Between Events (hours)		12.5	49	4.5	106.75
Duration (hours)		14.5	5.5	4.25	24.5
Start Date		5/4/19	8/24/19	9/23/19	9/30/19
Start Time		13:45	8:00	8:30	13:00
Precipitation (inches)		0.36	0.25	0.12	0.81

Table 5: Storm Water Outfall Area and Estimated Total Discharge Volume

Outfall	Date	Catchment Area (acres)	Total Discharge (gallons)
008	5/6/2019	0.7	3,512
009	5/6/2019	3.3	16,556
008	8/27/2019	0.7	4,615
009	8/27/2019	3.3	21,755
005.2	9/24/2019	0.6	4,537
005.3	9/24/2019	6.8	85,702
005.4	9/24/2019	1.9	19,157
003	10/6/2019	0.2	3,235

Table 6: Storm Water Outfall and Receiving Water Monitoring Results

Outfall	Date	Time	Site	Type *	Flow	pH	Hardness	Lead-TR			Zinc-TR			Oil & Grease			TSS		
					(gpm)	(su)	(mg/L)	(µg/L)	MDL	ML	(µg/L)	MDL	ML	(mg/L)	MDL	ML	(mg/L)	MDL	ML
003	18-Mar	14:40	527SW	S	0.39	7.35	134	1.9	0.1	0.5	67	4	10	<2	2	10	<5	5	20
		14:52	529SW	RD		7.68	1990	1	0.2	1	18	8	20	<2	2	10	24	5	20
	6-Oct	12:35	527SW	S	4.5	7.04	101	4.1	0.1	0.5	85	4	10	<2	2	10	6	5	20
		13:01	529SW	RD		7.44	2530	1.6	0.5	3	14	8	20	<2	2	10	25	5	20
004	18-Mar		520SW	S	0	No sample taken due to no discharge													
	24-Sep		520SW	S	0	No sample taken due to no discharge													
	6-Oct		520SW	S	0	No sample taken due to no discharge													
005.2	6-May	15:00	539SW	S	0	No sample taken due to no discharge													
	24-Sep	12:40	539SW	S	1	3.76	78	5.5	0.1	0.5	168	4	10	<2	2	10	<5	5	20
		12:50	371SW	RU		6.88	26	2.3	0.1	0.5	66	4	10	<2	2	10	98	5	20
		13:05	368SW	RD		7.18	27	2.3	0.1	0.5	60	4	10	<2	2	10	89	5	20
005.3	18-Mar	11:23	545SW	S	50	7.14	161	7.5	0.1	0.5	392	4	10	<2	2	10	13	5	20
		12:50	595SW	RU		7.74	47	2.1	0.1	0.5	31	4	10	<2	2	10	32	5	20
		12:31	591SW	RD		7.58	46	2.2	0.1	0.5	23	4	10	<2	2	10	23	5	20
	24-Sep	09:40	545SW	S	100	7.21	239	31.4	0.1	0.5	875	4	10	<2	2	10	67	5	20
		11:20	595SW	RU		7.55	46	5.7	0.1	0.5	44	4	10	<2	2	10	69	5	20
		11:00	591SW	RD		7.53	46	3.8	0.1	0.5	30	4	10	<2	2	10	49	5	20
005.4	18-Mar	11:48	547SW	S	3	7.48	47	<0.1	0.1	0.5	<4	4	10	<2	2	10	<5	5	20
		12:50	595SW	RU		7.74	47	2.1	0.1	0.5	31	4	10	<2	2	10	32	5	20
		12:31	591SW	RD		7.58	46	2.2	0.1	0.5	23	4	10	<2	2	10	23	5	20
	24-Sep	10:15	547SW	S	2	7.17	73	<0.1	0.1	0.5	6	4	10	<2	2	10	<5	5	20
		11:20	595SW	RU		7.55	46	5.7	0.1	0.5	44	4	10	<2	2	10	69	5	20
		11:00	591SW	RD		7.53	46	3.8	0.1	0.5	30	4	10	<2	2	10	49	5	20
005.5	6-May	14:30	560SW	S	0	No sample taken due to no discharge													
	27-Aug	8:30	560SW	S	0	No sample taken due to no discharge													
	24-Sep	9:15	560SW	S	0	No sample taken due to no discharge													
	6-Oct	15:08	560SW	S	0	No sample taken due to no discharge													
006	6-May	10:00	562SW	S	0	No sample taken due to no discharge													
	27-Aug	8:40	562SW	S	0	No sample taken due to no discharge													
	24-Sep	9:10	562SW	S	0	No sample taken due to no discharge													
007	6-May	10:30	565SW	S	0	No sample taken due to no discharge													
	27-Aug	8:55	565SW	S	0	No sample taken due to no discharge													
	24-Sep	9:05	565SW	S	0	No sample taken due to no discharge													

Outfall	Date	Time	Site	Type *	Flow	pH	Hardness	Lead-TR			Zinc-TR			Oil & Grease			TSS		
					(gpm)	(su)	(mg/L)	(µg/L)	MDL	ML	(µg/L)	MDL	ML	(mg/L)	MDL	ML	(mg/L)	MDL	ML
008	6-May	12:12	570SW	S	10	7.64	188	<0.1	0.1	0.5	28	4	10				<5	5	20
		13:52	1SW	RU	29,562	7.87	44	0.4	0.1	0.5	6	4	10				<5	5	20
		10:08	6SW	RD		7.74	42	0.2	0.1	0.5	8	4	10	<2	2	10	5	5	20
	27-Aug	09:05	570SW	S	3	7.46	234	0.1	0.1	0.5	18	4	10				<5	5	20
		09:45	1SW	RU	21,632	7.72	53	0.1	0.1	0.5	7	4	10				<5	5	20
		08:47	6SW	RD		7.59	48	0.1	0.1	0.5	10	4	10	<2	2	10	<5	5	20
009	6-May	13:03	580SW	S	5	7.54	77	0.6	0.1	0.5	402	4	10				10	5	20
		13:34	48SW	RU		7.79	42	0.1	0.1	0.5	5	4	10				<5	5	20
		13:52	1SW	RD	29,562	7.87	44	0.4	0.1	0.5	6	4	10				<5	5	20
	27-Aug	09:24	580SW	S	6	7.46	100	<0.1	0.1	0.5	204	4	10				<5	5	20
		09:52	048SW	RU		7.75	47	<0.1	0.1	0.5	6	4	10				<5	5	20
		09:45	001SW	RD	21,632	7.72	53	0.1	0.1	0.5	7	4	10				<5	5	20

Note * S = Stormwater
RU = Receiving water upstream
RD = Receiving water downstream

3.0 Water Quality Monitoring Summary

Permit AK-0043206 does not establish numeric effluent limits for the individual storm water outfalls. As stated in the Permit Fact Sheet, this is due to the difficulty in developing numeric limits for storm water discharges that are extremely variable in flow and pollutant concentrations and the uncertainty regarding the effect of the storm water discharges on the receiving waters. Instead, the permit requires HGCMC to implement corrective action if a storm water discharge exceeds a water quality criterion *and* results in a statistically significant reduction in receiving water quality for the same criterion.

Statistics can be used to define the statistical uncertainty between sample values collected at different sites (e.g., upstream and downstream receiving waters). Statistics can never prove that a difference between sample values is real, only the probability that one may exist, given the available data. Statistical tests rely on using estimates of the true mean and true variance of a population, where larger sample populations increase statistical confidence. Because the upstream and downstream receiving water monitoring program was implemented in 2016, there are not yet adequate data to perform valid statistical testing to determine if storm water outfall discharges are causing significant reduction in receiving water quality. For this report, monitoring results are discussed in general terms as well as in relation to Alaska Water Quality Standards (AWQS). Table 7 is a tabulation of water quality collected during the reporting period compared to applicable AWQS[1].

[1] Water quality standards are from the Alaska Department of Conservation "ALASKA WATER QUALITY CRITERIA MANUAL FOR TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES" as amended through December 12, 2008

Table 7: Comparison of Water Quality Data to Alaska Water Quality Standards

Sample Data[1,2]							Alaska Water Quality Standards (AWQS)[3]			
Outfall	Date	Site	Type[4]	pH	Pb (µg/L)	Zn (µg/L)	Acute Pb (µg/L)	Chronic Pb (µg/L)	Acute Zn (µg/L)	Chronic Zn (µg/L)
003	18-Mar	527SW	S	7.35	1.9	67	118.5	4.6	153.5	153.5
		529SW	RD	7.68	1	18	217.2	8.5	95.1	86.1
	6-Oct	527SW	S	7.04	4.1	85	82.7	3.2	120.8	120.8
		529SW	RD	7.44	1.6	14	217.2	8.5	95.1	86.1
005.2	24-Sep	539SW	S	3.76	5.5	168	59.5	2.3	97.1	97.1
		371SW	RU	6.88	2.3	66	14.7	0.6	38.3	38.3
		368SW	RD	7.18	2.3	60	15.4	0.6	39.5	39.5
005.3	18-Mar	545SW	S	7.14	7.5	392	149.7	5.8	179.4	179.4
		595SW	RU	7.74	2.1	31	31.2	1.2	63.2	63.2
		591SW	RD	7.58	2.2	23	30.4	1.2	62.1	62.1
	24-Sep	545SW	S	7.21	31.4	875	247.5	9.7	250.7	250.7
		595SW	RU	7.55	5.7	44	30.4	1.2	62.1	62.1
		591SW	RD	7.53	3.8	30	30.4	1.2	62.1	62.1
005.4	18-Mar	547SW	S	7.48	*0*	*0*	31.2	1.2	63.2	63.2
		595SW	RU	7.74	2.1	31	31.2	1.2	63.2	63.2
		591SW	RD	7.58	2.2	23	30.4	1.2	62.1	62.1
	24-Sep	547SW	S	7.17	*0*	6	54.7	2.1	91.8	91.8
		595SW	RU	7.55	5.7	44	30.4	1.2	62.1	62.1
		591SW	RD	7.53	3.8	30	30.4	1.2	62.1	62.1
008	6-May	570SW	S	7.64	*0*	28	182.4	7.1	204.6	204.6
		1SW	RU	7.87	0.4	6	28.7	1.1	59.8	59.8
		6SW	RD	7.74	0.2	8	27.1	1.1	57.5	57.5
	27-Aug	570SW	S	7.46	0.1	18	241.0	9.4	246.2	246.2
		001SW	RU	7.72	0.1	7	36.4	1.4	70.0	70.0
		006SW	RD	7.59	0.1	10	32.1	1.3	64.3	64.3
009	6-May	580SW	S	7.54	0.6	402	58.5	2.3	96.0	96.0
		48SW	RU	7.79	0.1	5	27.1	1.1	57.5	57.5
		1SW	RD	7.87	0.4	6	28.7	1.1	59.8	59.8
	27-Aug	580SW	S	7.46	*0*	204	81.6	3.2	119.8	119.8
		048SW	RU	7.75	*0*	6	31.2	1.2	63.2	63.2
		001SW	RD	7.72	0.1	7	36.4	1.4	70.0	70.0

1 - Shaded cells indicate exceedance of AWQS

2 - Italic font indicates the laboratory result was non-detect and tabulated value is zero if less than the Method Detection Limit (MDL) or the value of MDL if less than the Minimum Level of Quantification (ML)

3 - AWQS are from the Alaska Department of Conservation "ALASKA WATER QUALITY CRITERIA MANUAL FOR TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES" as amended through December 12, 2008

4 - S = Storm water, RU = Receiving water upstream, RD = Receiving water downstream

3.1 Storm Water Outfall 003 – Hawk Inlet

Outfall 003, a culvert pipe located adjacent to the North Cannery Building, drains the storm water runoff from a small area approximately 0.2 acres in size (Figure 2). Outfall 003 discharges directly into Hawk Inlet, and therefore there is only one associated receiving water monitoring site (Site 529). The lead concentration in the October sample from the outfall exceeded the chronic AWQS (Table 7) but the lead concentration in the receiving Hawk Inlet water was well below the marine chronic aquatic life criteria due to low discharge rate through the outfall and the immense dilution volume of Hawk Inlet.

3.2 Storm Water Outfall 004 – Pit 7

Outfall 004 is located downgradient of a constructed wetlands that receives runoff from Pit 7 (Figure 3), which is a former rock quarry and current reclamation material storage pile. Flow has not been observed at this outfall during storm events since 2012, and there was no flow observed during the storm event monitoring conducted during this reporting period. There was no activity at Pit 7 during the reporting period, and no signs of erosion from the reclamation material stockpile.

3.3 Storm Water Outfall 005.2 – Zinc Creek Bridge

Outfall 005.2 is located near the bottom of the north abutment, upstream side, of the Zinc Creek Bridge located at 3.0-mile on the B-Road (Figure 4). The drainage area for this outfall, approximately 0.6 acres in size, captures runoff from a short section of road and a portion of the abutment. Receiving water monitoring is conducted at Site 371 (upstream) and Site 368 (downstream) in Zinc Creek.

The pH of the outfall sample collected during 2019 storm event monitoring is lower than in samples collected since 2010 but is within the range of historical values for this outfall. Concentrations of lead and zinc in the outfall exceed AWQS (Table 7). In samples collected from the receiving water, pH is near neutral but metal concentrations exceed standards in both the upstream and downstream receiving water samples. Metal concentrations in the upstream and downstream receiving water samples are either the same (lead) or lower (zinc) in the downstream

sample, and the pH in the downstream sample was slightly higher than in the upstream sample. The data, therefore, indicate that the discharge from the outfall did not have an adverse impact on Zinc Creek.

3.4 Storm Water Outfall 005.3 – Site E

Outfall 005.3 is located in a small drainage that runs between the B-Road and inactive waste rock Site E (Figure 5). The drainage area contributing to the outfall location is approximately 6.8 acres. The drainage flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is conducted in Greens Creek at Site 595 (upstream) and Site 591 (downstream).

Water quality at the outfall is influenced by the Site E waste rock and has exhibited highly variable lead and zinc concentrations throughout its monitoring history (Attachment A). Samples collected during the reporting period show that monitored constituent concentrations are within the normal range of historical fluctuation, but both lead and zinc exceed AWQS (Table 7). The lead concentration in both the upstream and downstream receiving water samples also exceeded the chronic lead standard.

In 2008, HGCMC initiated a program of removing Site E waste rock for co-disposal in the tailings facility. Through 2019, over 121,000 cubic yards of material were removed. The water quality at Outfall 005.3 is expected to show gradual improvement as the waste rock removal activities progress.

3.5 Storm Water Outfall 005.4 – Pit 6

Outfall 005.4 is the discharge location for runoff from a reclamation material storage area in an old road construction quarry called Pit 6 (Figure 5). The catchment area draining to the outfall is approximately 0.9 acres in size. There has been no activity in Pit 6 since 2009 and the area is stabilized and vegetated. Storm water runoff flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at Site 595 (upstream) and Site 591 (downstream).

Water quality at Outfall 005.4 is excellent, with lead and zinc concentrations consistently below the Alaska Water Quality Standards since 2009.

3.6 Storm Water Outfall 005.5 – 7.8 Mile B-Road Culvert

Outfall 005.5 is a culvert that drains a portion of the B-Road surface above mile 7.8 (Figure 6). The catchment area draining to the culvert is approximately 5.3 acres, most of which is undisturbed forest on the uphill side of the road. Discharge from the culvert is to a forested hillside, approximately 200 feet from Greens Creek. Flows through the culvert during storm event monitoring have been low and typically less than 10 gpm. As a result, the drainage infiltrates into the forest duff and a point source discharge to Greens Creek has not been observed.

Access to this section of Greens Creek below the culvert is challenging, particularly during storm events. Therefore, the sites for the upstream and downstream receiving water monitoring were chosen to address safety concerns while also satisfying the intent of the Permit. Site 6, which is also sampled on a monthly basis under the Fresh Water Monitoring Program (FWMP), was selected as the upstream receiving water site. Site 590, located below mile 7.6, was selected as the downstream site.

BMPs previously implemented near this outfall resulted in a reduction in sediment load and additional recent improvements (spring of 2019) have prevented the discharge of storm water at this outfall. There was no discharge from the outfall during the reporting period.

3.7 Storm Water Outfall 006 – Pond D Overflow

Pump systems maintain a low water level in Pond D and route storm water to treatment facilities or for use in the mill. There were no storm water discharges through Outfall 006 during the reporting period. If a discharge were to occur, receiving water monitoring in Greens Creek would be performed at Site 6 for the upstream site and at Site 590 for the downstream site (Figure 6).

3.8 Storm Water Outfall 007 – Pond C Overflow

The Pond C system, consisting of an upper and lower pond, collects storm water runoff from an inactive waste rock storage area and a section of the B-Road (Figure 7). Due to the potential for sediment-laden runoff from the catchment area, Hecla's standard practice is to pump accumulated

storm water from the upper Pond C to water treatment facilities and not routinely discharge storm water through Outfall 007. Should discharge from Outfall 007 occur, designated receiving water monitoring locations in Greens Creek are Site 1 (the 920 weir) for the upstream site and at Site 6 for the downstream site.

There were no storm water discharges through Outfall 007 in 2019.

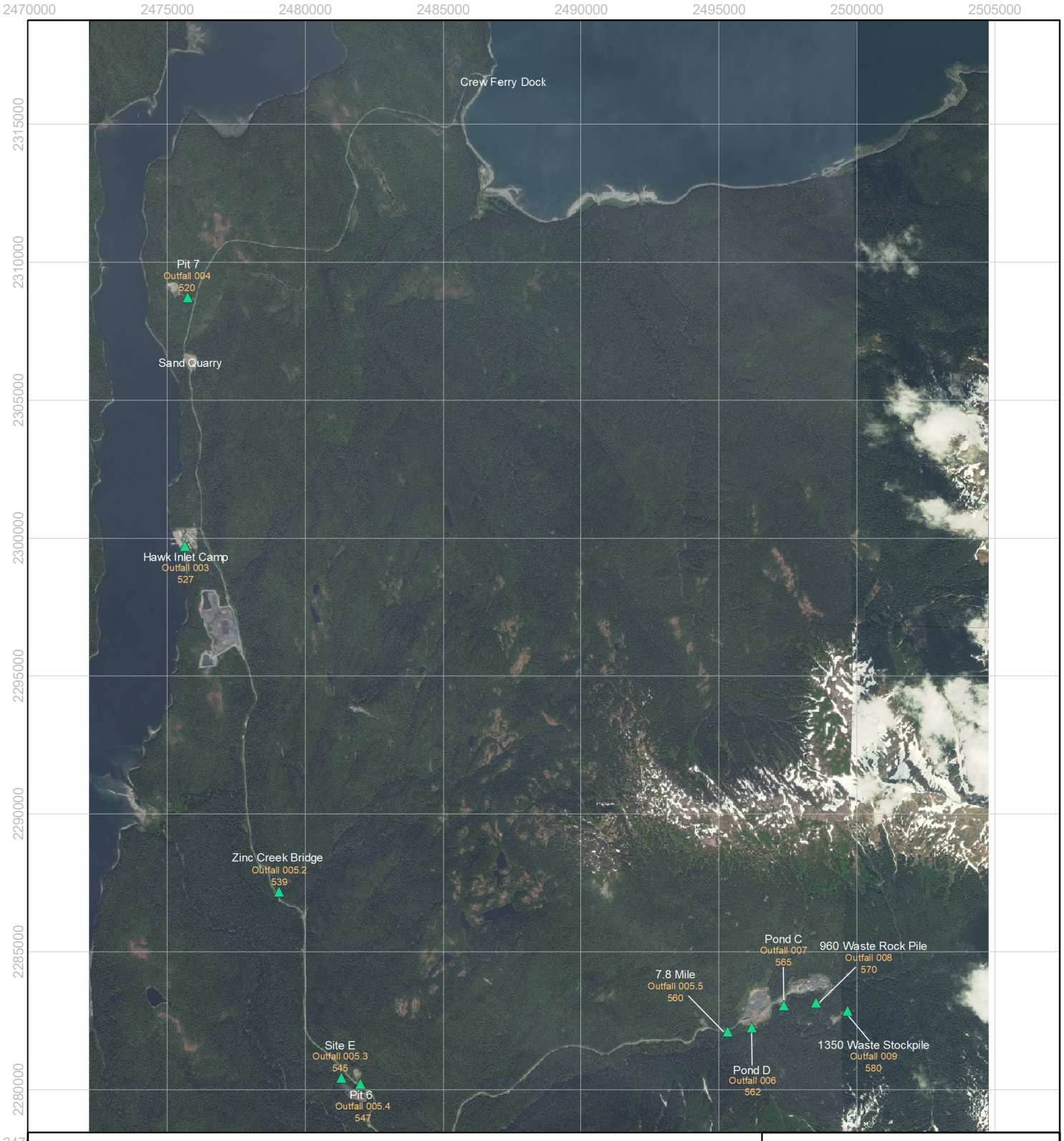
3.9 Storm Water Outfall 008 – 960 Site

Outfall 008 is the discharge location (Figure 8) for runoff from a former waste rock storage pile placed during initial development of the 920 mine portal. The majority of the waste rock was removed in 2005. The catchment area contributing runoff to the outfall is approximately 0.7 acres. Since removal of the waste rock material the water quality at the outfall has consistently met the AWQS for lead and zinc.

3.10 Storm Water Outfall 009 – 1350 Site

Outfall 009 monitors the runoff quality from an inactive waste rock pile that was placed during the development of the 1350 adit (Figure 9). Between 2005 and 2015, over 80 percent of the waste rock was removed for disposal in the underground mine. The catchment area contributing runoff to the outfall is approximately 3.3 acres in size. Receiving water monitoring is performed in Greens Creek at Site 48 (upstream) and Site 1 (downstream). Site 48, also sampled monthly as part of the FWMP, is located upstream of all mining activity and represents natural background quality for Greens Creek.

Zinc concentrations in the outfall samples collected during the reporting period exceeded AWQS (Table 7). Concentrations in the receiving water, however, were well below standards indicating no substantial impact from the outfall.



Legend

▲ APDES Outfall

N

2500 0 2500 5000 ft

Outfall Locations

Hecla MINING COMPANY

FIGURE 1

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

EDE

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:60,000
DATE: 02/15/2019
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

LEGEND

- APDES Outfall
- Storm Water Site
- Hawk Inlet Runoff Area

N

100 0 100 ft

APDES Outfall 003 Monitoring Locations
Hawk Inlet

Hecla MINING COMPANY

FIGURE 2

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

EDE

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:1,200
DATE: 02/19/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

LEGEND

- APDES Outfall
- Storm Water Site
- Pit 7 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 004 Monitoring Locations
Pit 7

FIGURE 3

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:1,500
DATE: 02/19/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY

LEGEND

- APDES Outfall
- Storm Water Site
- Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 005.2 Monitoring Locations
Zinc Creek Bridge

FIGURE 4

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:2,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY

LEGEND

- APDES Outfall
- Storm Water Site
- Site E Runoff Area
- Pit 6 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 005.3 and 005.4 Monitoring Locations
Site E and Pit 6

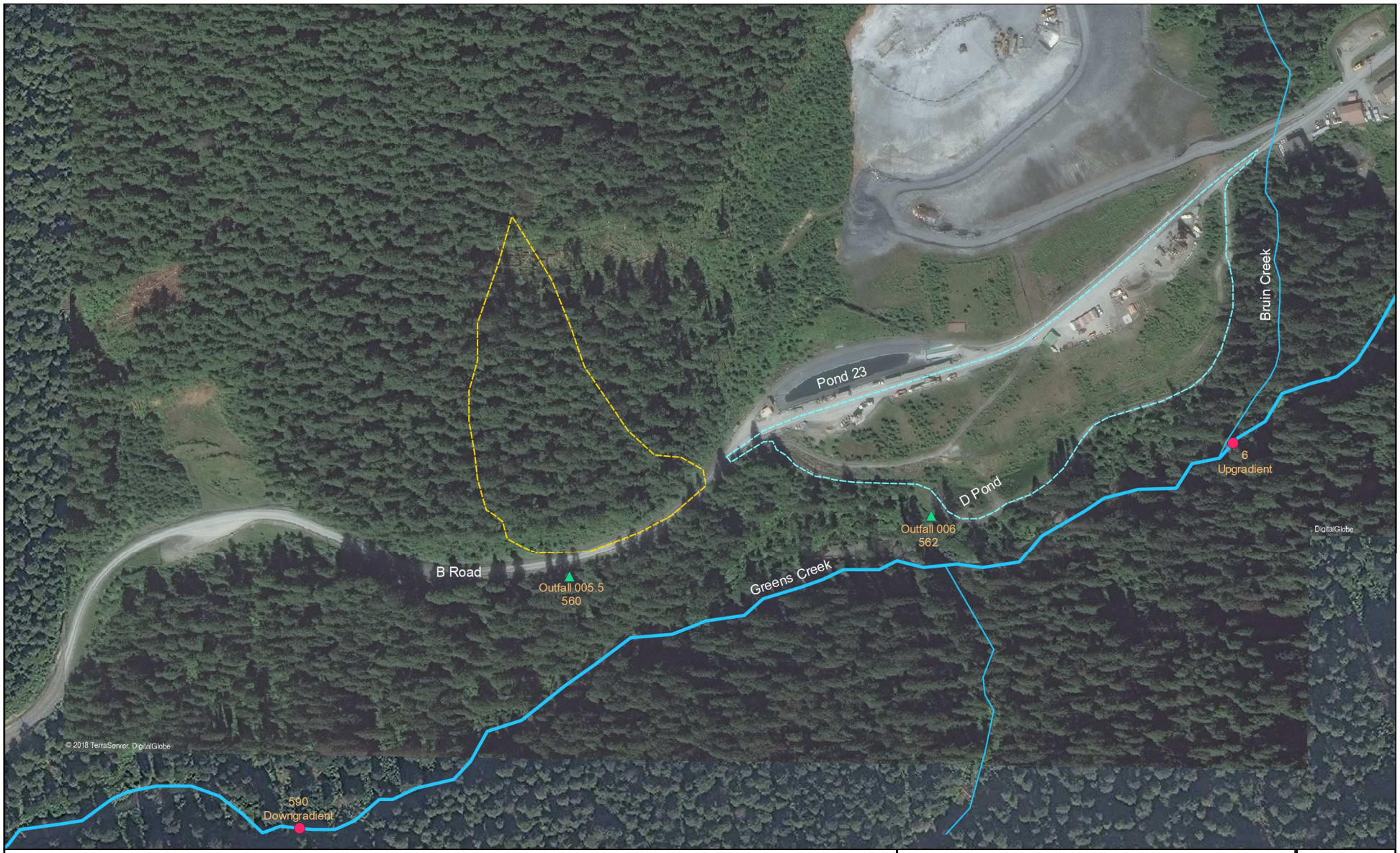
FIGURE 5

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:6,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- 7.8 Mile Runoff Area
- Pond D Runoff Area

N

100 0 100 200 300 ft

APDES Outfalls 005.5 and 006 Monitoring Locations
7.8 Mile B-Road Culvert and Pond D Overflow

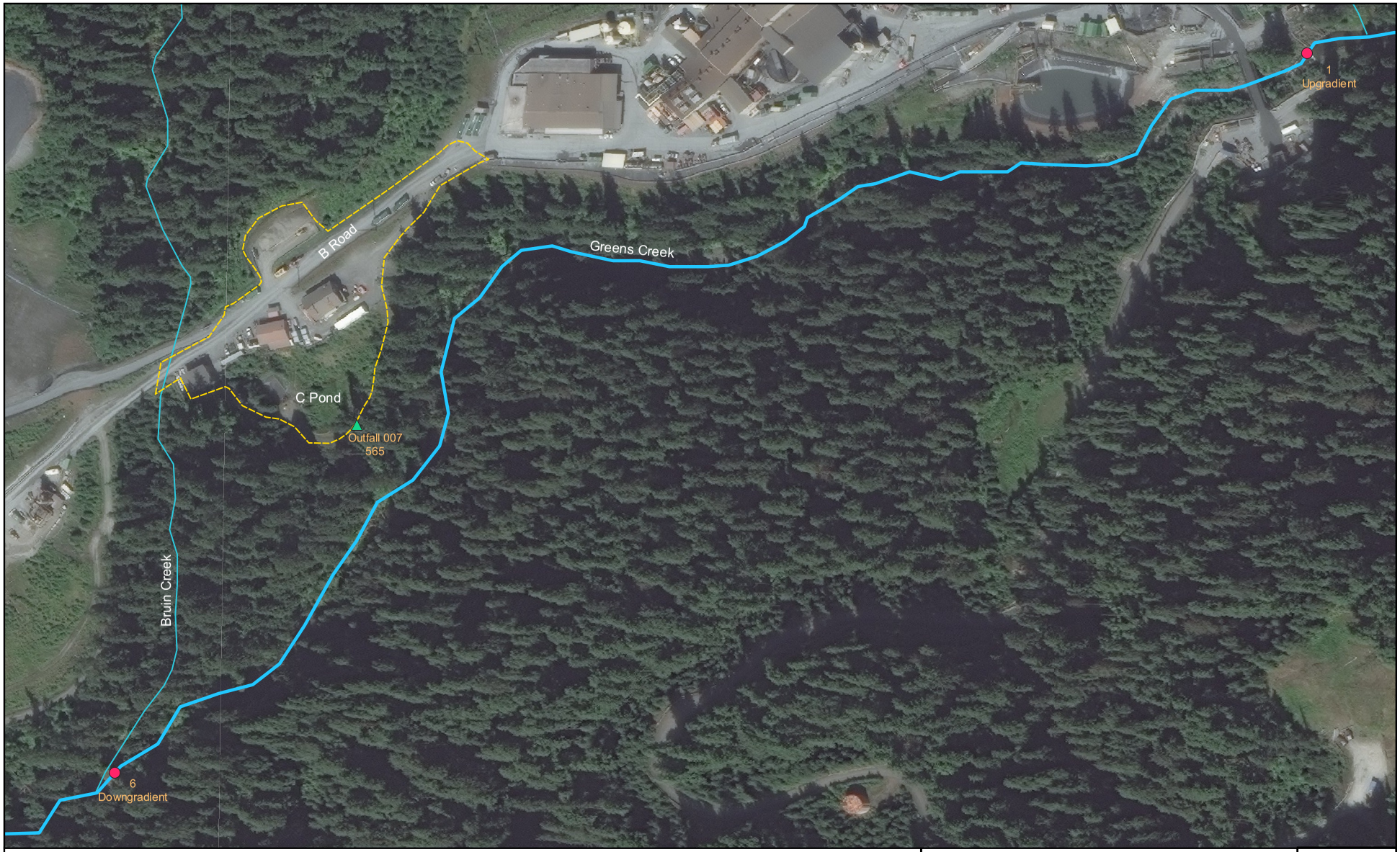
FIGURE 6

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:4,000
DATE: 02/15/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- Pond C Runoff Area

100 0 100 200 300 ft

APDES Outfall 007 Monitoring Locations
Pond C Overflow

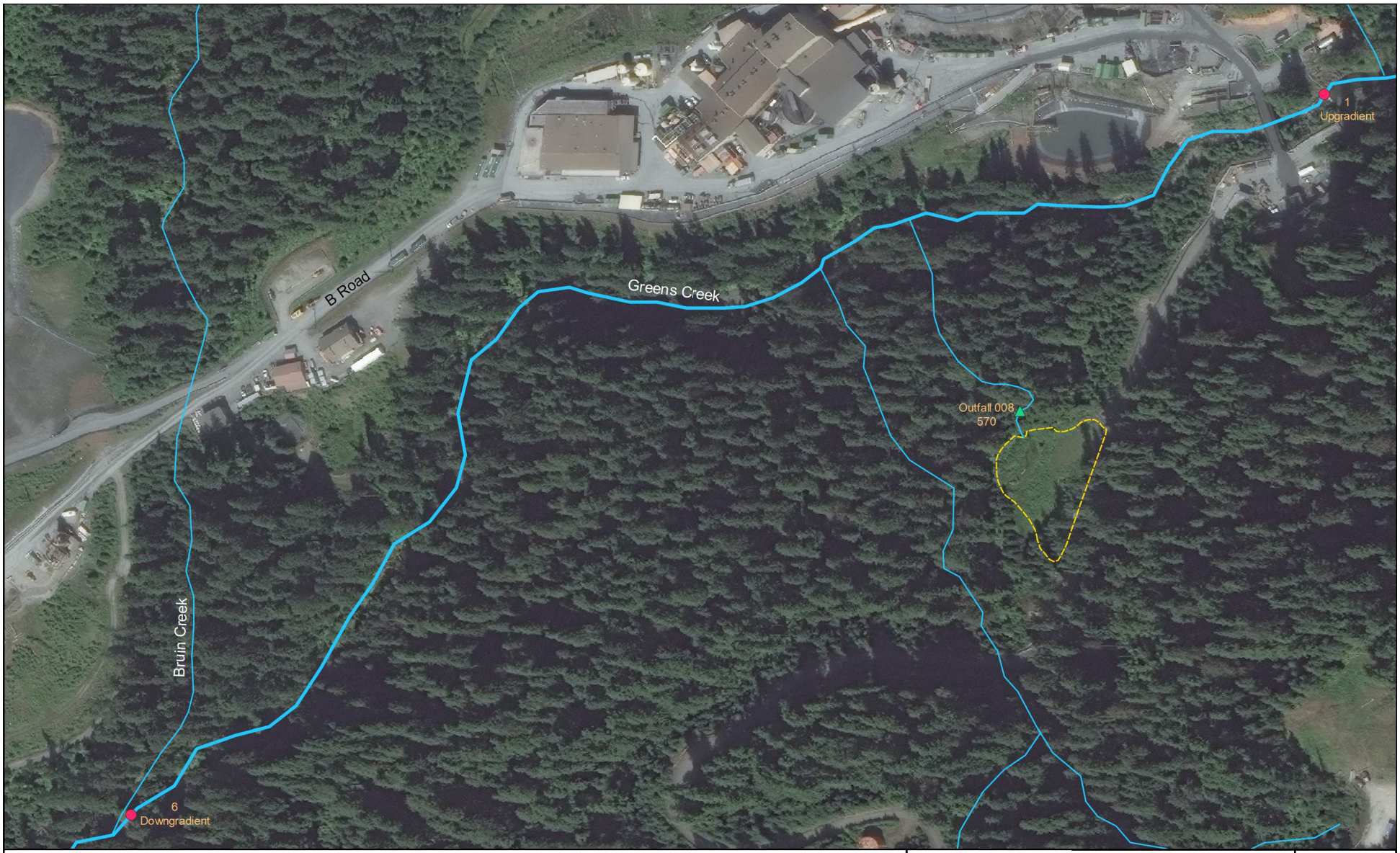
FIGURE 7

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE:
GCM_2019_Stormwater_Report.qgs
SCALE: 1:3,000
DATE: 02/18/2020
PROJECTION: AK State Plane NAD83 feet
DRAWN: CAN

EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- 960 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 008 Monitoring Locations
960 Site

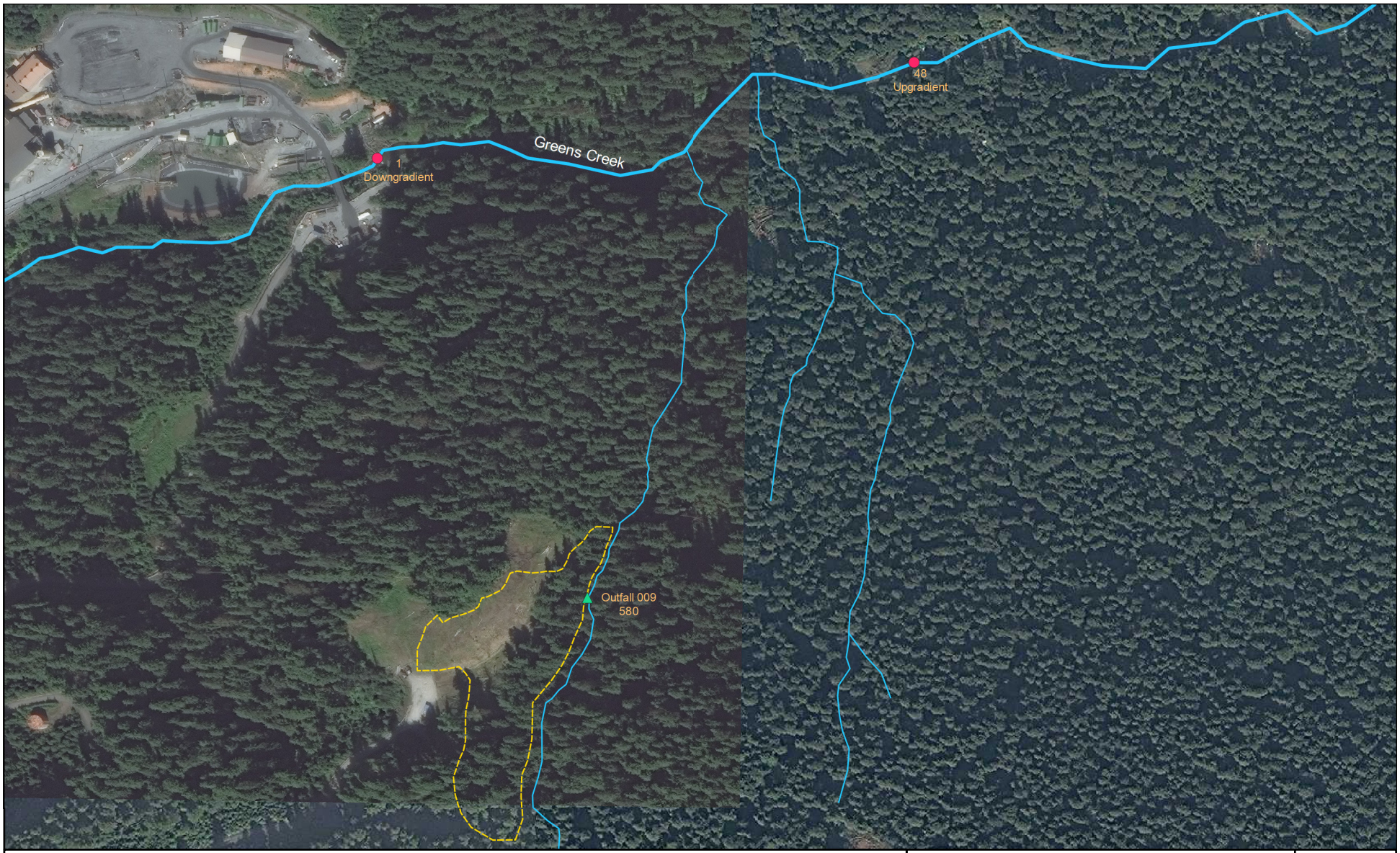
FIGURE 8

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:3,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- 1350 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 009 Monitoring Locations
1350 Site

FIGURE 9

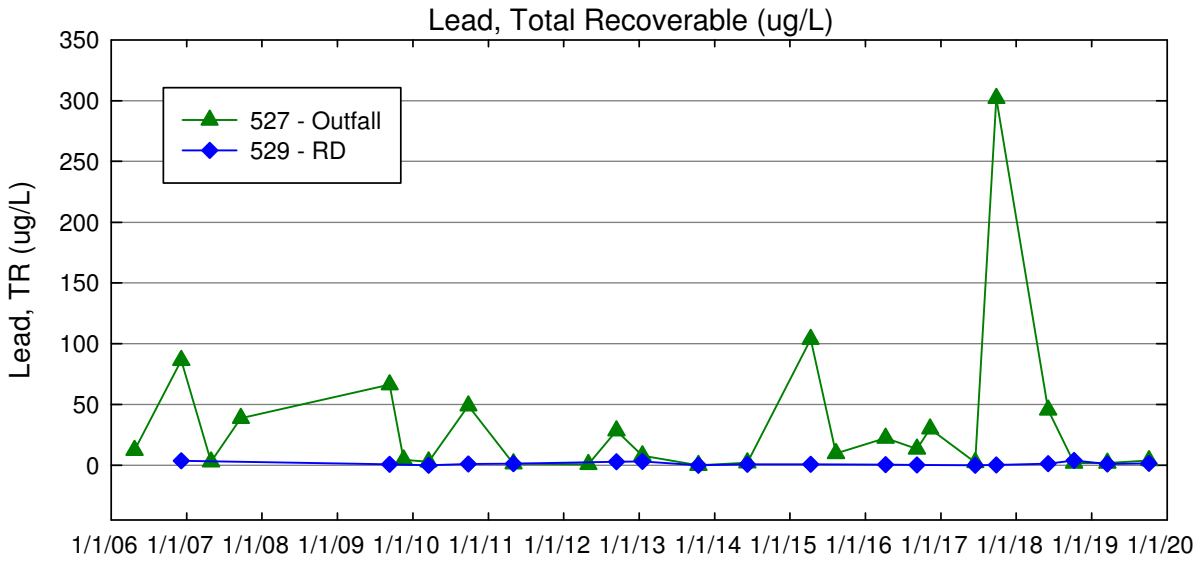
Hecla Greens Creek Mining Company
Admiralty Island, Alaska

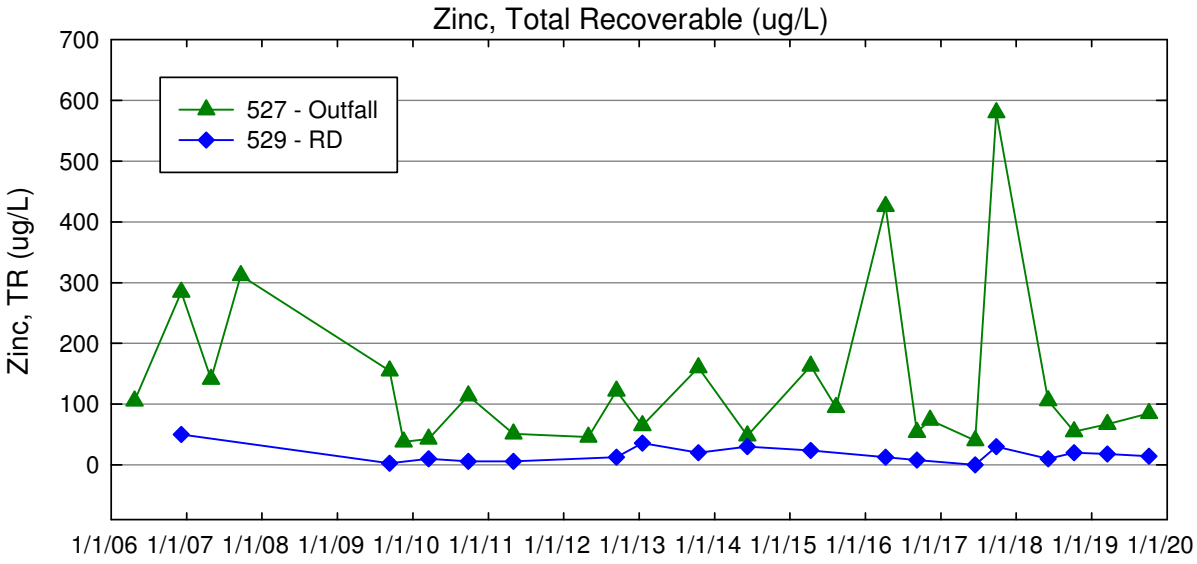
DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:4,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

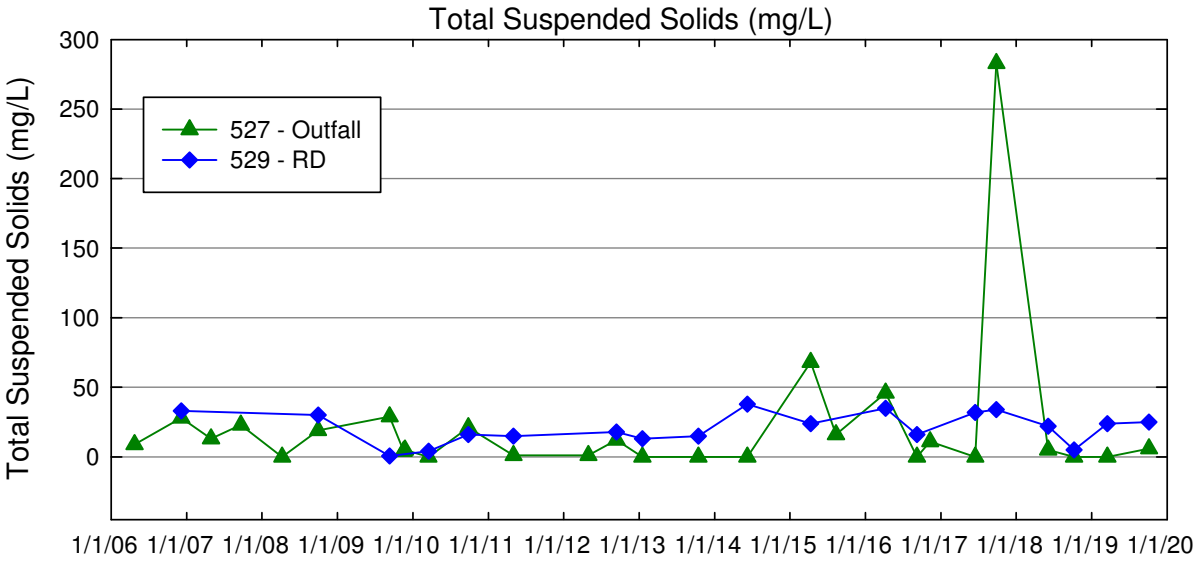
EDE

Hecla MINING COMPANY

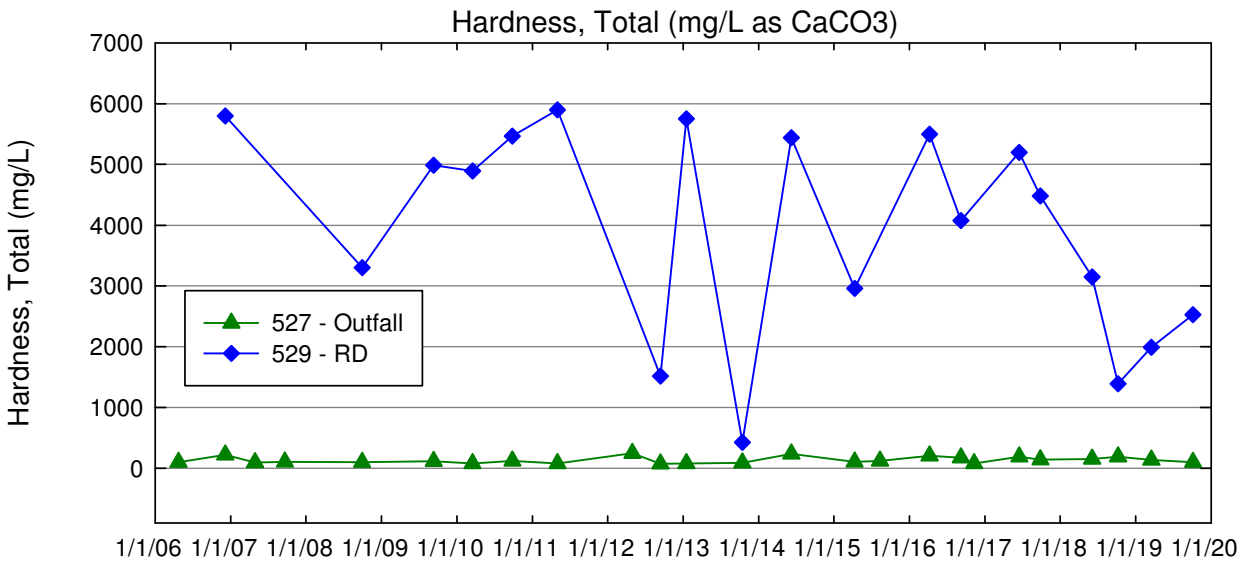
OUTFALL 003

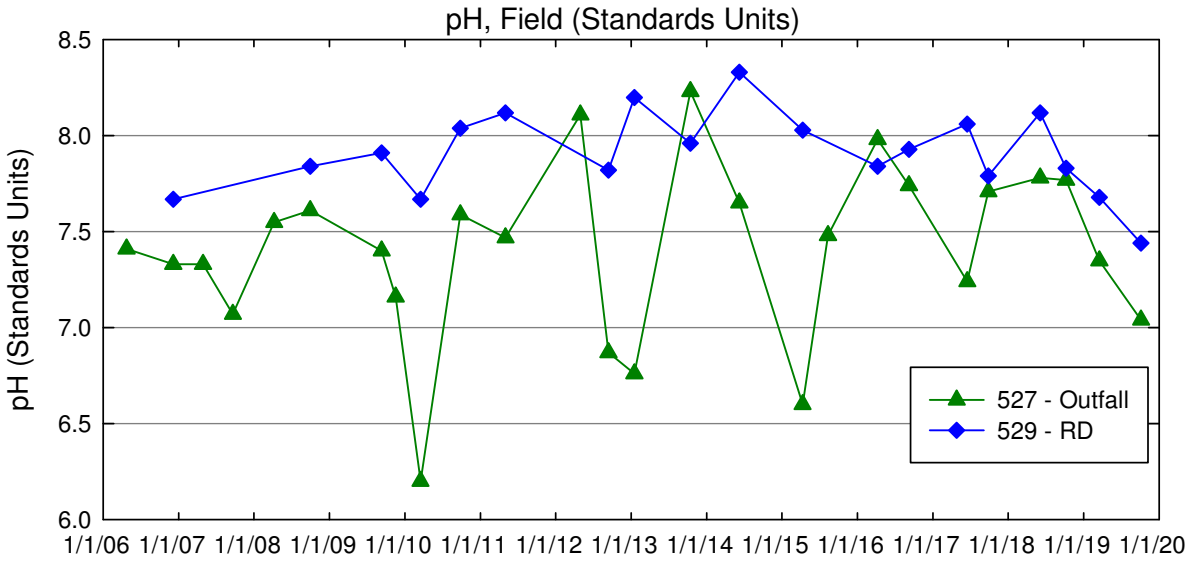

Lead, Total Recoverable (ug/L)
Lead, TR (ug/L)
350
300
250
200
150
100
50
0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


Zinc, Total Recoverable (ug/L)
Zinc, TR (ug/L)
700
600
500
400
300
200
100
0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20

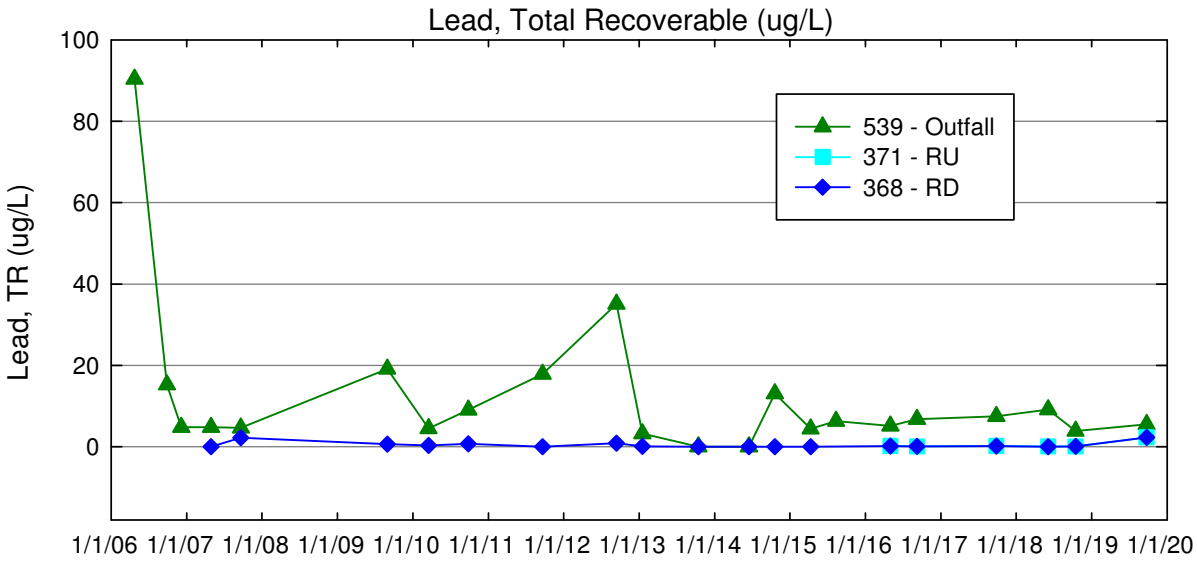

Total Suspended Solids (mg/L)
Total Suspended Solids (mg/L)
300
250
200
150
100
50
0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20

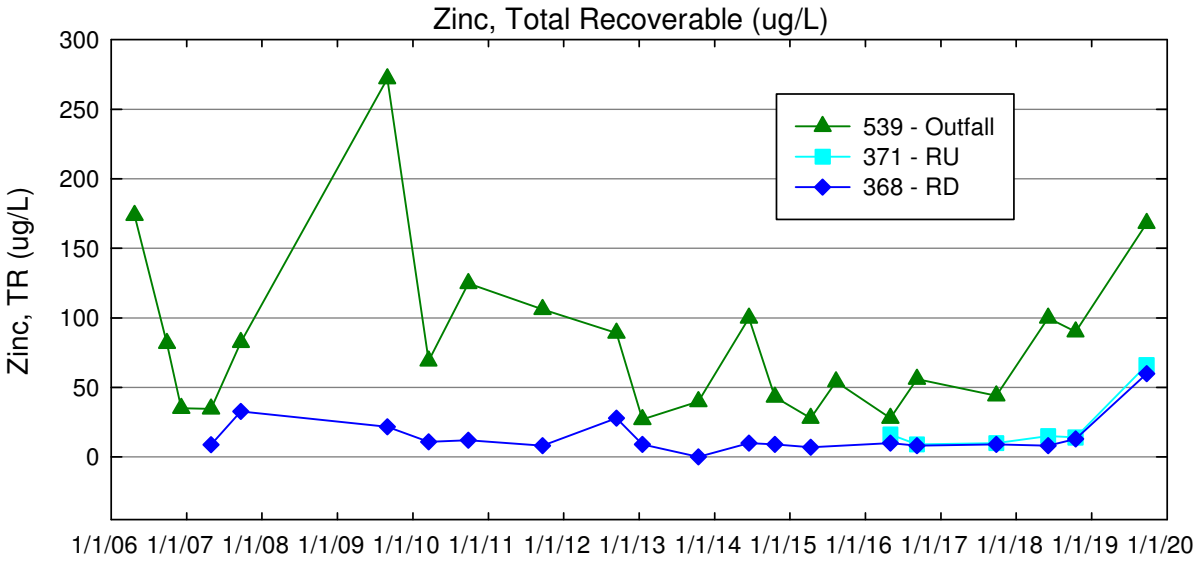
OUTFALL 003

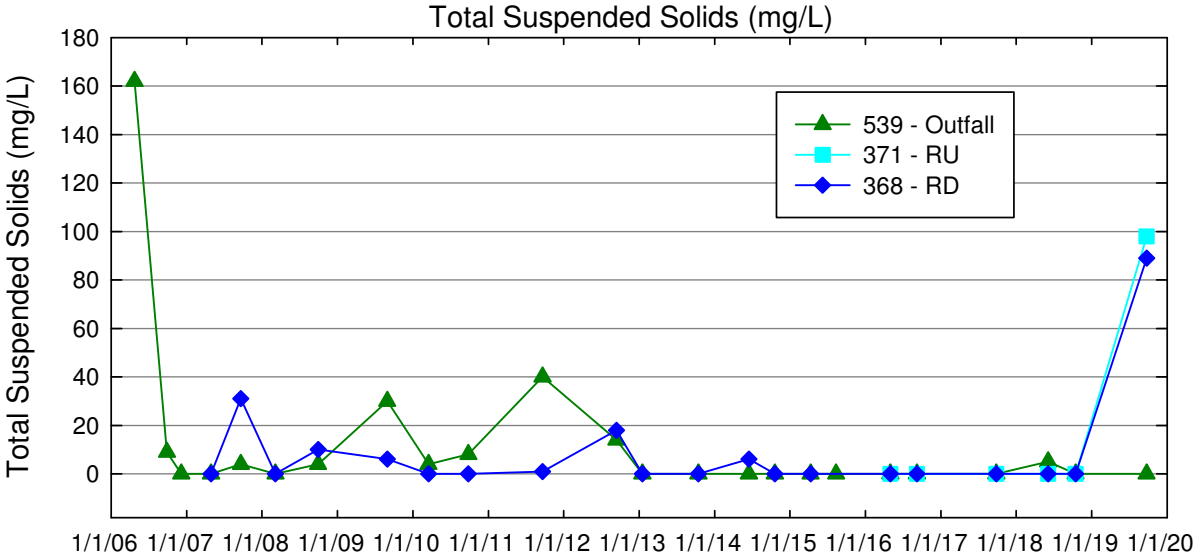

Hardness, Total (mg/L as CaCO3)
Hardness, Total (mg/L)
7000
6000
5000
4000
3000
2000
1000
0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


pH, Field (Standards Units)
pH (Standards Units)
8.5
8.0
7.5
7.0
6.5
6.0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20

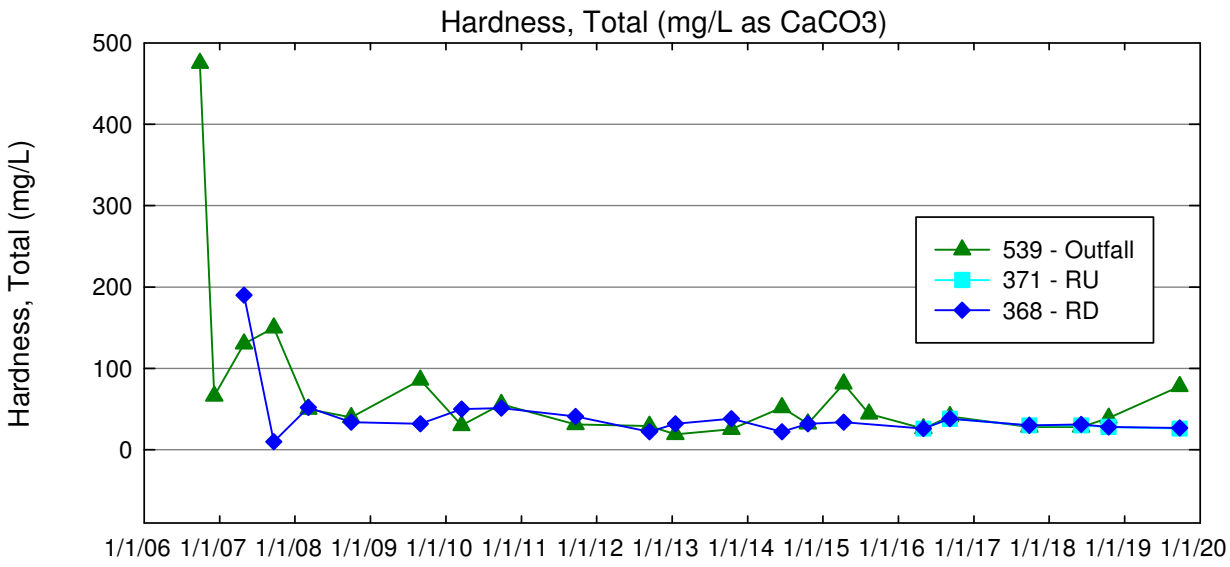
OUTFALL 005.2

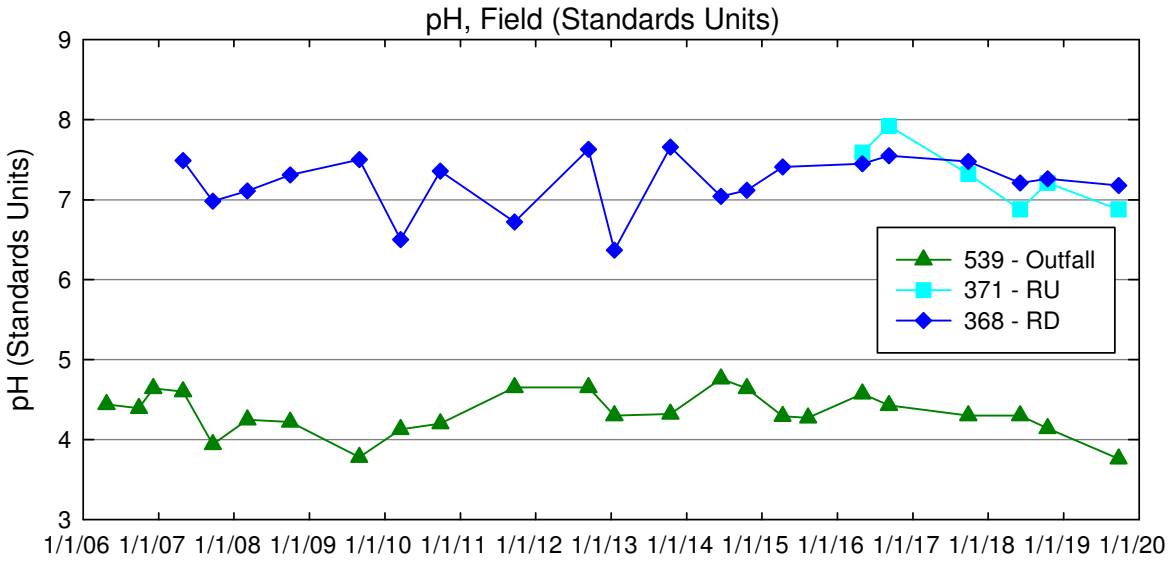




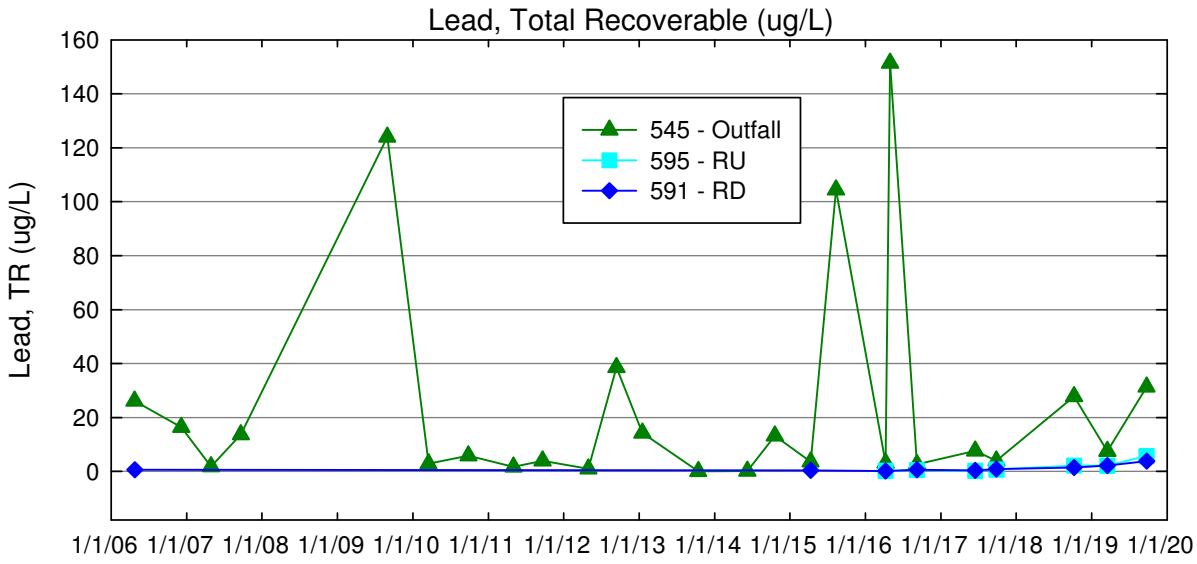


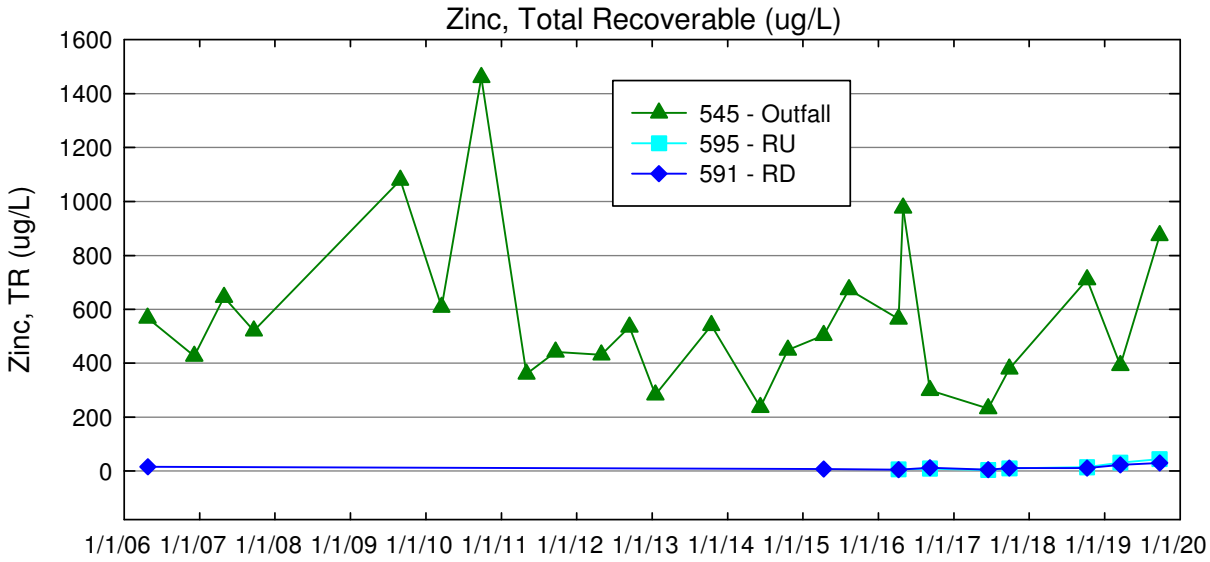
OUTFALL 005.2

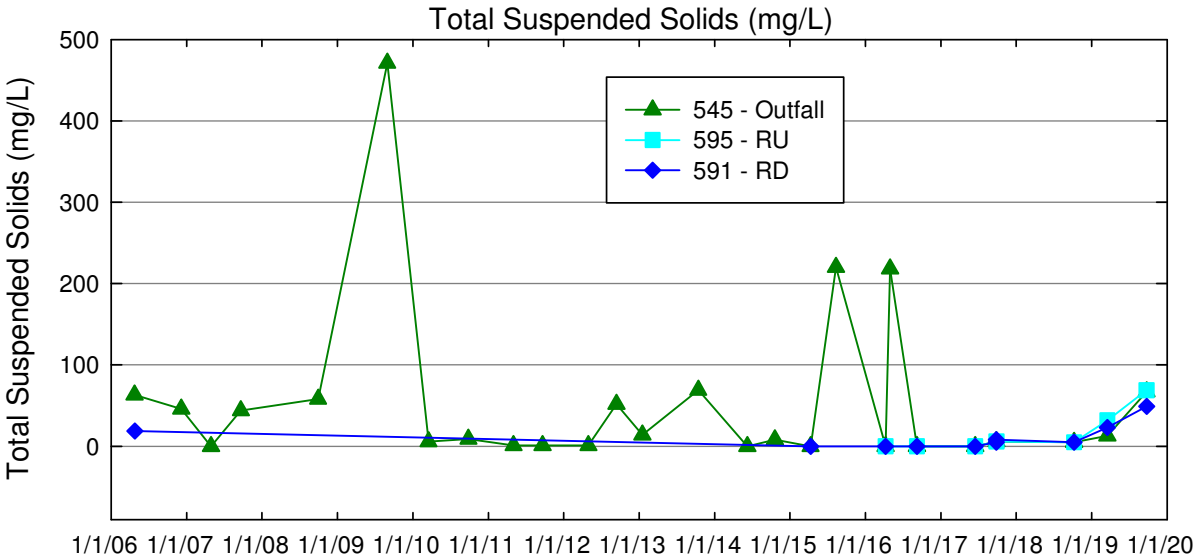




OUTFALL 005.3







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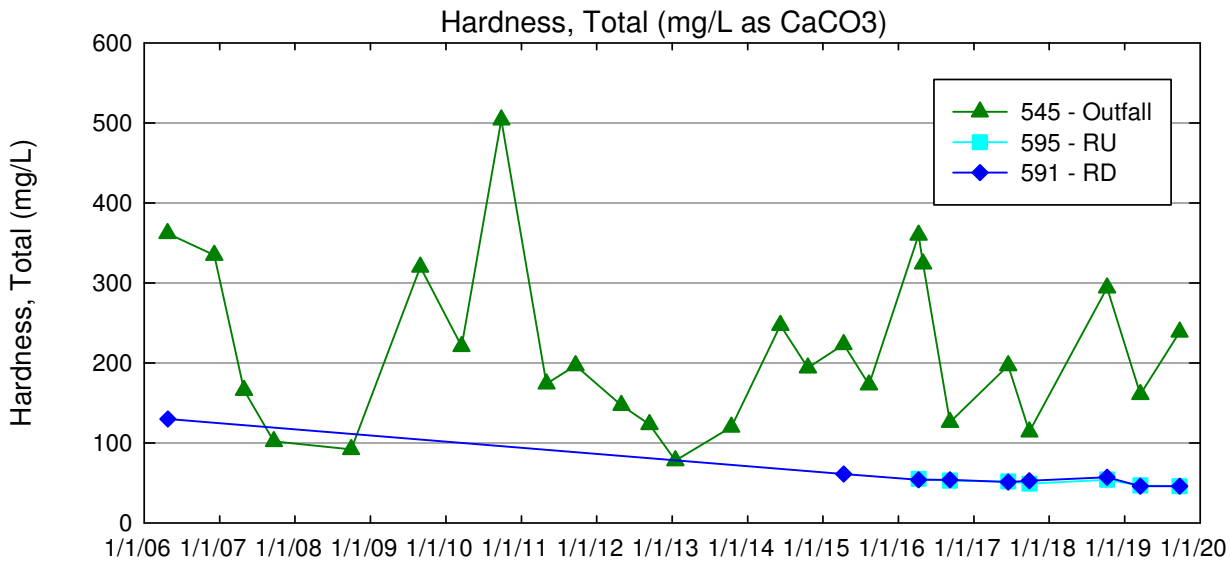
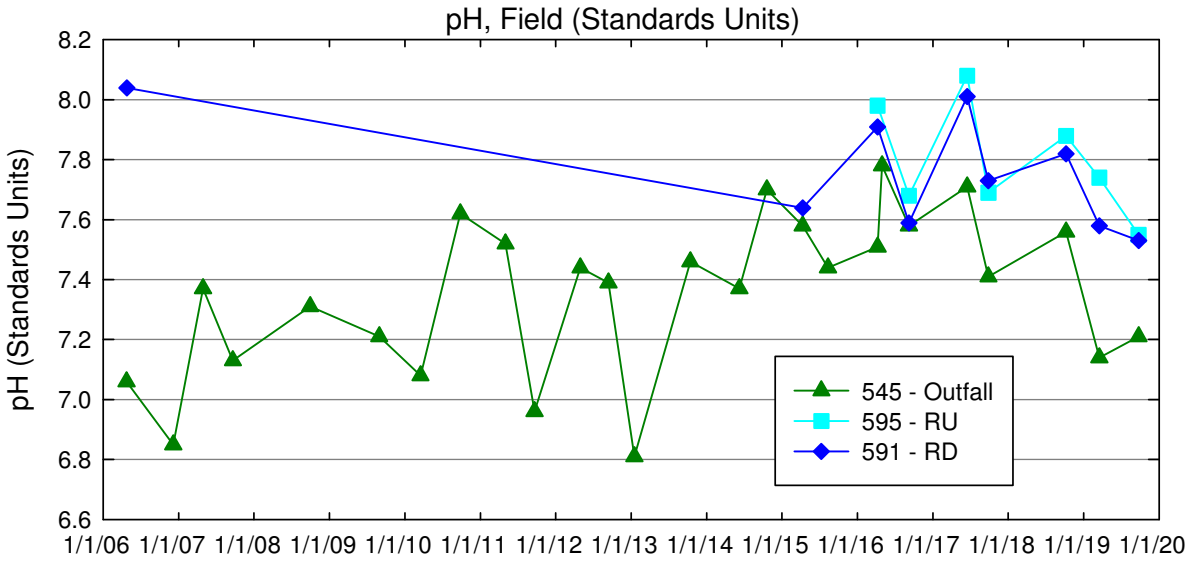
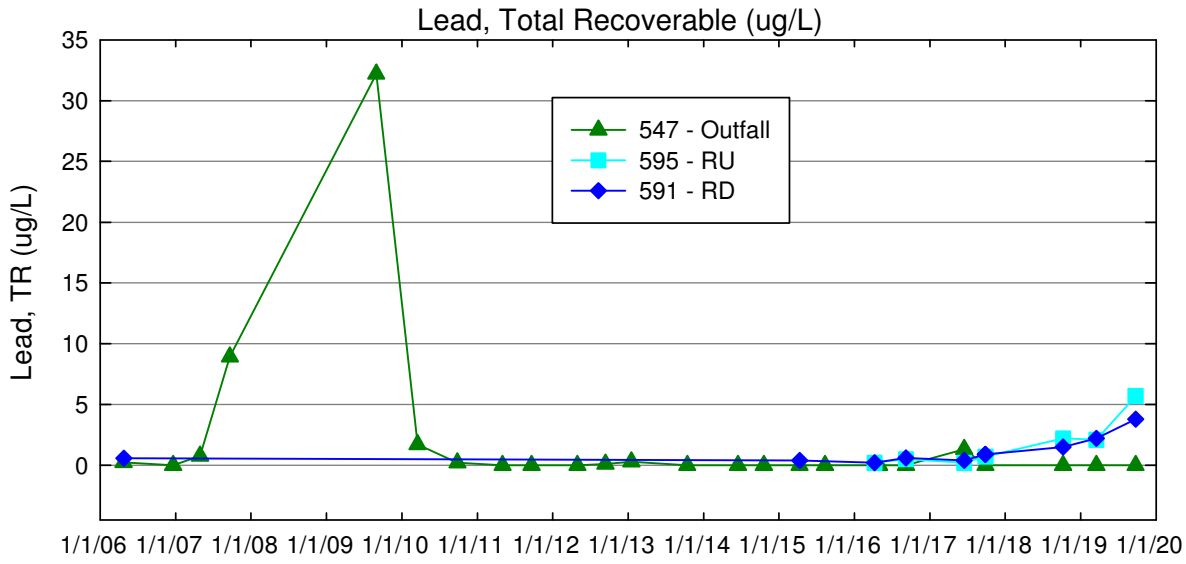
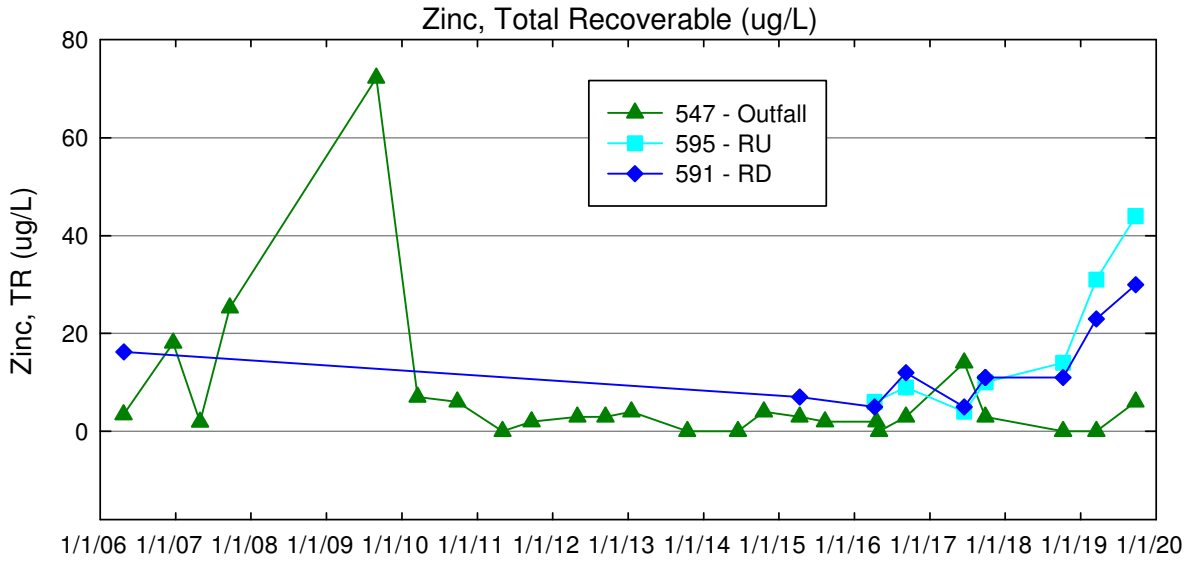
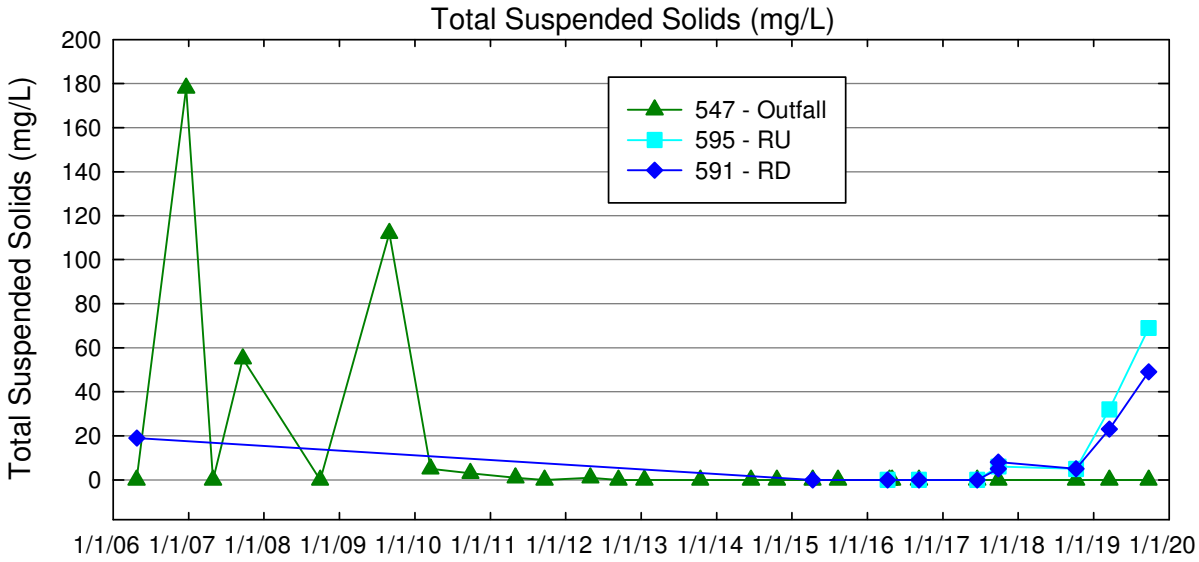




OUTFALL 005.4







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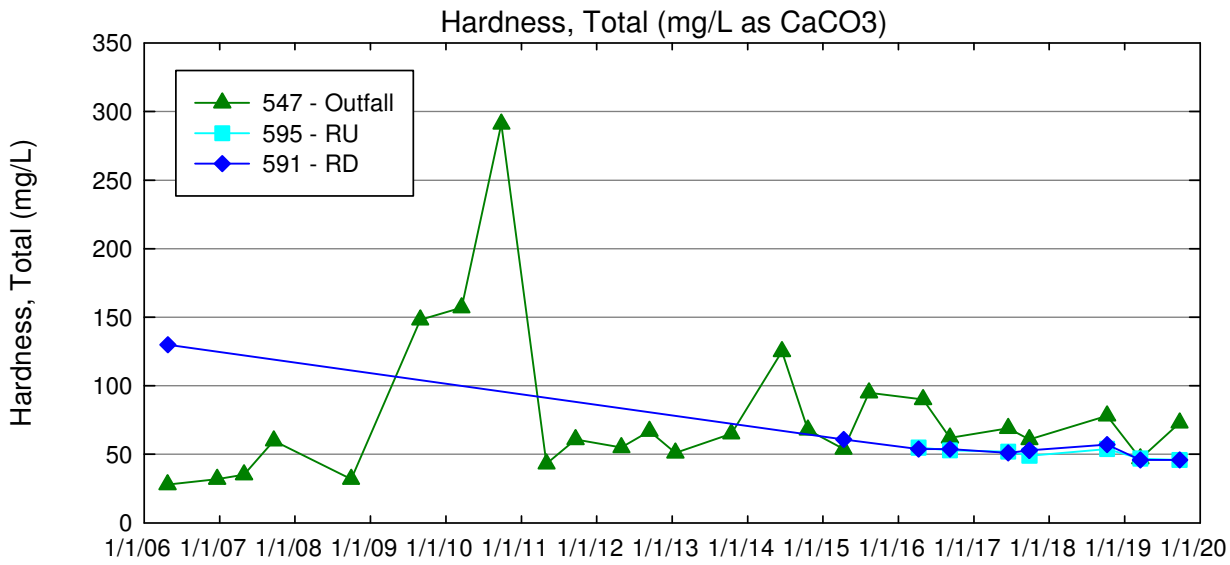
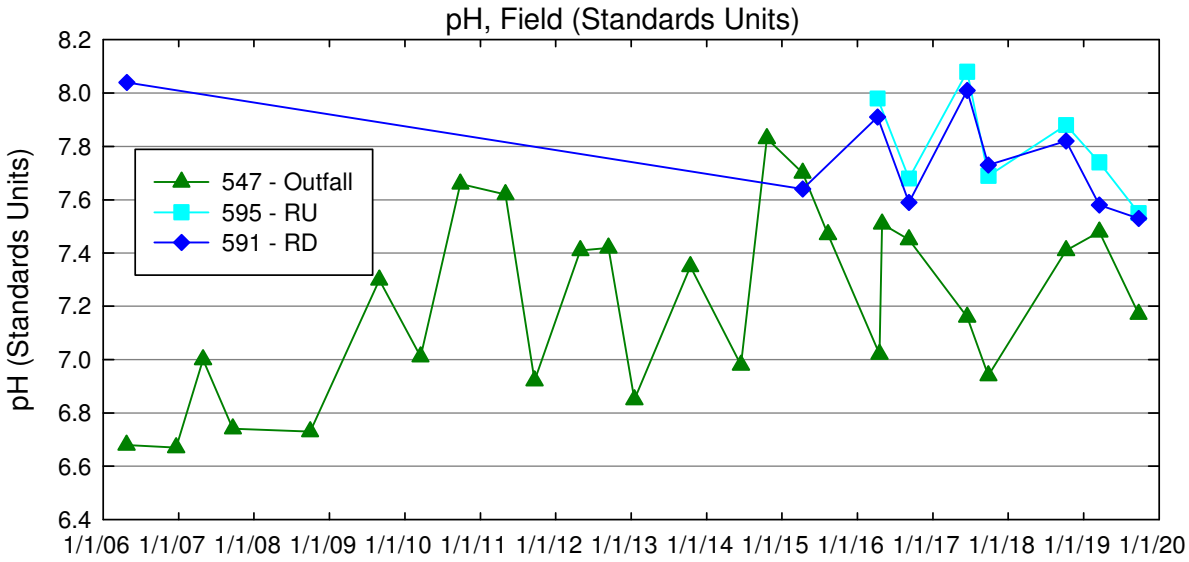
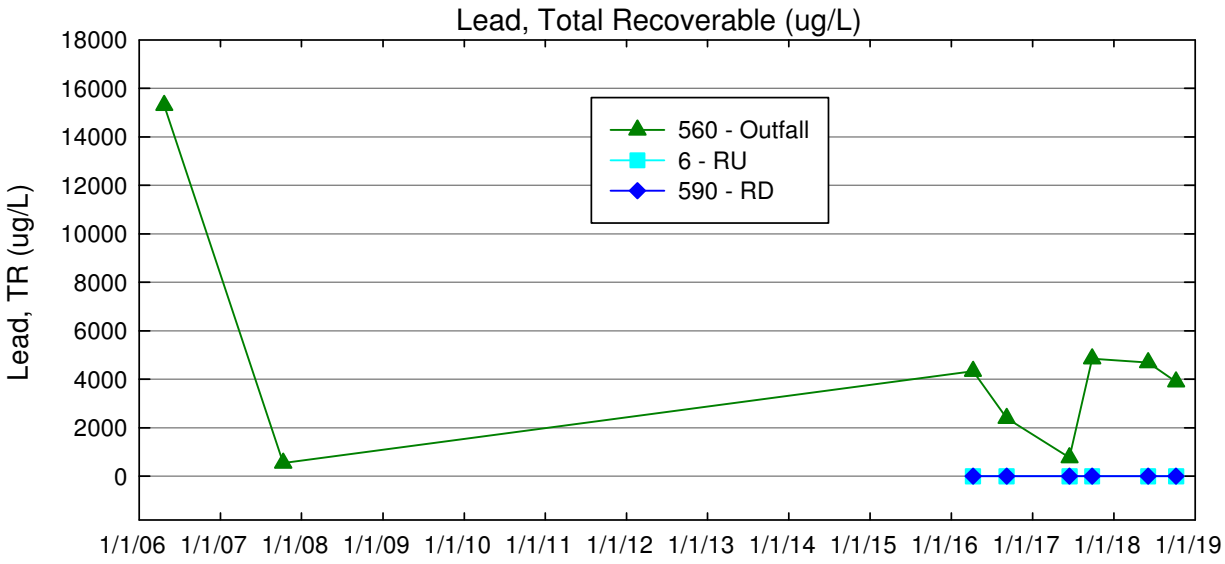
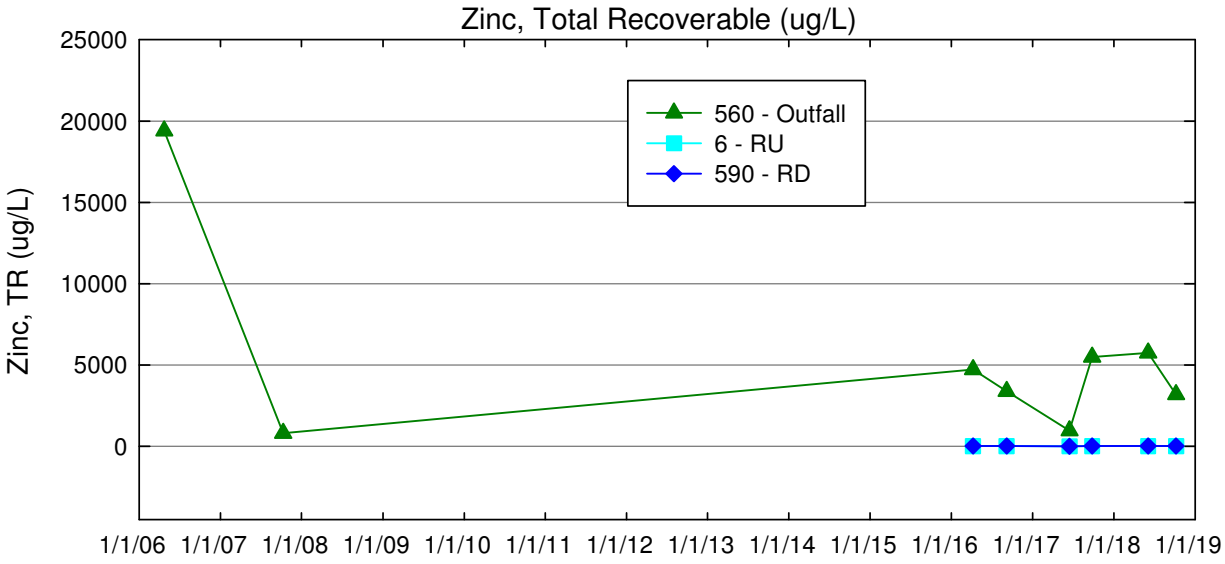
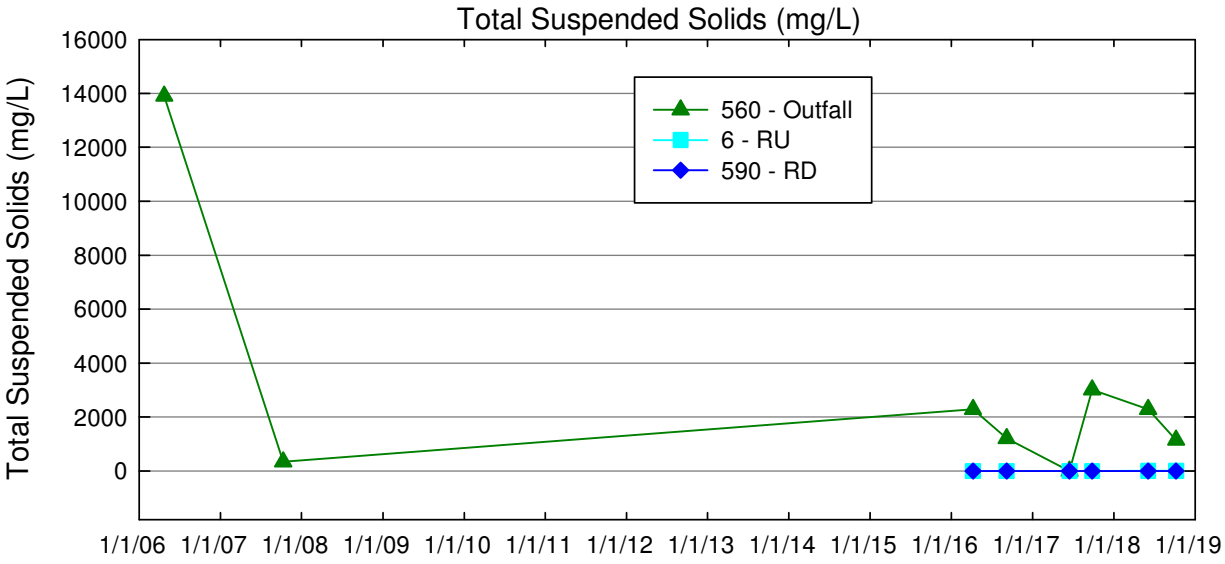




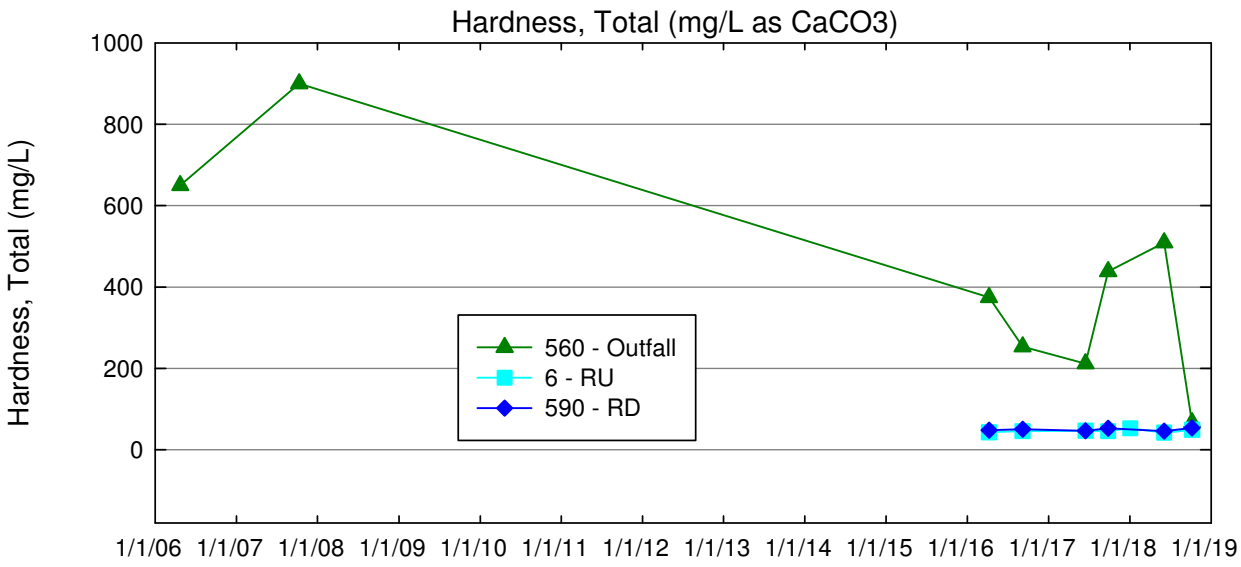
OUTFALL 005.5

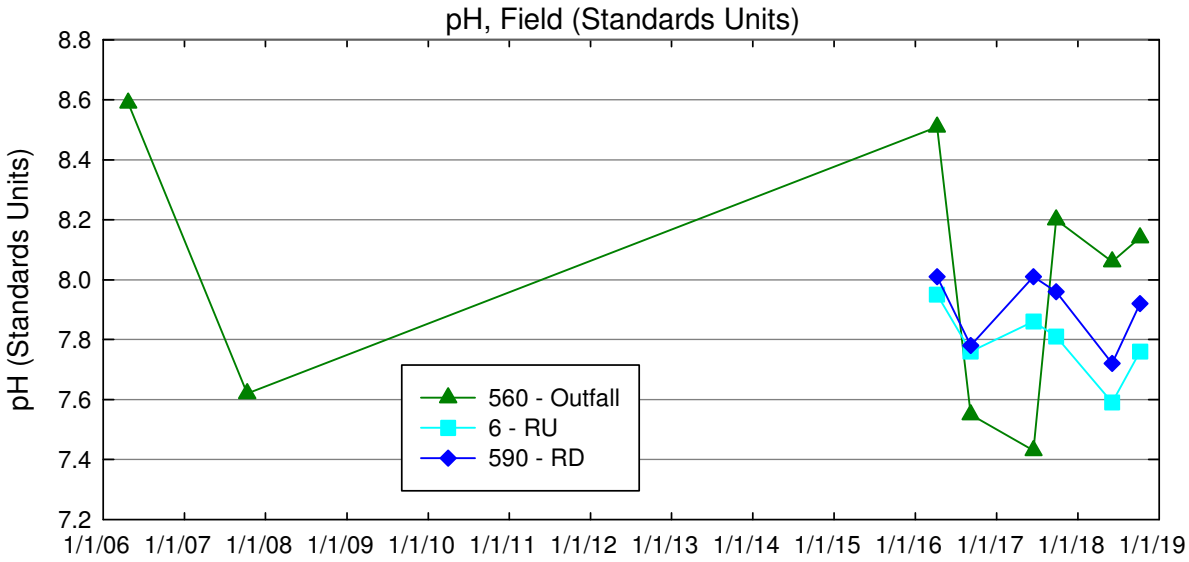




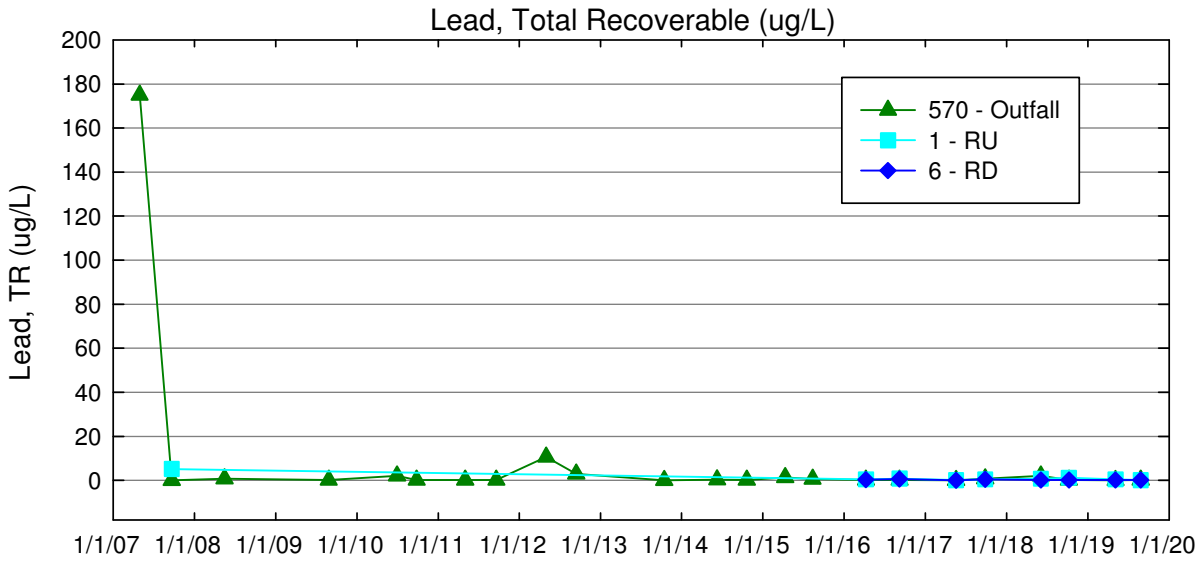


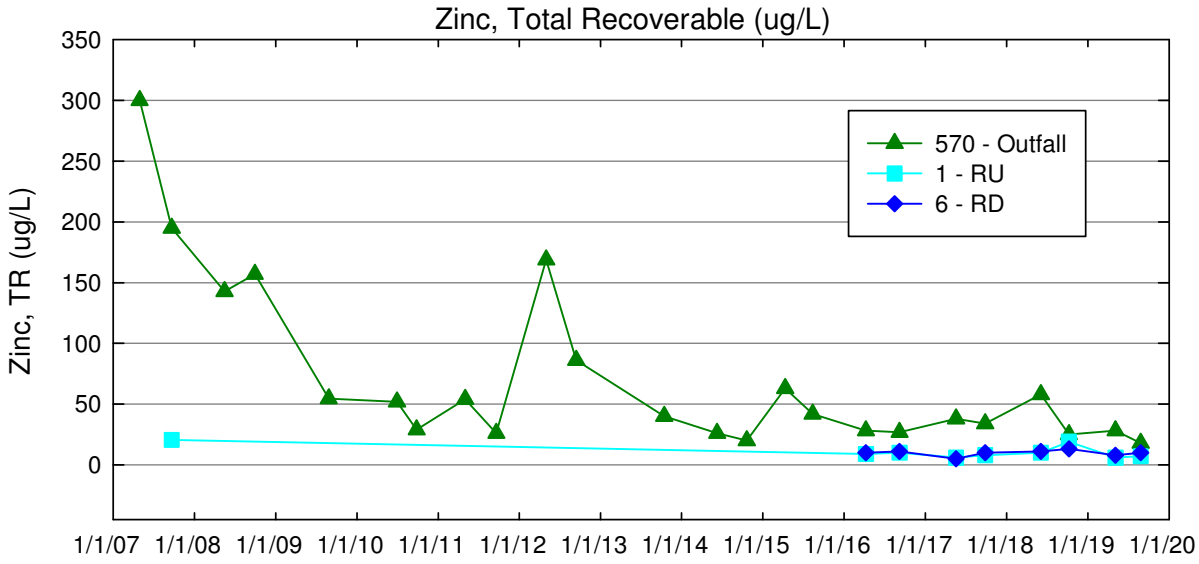
OUTFALL 005.5

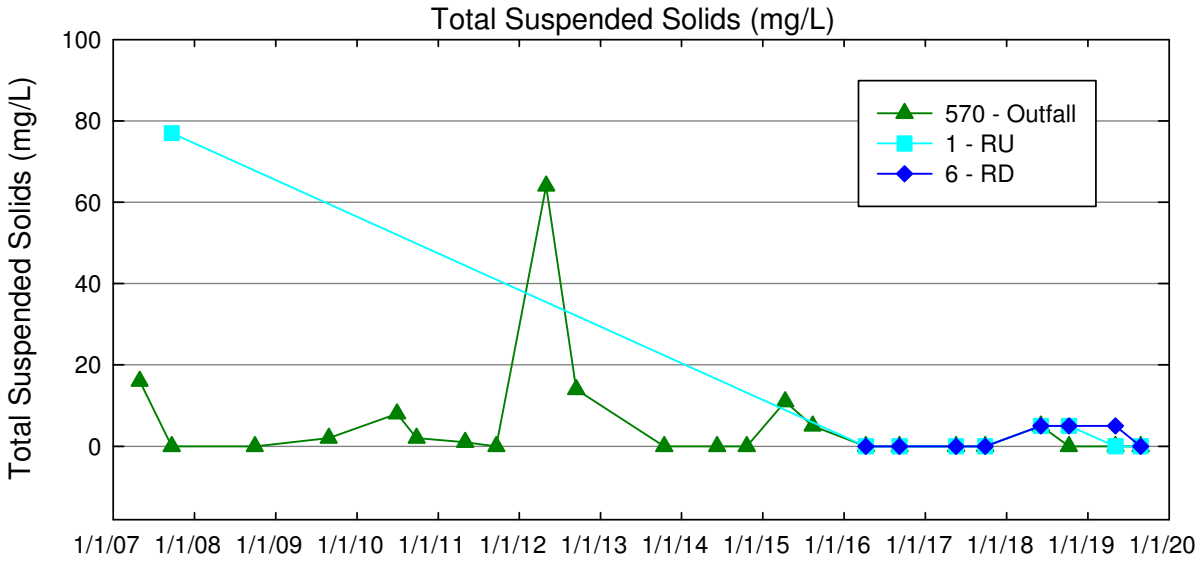




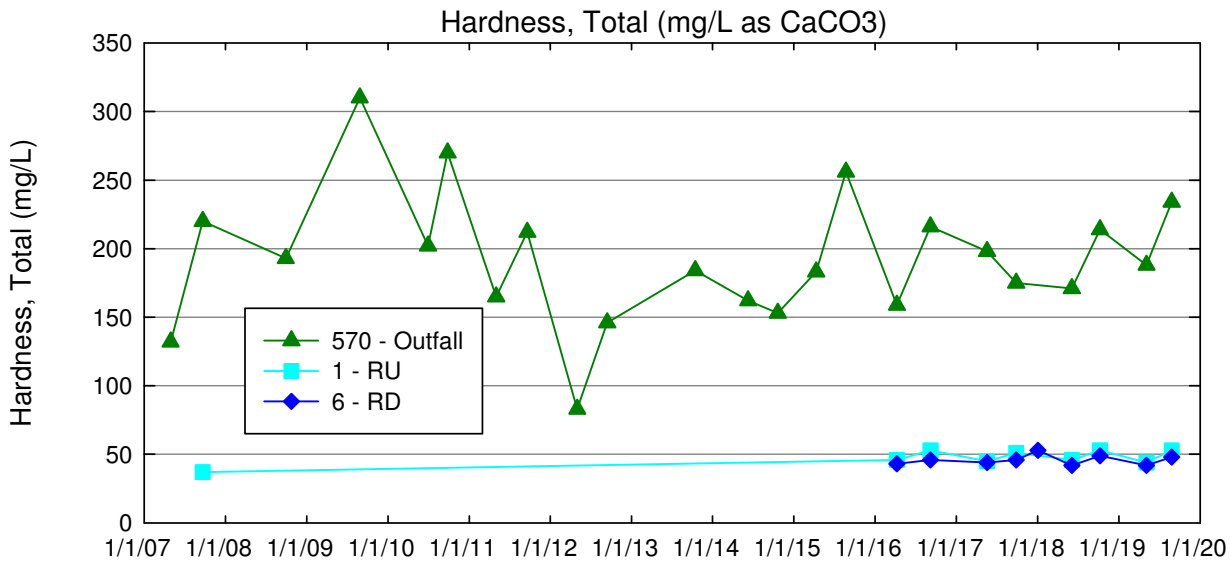
OUTFALL 008


Lead, Total Recoverable (ug/L)
Lead, TR (ug/L)
200
180
160
140
120
100
80
60
40
20
0
570 - Outfall
1 - RU
6 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


Zinc, Total Recoverable (ug/L)
Zinc, TR (ug/L)
350
300
250
200
150
100
50
0
570 - Outfall
1 - RU
6 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


Total Suspended Solids (mg/L)
Total Suspended Solids (mg/L)
100
80
60
40
20
0
570 - Outfall
1 - RU
6 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20

OUTFALL 008


Hardness, Total (mg/L as CaCO3)
Hardness, Total (mg/L)
350
300
250
200
150
100
50
0
570 - Outfall
1 - RU
6 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
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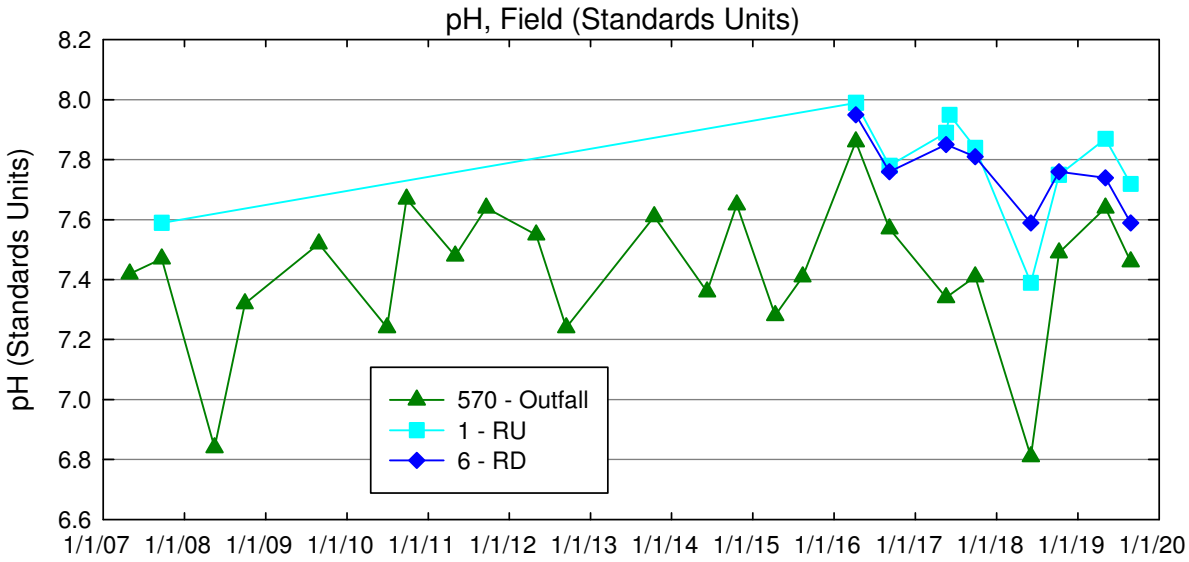
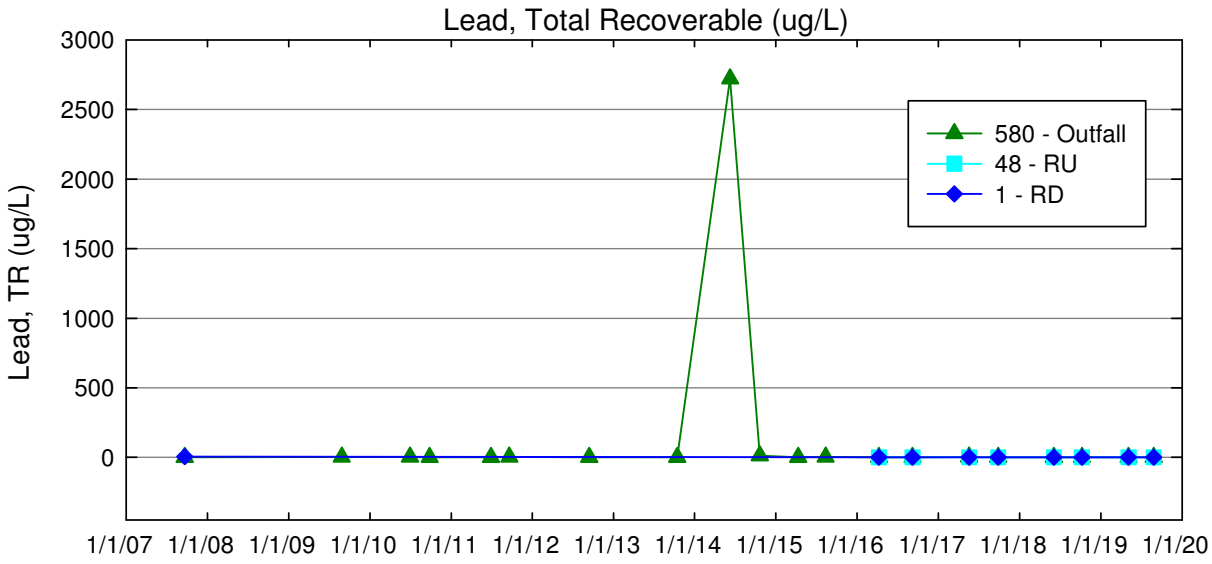
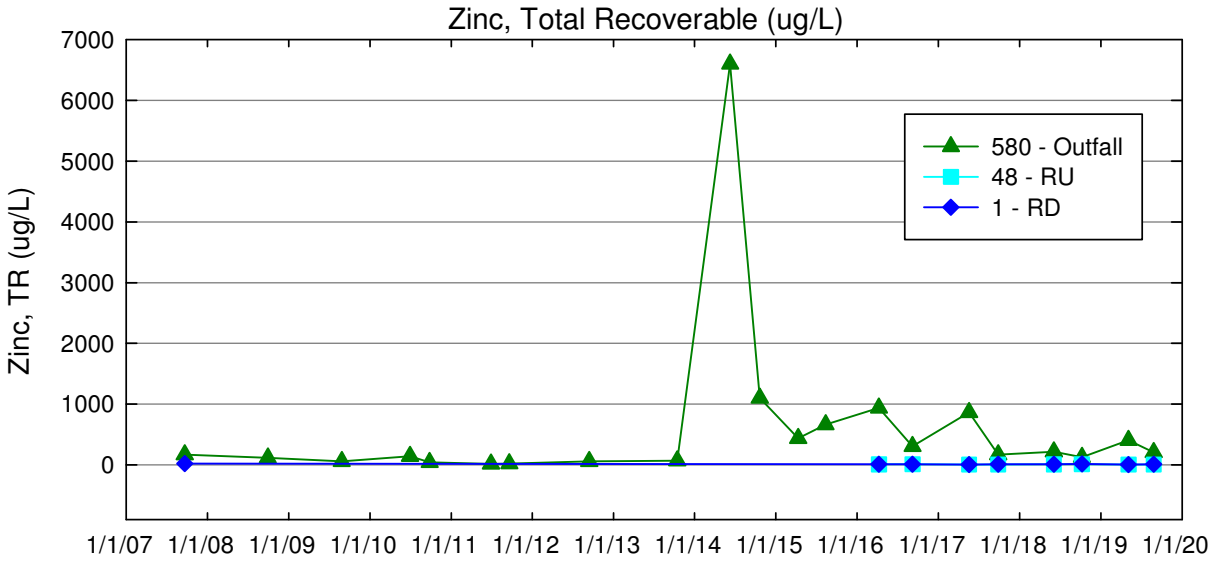
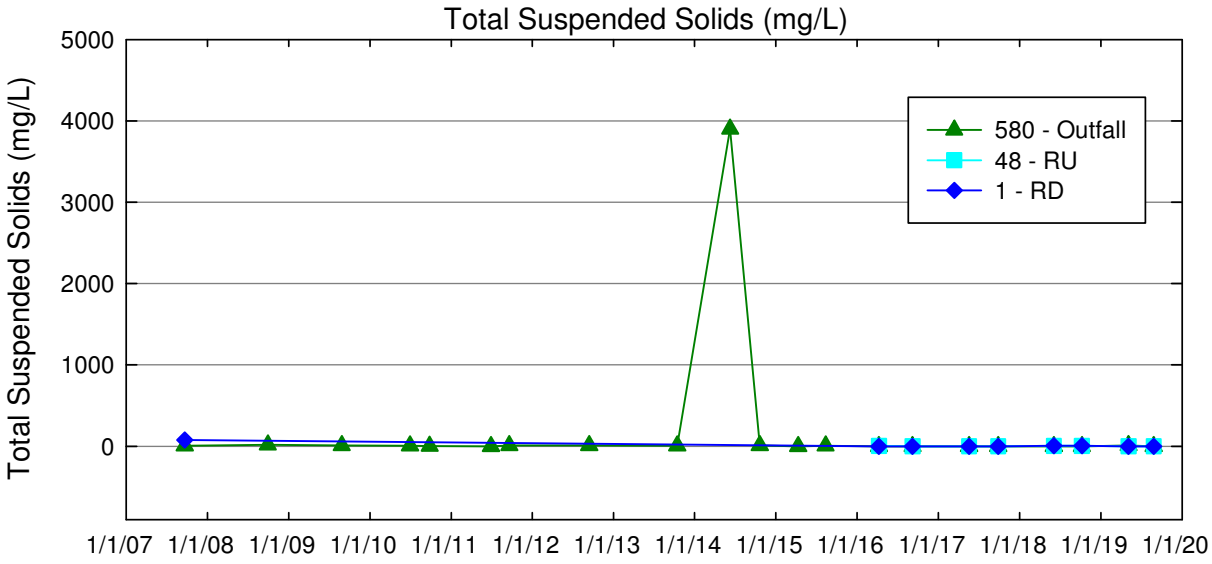
1/1/17
1/1/18
1/1/19
1/1/20


pH, Field (Standards Units)
pH (Standards Units)
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
570 - Outfall
1 - RU
6 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19
1/1/20

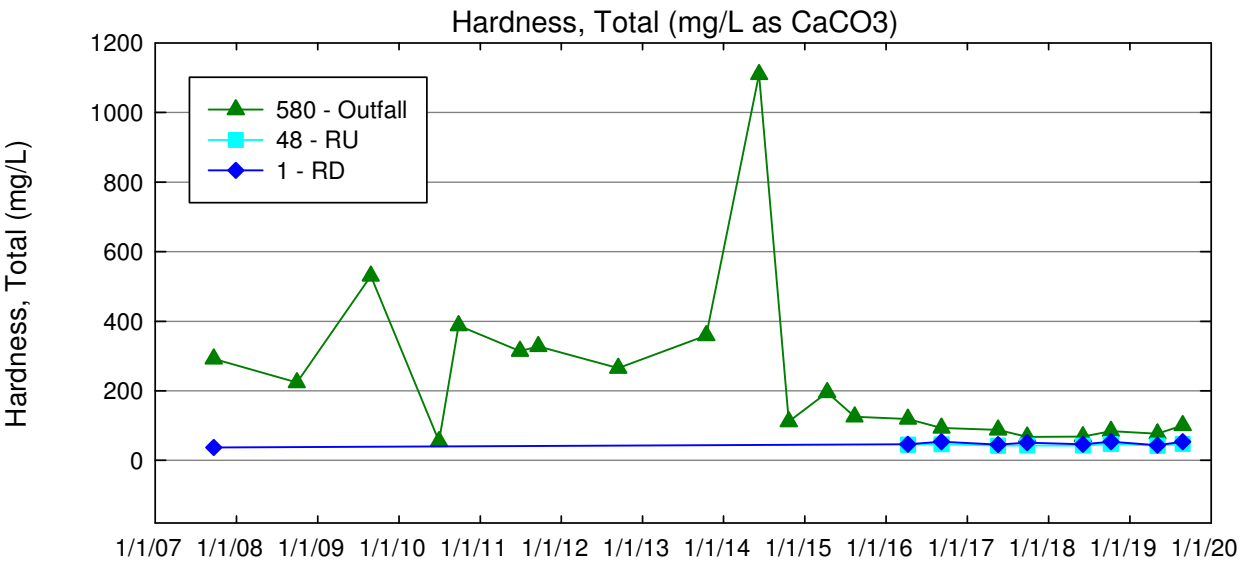
OUTFALL 009

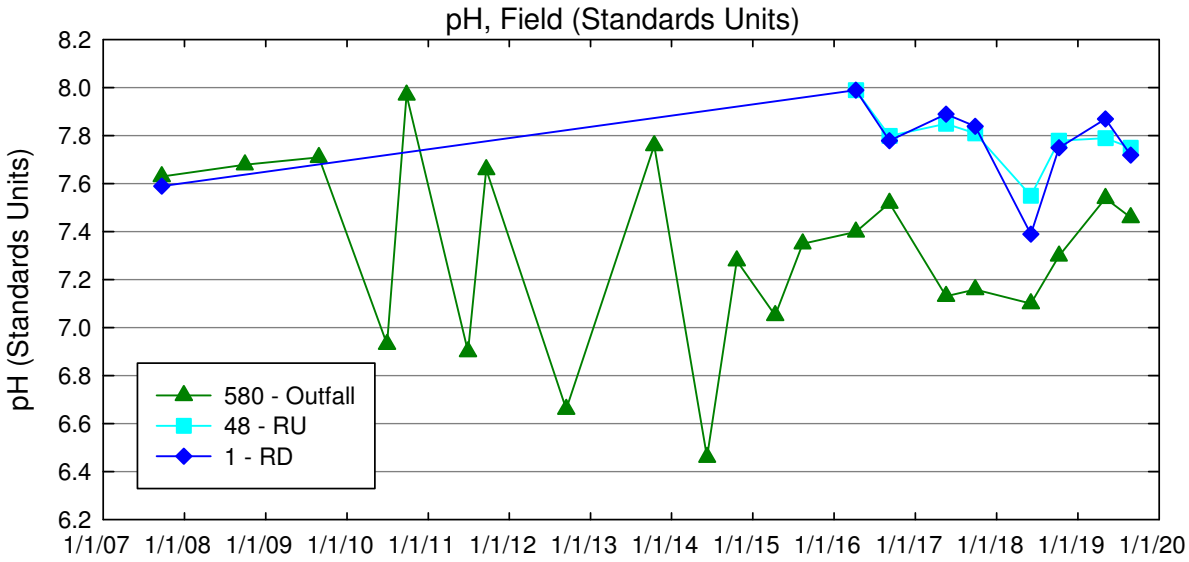

Lead, Total Recoverable (ug/L)
Lead, TR (ug/L)
3000
2500
2000
1500
1000
500
0
580 - Outfall
48 - RU
1 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


Zinc, Total Recoverable (ug/L)
Zinc, TR (ug/L)
7000
6000
5000
4000
3000
2000
1000
0
580 - Outfall
48 - RU
1 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


Total Suspended Solids (mg/L)
Total Suspended Solids (mg/L)
5000
4000
3000
2000
1000
0
580 - Outfall
48 - RU
1 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20

OUTFALL 009


Hardness, Total (mg/L as CaCO3)
Hardness, Total (mg/L)
1200
1000
800
600
400
200
0
580 - Outfall
48 - RU
1 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20


pH, Field (Standards Units)
pH (Standards Units)
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
580 - Outfall
48 - RU
1 - RD
1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19 1/1/20