

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

January 10th, 2017

TO: The Utah Board of Oil, Gas and Mining

THRU:  Dana Dean, Associate Director
Daron Haddock, Program Manager 

FROM: Steve Christensen, Hydrologist 

RE: Crandall Canyon Mine Discharge Water Board Update, Docket No. 2010-026,
Cause No. C/015/0032

SUMMARY:

Attached is the Division of Oil, Gas and Mining's six month update report on the total iron concentrations in the mine discharge at the Crandall Canyon Mine. The report is submitted per the direction of the January 28th, 2013 Board Order.

Crandall Canyon Mine Hydrologic Evaluation Update

December 28th, 2016

Introduction

The Division of Oil, Gas and Mining (the Division) completed a Hydrologic Evaluation of the Crandall Canyon Mine Water Discharge in June 2010. Since that time, numerous reports have been prepared by the Division and Genwal Resources, Inc. (Genwal) that examine the mine discharge water at Crandall Canyon. In compliance with the January 28, 2013, Board of Oil, Gas and Mining (the Board) Order¹, the following report presents an update on the data collected through May 2016. The report will focus on data collected since approximately January 2010 (after total iron concentrations in the discharge peaked). The following sections of this updated report describe: the data currently being collected, plots which have been prepared to examine the data, and a recent data evaluation. Due to upcoming changes to the Genwal UPDES permit, and current data trends, a predictive compliance analysis was not conducted.

Sampling

Genwal has continued to perform monthly sampling and analysis of the mine discharge water in accordance with the Crandall Canyon Mining and Reclamation Plan (MRP). In addition, Genwal has occasionally collected laboratory analysis samples more frequently than required by the MRP and has also been sampling the discharge using a total iron field analysis. The sampling is conducted to evaluate the need for continued treatment of the mine discharge water in order to meet the 1.24 mg/L maximum daily effluent limitation (MDEL) for total iron in accordance with their Utah Pollutant Discharge Elimination System (UPDES) permit. In addition, treatment is required for compliance with the narrative standard of Section I.C of the UPDES permit.

In October 2012, Genwal installed a new continuous flow sampling port and began collecting samples at this location. In March 2013, the continuous flow sampling port was destroyed by a rock fall from a high wall. After consultation with the Division, a new continuous flow sampling port was installed in March 2013. For purposes of this report, data from both continuous flow sampling ports will be viewed as equivalent. All samples taken since March 2013 were collected at the new continuous flow sampling port.

Current Data Graphs

Untreated total iron concentrations from January 2007 through November 2016 are plotted in Exhibit 1. The monthly median total iron concentrations from January 2010 to November 2016 are plotted in Exhibit 2. Exhibit 3 shows only the continuous flow sampling port, monthly median total iron concentrations, from October 2012 to November 2016. Average mine discharge flow rates are displayed in Exhibit 4. Mine discharge water chemistry analytical results from January 2007 to November 2016 and monthly medians for total iron are tabulated in Exhibit 5.

Recent Data

The total iron concentrations, collected from June to November of 2016, have fluctuated from a low concentration of 0.69 mg/L (July sample) to a high of 1.14 mg/L (August sample). The average concentration since May of this year is 1.04 mg/L (standard deviation of 0.08). The average total iron concentration from January to November of this year is 1.09 ppm (standard deviation of 0.17).

Compliant Discharge

Of the 12 mine discharge water samples collected (Genwal and Division collectively) from June through November, all of the samples reported total iron concentrations below the effluent limitation of 1.24 mg/L as defined in Genwal's Utah Pollutant Discharge Elimination System (UPDES) permit.

The Utah Division of Water Quality is in the final stages of renewing Genwal's Utah Pollutant Discharge Elimination System (UPDES) permit. During UPDES permit renewals, the allowable concentration limit of each effluent parameter, as outlined in the discharge permit (Section I.D), are re-calculated by the DWQ. These re-calculations are conducted using a standardized method that evaluates the most recent data available for the effluent receiving stream. The DWQ has indicated to Division staff that the effluent limit of total iron at Genwal will remain at 1.24 mg/L .

Conclusion

With the exception of the March sampling event (for both Genwal and the Division), every month's sampling event from January to November produced a total iron concentration below the UPDES limit of 1.24 mg/L. March's Genwal and Division sampling produced total iron concentrations of 1.6 mg/L and 1.51 mg/L respectively. The reduction in standard deviation (both on a six month and 11 month basis) demonstrate that the total iron concentrations appear to be stabilizing near or below the effluent limitation of 1.24 mg/L.

Although the data collected since June of this year is very encouraging that the iron concentrations are trending in the right direction, the Division feels that it is prudent to continue collecting data to support accurate evaluations of total iron trends. The Division recommends continuing to compile total iron concentration evaluations every six months based on newly available data.

References

1. Board of Oil, Gas and Mining., Findings of Fact, Conclusions of Law and Order, Docket No. 2010-026, Cause No. C/0150032, January 28, 2013.
2. Petersen, E.C. 2011. Investigation of Iron Concentration in the Genwal Resources, Inc. Crandall Canyon Mine Discharge Water, November 7, 2011
3. Gilbert, R.O., 1987. Statistical methods for environmental pollution monitoring. Van Nostrand Reinhold, New York.
4. Perry and Rauch. Estimating Water Quality Trends in Abandoned Coal Mine-pools, Presented at West Virginia Mine Drainage Task Force Meeting (sourced online as a white paper), March 26-27, 2013, Morgantown, WV

EXHIBIT 1: Crandall Mine - Untreated Mine Water - Total Iron

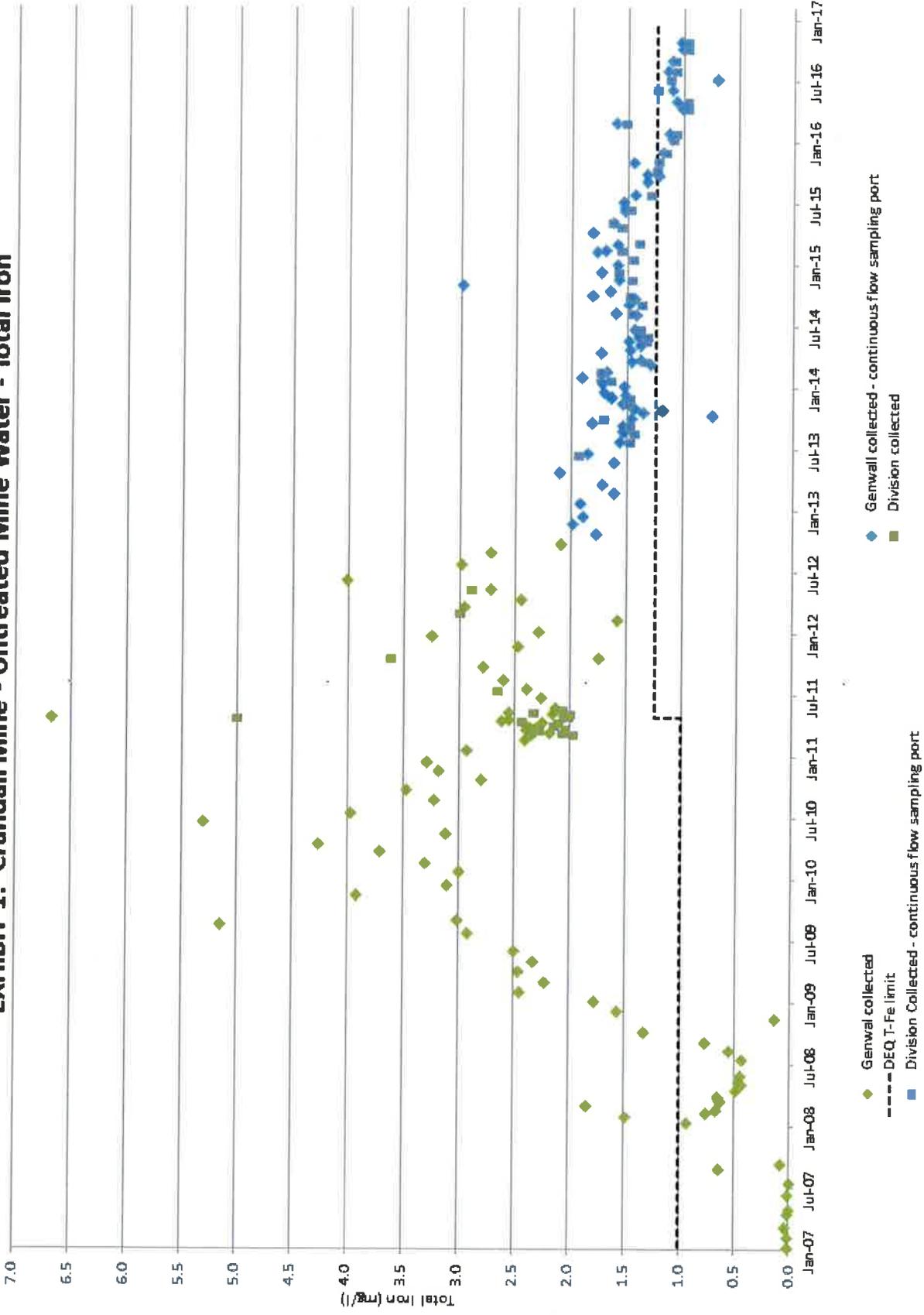
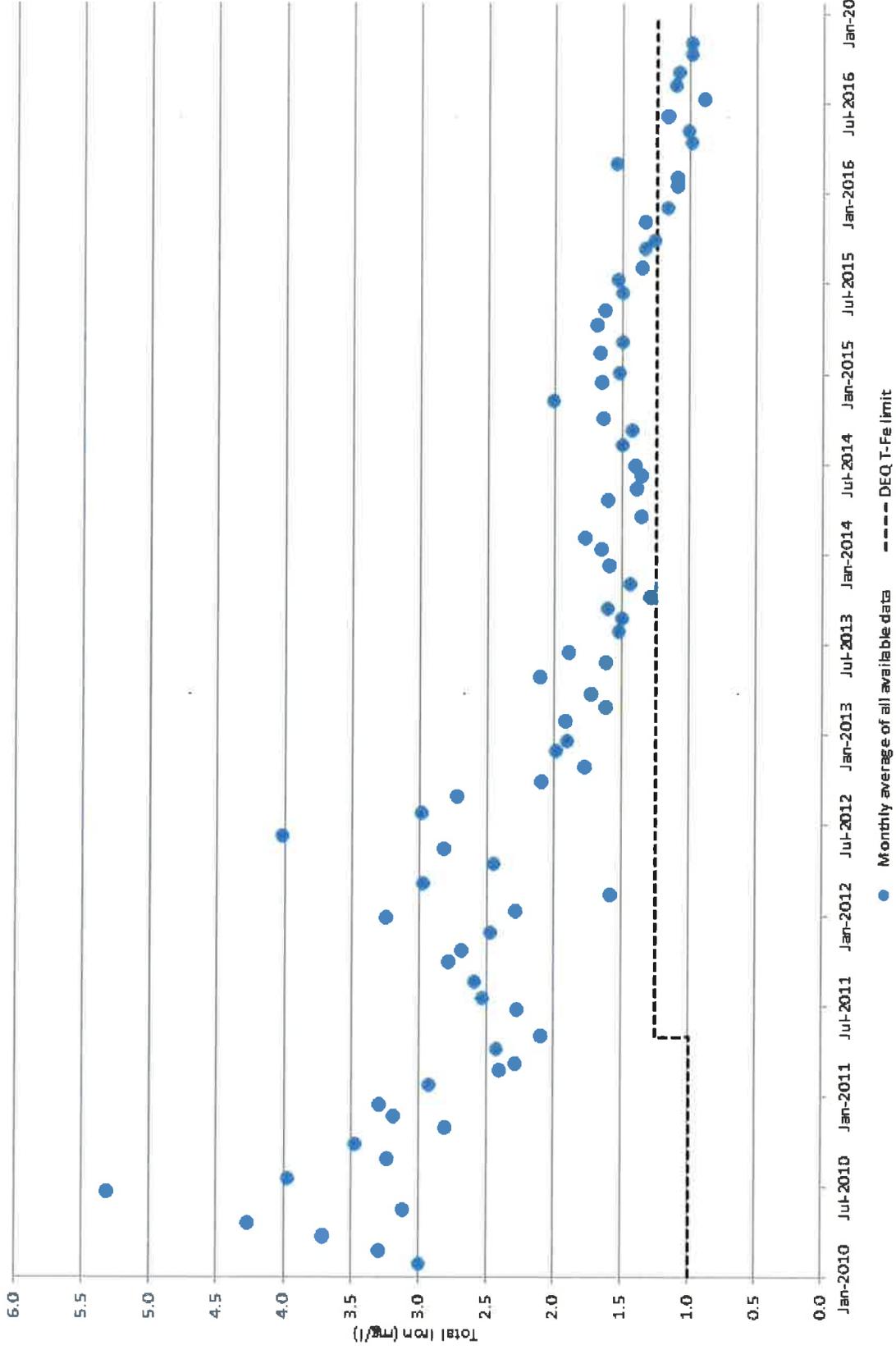


EXHIBIT 2: Crandall Mine - Untreated Mine Water - Total Iron Monthly Average



**EXHIBIT 3: Crandall Mine - Untreated Mine Water
Monthly Median - Continuous Flow Sampling Port**

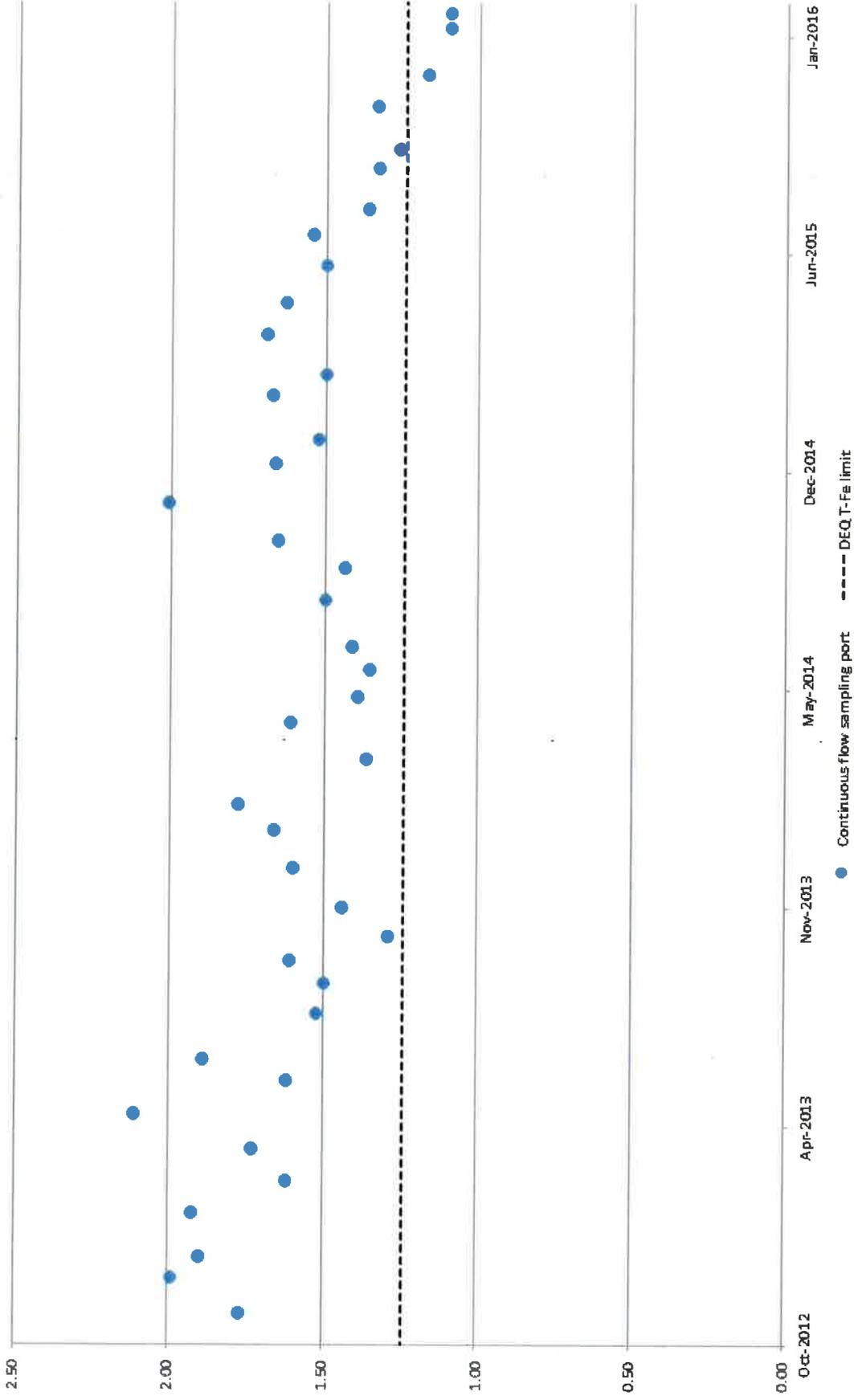


EXHIBIT 4: Mine Discharge

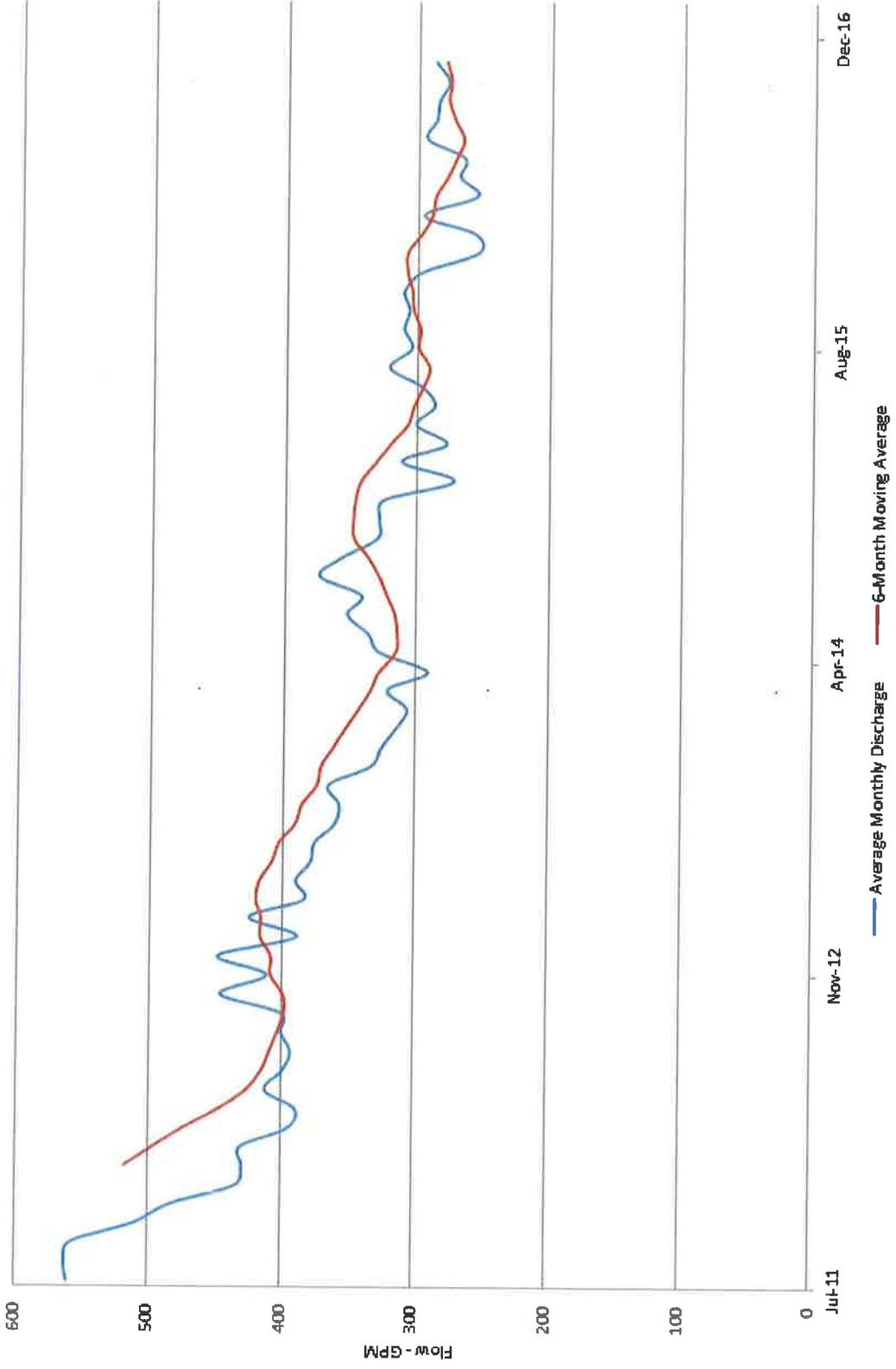


Exhibit 5

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
1/8/2007	0.012		G	
2/6/2007	0.015		G	
3/7/2007	0.033		G	
4/18/2007	0.013		G	
5/1/2007	< .005		G	
6/13/2007	0.012		G	
7/16/2007	< .01		G	
8/30/2007	0.64		G	
9/11/2007	0.073		G	
10/15/2007	no flow		G	
11/15/2007	no flow		G	
12/15/2007	no flow		G	
1/10/2008	0.937		G	
1/28/2008	1.491		G	
2/11/2008	0.765		G	
2/18/2008	0.668		G	
3/3/2008	1.846		G	
3/17/2008	0.626		G	
4/1/2008	0.653		G	
4/15/2008	0.491		G	
5/5/2008	0.433		G	
5/14/2008	0.457		G	
6/1/2008	0.448		G	
7/16/2008	0.434		G	
8/14/2008	0.546		G	
9/9/2008	0.775		G	
10/10/2008	1.335		G	
11/15/2008	0.141		G	
12/9/2008	1.569		G	
1/7/2009	1.783		G	
2/3/2009	2.454		G	
3/4/2009	2.23		G	
4/6/2009	2.455		G	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
5/6/2009	2.331		G	
6/3/2009	2.501		G	
7/29/2009	2.924		G	
8/24/2009	5.151		G	5.15
9/3/2009	3.012		G	3.01
10/28/2009	8.03		G	8.03
11/18/2009	3.927		G	3.93
12/16/2009	3.102		G	3.10
1/28/2010	3.000		G	3.00
2/23/2010	3.300		G	3.30
3/26/2010	3.709		G	3.71
4/21/2010	4.268		G	4.27
5/18/2010	3.119		G	3.12
6/23/2010	5.312		G	5.31
7/21/2010	3.970		G	3.97
8/27/2010	3.230		G	3.23
9/29/2010	3.470		G	3.47
10/29/2010	2.810		G	2.81
11/22/2010	3.190		G	3.19
12/17/2010	3.290		G	3.29
1/24/2011	2.930		G	2.93
2/23/2011	2.410		G	2.41
3/10/2011	2.340		G	2.28
3/10/2011	1.98		D	
3/17/2011	2.180		G	
3/17/2011	2.06		D	
3/24/2011	2.390		G	
3/24/2011	2.28		D	
3/28/2011	2.310		G	
3/30/2011	2.360		G	
3/30/2011	2.04		D	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
4/7/2011	2.390		G	2.43
4/7/2011	2.15		D	
4/14/2011	2.250		G	
4/14/2011	2.11		D	
4/19/2011	2.620		G	
4/19/2011	2.43		D	
4/26/2011	2.550		G	
4/27/2011	6.680		G	
4/27/2011	5.00		D	
5/3/2011	2.050		G	
5/3/2011	2.02		D	
5/12/2011	2.160		G	
5/12/2011	2.00		D	
5/17/2011	2.560		G	
5/17/2011	2.33		D	
5/25/2011	2.07		D	
5/31/2011	2.130		G	
6/27/2011	2.270		G	2.27
7/21/2011	2.660		D	2.53
7/25/2011	2.400		G	
8/22/2011	2.600		G	2.60
9/30/2011	2.790		G	2.79
10/24/2011	1.750		G	2.69
10/25/2011	3.62		D	
11/28/2011	2.470		G	2.47
12/28/2011	3.250		G	3.25
1/12/2012	2.29		G	2.29
2/15/2012	1.58		G	1.58
3/7/2012	3.00		D	2.98
3/23/2012	2.96		G	
4/17/2012	2.45		G	2.45

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
5/15/2012	2.73		G	2.82
5/15/2012	2.90		D	
6/12/2012	4.02		G	4.02
7/30/2012	2.99		G	2.99
8/31/2012	2.72		G	2.72
9/30/2012	2.09		G	2.09
10/30/2012		1.77	G	1.77
11/30/2012		1.99	G	1.99
12/20/2012		1.9	G	1.90
1/29/2013		1.92	G	1.92
2/28/2013		1.62	G	1.62
3/28/2013		1.73	G	1.73
4/30/2013		2.11	G	2.11
5/30/2013		1.65	G	1.62
6/19/2013		1.93	D	1.89
6/24/2013		1.85	G	
7/30/2013		1.47	D	1.52
7/30/2013		1.57	G	
8/27/2013		1.44	D	1.49
8/28/2013		1.54	G	
8/29/2013		1.52	G	
9/17/2013		1.48	D	1.51
9/17/2013		1.54	G	
9/26/2013		1.81	G	
10/9/2013		1.71	D	1.59
10/9/2013		1.46	G	
10/17/2013		0.74	G	
10/24/2013		1.35	G	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
11/4/2013		1.19	G	1.31
11/8/2013		1.43	G	
11/14/2013		1.46	G	
11/19/2013		1.49	D	
11/19/2013		1.54	G	
11/26/2013		1.52	G	
12/10/2013		1.65	G	1.60
12/10/2013		1.48	D	
12/12/2013		1.65	G	
12/17/2013		1.51	G	
12/26/2013		1.71	G	
1/14/2014		1.53	G	1.66
1/22/2014		1.72	G	
1/28/2014		1.74	G	
1/28/2014		1.65	D	
2/7/2014		1.91	G	1.78
2/26/2014		1.68	G	
2/26/2014		1.74	D	
3/20/2014		1.29	G	1.37
3/25/2014		1.46	G	
3/25/2014		1.33	D	
3/31/2014		1.38	G	
4/23/2014		1.74	G	1.61
4/30/2014		1.48	G	
5/16/2014		1.38	G	1.39
5/23/2014		1.37	G	
5/28/2014		1.33	D	
5/29/2014		1.49	G	
6/10/2014		1.39	G	1.36
6/10/2014		1.32	D	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
7/1/2014		1.44	G	1.41
7/1/2014		1.38	D	
8/13/2014		1.42	G	1.50
8/19/2014		1.61	G	
8/19/2014		1.46	D	
9/12/2014		1.49	G	1.43
9/15/2014		1.37	D	
9/29/2014		1.44	G	
10/7/2014		1.48	D	1.65
10/9/2014		1.81	G	
10/20/2014		1.66	G	
11/10/2014		2.99	G	2.01
11/24/2014		1.58	G	
11/25/2014		1.46	D	
12/16/2014		1.58	D	1.66
12/16/2014		1.74	G	
1/8/2015		1.59	G	1.52
1/27/2015		1.45	D	
2/17/2015		1.77	G	1.67
2/23/2015		1.55	D	
2/23/2015		1.70	G	
3/9/2015		1.59	G	1.50
3/17/2015		1.40	D	
4/14/2015		1.82	G	1.69
4/30/2015		1.55	D	
5/13/2015		1.63	D	1.63
5/13/2015		1.63	G	
6/17/2015		1.52	G	1.50
6/22/2015		1.47	D	
6/29/2015		1.52	G	

Sample Date	Total iron (mg/L) pretreatment sampling results	Continuous Flow Sampling Port	Genwal (G) or Division (D) Sample	Monthly Median
total iron (mg/L)				
7/14/2015		1.54	G	1.54
8/6/2015		1.29	D	1.37
8/7/2015		1.44	G	
9/14/2015		1.33	G	1.33
10/1/2015		1.22	G	1.26
10/5/2015		1.33	G	
10/20/2015		1.24	D	
11/9/2015		1.45	G	1.34
11/16/2015		1.22	D	
12/8/2015		1.18	G	1.17
12/8/2015		1.16	D	
1/20/2016		1.11	G	1.10
1/20/2016		1.09	D	
2/4/2016		1.13	G	1.10
2/4/2016		1.07	D	
3/7/2016		1.6	G	1.56
3/7/2016		1.51	D	
4/18/2016		1.01	G	0.99
4/18/2016		0.96	D	
5/10/2016		1.07	G	1.02
5/10/2016		0.96	D	
6/15/2016		1.11	G	1.17
6/15/2016		1.23	D	
7/13/2016		0.69	G	0.9
7/13/2016		1.11	D	
8/11/2016		1.14	G	1.105
8/11/2016		1.07	D	
9/8/2016		1.1	G	1.09
9/8/2016		1.08	D	
10/13/2016		1.01	G	0.99
10/13/2016		0.97	D	
11/7/2016		1.02	G	0.995
11/7/2016		.097	D	