Eagle Mine - Groundwater Discharge Permit Exceedance Summary through Q1 2016

SUPERIOR WATERSHED PARTNERSHIP AND LAND TRUST

Community Environmental Monitoring Program
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Groundwater Discharge Permit Exceedance Summary through Q1 2016

Groundwater Discharge Permit Exceedance Summary at Compliance (Downgradient) Monitoring Locations through Q1 2016

Eagle Mine's Groundwater Discharge Permit (GWDP) includes regulatory limits and reporting guidelines for groundwater sampled quarterly at both background (hydraulically upgradient/side gradient) and compliance (hydraulically downgradient) monitoring locations (see Table 1 and Figure 1 for well classifications and locations). For compliance monitoring wells, permit levels used to screen GWDP groundwater monitoring data are specified by the MDEQ and are referred to as Maximum Daily Limits (MDLs). These permit levels are regulatory program derived rather than reflective of site-specific baseline conditions, and they only apply to compliance monitoring locations. All Parameters measured at background monitoring wells and some collected at compliance monitoring wells are labeled as "report," meaning that there is no limit associated with the parameter being sampled; however, Eagle Mine is required to report the results of the laboratory analyses. Exceedances are only noted to have occurred when a parameter measured at a compliance monitoring location exceeds its MDL.

The Groundwater Discharge Permit, originally issued in 2007, was updated in March of 2015. Updates to the permit include updated MDLs for compliance wells (Table 2). Based on the new limits, three wells (QAL050A, QAL051A, and QAL052A) have exceeded MDLs for one or more parameters since 2008. Parameters that have exceeded MDLs include: Aluminum, Copper, Lead, and Molybdenum (Table 3). In 2015, only two wells (QAL050A and QAL052A) reported exceedances, for copper and aluminum, respectively. In both cases, the wells were immediately resampled and found to be below the MDL indicating that no water quality issues actually existed and that the elevated results were due to contamination of the sample which occurred in either the field or laboratory. All MDL exceedances observed prior to the updated permit limits are detailed in Table 4.

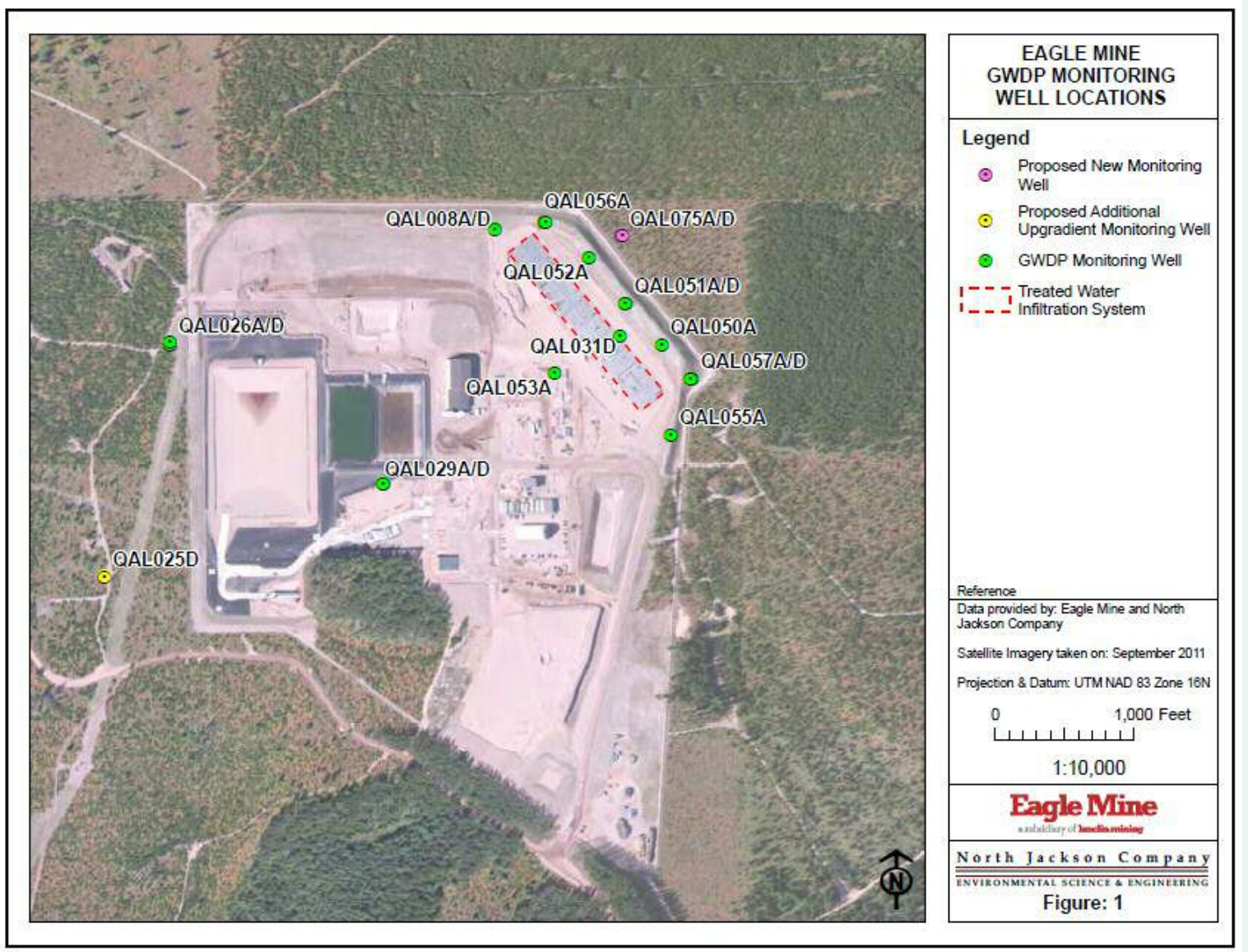


Figure 1. Eagle Mine Groundwater Discharge Permit Groundwater Monitoring Locations

Table 1. Groundwater Discharge Permit Monitoring Wells

Upgradient/Side Gradient (Background) Monitoring Wells	Downgradient (Compliance) Monitoring Wells
QAL025D	QAL008A
QAL026A	QAL008D
QAL026D	QAL050A
QAL029A	QAL051A
QAL029D	QAL051D
QAL053A	QAL052A
QAL055A	QAL057A
QAL056A	QAL057D
	QAL075A
	QAL075D

Table 2. Compliance (Downgradient) Monitoring Parameters and Maximum Daily Limits

Parameter	Original Maximum Daily Limit	Updated Maximum Daily Limit (Effective 4/1/15)	Units
Static Water Elevation	Report	Report	USGS - Ft
Bicarbonate	Report	Report	mg/l
Dissolved Oxygen	Report	Report	mg/l
Total Inorganic Nitrogen	-	10.0	mg/l
Ammonia Nitrogen	10.0	10.0	mg/l
Nitrate Nitrogen	10.0	10.0	mg/l
Nitrite Nitrogen	Report	Report	mg/l
pH (Minimum)	6.5	6.5	SU
pH (Maximum)	9	9.7	SU
Total Phosphorous	Report	Report	mg/l
Specific Conductance	Report	Report	umhos/cm
Sulfate	250	250	mg/l
Chloride	250	Report	mg/l
Sodium	120	Report	mg/l
Aluminum	-	150	ug/l
Antimony	5.0	5.0	ug/l
Arsenic	6.0	6.0	ug/l
Barium	1000	1000	ug/l
Beryllium	3	3	ug/l
Boron	285	285	ug/l
Cadmium	3.0	3.0	ug/l
Calcium	Report	Report	mg/l
Chromium	52	52	ug/l
Copalt	23	23	ug/l
Copper	10	10	ug/l
Total Fluoride	-	1000	ug/l
Iron	Report	Report	ug/l
Lead	3.0	3.0	ug/l
Lithium	88	88	ug/l
Magnesium	Report	Report	mg/l
Manganese	50	50	ug/l
Mercury	Report	Report	ug/l
Molybdenum	22	22	ug/l
Nickel	57	57	ug/l
Potassium	Report	Report	mg/l
Selenium	5.0	5.0	ug/l
Silver	0.4	0.4	ug/l
Strontium	2300	2300	ug/l
Thallium	1.0	1.0	ug/l
Uranium	-	Report	ug/l
Vanadium	2.2	3.1**	ug/l
Zinc	1200	1200	ug/l

**QAL008A and QAL051a are report only for vanadium

Table 3. Compliance Wells and Parameters Exceeding Updated Groundwater Discharge Permit Limits

Location	Parameter	Unit	Maximum Daily Limit		Result	Date	Comments
			Under Original Permit (prior to 4/1/15)	Under Updated Permit (Effective 4/1/15)			
QAL050A	Copper	ug/L	10.0	10.0	13	2/10/2015	QAL050A was immediately resampled upon receipt of the elevated results. The result of the re-sample was non-detect for copper and therefore the elevated result was likely due to contamination either introduced in the field or laboratory.
QAL051A	Molybdenum	ug/L	22.0	22.0	46	6/11/2008	
QAL051A	Molybdenum	ug/L	22.0	22.0	27	9/17/2008	
QAL051A	Molybdenum	ug/L	22.0	22.0	27	8/5/2009	
QAL052A	Aluminum	ug/L	-	150	200	11/3/2015	QAL052A was resampled and results were found to be consistent with historical values. The elevated results was likely due to contamination either introduced in the field or laboratory.
QAL052A	Copper	ug/L	10	10	67 R	11/4/2010	Results collected after the well was disturbed (well casing extended due to its location near a berm). QAL052A was resampled and the results returned to baseline levels, indicating that no persistent water quality issues exist.
QAL052A	Copper	ug/L	10	10	17 R	2/2/2011	
QAL052A	Copper	ug/L	10	10	35	5/16/2013	Results collected after the well was disturbed (while removing a pump that failed). QAL052A was resampled and the results returned to baseline

Location	Parameter	Unit	Maximum Daily Limit		Result	Date	Comments
			Under Original Permit (prior to 4/1/15)	Under Updated Permit (Effective 4/1/15)			
							levels, indicating that no persistent water quality issues exist.
QAL052A	Lead	ug/L	3.0	3.0	14 R	11/4/2010	Results collected after the well was disturbed (well casing extended due to its location near a berm). QAL052A was resampled and the results returned to baseline levels, indicating that no persistent water quality issues exist.
QAL052A	Lead	ug/L	3.0	3.0	7.4	5/16/2013	Results collected after the well was disturbed (while removing a pump that failed). QAL052A was resampled and the results returned to baseline levels, indicating that no persistent water quality issues exist.

R = Measured value was rejected based on quality control measure.

Table 4. Compliance Wells and Parameters Exceeding Original Groundwater Discharge Permit Limits

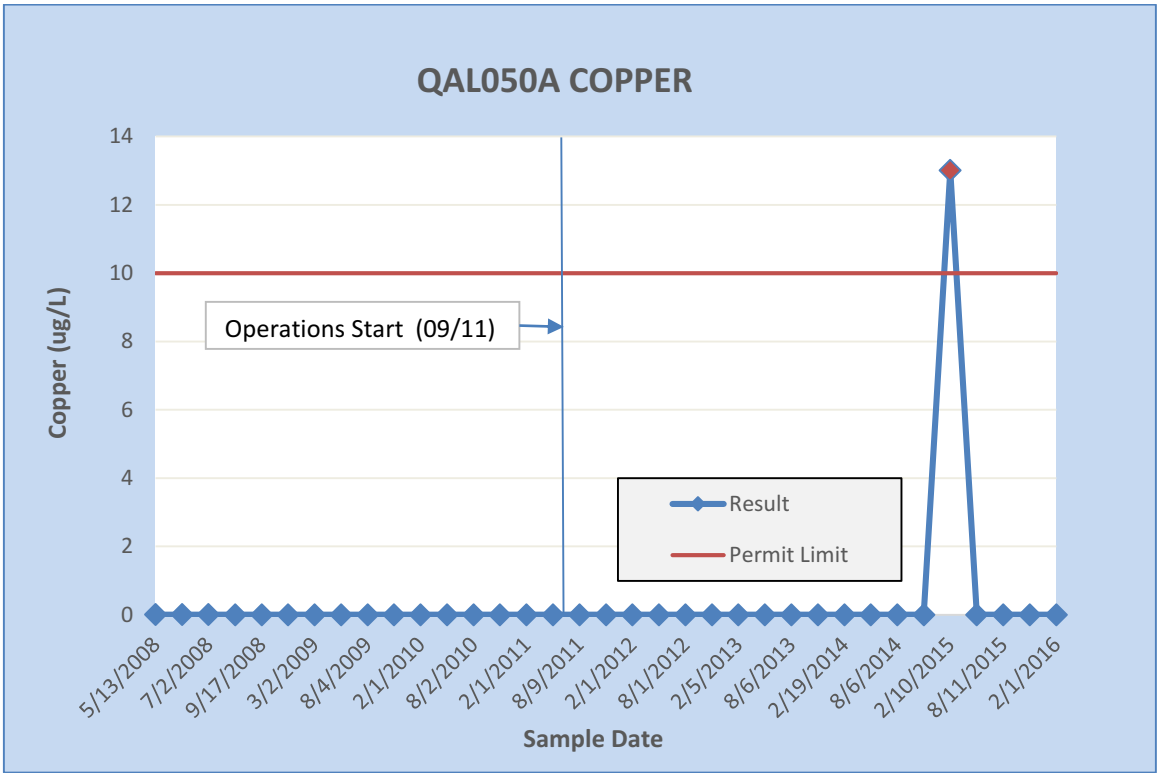
Location	Parameter	Unit	Maximum Daily Limit		Result	Date
			Under Original Permit (prior to 4/1/15)	Under Updated Permit (Effective 4/1/15)		
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.4	5/13/2008
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	6/11/2008
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.4	7/2/2008
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	8/13/2008
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	9/16/2008
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.4	10/1/2008
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.7	2/26/2009
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.1	11/2/2009
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.1	2/1/2010
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	8/8/2011
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.1	11/1/2011
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.1	2/5/2013
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.2	2/18/2014
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.4	5/12/2014
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	11/5/2014
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	2/9/2015
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.2	5/11/2015
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.2	8/11/2015
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.3	11/2/2015
QAL008A	pH	SU	6.5-9.0	6.5-9.7	9.2	2/1/2016
QAL008A	Vanadium	ug/L	2.2	Report	2.9	5/12/2014
QAL008A	Vanadium	ug/L	2.2	Report	4.3	8/6/2014
QAL008A	Vanadium	ug/L	2.2	Report	4.8	11/5/2014
QAL008A	Vanadium	ug/L	2.2	Report	4.1	2/9/2015
QAL008A	Vanadium	ug/L	2.2	Report	4.3	5/11/2015
QAL008A	Vanadium	ug/L	2.2	Report	3.8	8/11/2015
QAL008A	Vanadium	ug/L	2.2	Report	3.4	11/2/2015
QAL008A	Vanadium	ug/L	2.2	Report	3.1	2/1/2016
QAL008D	pH	SU	6.5-9.0	6.5-9.7	9.3	7/1/2008
QAL008D	Vanadium	ug/L	2.2	3.1	2.3	2/26/2009
QAL008D	Vanadium	ug/L	2.2	3.1	2.3	5/1/2012
QAL008D	Vanadium	ug/L	2.2	3.1	2.6	11/4/2013
QAL008D	Vanadium	ug/L	2.2	3.1	2.4	2/18/2014
QAL008D	Vanadium	ug/L	2.2	3.1	2.3	5/12/2014
QAL008D	Vanadium	ug/L	2.2	3.1	2.4	11/4/2014
QAL008D	Vanadium	ug/L	2.2	3.1	2.3	5/11/2015

Location	Parameter	Unit	Maximum Daily Limit		Result	Date
			Under Original Permit (prior to 4/1/15)	Under Updated Permit (Effective 4/1/15)		
QAL050A	pH	SU	6.5-9.0	6.5-9.7	9.1	2/5/2013
QAL050A	pH	SU	6.5-9.0	6.5-9.7	9.1	5/12/2014
QAL051A	Vanadium	ug/L	2.2	Report	2.7	8/21/2008
QAL051A	Vanadium	ug/L	2.2	Report	2.5	11/3/2009
QAL051A	Vanadium	ug/L	2.2	Report	3.4	8/3/2010
QAL051A	Vanadium	ug/L	2.2	Report	2.3	11/4/2010
QAL051A	Vanadium	ug/L	2.2	Report	2.3	5/2/2011
QAL051A	Vanadium	ug/L	2.2	Report	2.5	11/2/2011
QAL051A	Vanadium	ug/L	2.2	Report	3.3	5/3/2012
QAL051A	Vanadium	ug/L	2.2	Report	2.6	8/1/2012
QAL051A	Vanadium	ug/L	2.2	Report	3	11/6/2012
QAL051A	Vanadium	ug/L	2.2	Report	2.9 f	2/12/2013
QAL051A	Vanadium	ug/L	2.2	Report	3.3	5/15/2013
QAL051A	Vanadium	ug/L	2.2	Report	3.9	8/5/2013
QAL051A	Vanadium	ug/L	2.2	Report	3.2	11/5/2013
QAL051A	Vanadium	ug/L	2.2	Report	3.7	2/18/2014
QAL051A	Vanadium	ug/L	2.2	Report	3.8	5/12/2014
QAL051A	Vanadium	ug/L	2.2	Report	3.9	8/5/2014
QAL051A	Vanadium	ug/L	2.2	Report	3.7	11/5/2014
QAL051A	Vanadium	ug/L	2.2	Report	3.9	2/9/2015
QAL051A	Vanadium	ug/L	2.2	Report	3.6	5/11/2015
QAL051A	Vanadium	ug/L	2.2	Report	3.8	8/11/2015
QAL051A	Vanadium	ug/L	2.2	Report	3.8	11/2/2015
QAL051A	Vanadium	ug/L	2.2	Report	3.8	2/1/2016
QAL051D	pH	SU	6.5-9.0	6.5-9.7	9.5	7/1/2008
QAL051D	Vanadium	ug/L	2.2	3.1	2.6	5/13/2008
QAL051D	Vanadium	ug/L	2.2	3.1	2.7	11/3/2010
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	6/11/2008
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	9/16/2008
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.2	10/1/2008
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.2	8/4/2009
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	11/3/2009
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	2/1/2010
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.2	2/5/2013
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	5/13/2013
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.2	2/18/2014
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.2	5/12/2014

Location	Parameter	Unit	Maximum Daily Limit		Result	Date
			Under Original Permit (prior to 4/1/15)	Under Updated Permit (Effective 4/1/15)		
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	2/10/2015
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.3	8/12/2015
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.2	11/2/2015
QAL057A	pH	SU	6.5-9.0	6.5-9.7	9.1	2/1/2016

f = Value should be considered an estimate because field stabilization was not achieved of at least one parameter

Figures.
Compliance Wells and Parameters Exceeding Original and Updated Groundwater Discharge Permit Limits


QAL050A COPPER
Copper (ug/L)
14
12
10
8
6
4
2
0
Operations Start (09/11)
Result
Permit Limit
5/13/2008
7/2/2008
9/17/2008
3/2/2009
8/4/2009
2/1/2010
8/2/2010
2/1/2011
8/9/2011
2/1/2012
8/1/2012
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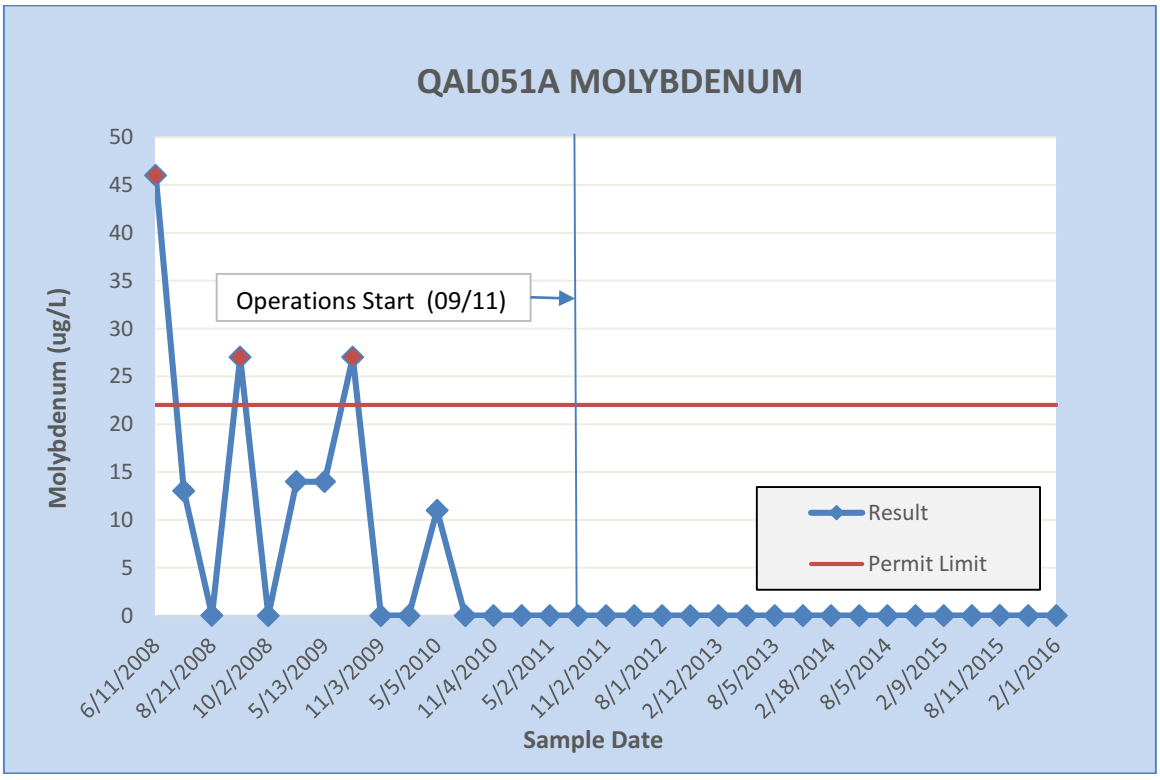
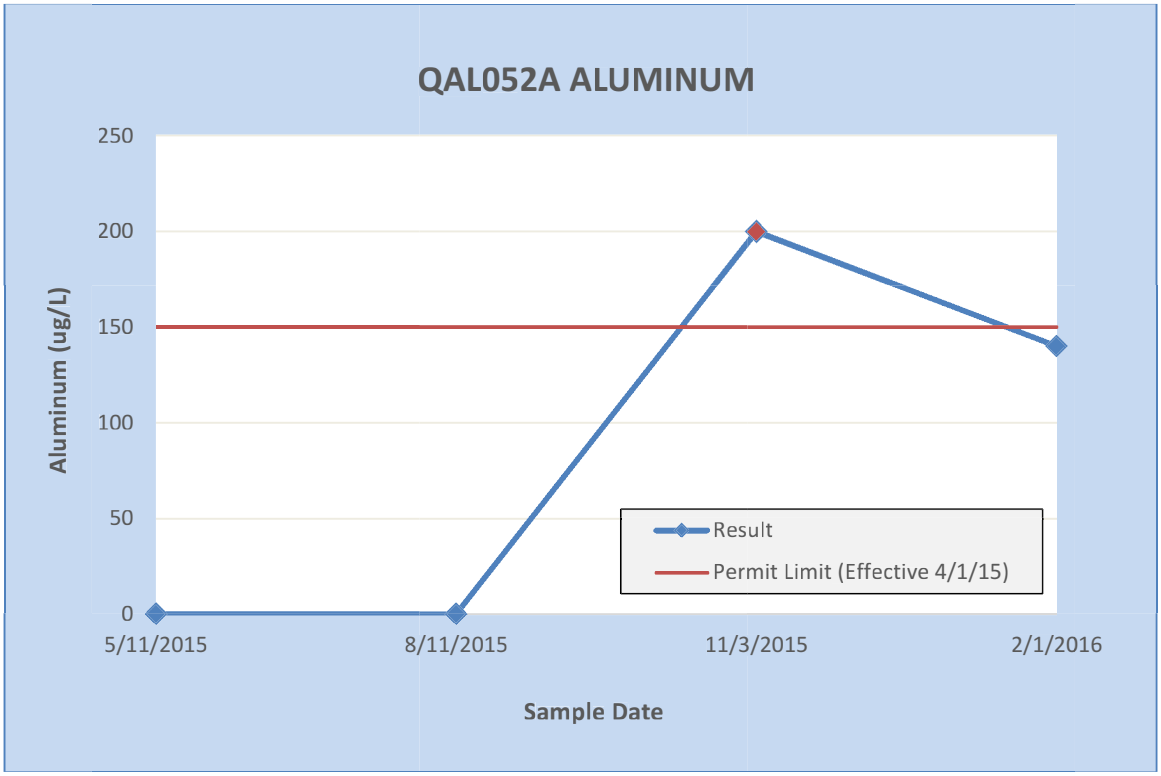
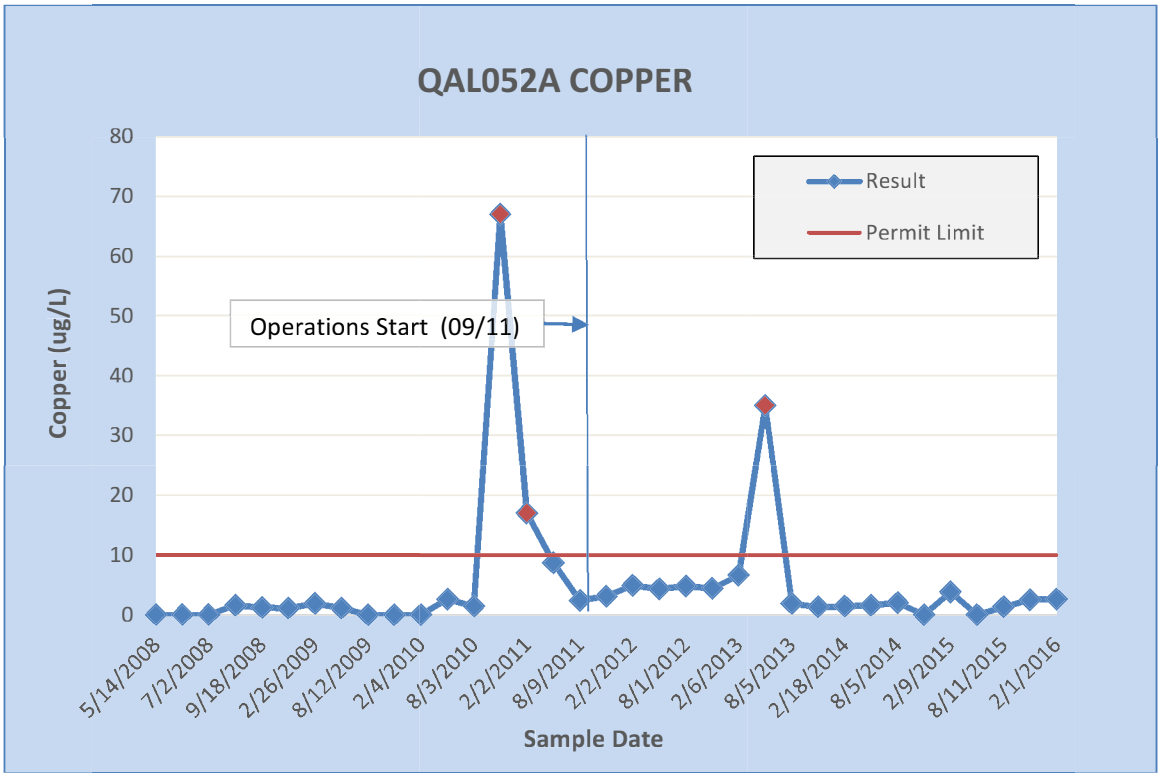
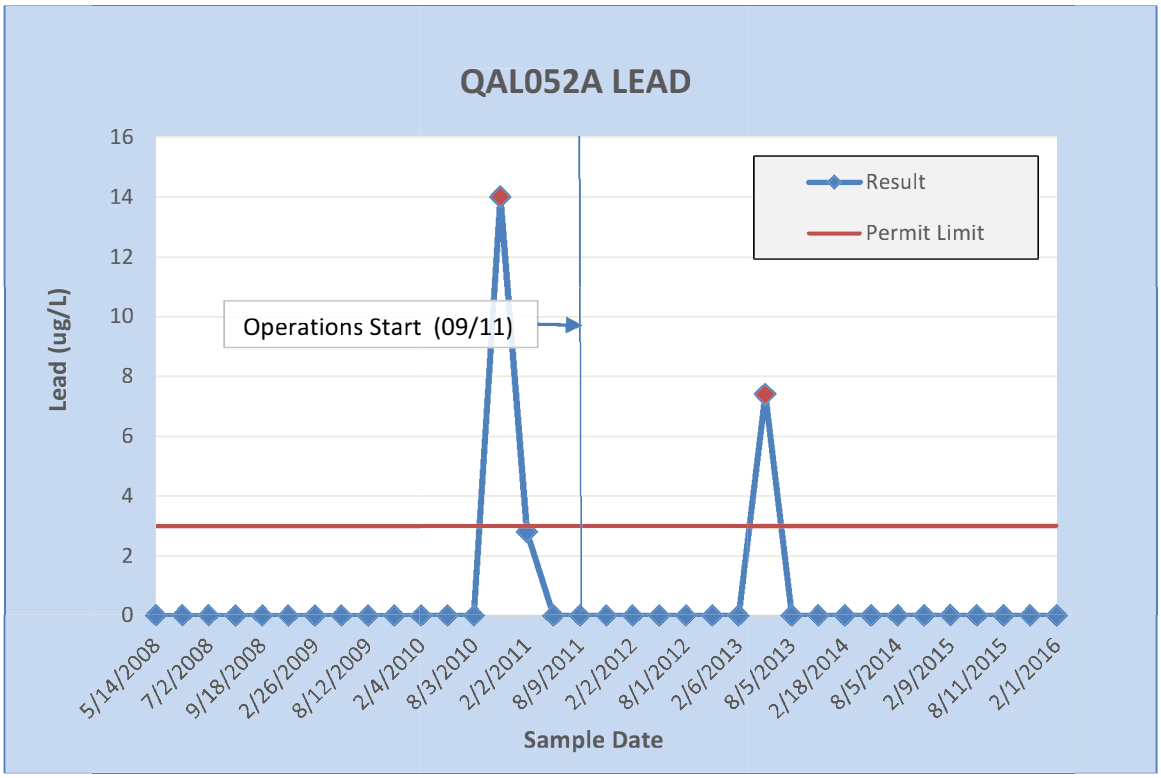
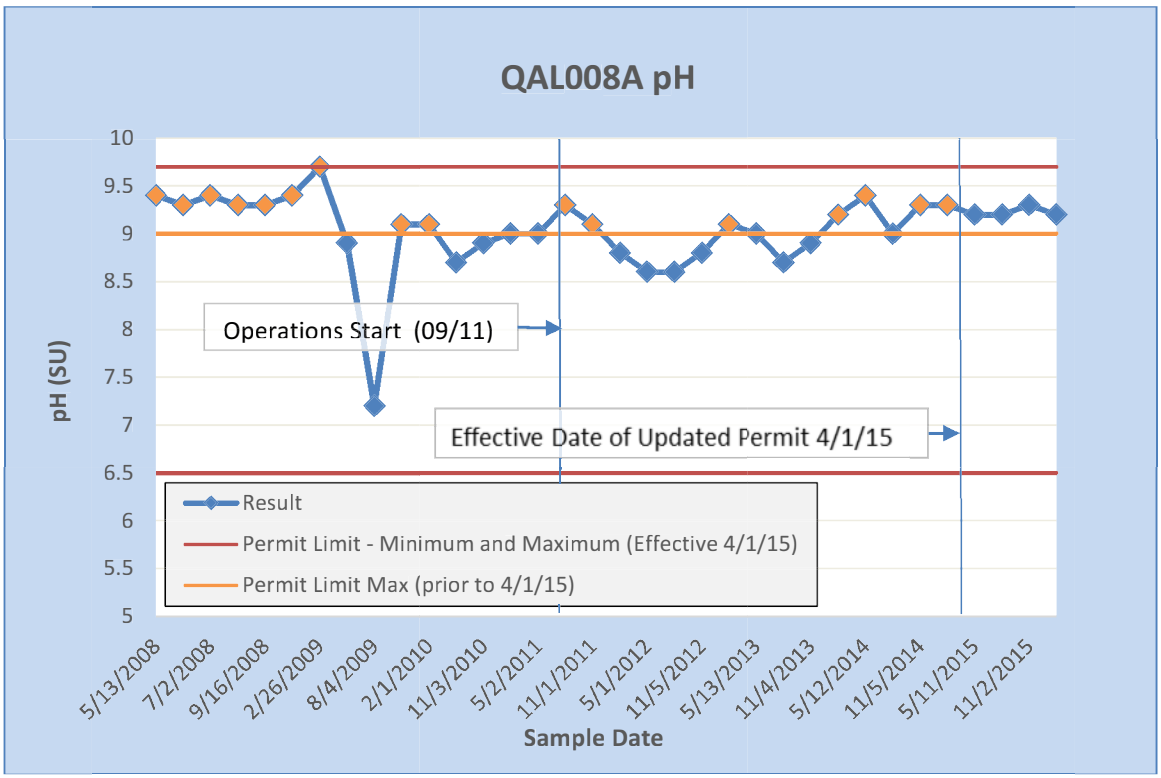
2/19/2014
8/6/2014
2/10/2015
8/11/2015
2/1/2016
Sample Date

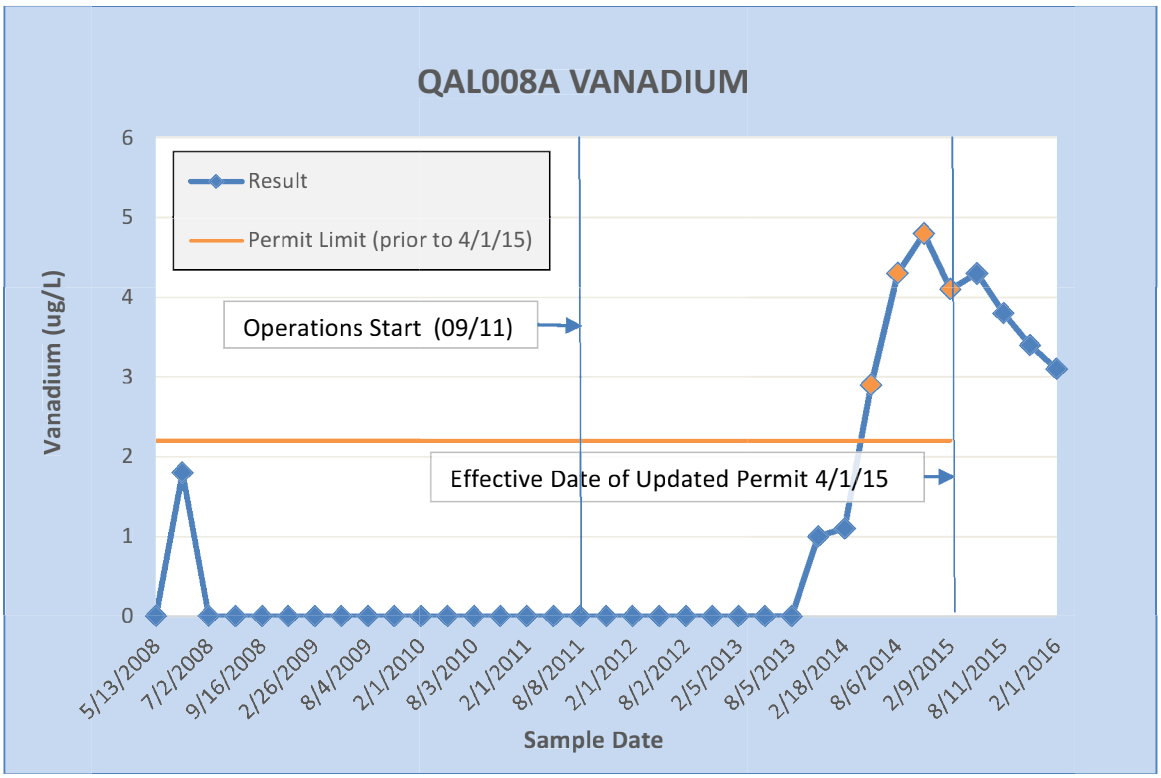

QAL051A MOLYBDENUM
Molybdenum (ug/L)
50
45
40
35
30
25
20
15
10
5
0
Operations Start (09/11)
Result
Permit Limit
6/11/2008
8/21/2008
10/2/2008
5/13/2009
11/3/2009
5/5/2010
11/4/2010
5/2/2011
11/2/2011
8/1/2012
2/12/2013
8/5/2013
2/18/2014
8/5/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date

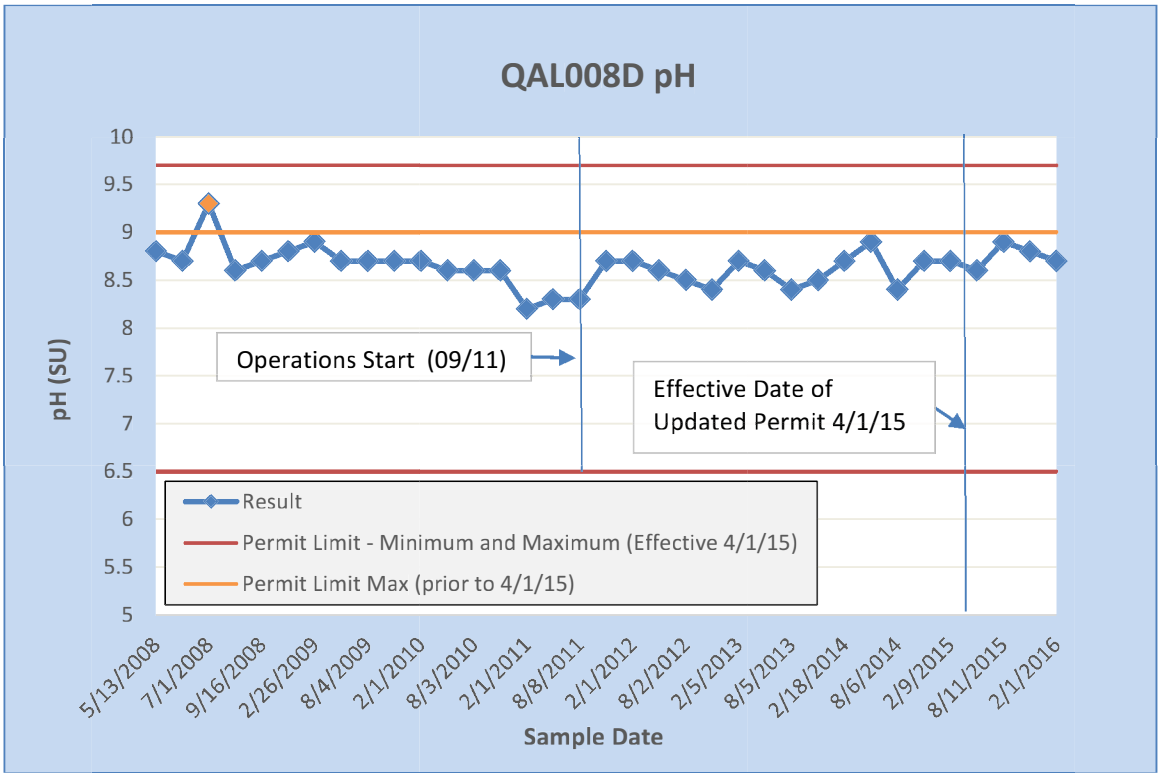

QAL052A ALUMINUM
250
200
150
100
50
0
Aluminum (ug/L)
5/11/2015
8/11/2015
11/3/2015
2/1/2016
Sample Date
Result
Permit Limit (Effective 4/1/15)

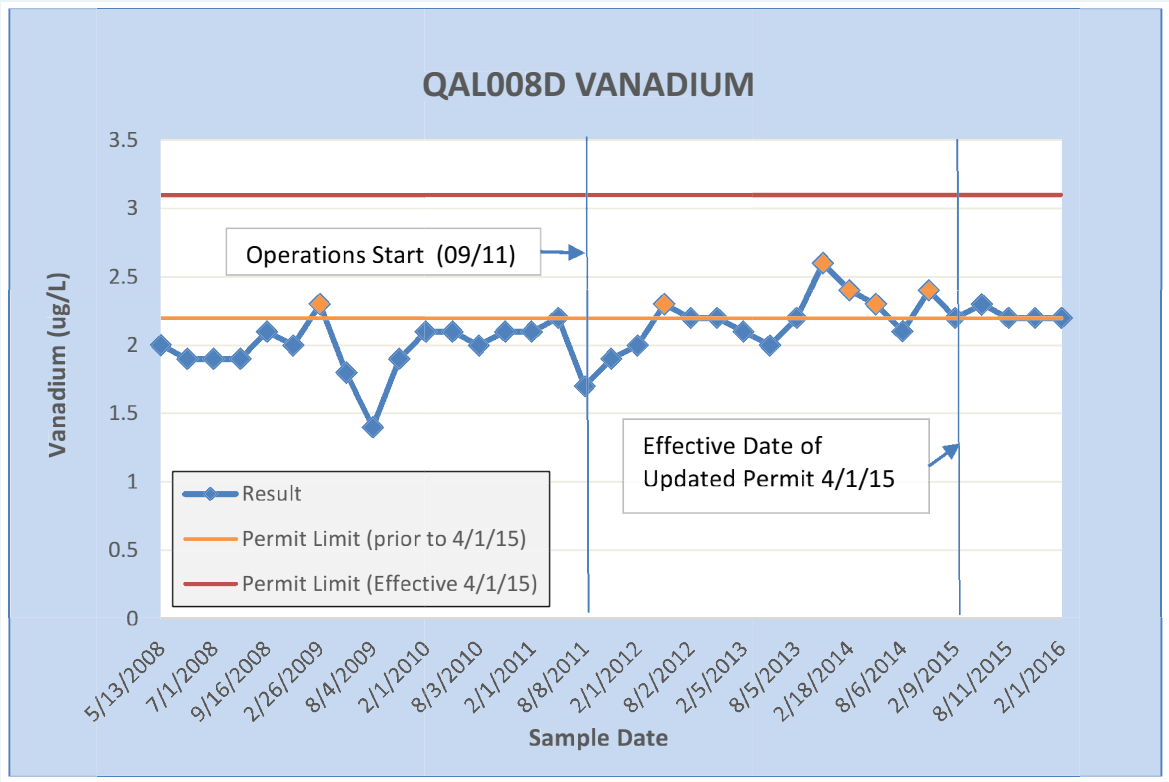

QAL052A COPPER
80
70
60
50
40
30
20
10
0
Copper (ug/L)
Operations Start (09/11)
Result
Permit Limit
5/14/2008
7/2/2008
9/18/2008
2/26/2009
8/12/2009
2/4/2010
8/3/2010
2/2/2011
8/9/2011
2/2/2012
8/1/2012
2/6/2013
8/5/2013
2/18/2014
8/5/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date

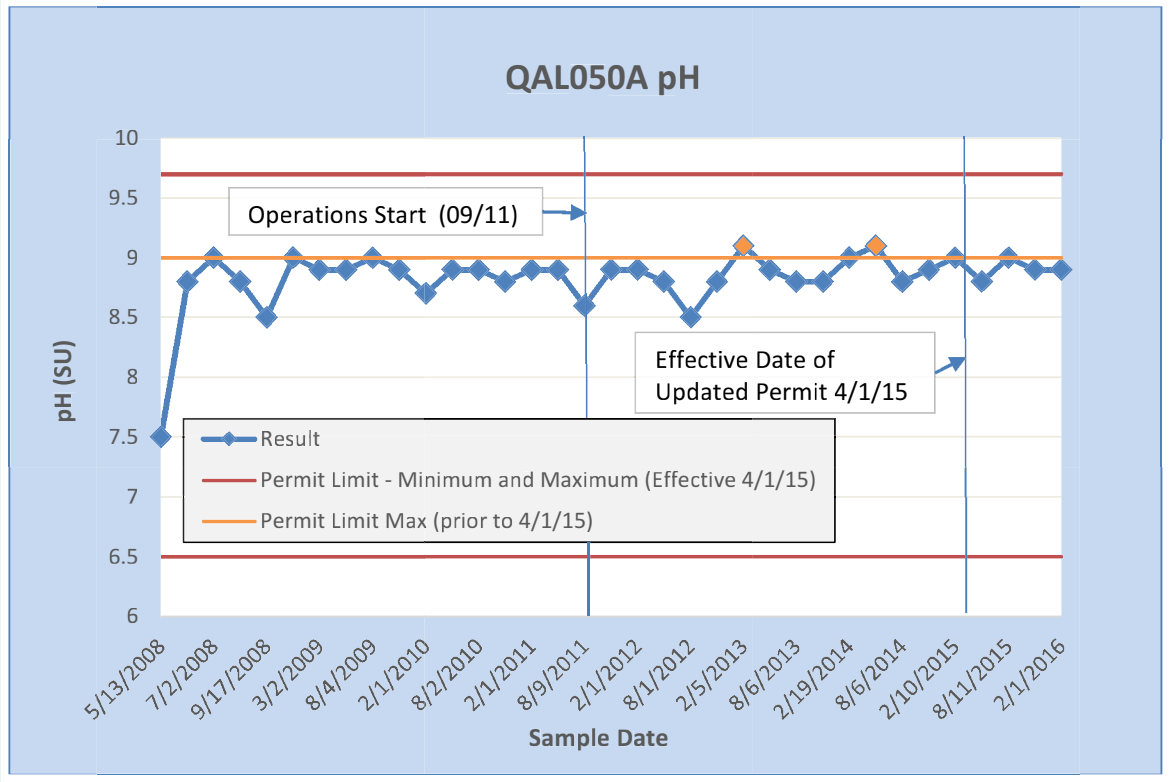

QAL052A LEAD
Lead (ug/L)
16
14
12
10
8
6
4
2
0
Result
Permit Limit
Operations Start (09/11)
5/14/2008
7/2/2008
9/18/2008
2/26/2009
8/12/2009
2/4/2010
8/3/2010
2/2/2011
8/9/2011
2/2/2012
8/1/2012
2/6/2013
8/5/2013
2/18/2014
8/5/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date

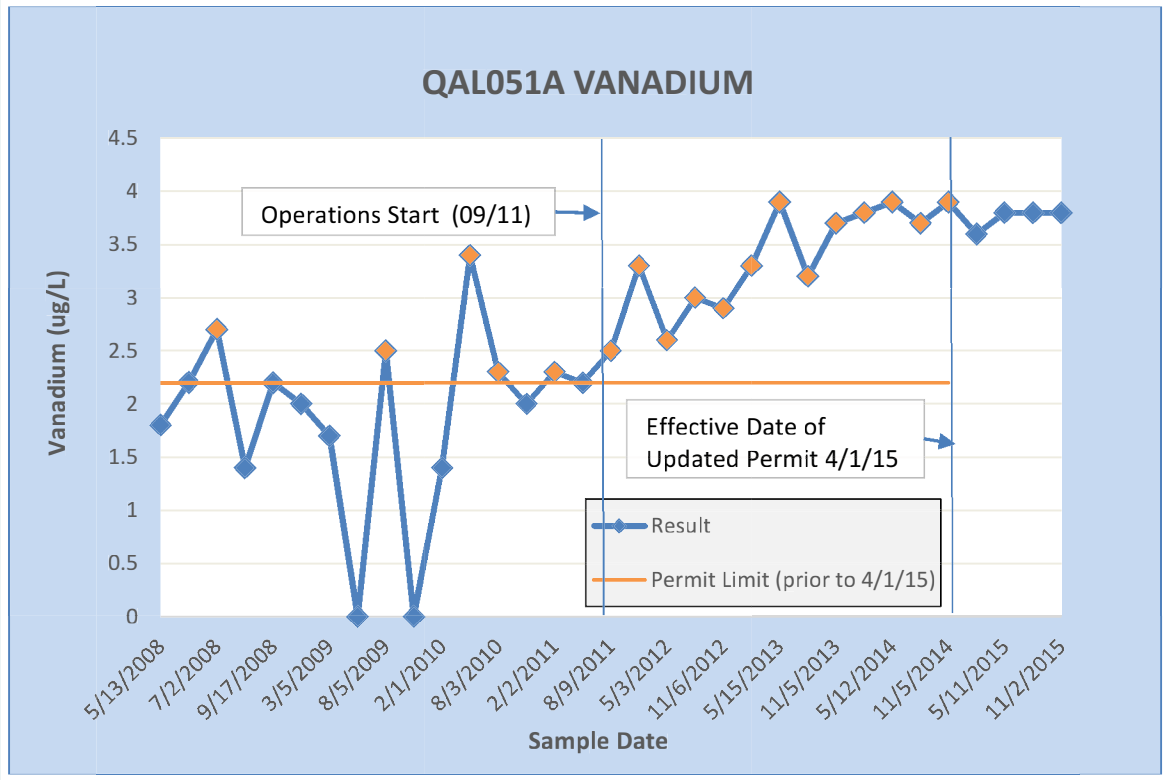

QAL008A pH
pH (SU)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
Operations Start (09/11)
Effective Date of Updated Permit 4/1/15
Result
Permit Limit - Minimum and Maximum (Effective 4/1/15)
Permit Limit Max (prior to 4/1/15)
5/13/2008
7/2/2008
9/16/2008
2/26/2009
8/4/2009
2/1/2010
11/3/2010
5/2/2011
11/1/2011
5/1/2012
11/5/2012
5/13/2013
11/4/2013
5/12/2014
11/5/2014
5/11/2015
11/2/2015
Sample Date

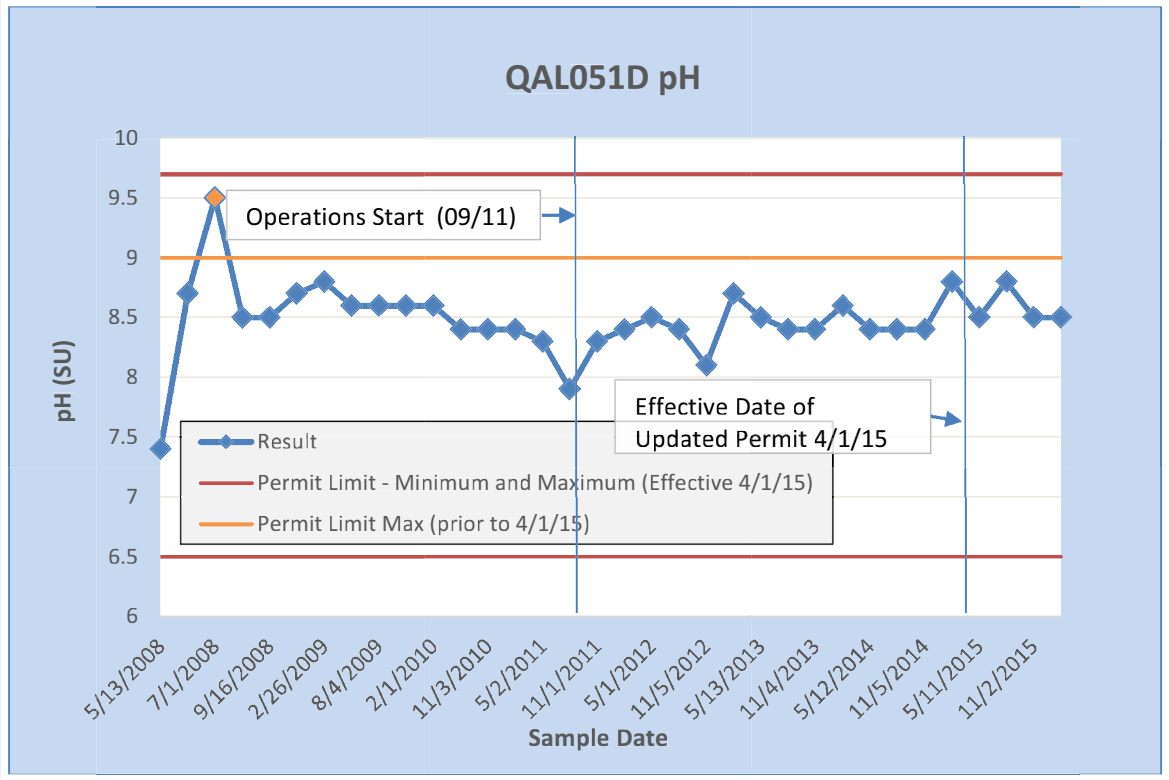

QAL008A VANADIUM
Vanadium (ug/L)
6
5
4
3
2
1
0
Result
Permit Limit (prior to 4/1/15)
Operations Start (09/11)
Effective Date of Updated Permit 4/1/15
5/13/2008
7/2/2008
9/16/2008
2/26/2009
8/4/2009
2/1/2010
8/3/2010
2/1/2011
8/8/2011
2/1/2012
8/2/2012
2/5/2013
8/5/2013
2/18/2014
8/6/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date

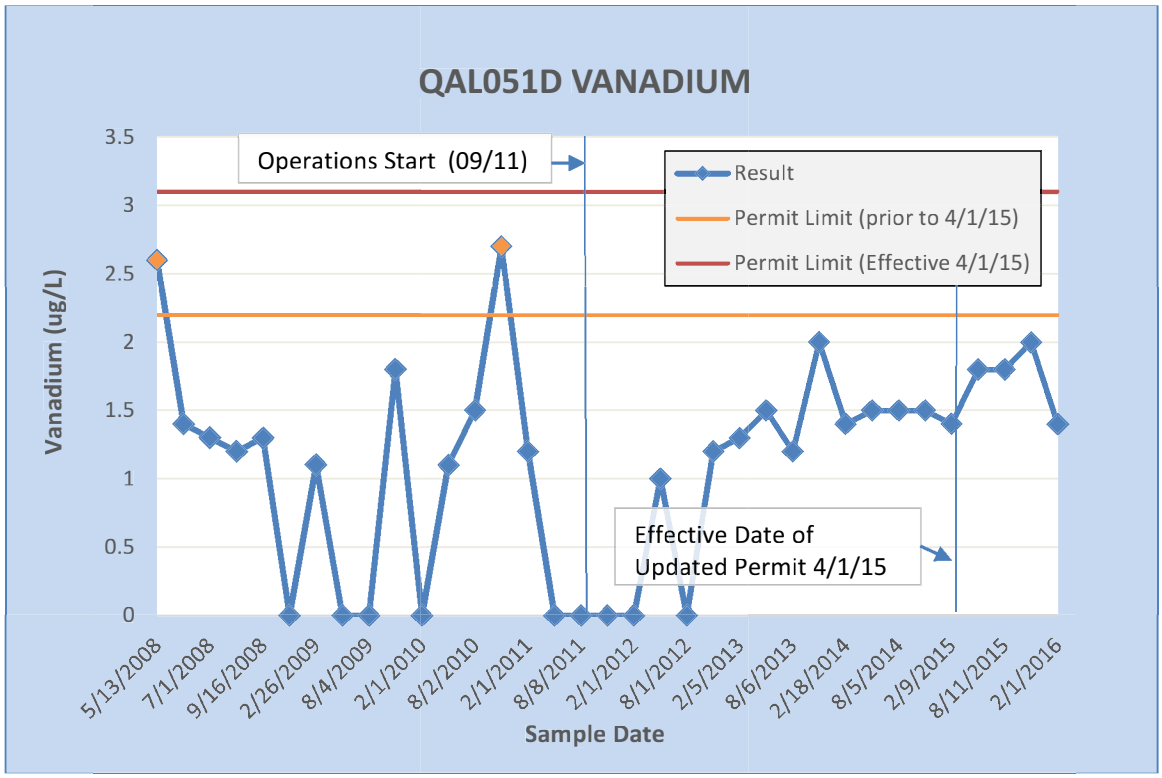

QAL008D pH
pH (SU)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
Operations Start (09/11)
Effective Date of
Updated Permit 4/1/15
Result
Permit Limit - Minimum and Maximum (Effective 4/1/15)
Permit Limit Max (prior to 4/1/15)
5/13/2008
7/1/2008
9/16/2008
2/26/2009
8/4/2009
2/1/2010
8/3/2010
2/1/2011
8/8/2011
2/1/2012
8/2/2012
2/5/2013
8/5/2013
2/18/2014
8/6/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date

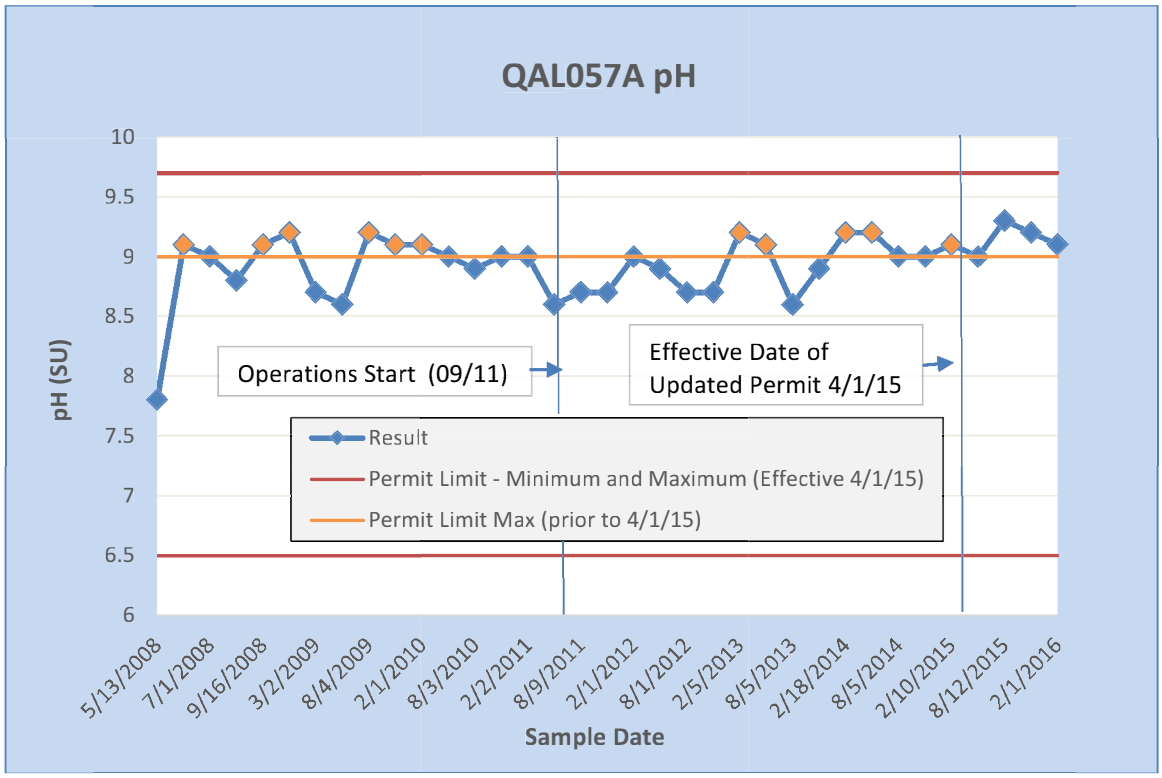

QAL008D VANADIUM
Vanadium (ug/L)
3.5
3
2.5
2
1.5
1
0.5
0
Operations Start (09/11)
Effective Date of
Updated Permit 4/1/15
Result
Permit Limit (prior to 4/1/15)
Permit Limit (Effective 4/1/15)
5/13/2008
7/1/2008
9/16/2008
2/26/2009
8/4/2009
2/1/2010
8/3/2010
2/1/2011
8/8/2011
2/1/2012
8/2/2012
2/5/2013
8/5/2013
2/18/2014
8/6/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date


QAL050A pH
pH (SU)
10
9.5
9
8.5
8
7.5
7
6.5
6
Operations Start (09/11)
Effective Date of
Updated Permit 4/1/15
Result
Permit Limit - Minimum and Maximum (Effective 4/1/15)
Permit Limit Max (prior to 4/1/15)
5/13/2008
7/2/2008
9/17/2008
3/2/2009
8/4/2009
2/1/2010
8/2/2010
2/1/2011
8/9/2011
2/1/2012
8/1/2012
2/5/2013
8/6/2013
2/19/2014
8/6/2014
2/10/2015
8/11/2015
2/1/2016
Sample Date


QAL051A VANADIUM
Vanadium (ug/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Operations Start (09/11)
Effective Date of Updated Permit 4/1/15
Result
Permit Limit (prior to 4/1/15)
5/13/2008
7/2/2008
9/17/2008
3/5/2009
8/5/2009
2/1/2010
8/3/2010
2/2/2011
8/9/2011
5/3/2012
11/6/2012
5/15/2013
11/5/2013
5/12/2014
11/5/2014
5/11/2015
11/2/2015
Sample Date


QAL051D pH
pH (SU)
10
9.5
9
8.5
8
7.5
7
6.5
6
Operations Start (09/11)
Effective Date of Updated Permit 4/1/15
Result
Permit Limit - Minimum and Maximum (Effective 4/1/15)
Permit Limit Max (prior to 4/1/15)
5/13/2008
7/1/2008
9/16/2008
2/26/2009
8/4/2009
2/1/2010
11/3/2010
5/2/2011
11/1/2011
5/1/2012
11/5/2012
5/13/2013
11/4/2013
5/12/2014
11/5/2014
5/11/2015
11/2/2015
Sample Date


QAL051D VANADIUM
Vanadium (ug/L)
3.5
3
2.5
2
1.5
1
0.5
0
Operations Start (09/11)
Result
Permit Limit (prior to 4/1/15)
Permit Limit (Effective 4/1/15)
Effective Date of
Updated Permit 4/1/15
5/13/2008
7/1/2008
9/16/2008
2/26/2009
8/4/2009
2/1/2010
8/2/2010
2/1/2011
8/8/2011
2/1/2012
8/1/2012
2/5/2013
8/6/2013
2/18/2014
8/5/2014
2/9/2015
8/11/2015
2/1/2016
Sample Date


QAL057A pH
pH (SU)
10
9.5
9
8.5
8
7.5
7
6.5
6
Operations Start (09/11)
Effective Date of
Updated Permit 4/1/15
Result
Permit Limit - Minimum and Maximum (Effective 4/1/15)
Permit Limit Max (prior to 4/1/15)
5/13/2008
7/1/2008
9/16/2008
3/2/2009
8/4/2009
2/1/2010
8/3/2010
2/2/2011
8/9/2011
2/1/2012
8/1/2012
2/5/2013
8/5/2013
2/18/2014
8/5/2014
2/10/2015
8/12/2015
2/1/2016
Sample Date