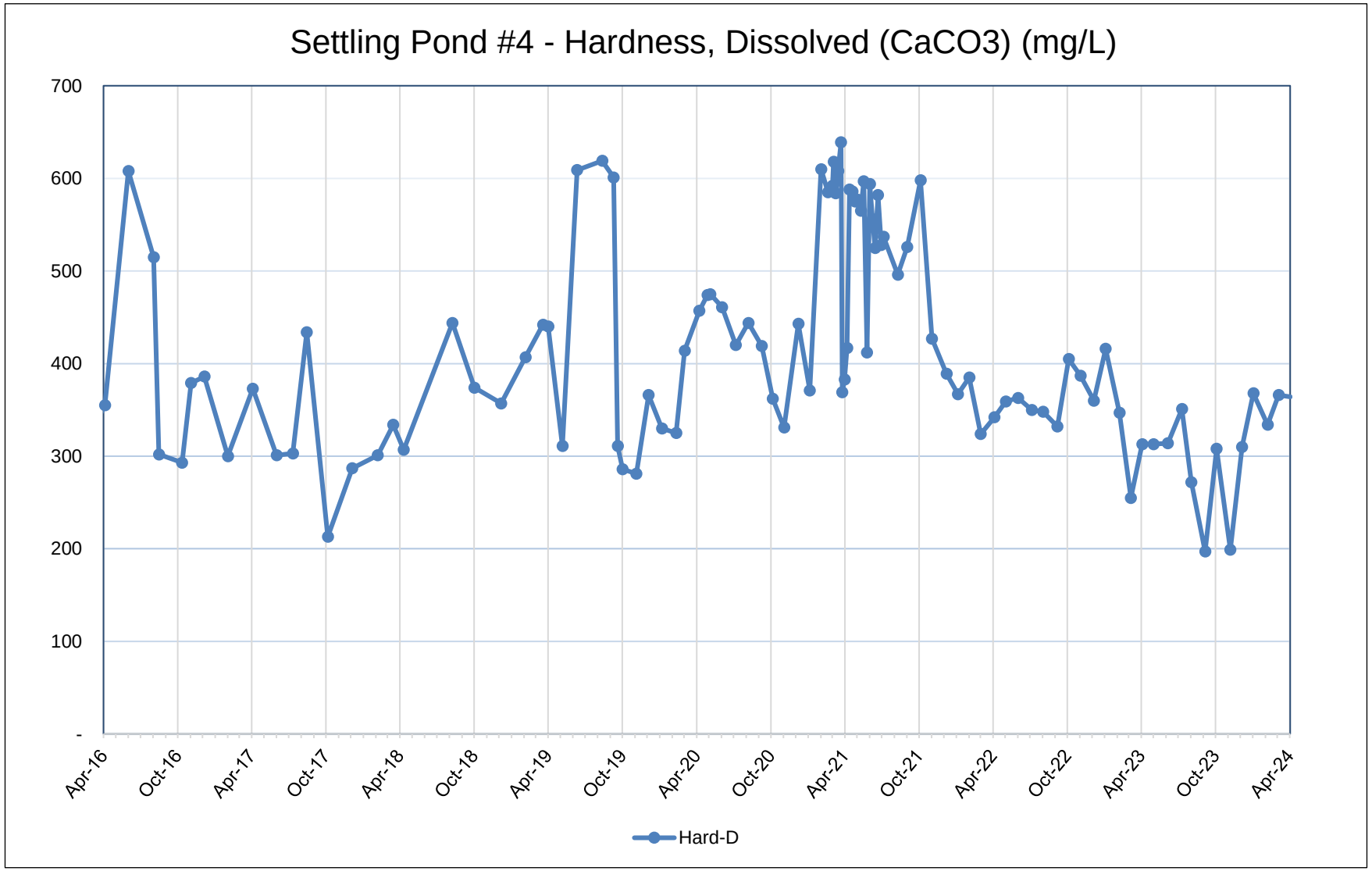
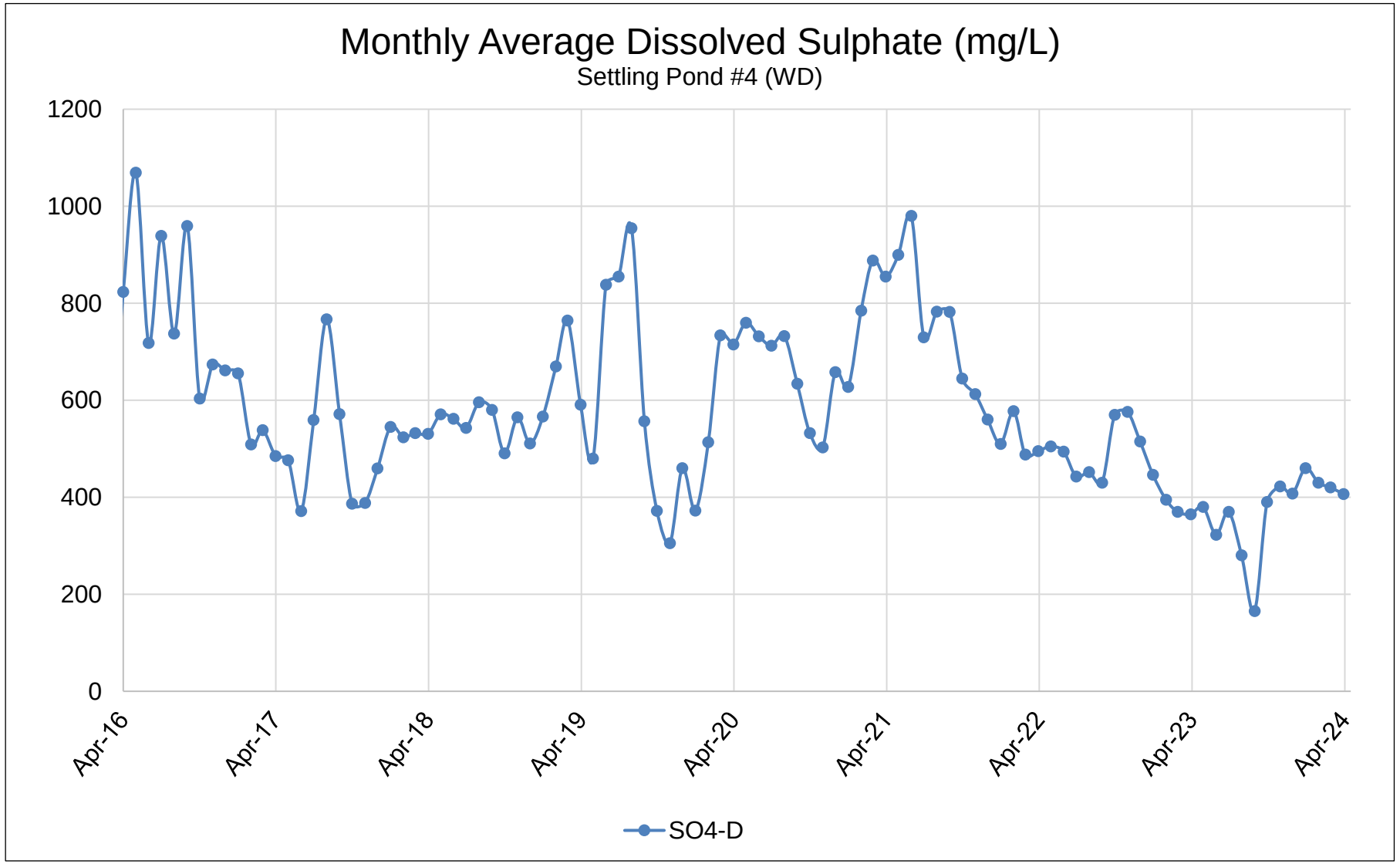
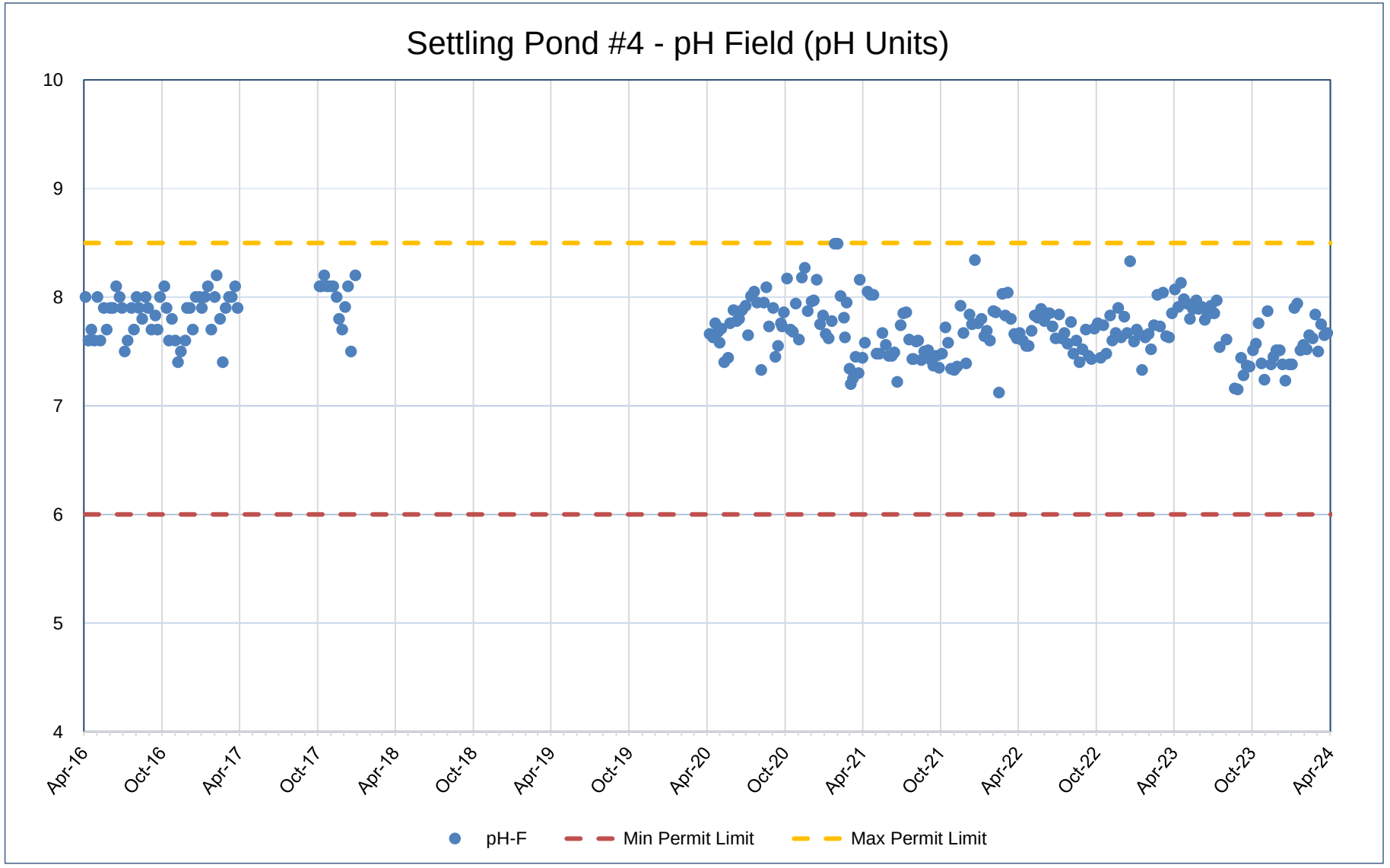
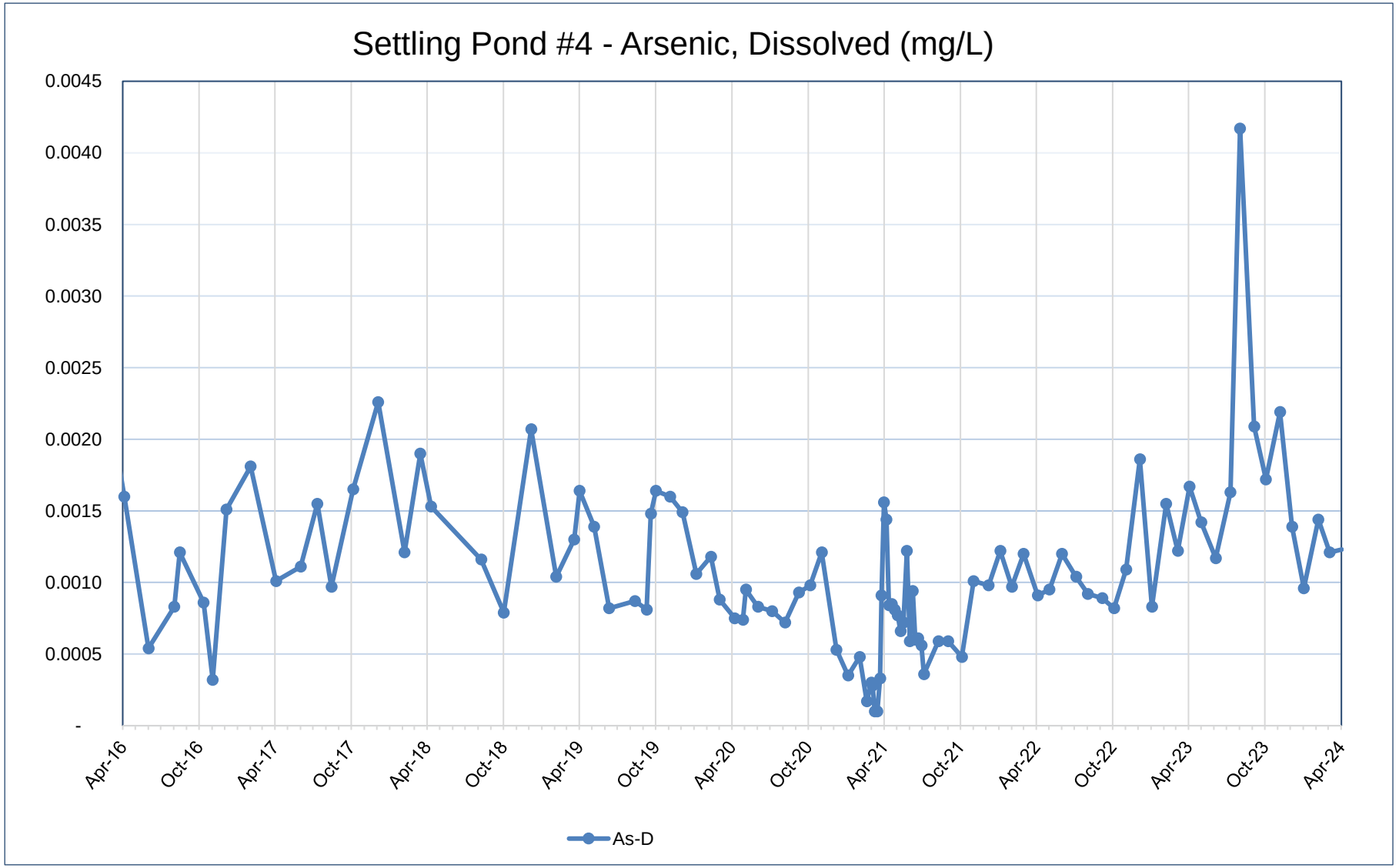
Appendix II - Graphs

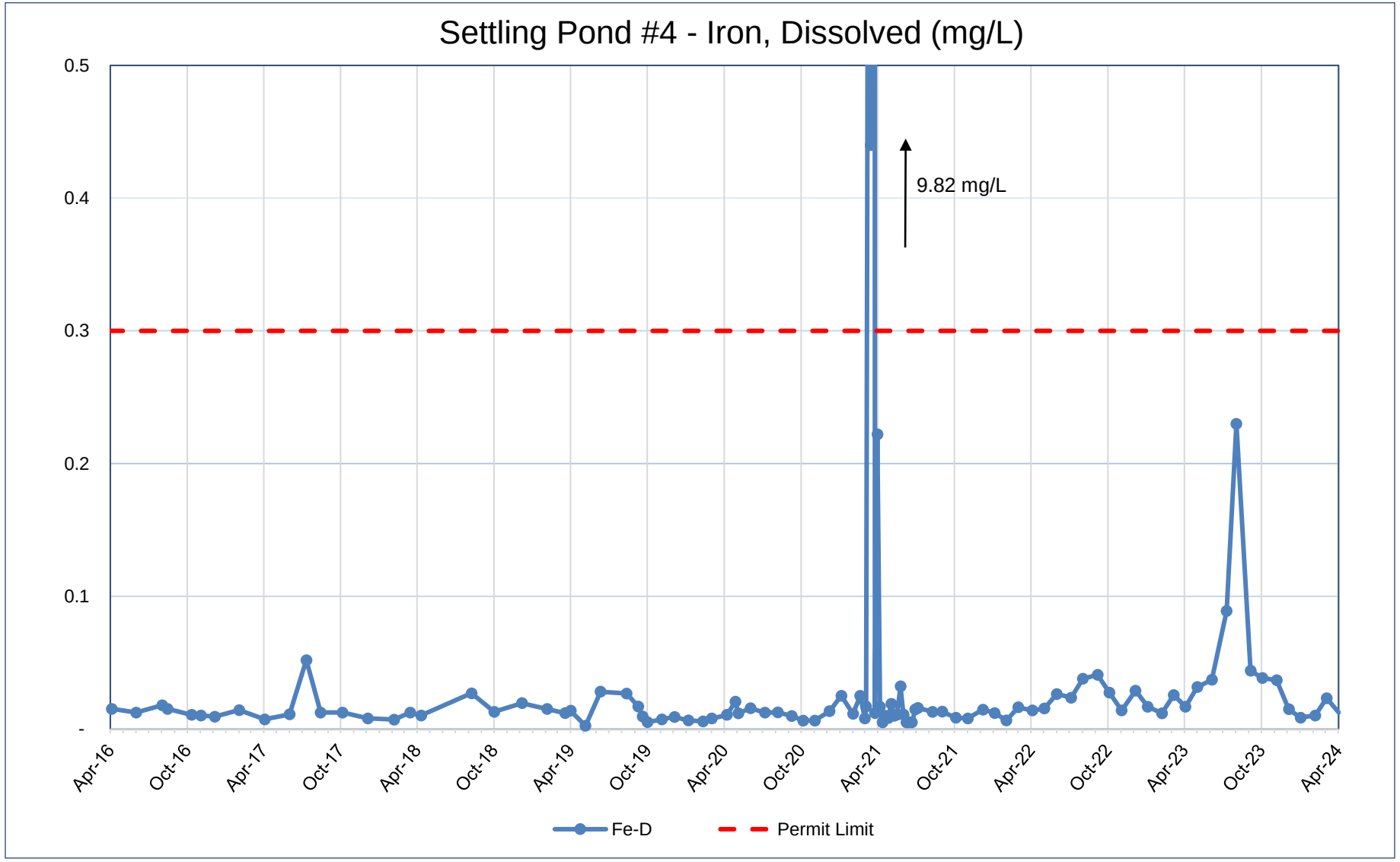
Appendix II Graphs

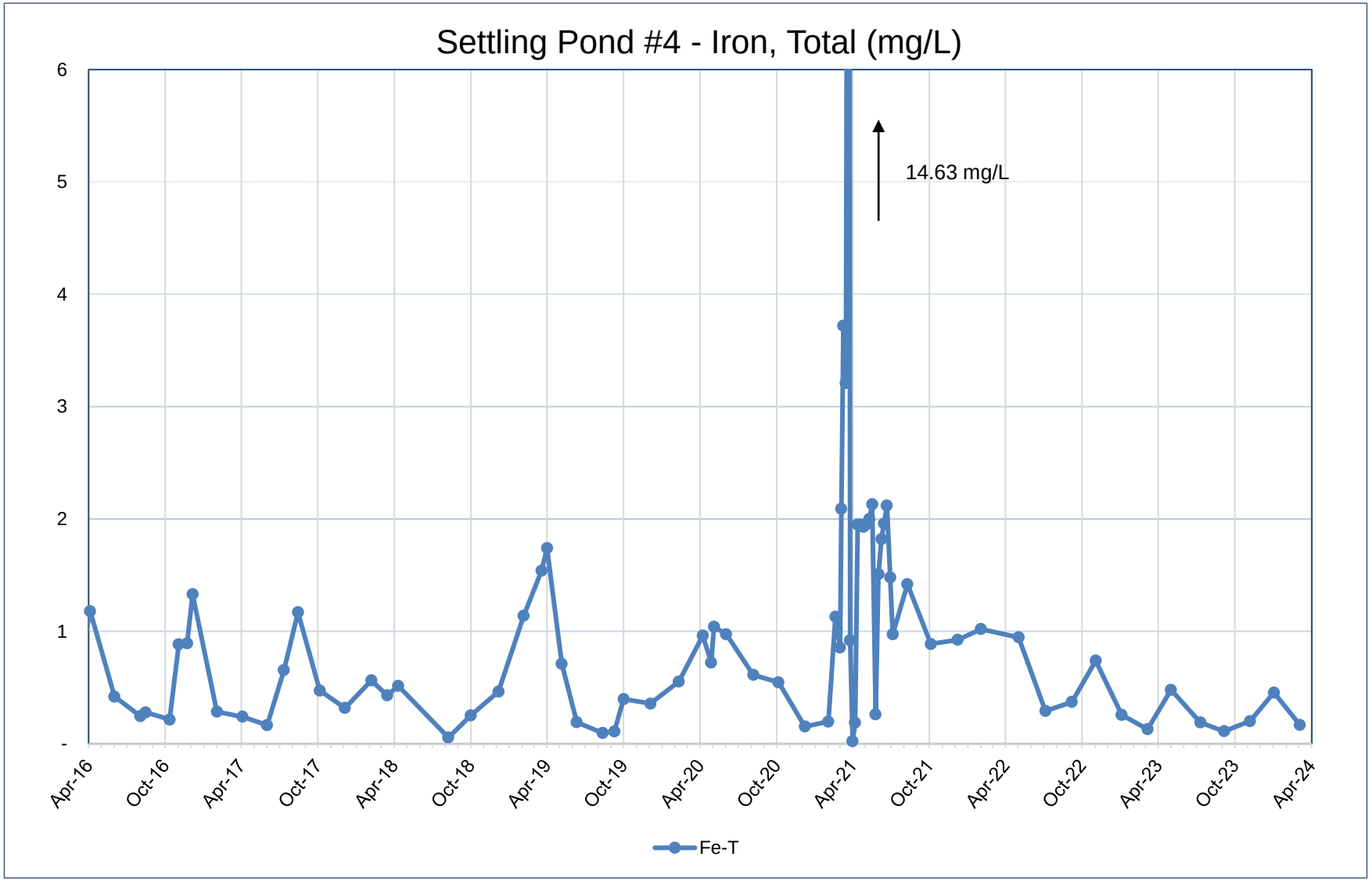

Settling Pond #4 - Hardness, Dissolved (CaCO3) (mg/L)
700
600
500
400
300
200
100
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Hard-D

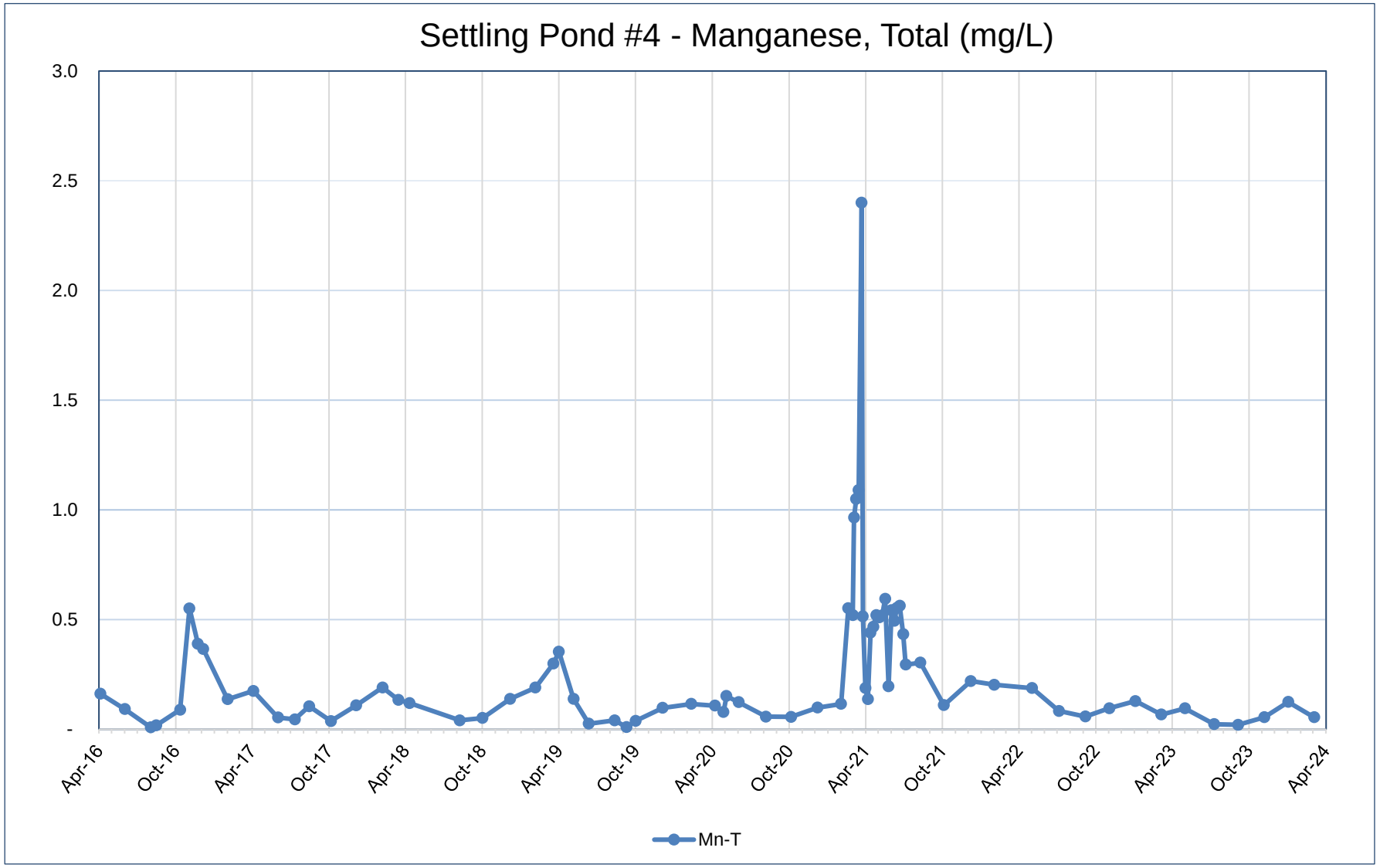

Monthly Average Dissolved Sulphate (mg/L)
Settling Pond #4 (WD)
1200
1000
800
600
400
200
0
Apr-16
Apr-17
Apr-18
Apr-19
Apr-20
Apr-21
Apr-22
Apr-23
Apr-24
SO4-D

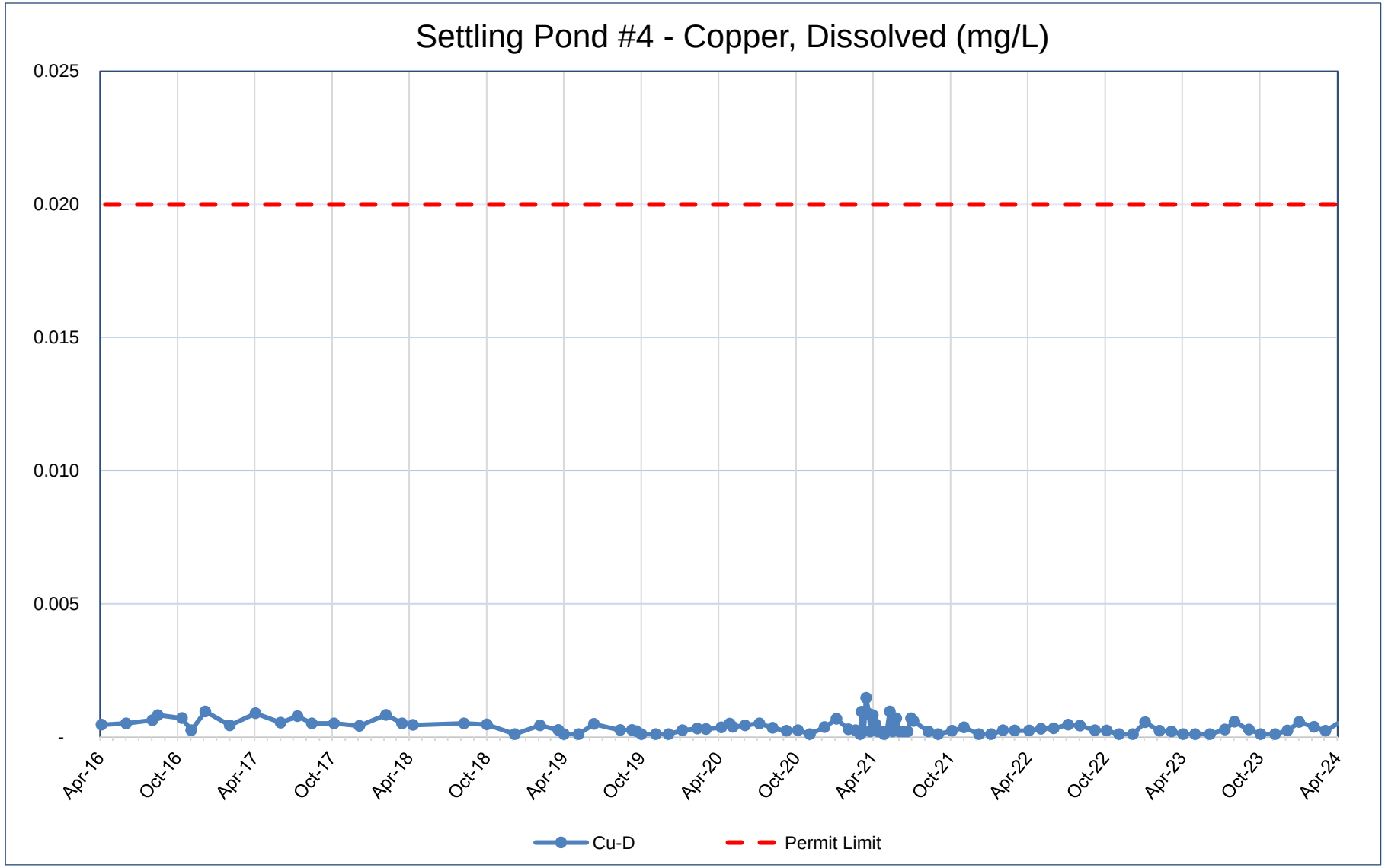

Settling Pond #4 - pH Field (pH Units)
10
9
8
7
6
5
4
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
pH-F
Min Permit Limit
Max Permit Limit

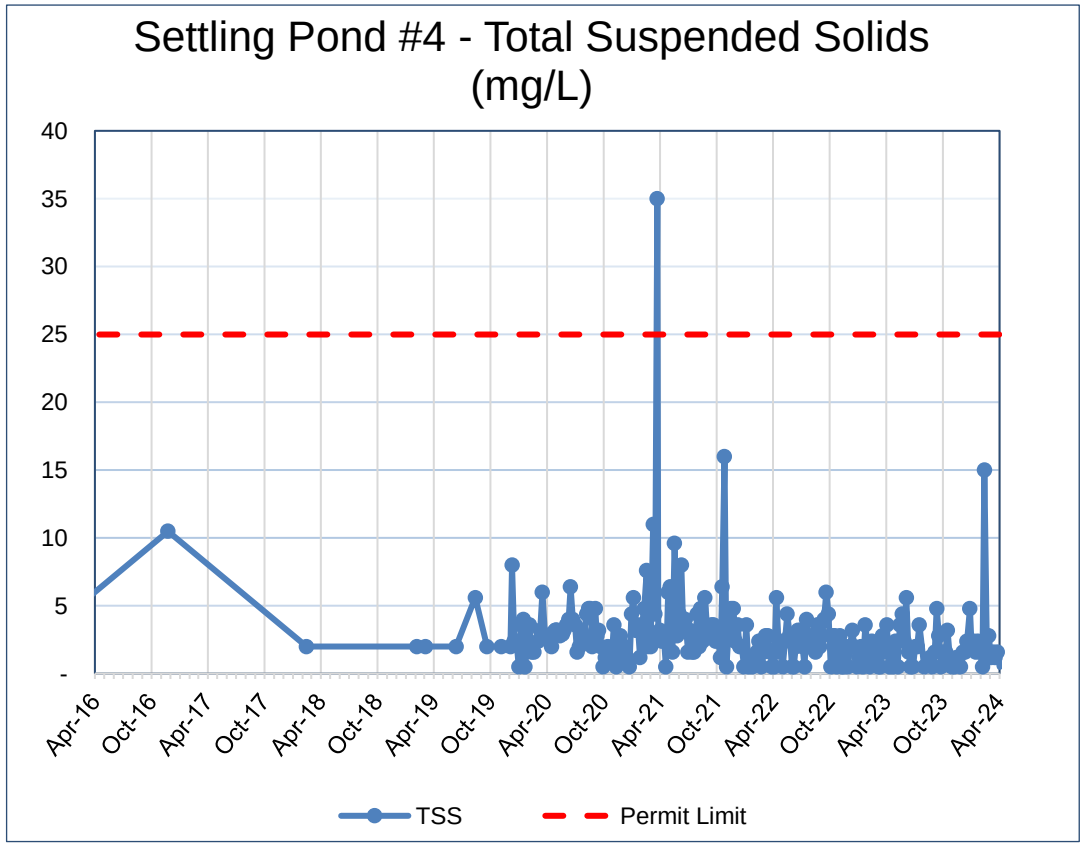

Settling Pond #4 - Arsenic, Dissolved (mg/L)
0.0045
0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
As-D

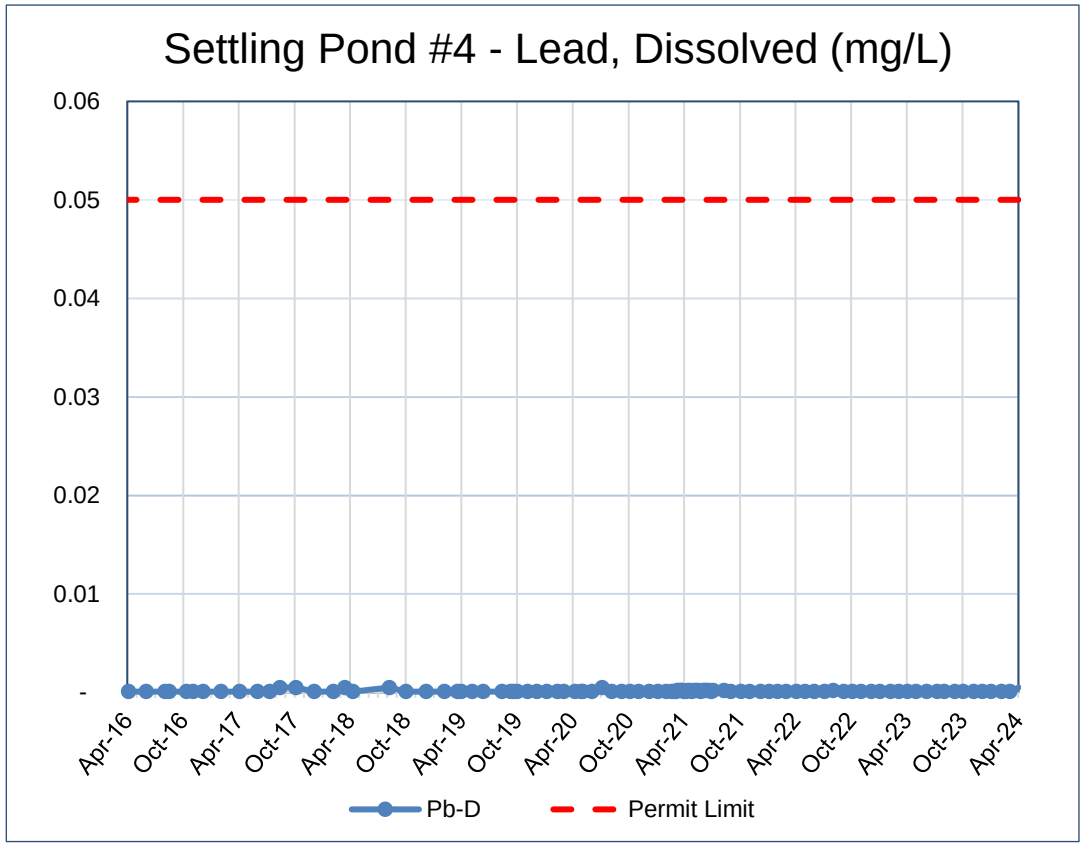

Settling Pond #4 - Iron, Dissolved (mg/L)
0.5
0.4
0.3
0.2
0.1
-
9.82 mg/L
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Fe-D
Permit Limit

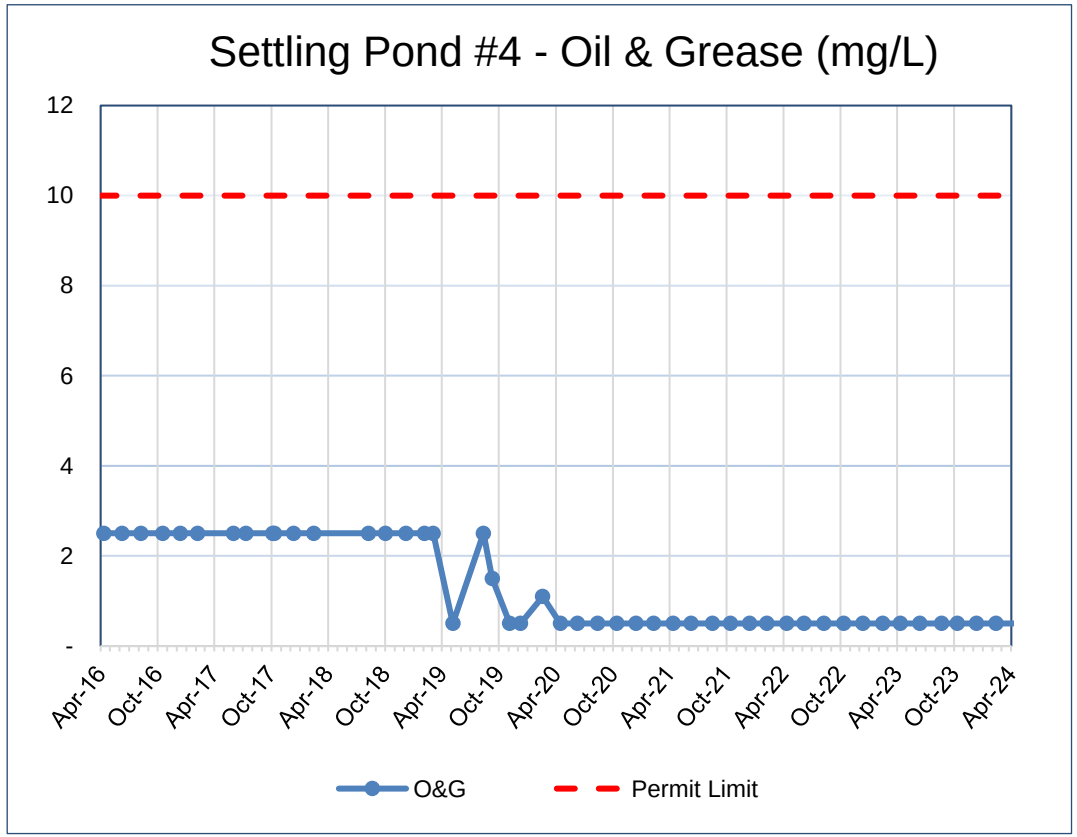

Settling Pond #4 - Iron, Total (mg/L)
6
5
4
3
2
1
-
14.63 mg/L
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Fe-T

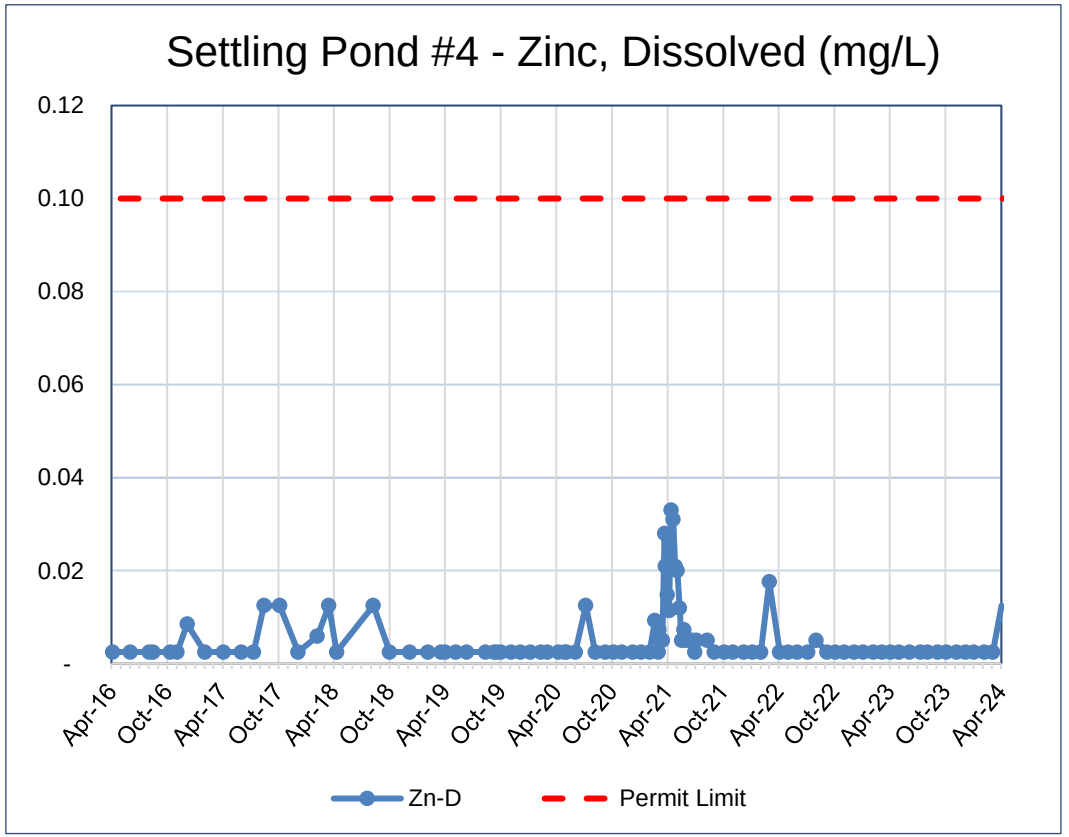

Settling Pond #4 - Manganese, Total (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Mn-T

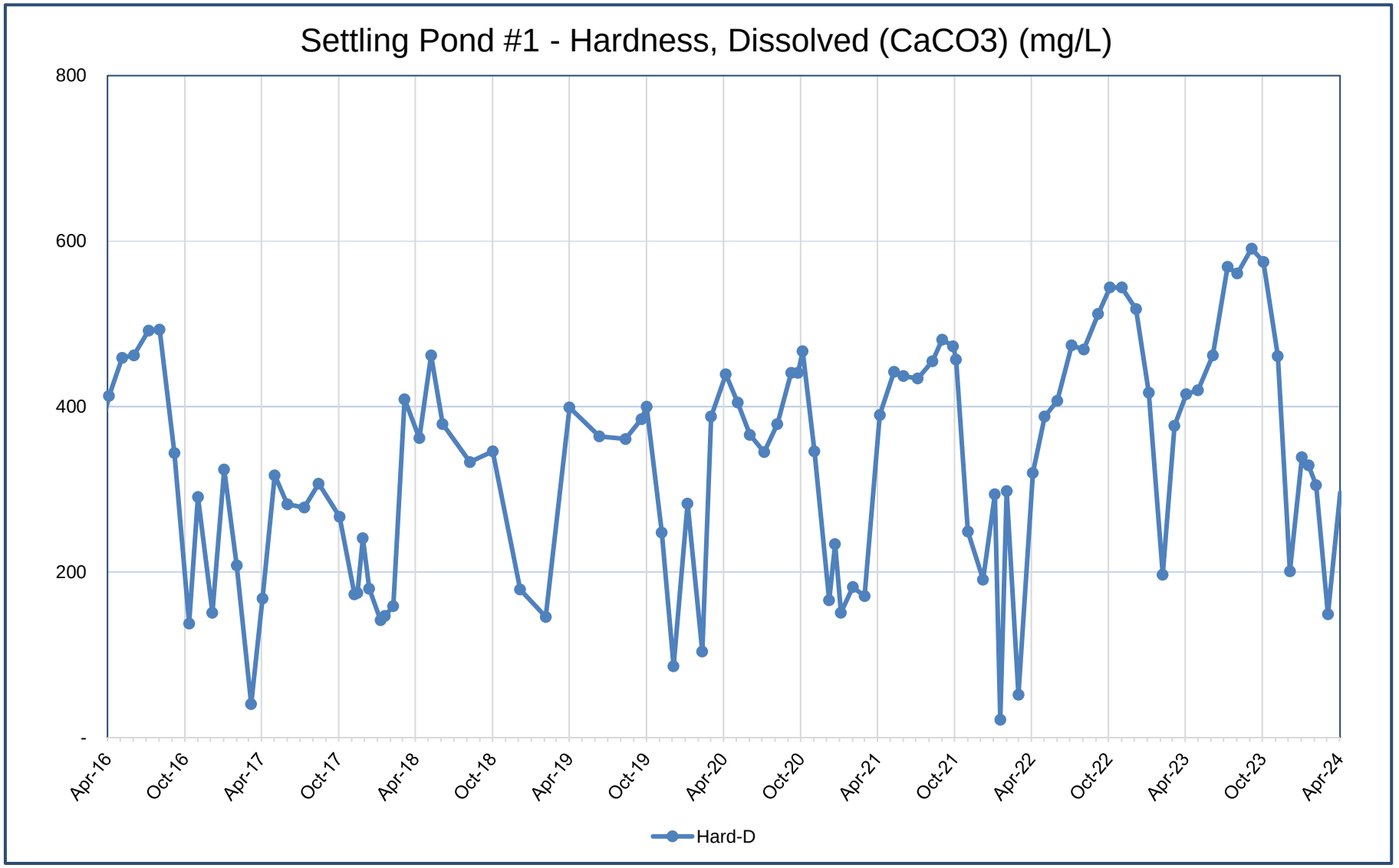

Settling Pond #4 - Copper, Dissolved (mg/L)
0.025
0.020
0.015
0.010
0.005
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Cu-D
Permit Limit

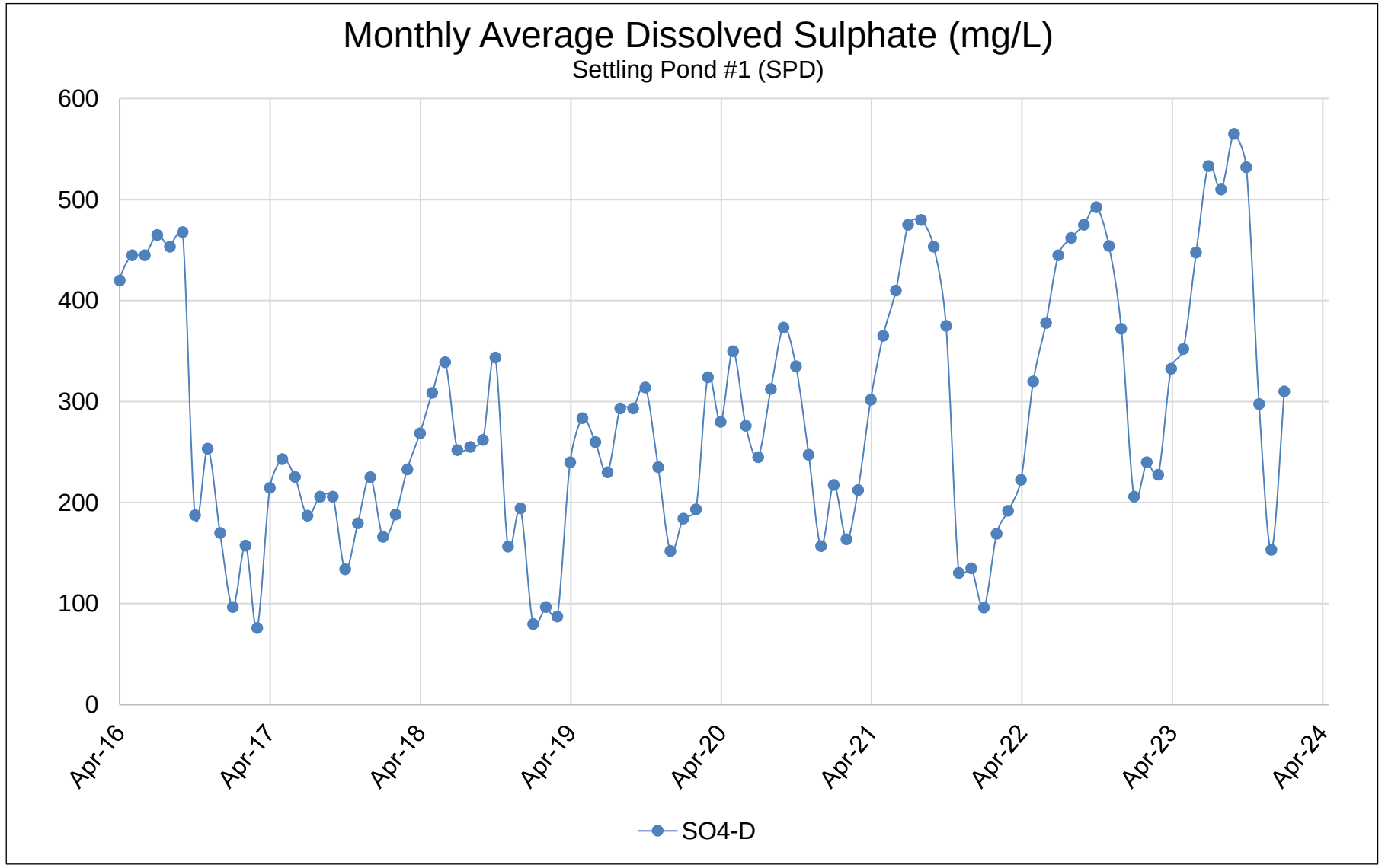

Settling Pond #4 - Total Suspended Solids (mg/L)
40
35
30
25
20
15
10
5
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
TSS
Permit Limit

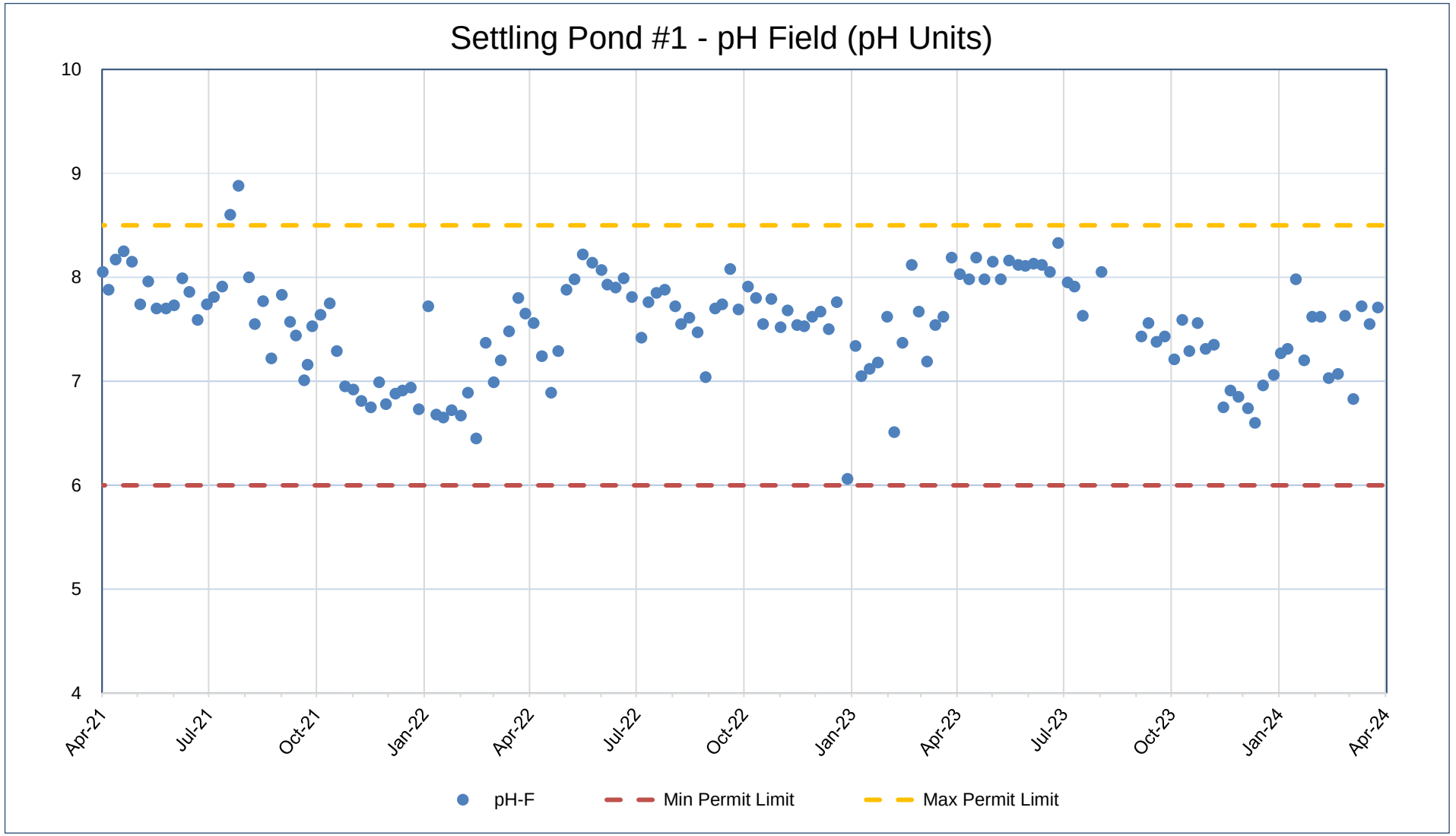

Settling Pond #4 - Lead, Dissolved (mg/L)
0.06
0.05
0.04
0.03
0.02
0.01
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Pb-D
Permit Limit

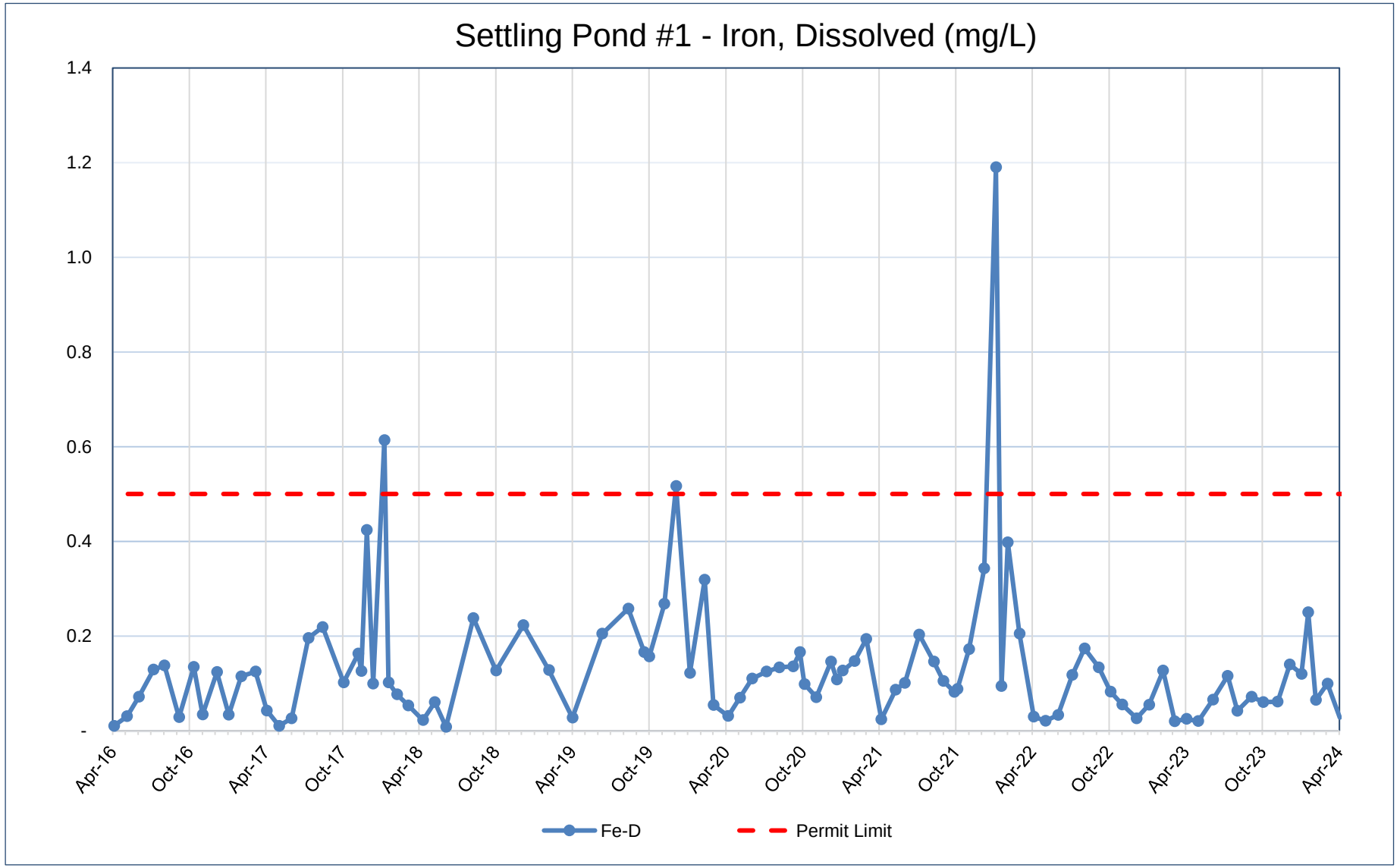

Settling Pond #4 - Oil & Grease (mg/L)
12
10
8
6
4
2
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
O&G
Permit Limit

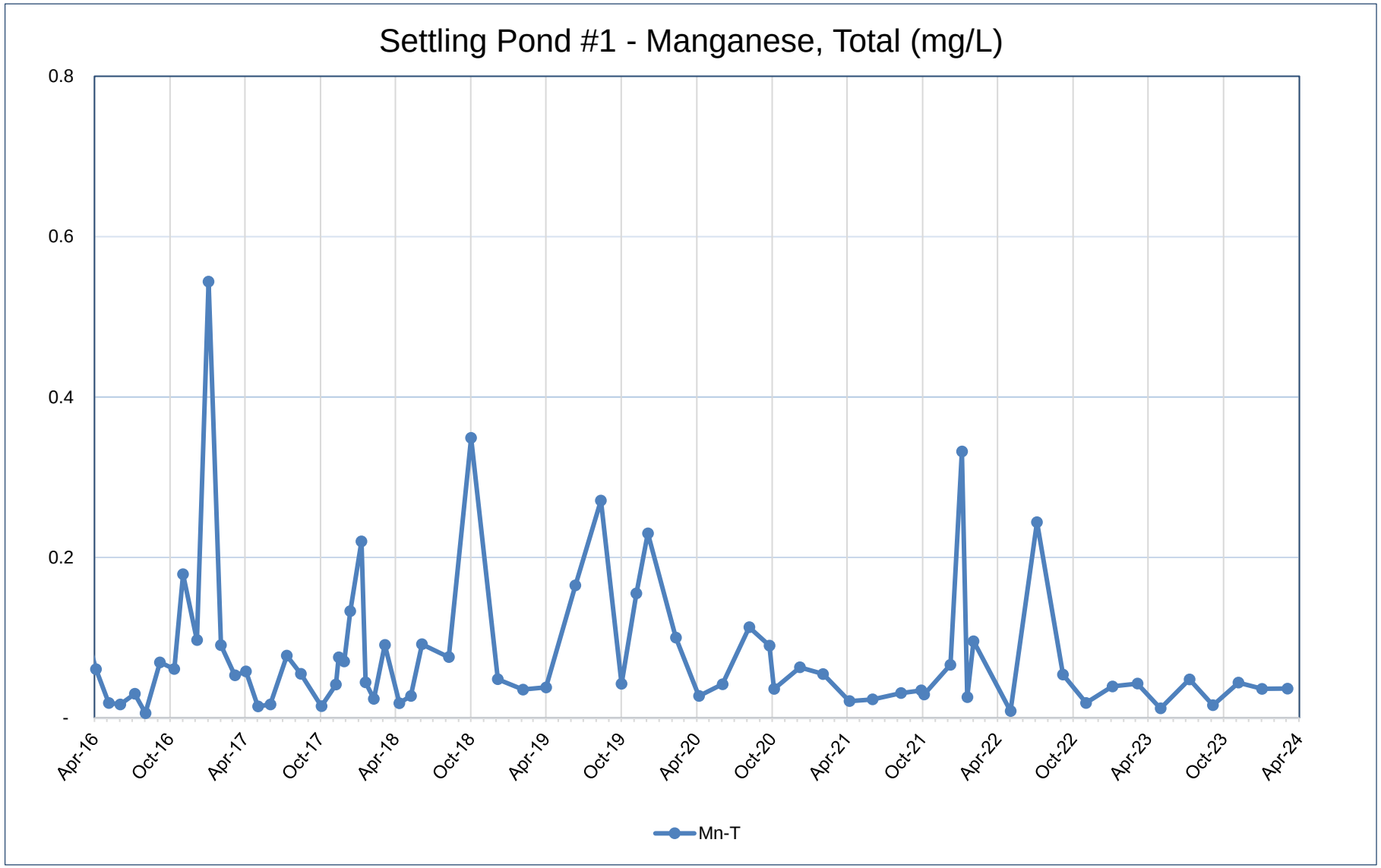

Settling Pond #4 - Zinc, Dissolved (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Zn-D
Permit Limit

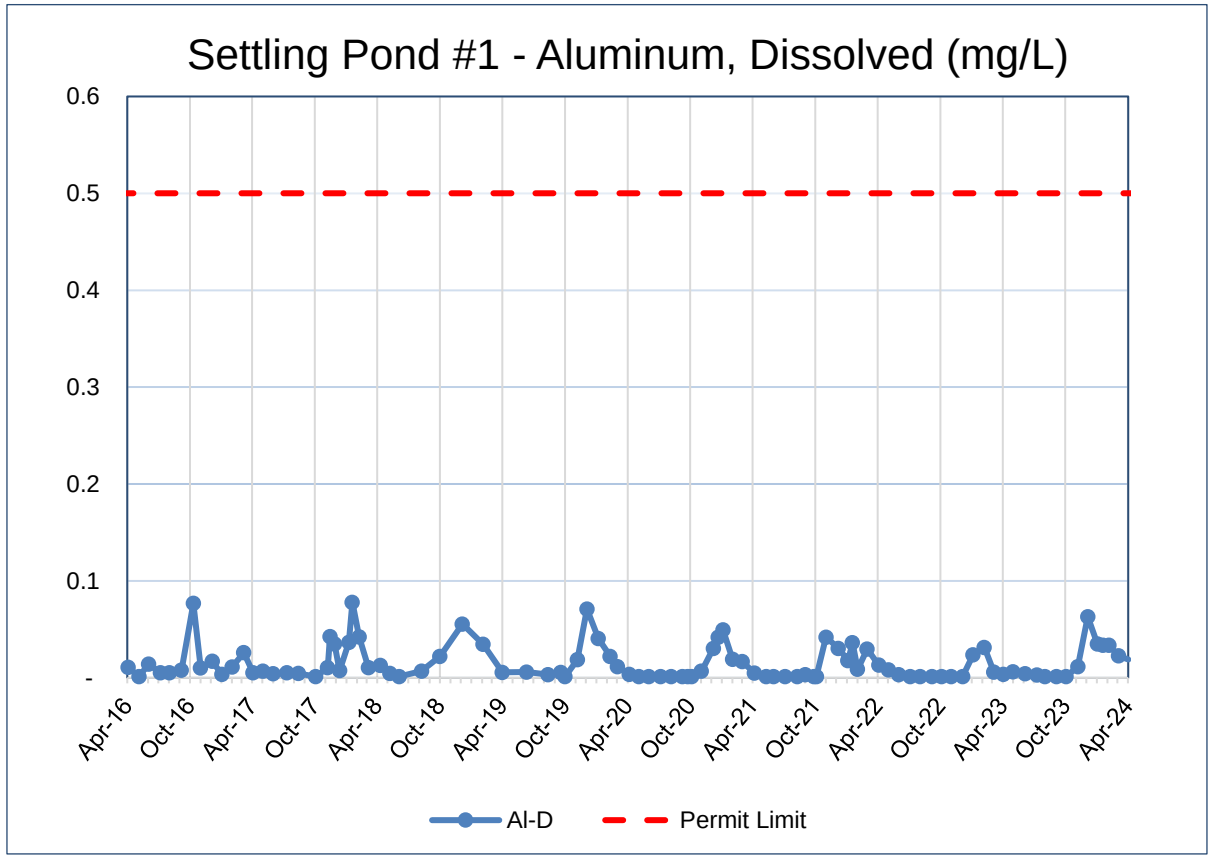

Settling Pond #1 - Hardness, Dissolved (CaCO3) (mg/L)
800
600
400
200
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Hard-D

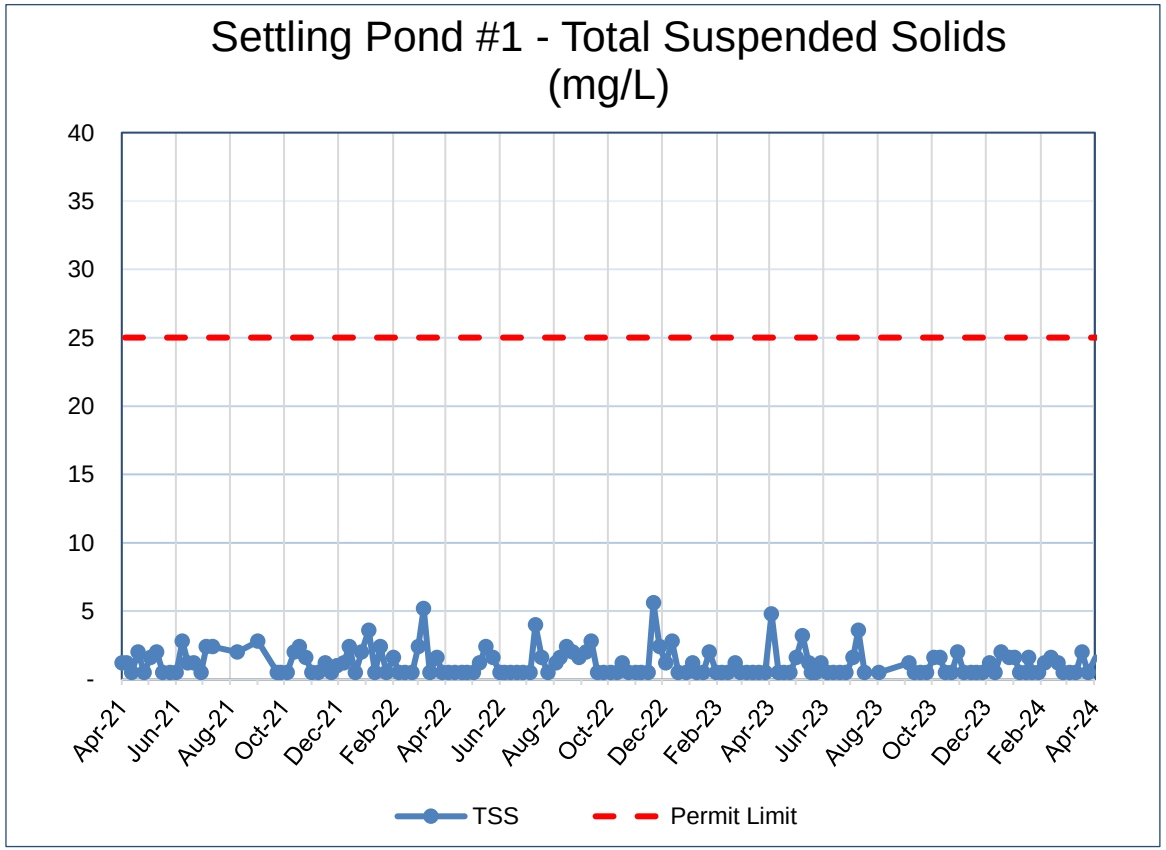

Monthly Average Dissolved Sulphate (mg/L)
Settling Pond #1 (SPD)
600
500
400
300
200
100
0
Apr-16
Apr-17
Apr-18
Apr-19
Apr-20
Apr-21
Apr-22
Apr-23
Apr-24
SO4-D

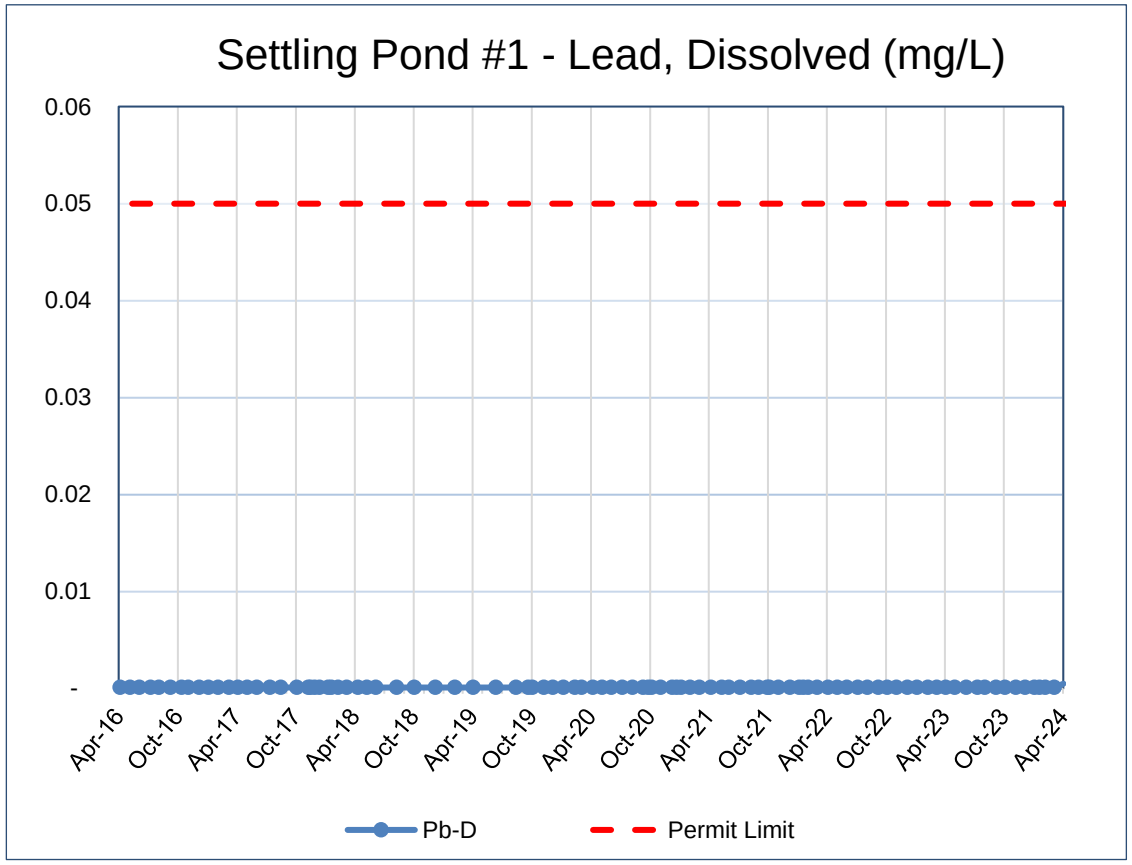

Settling Pond #1 - pH Field (pH Units)
10
9
8
7
6
5
4
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
Oct-23
Jan-24
Apr-24
pH-F
Min Permit Limit
Max Permit Limit

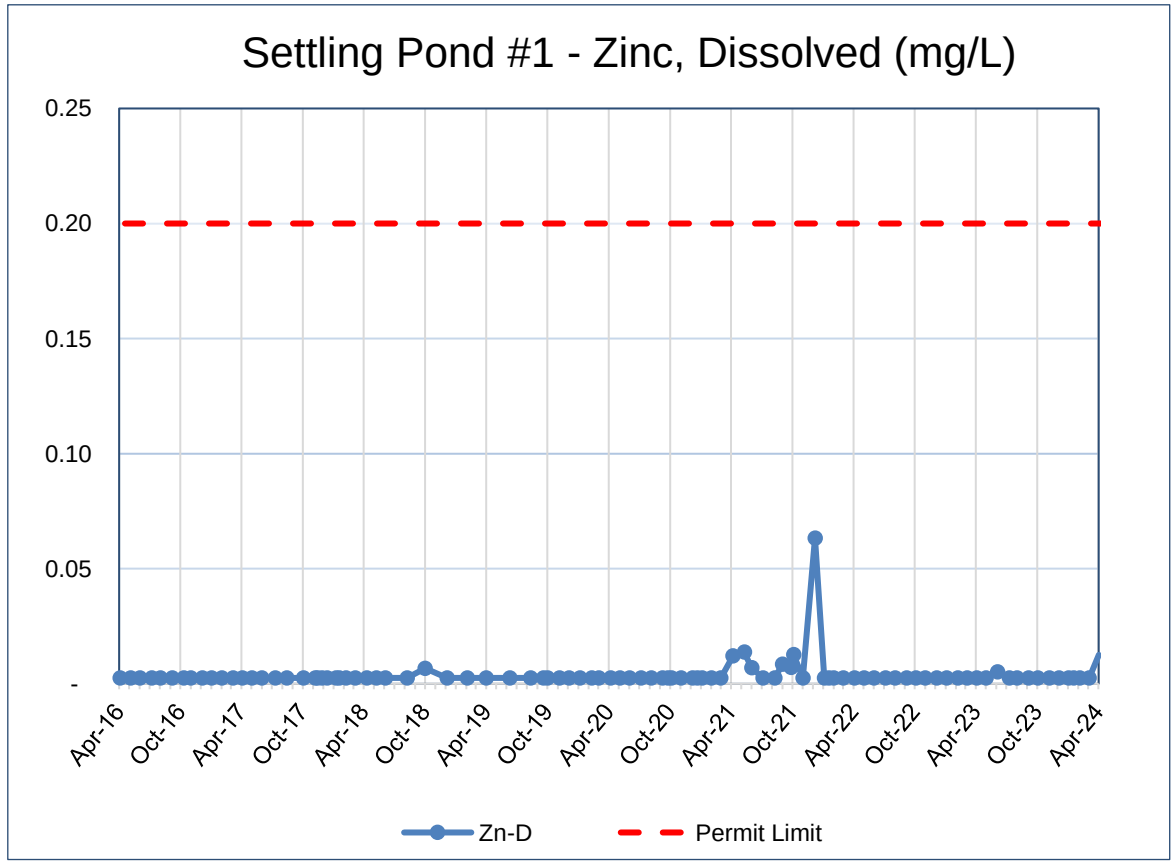

Settling Pond #1 - Iron, Dissolved (mg/L)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Fe-D
Permit Limit

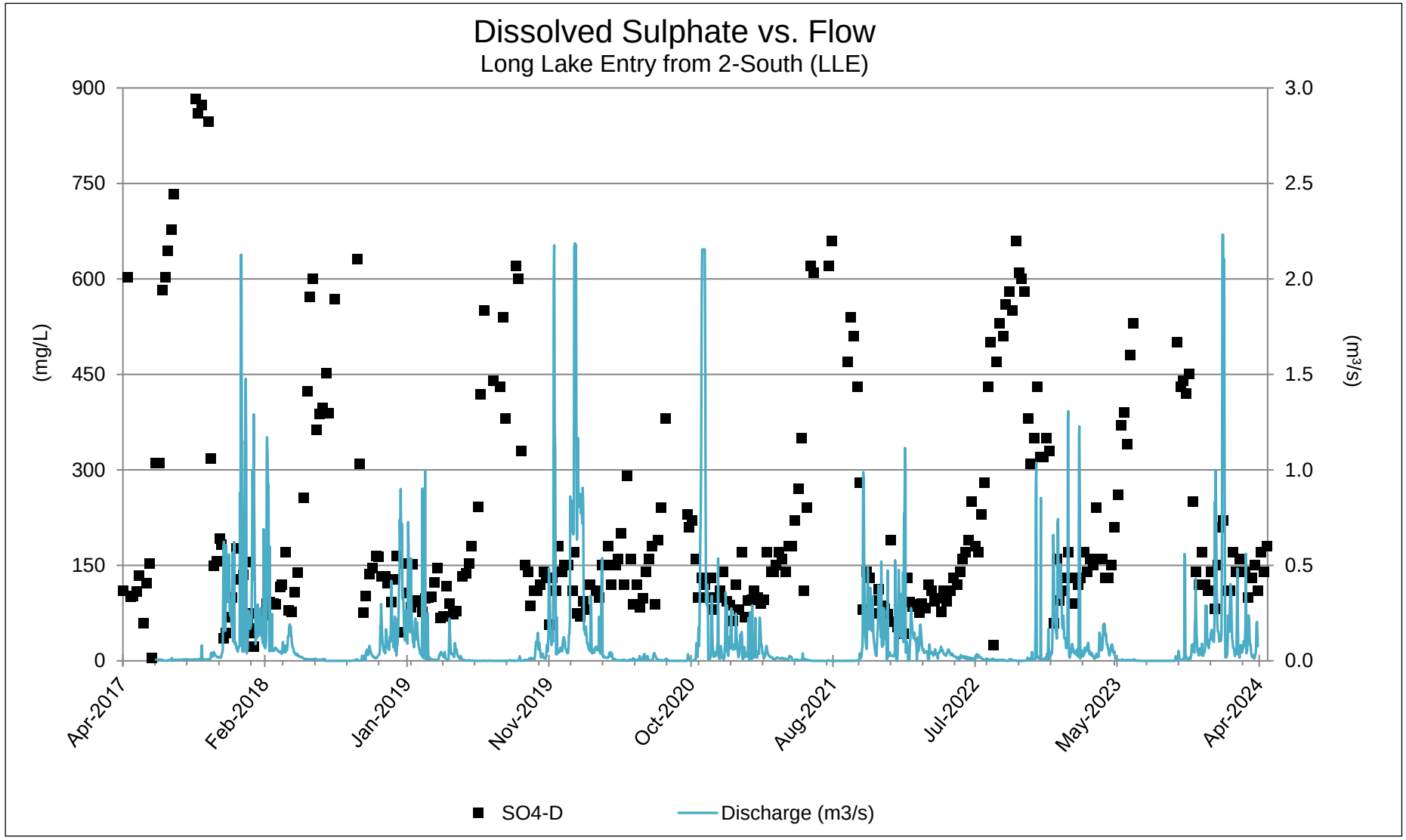

Settling Pond #1 - Manganese, Total (mg/L)
0.8
0.6
0.4
0.2
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Mn-T

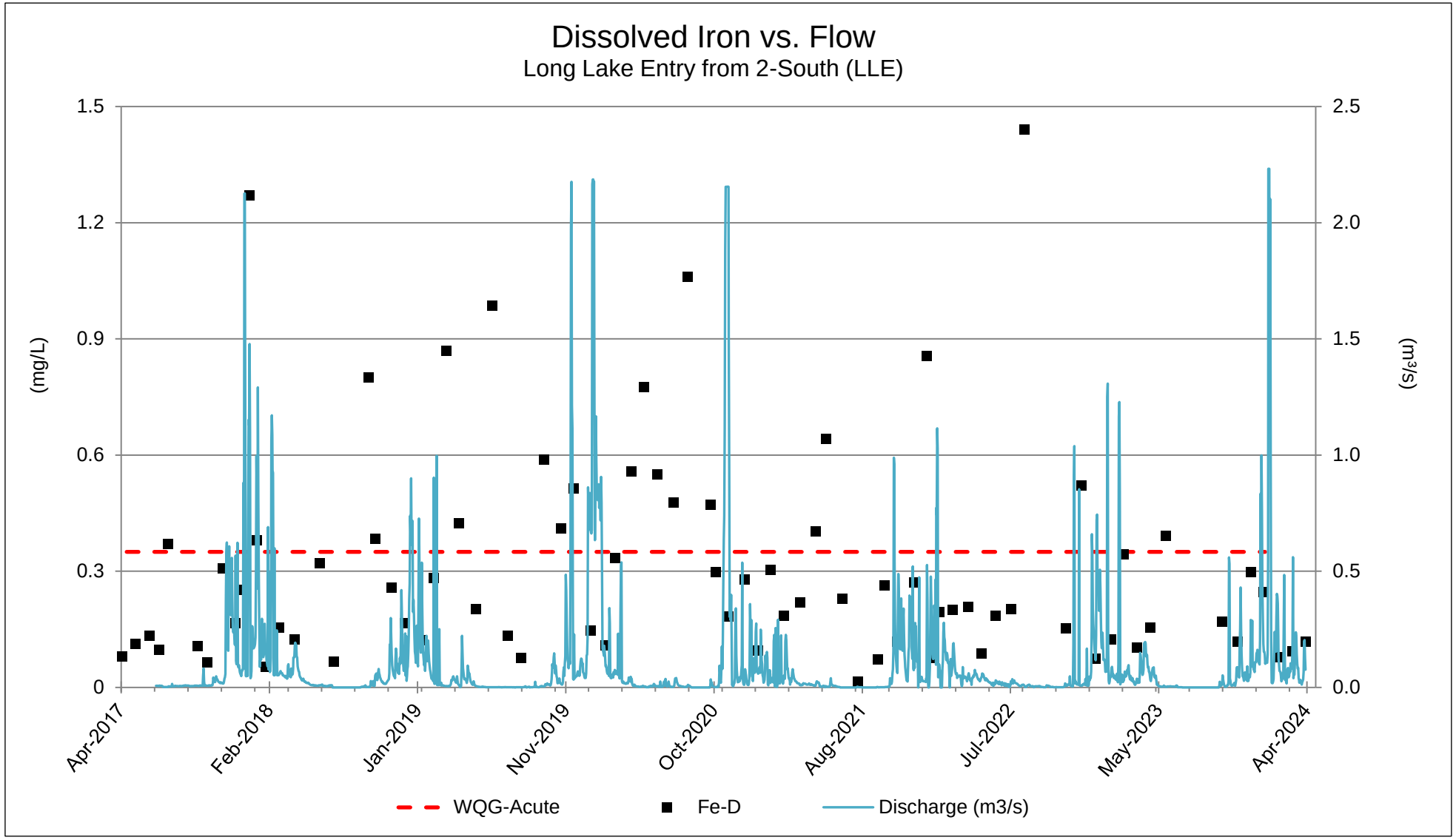

Settling Pond #1 - Aluminum, Dissolved (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Al-D
Permit Limit

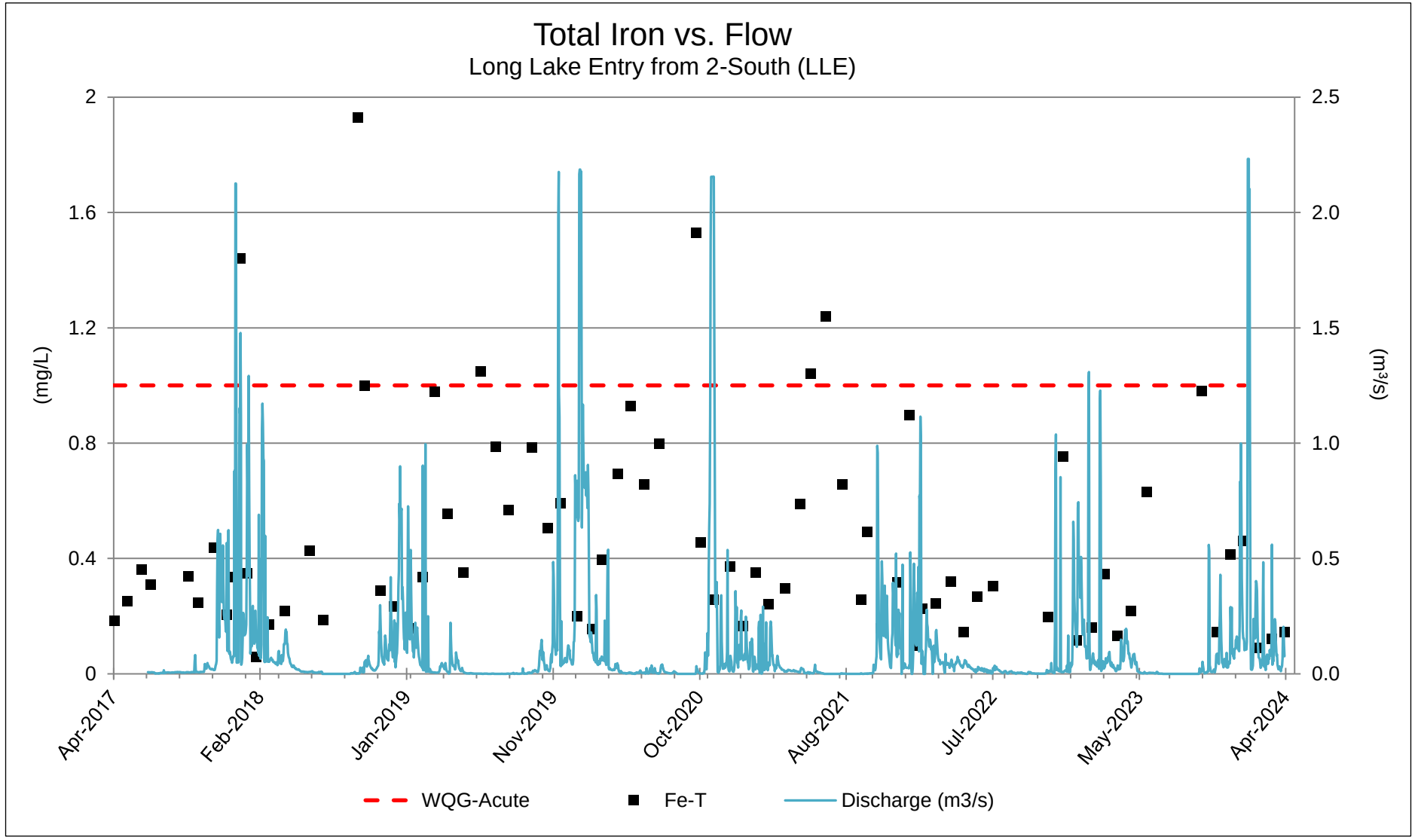

Settling Pond #1 - Total Suspended Solids (mg/L)
40
35
30
25
20
15
10
5
-
Apr-21
Jun-21
Aug-21
Oct-21
Dec-21
Feb-22
Apr-22
Jun-22
Aug-22
Oct-22
Dec-22
Feb-23
Apr-23
Jun-23
Aug-23
Oct-23
Dec-23
Feb-24
Apr-24
TSS
Permit Limit

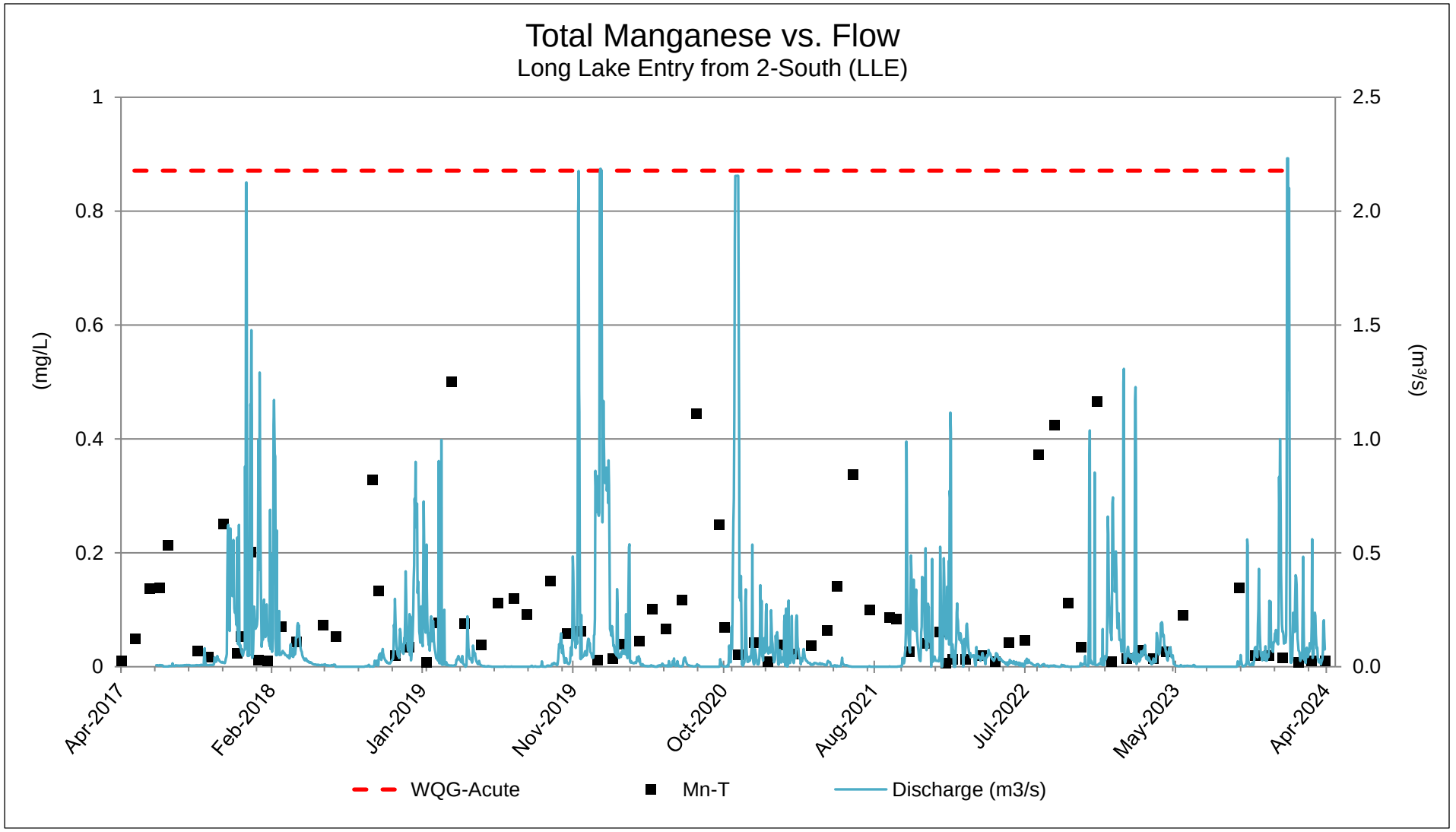

Settling Pond #1 - Lead, Dissolved (mg/L)
0.06
0.05
0.04
0.03
0.02
0.01
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Pb-D
Permit Limit

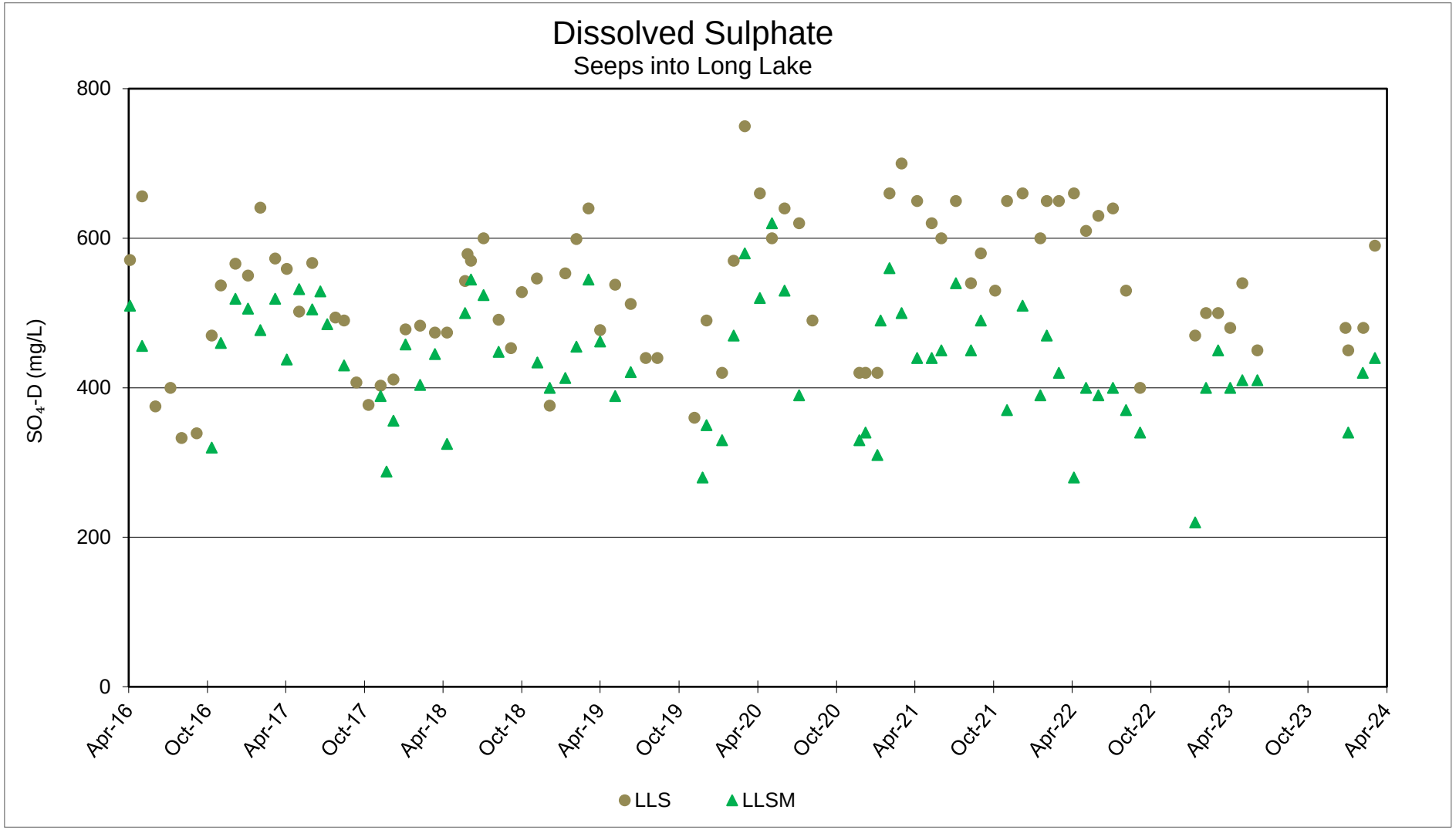

Settling Pond #1 - Zinc, Dissolved (mg/L)
0.25
0.20
0.15
0.10
0.05
-
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Zn-D
Permit Limit

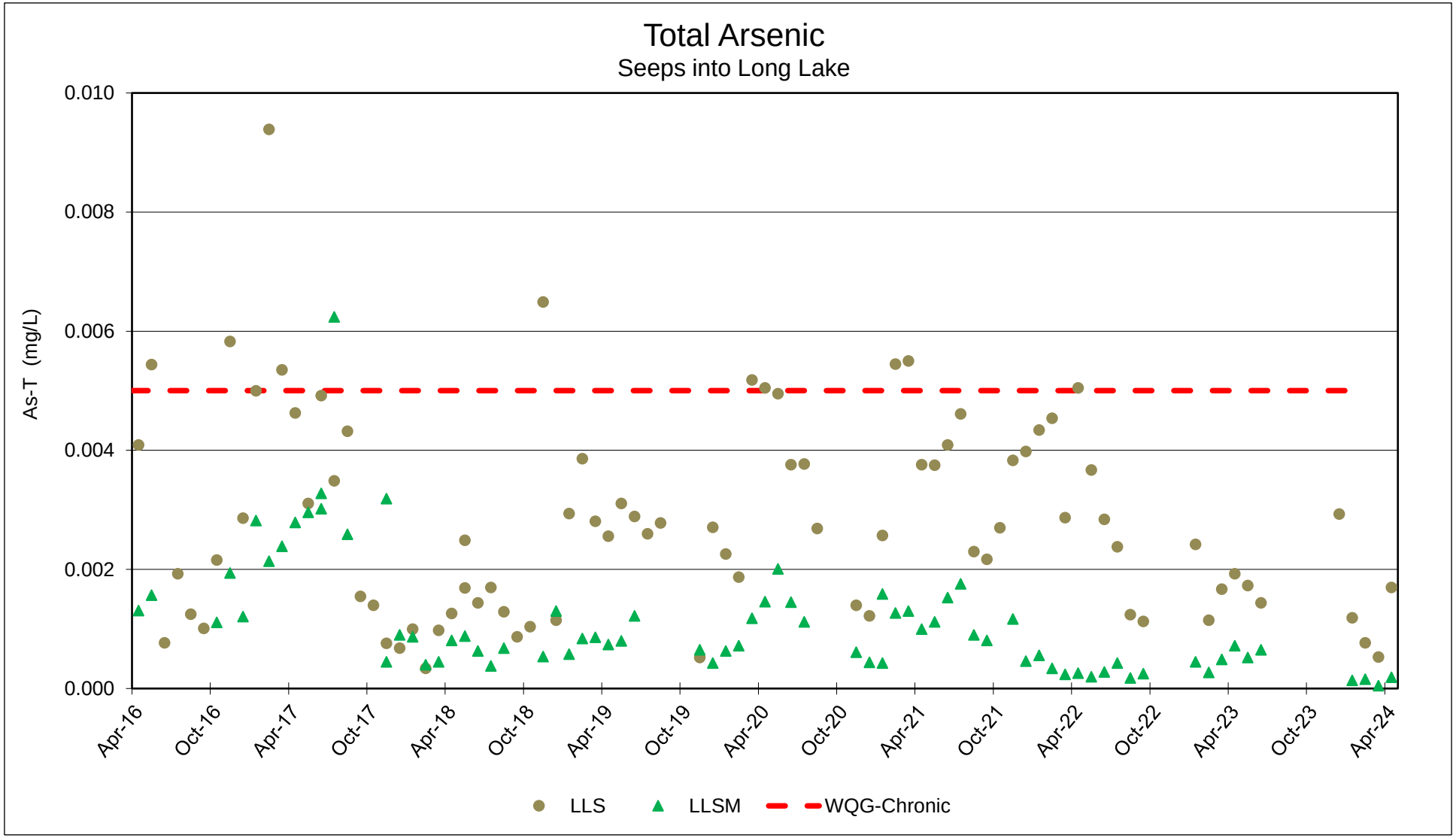

Dissolved Sulphate vs. Flow
Long Lake Entry from 2-South (LLE)
900
750
600
450
300
150
0
(mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
(m3/s)
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
SO4-D
Discharge (m3/s)

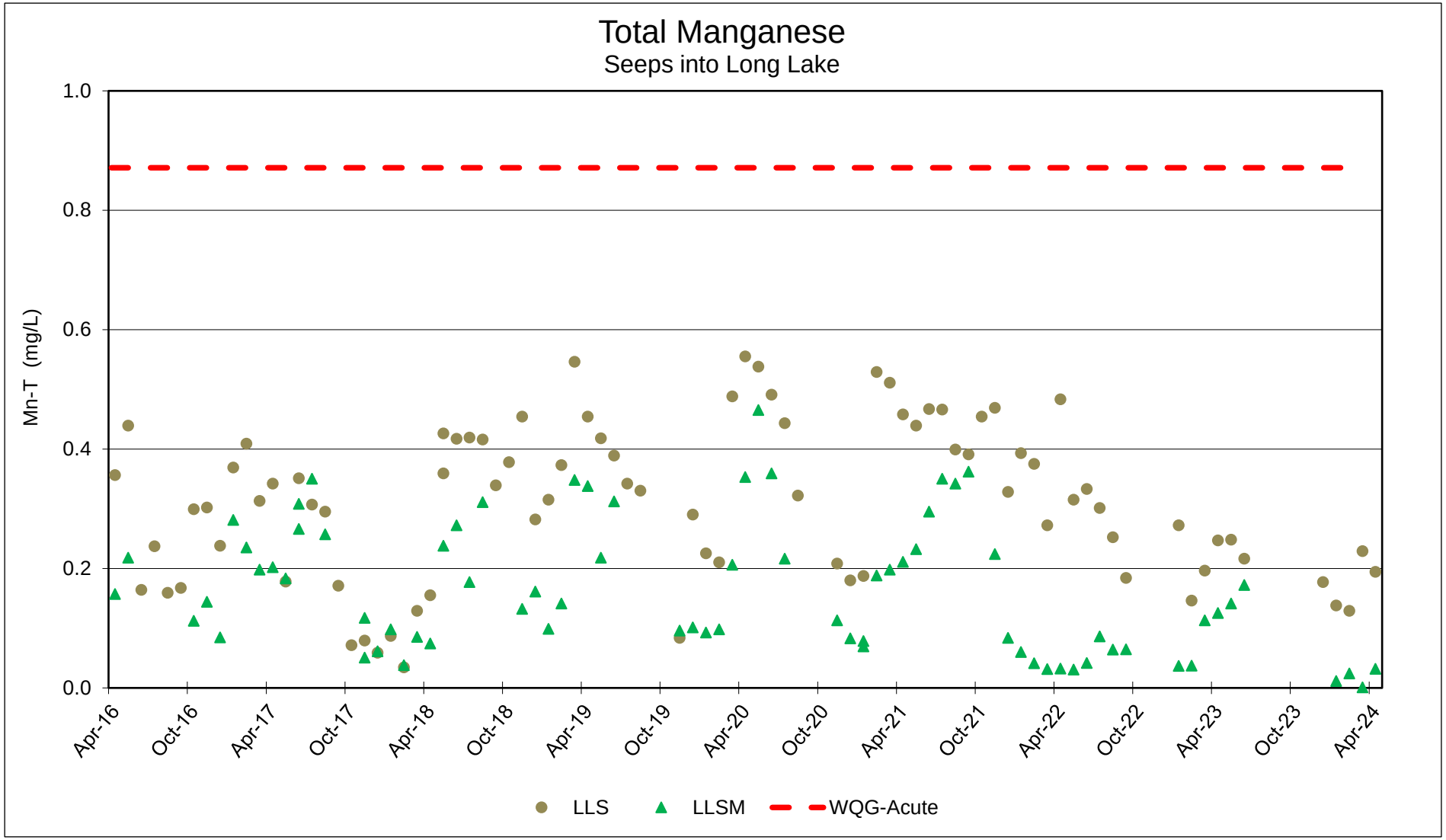

Dissolved Iron vs. Flow
Long Lake Entry from 2-South (LLE)
(mg/L)
(m3/s)
1.5
1.2
0.9
0.6
0.3
0
2.5
2.0
1.5
1.0
0.5
0.0
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
WQG-Acute
Fe-D
Discharge (m3/s)

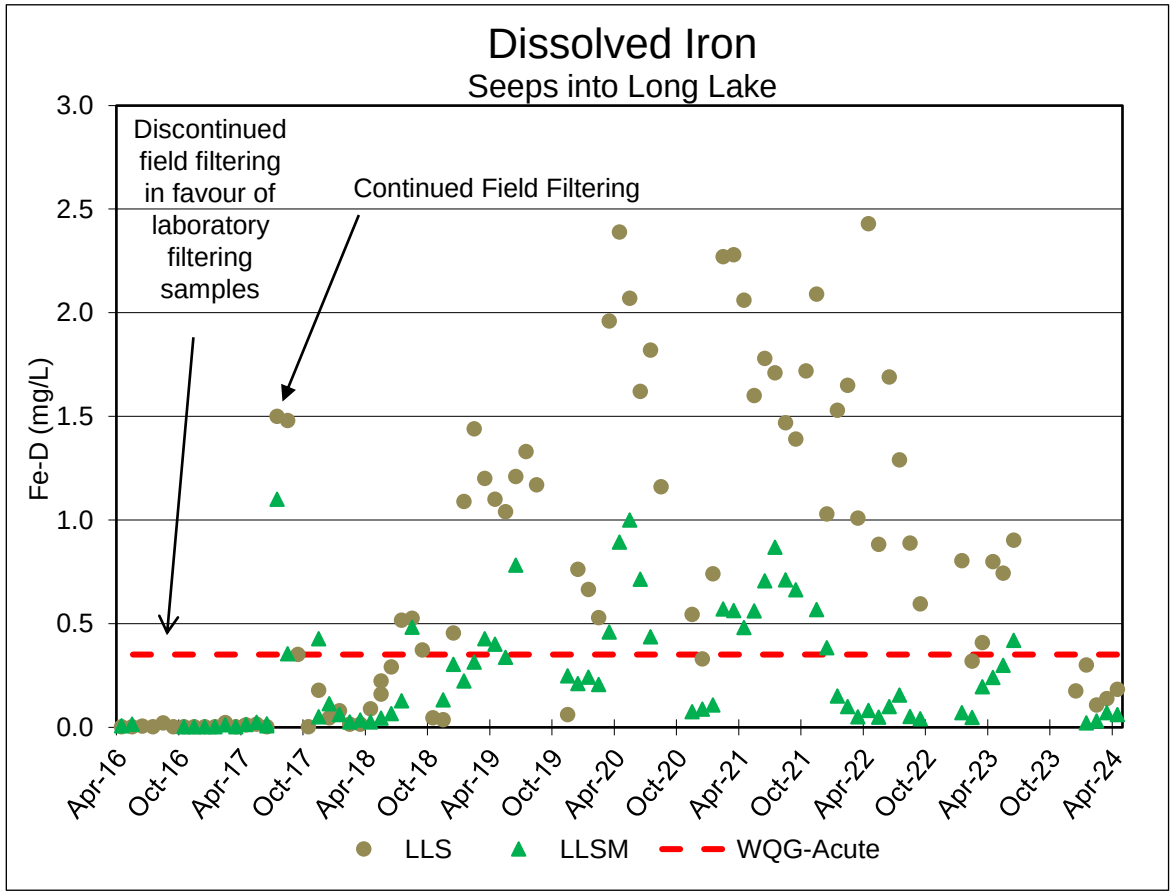

Total Iron vs. Flow
Long Lake Entry from 2-South (LLE)
(mg/L)
(m3/s)
2
1.6
1.2
0.8
0.4
0
2.5
2.0
1.5
1.0
0.5
0.0
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
WQG-Acute
Fe-T
Discharge (m3/s)

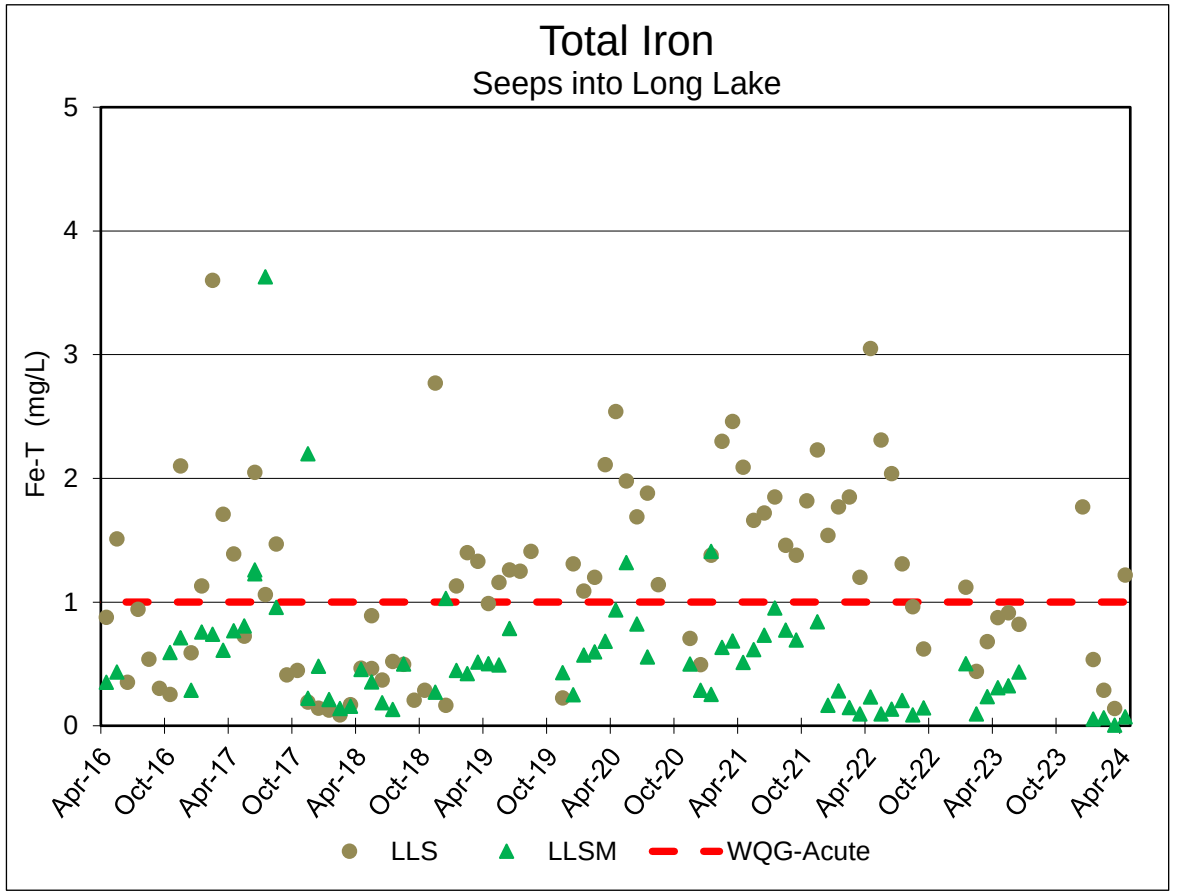

Total Manganese vs. Flow
Long Lake Entry from 2-South (LLE)
(mg/L)
(m³/s)
1
0.8
0.6
0.4
0.2
0
2.5
2.0
1.5
1.0
0.5
0.0
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
WQG-Acute
Mn-T
Discharge (m3/s)

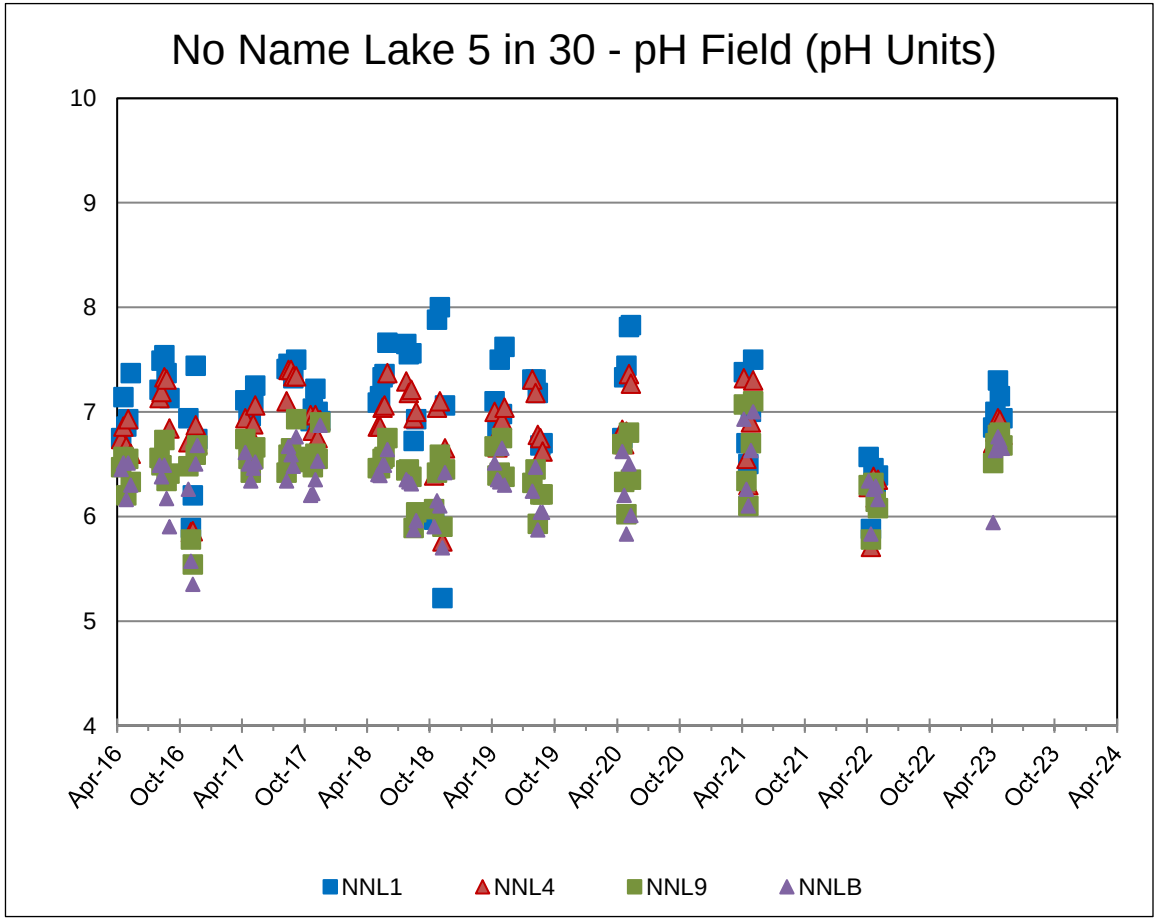

Dissolved Sulphate
Seeps into Long Lake
800
600
400
200
0
SO4-D (mg/L)
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LLS
LLSM

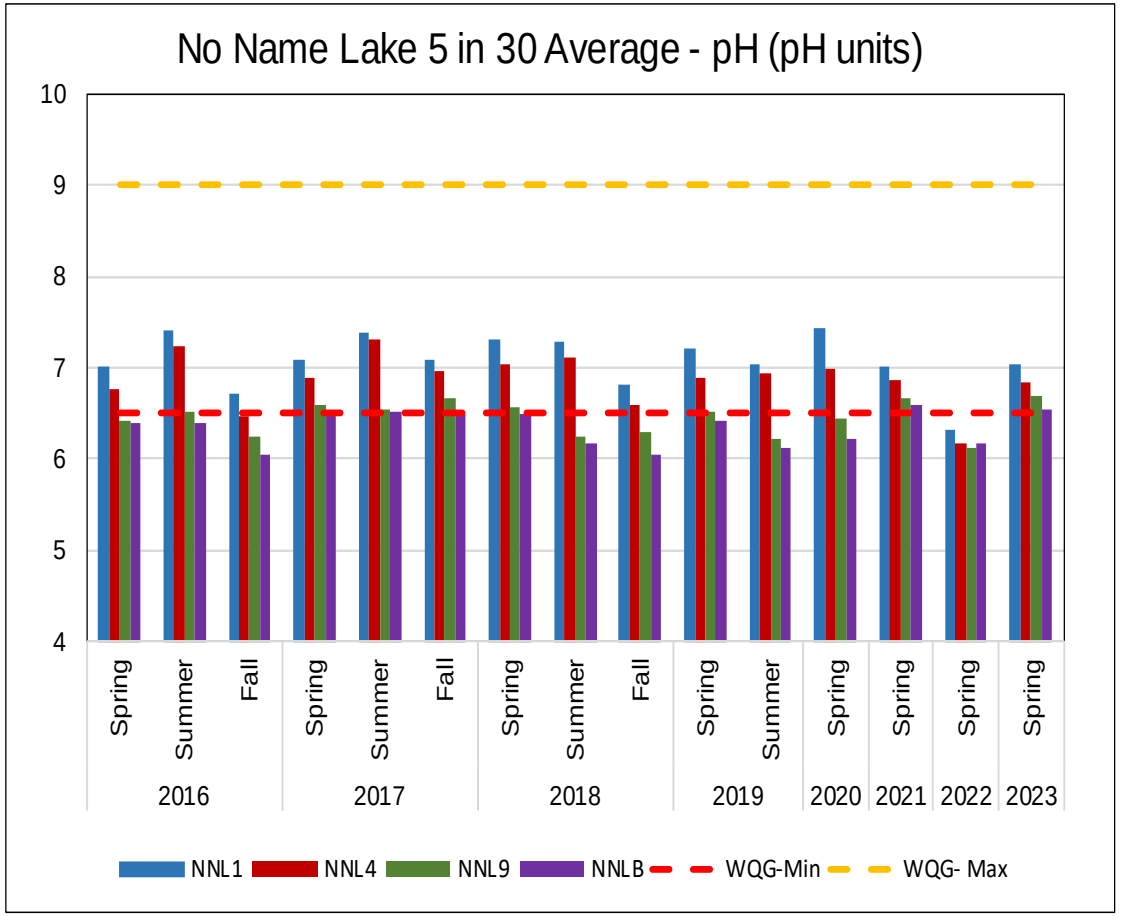

Total Arsenic
Seeps into Long Lake
As-T (mg/L)
0.010
0.008
0.006
0.004
0.002
0.000
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LLS
LLSM
WQG-Chronic

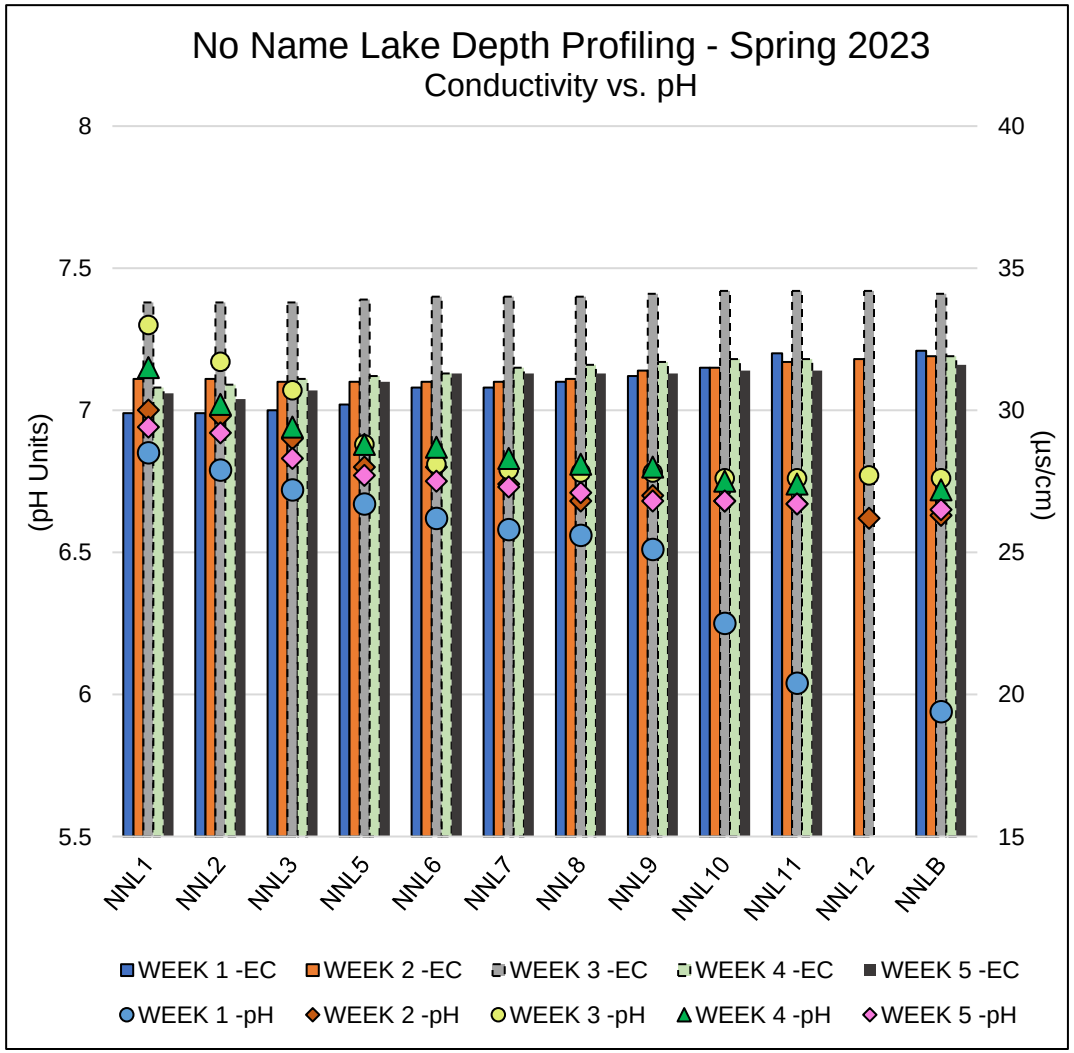

Total Manganese
Seeps into Long Lake
Mn-T (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LLS
LLSM
WQG-Acute

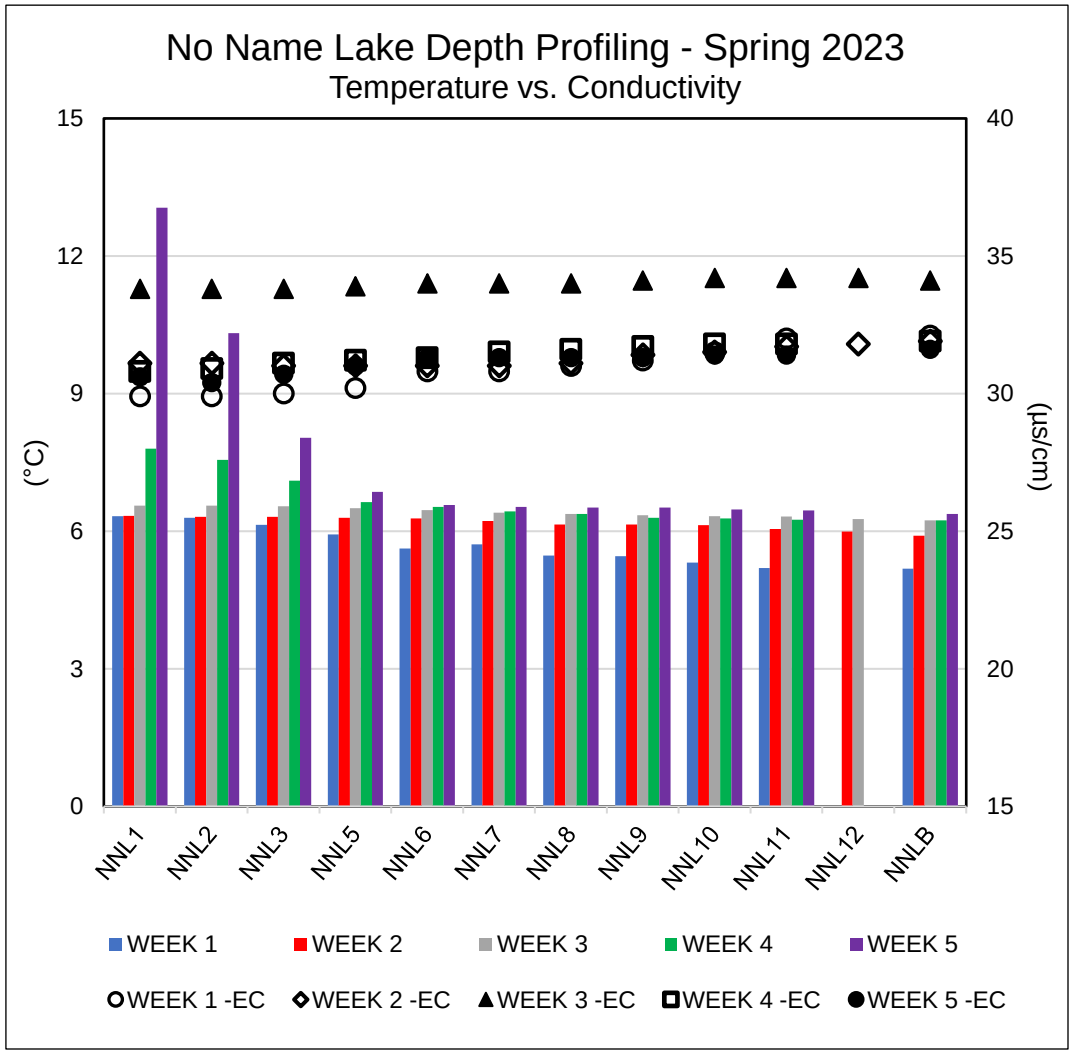

Dissolved Iron
Seeps into Long Lake
Discontinued field filtering in favour of laboratory filtering samples
Continued Field Filtering
Fe-D (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LLS
LLSM
WQG-Acute

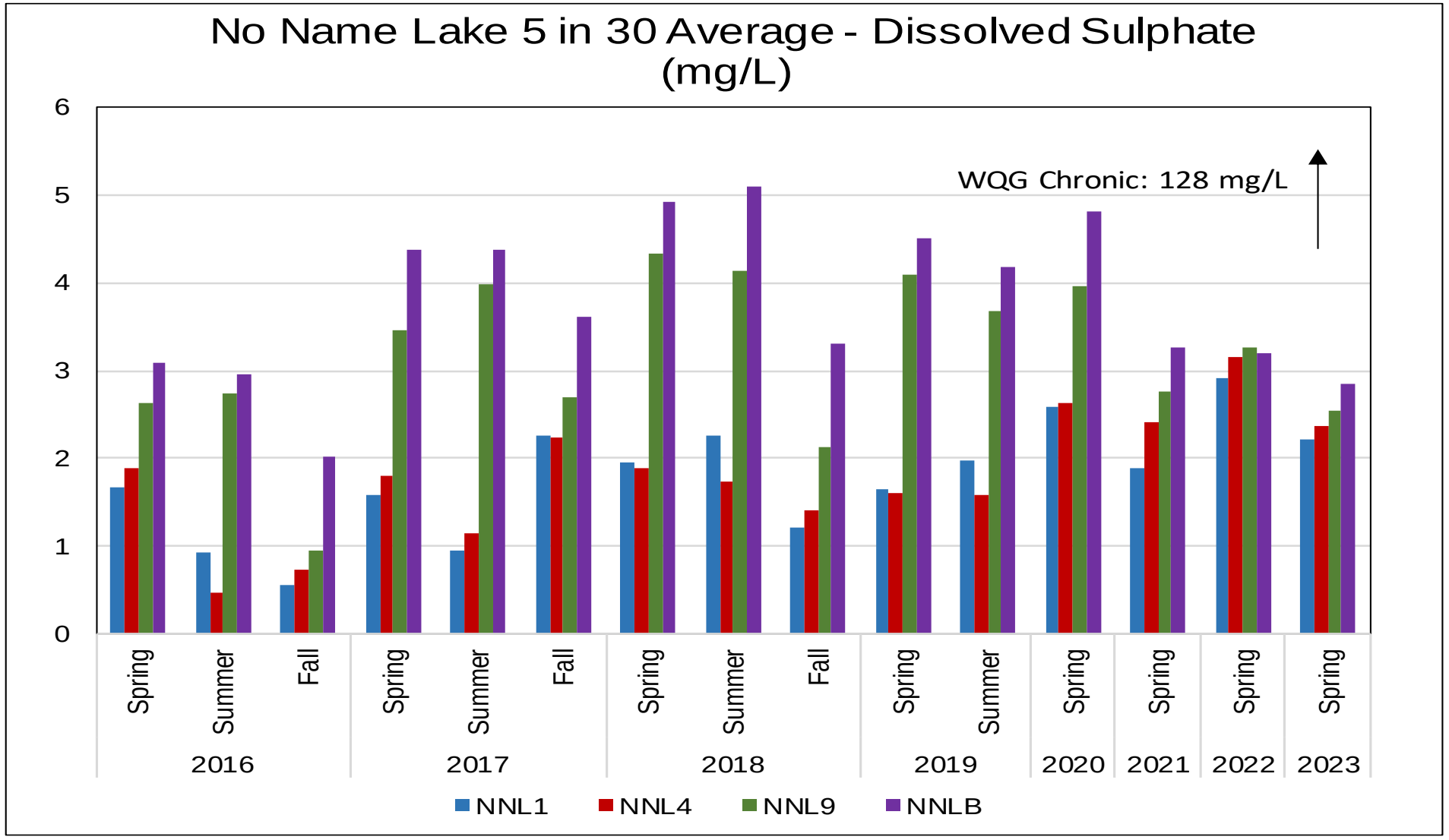

Total Iron
Seeps into Long Lake
Fe-T (mg/L)
5
4
3
2
1
0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LLS
LLSM
WQG-Acute

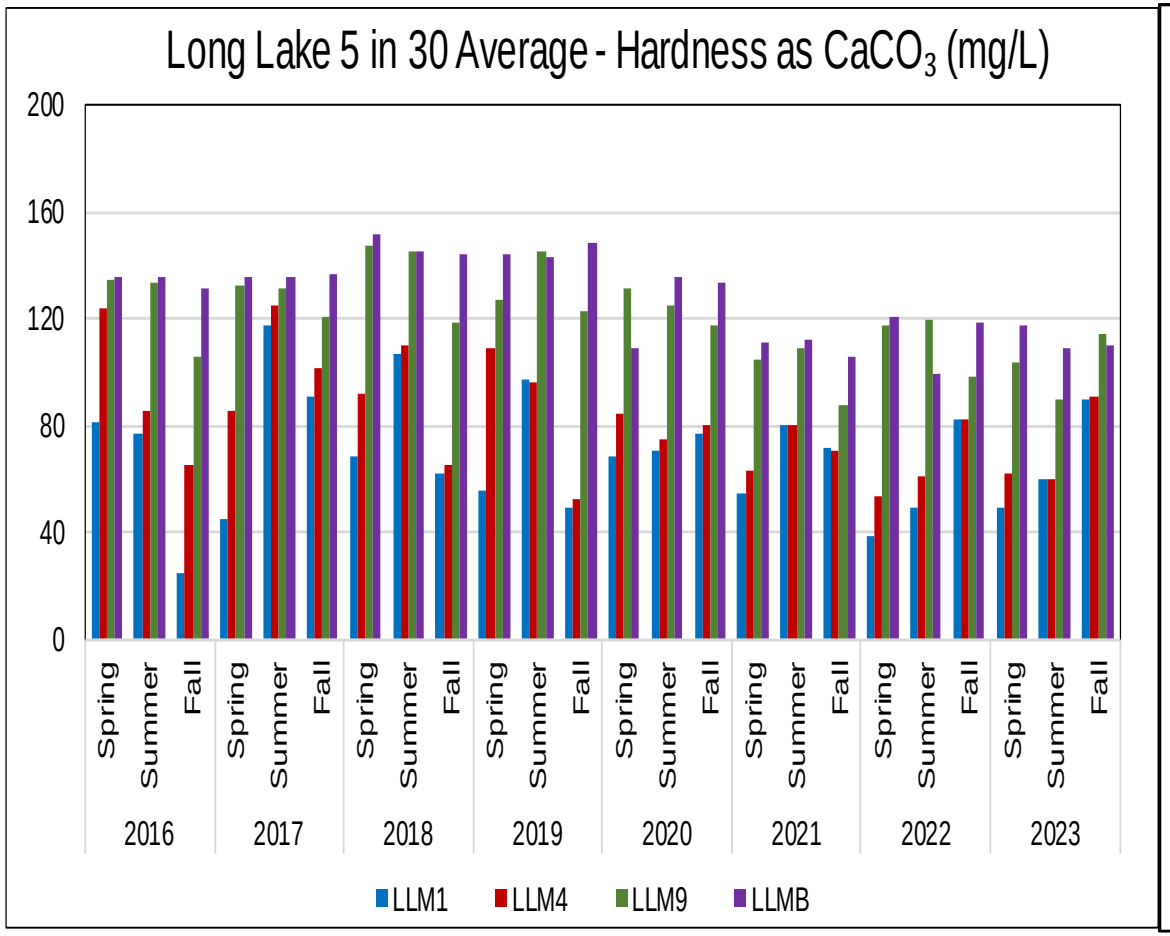

No Name Lake 5 in 30 - pH Field (pH Units)
10
9
8
7
6
5
4
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
NNL1
NNL4
NNL9
NNLB

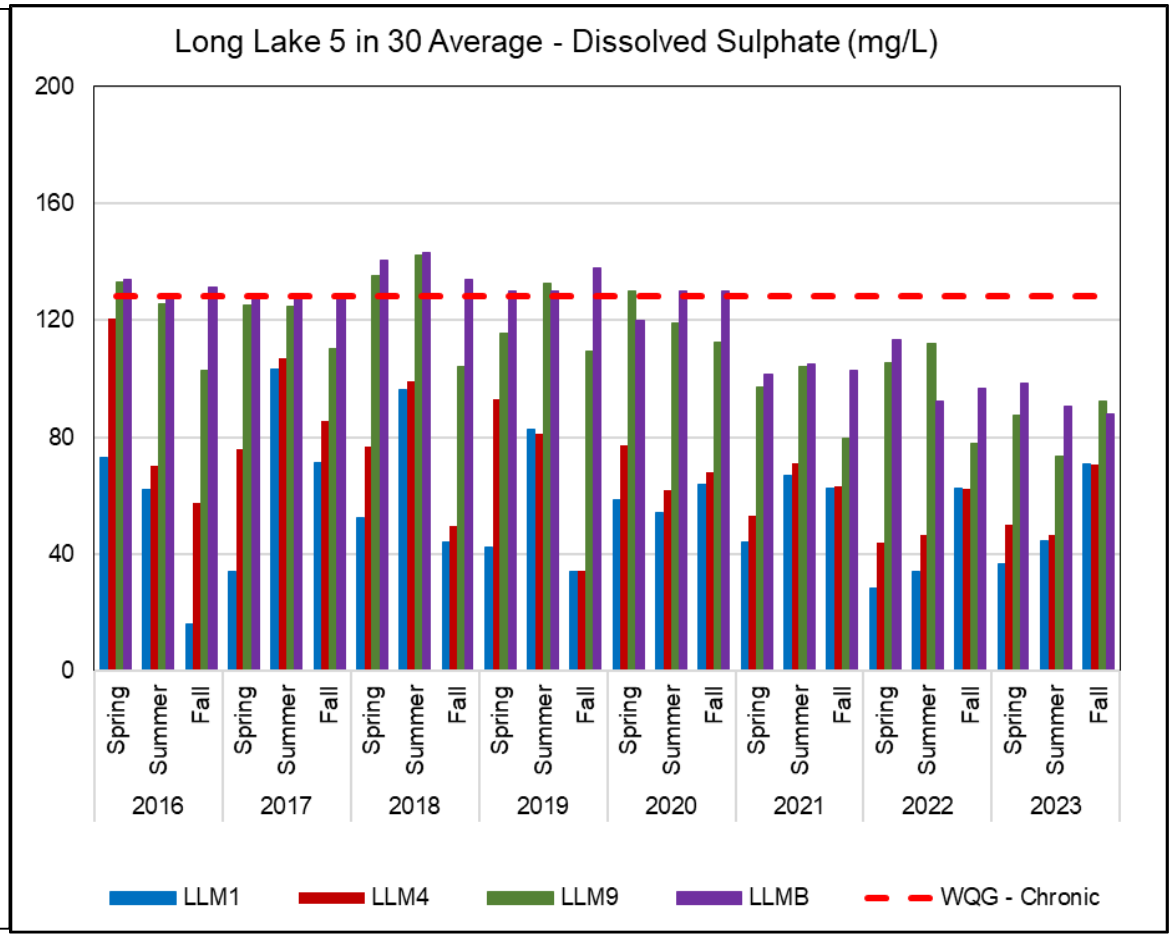

No Name Lake 5 in 30 Average - pH (pH units)
10
9
8
7
6
5
4
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
NNL1
NNL4
NNL9
NNLB
WQG-Min
WQG- Max

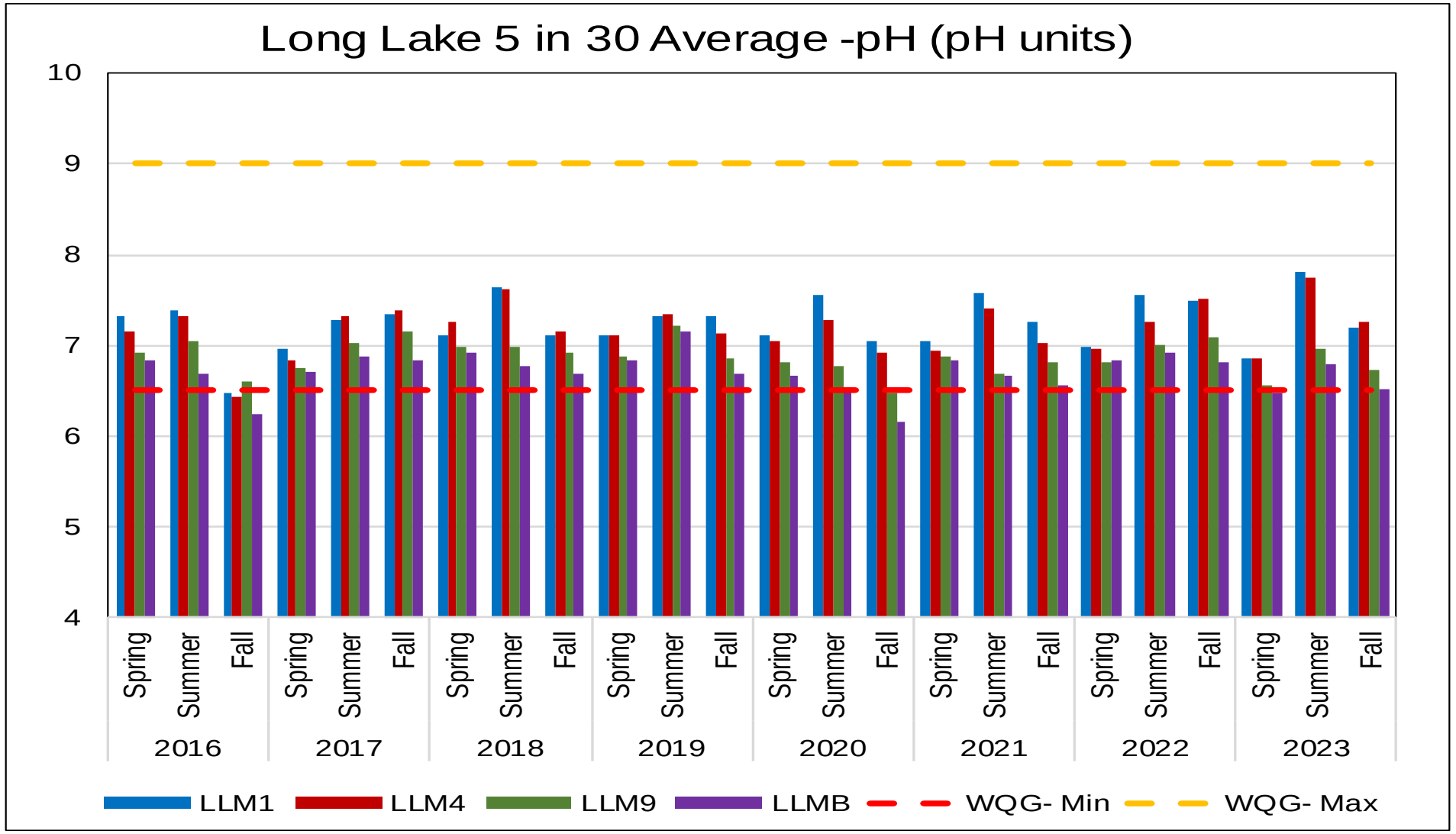

No Name Lake Depth Profiling - Spring 2023
Conductivity vs. pH
8
7.5
7
6.5
6
5.5
40
35
30
25
20
15
(pH Units)
(µs/cm)
NNL1
NNL2
NNL3
NNL5
NNL6
NNL7
NNL8
NNL9
NNL10
NNL11
NNL12
NNLB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

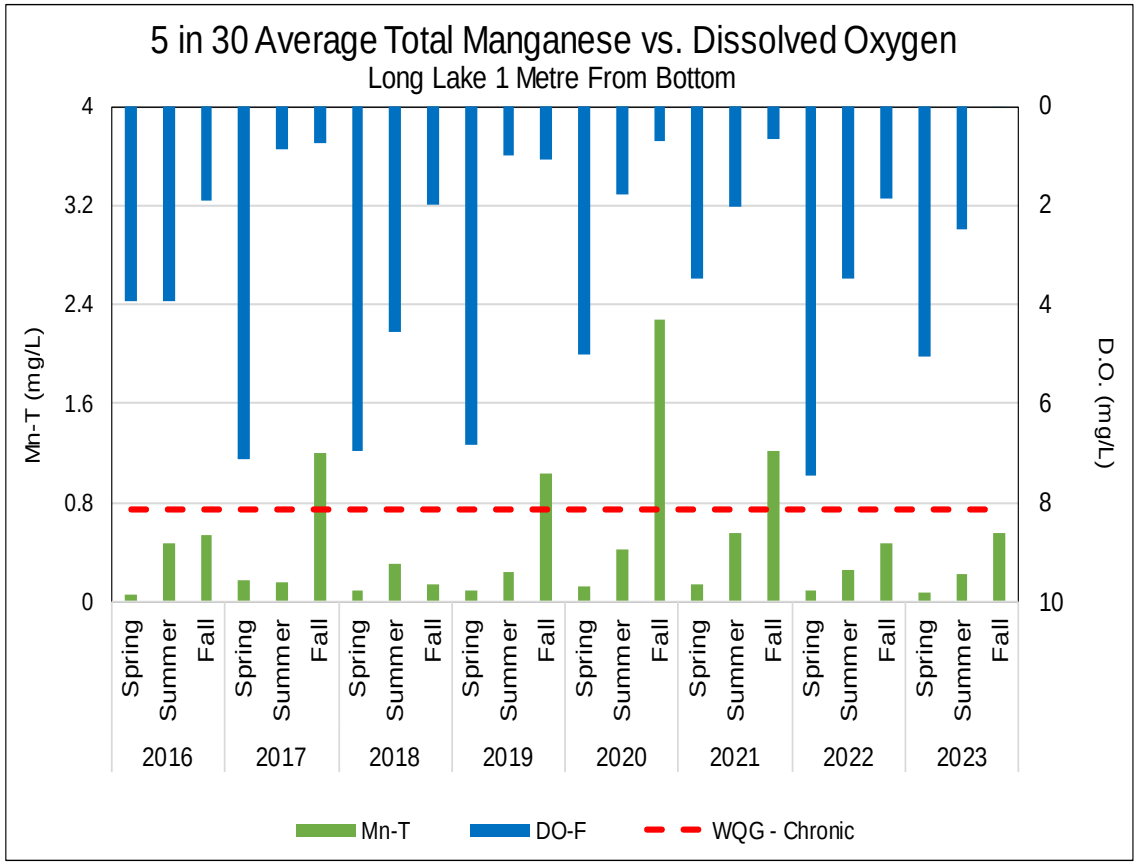

No Name Lake Depth Profiling - Spring 2023
Temperature vs. Conductivity
15
12
9
6
3
0
40
35
30
25
20
15
(°C)
(µs/cm)
NNL1
NNL2
NNL3
NNL5
NNL6
NNL7
NNL8
NNL9
NNL10
NNL11
NNL12
NNLB
WEEK 1
WEEK 2
WEEK 3
WEEK 4
WEEK 5
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC

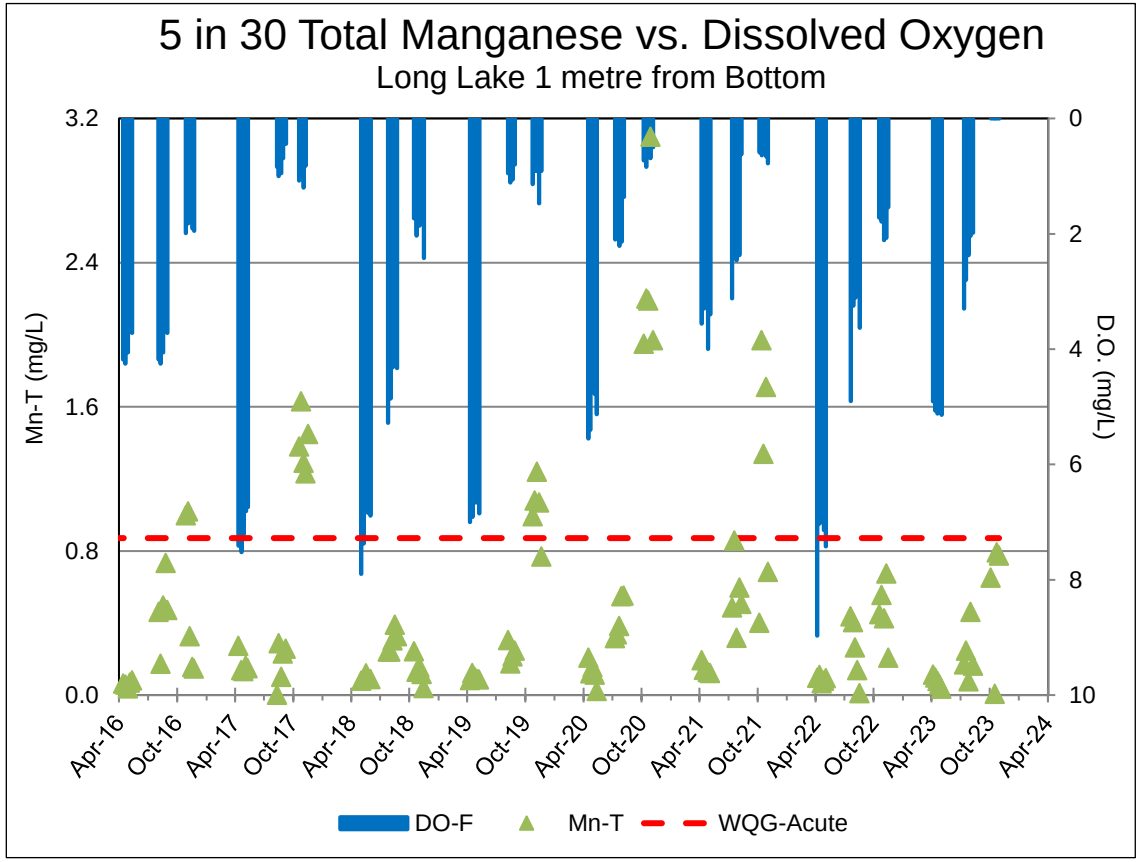

No Name Lake 5 in 30 Average - Dissolved Sulphate (mg/L)
6
5
4
3
2
1
0
WQG Chronic: 128 mg/L
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
NNL1
NNL4
NNL9
NNLB

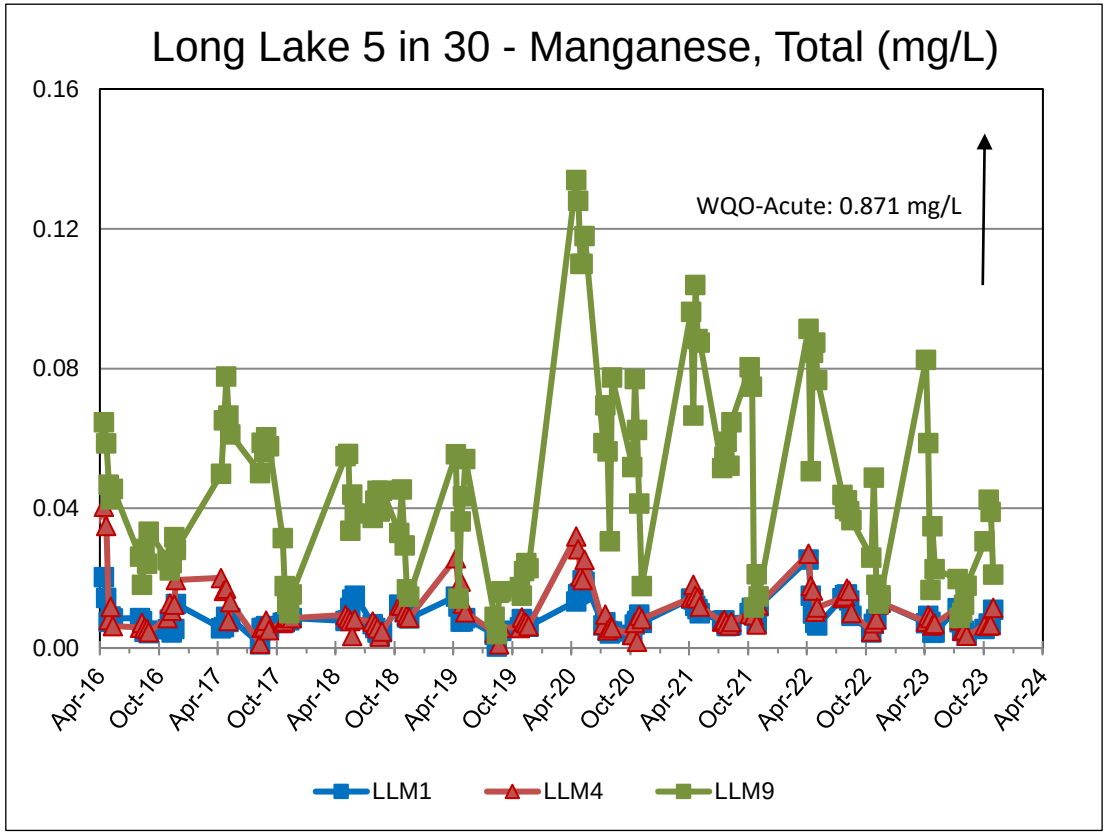

Long Lake 5 in 30 Average - Hardness as $CaCO_3$ (mg/L)
200
160
120
80
40
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
LLM1
LLM4
LLM9
LLMB

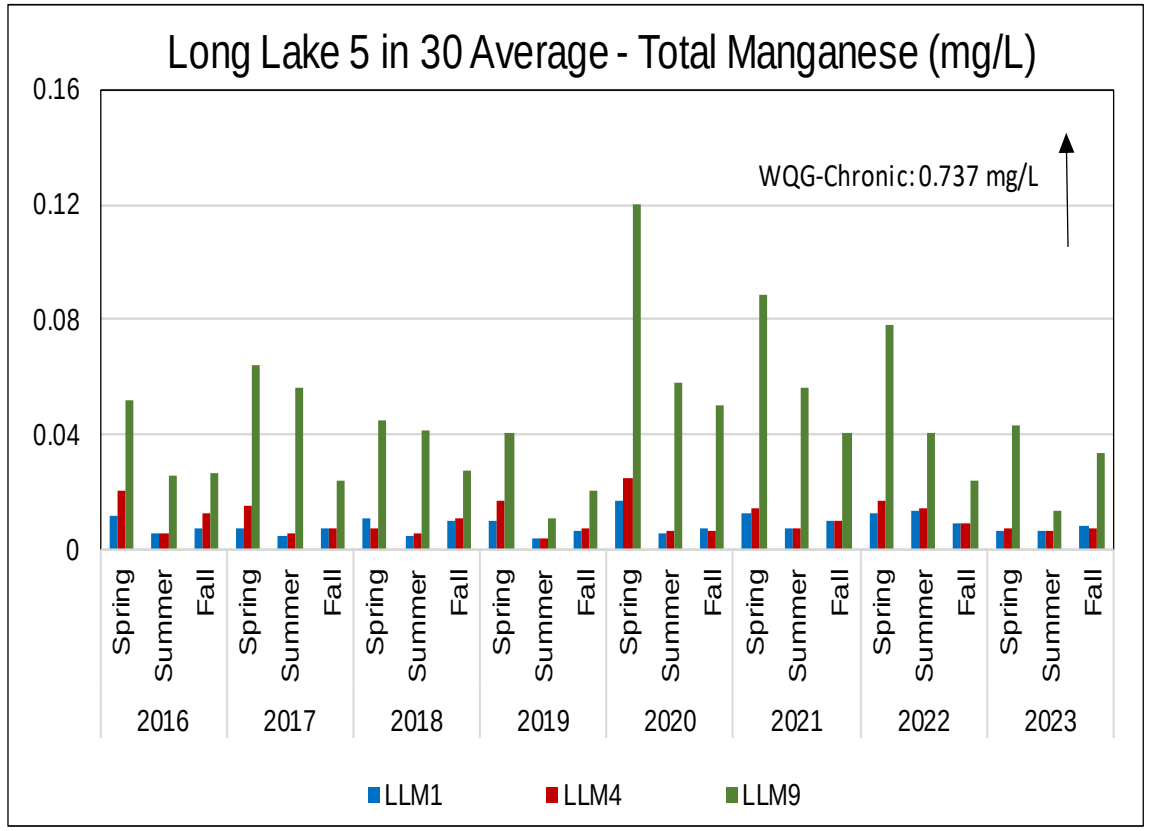

Long Lake 5 in 30 Average - Dissolved Sulphate (mg/L)
200
160
120
80
40
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
LLM1
LLM4
LLM9
LLMB
WQG - Chronic

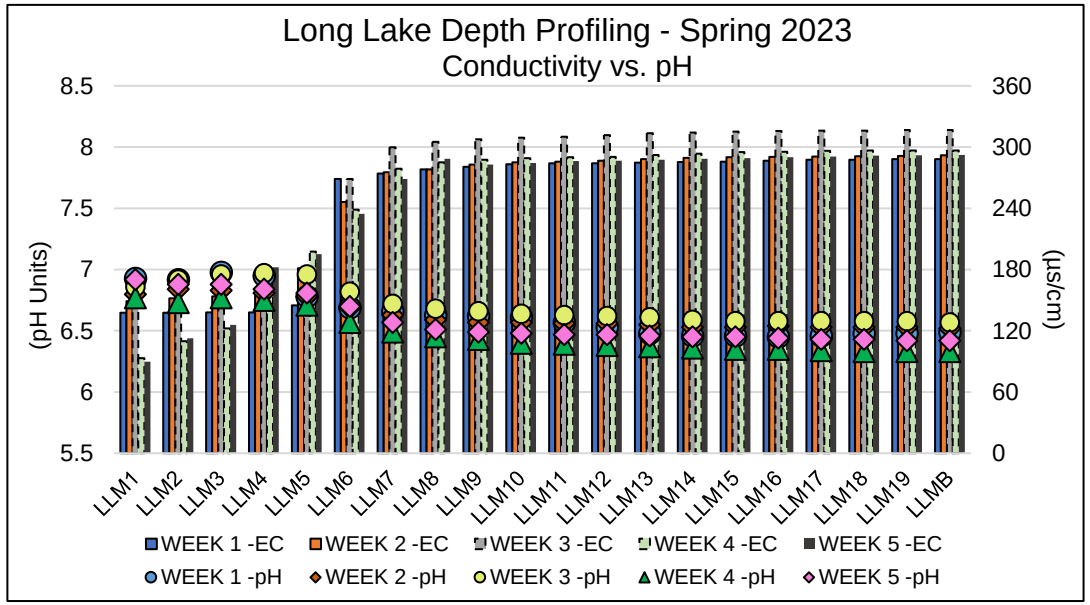

Long Lake 5 in 30 Average -pH (pH units)
10
9
8
7
6
5
4
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
LLM1
LLM4
LLM9
LLMB
WQG- Min
WQG- Max

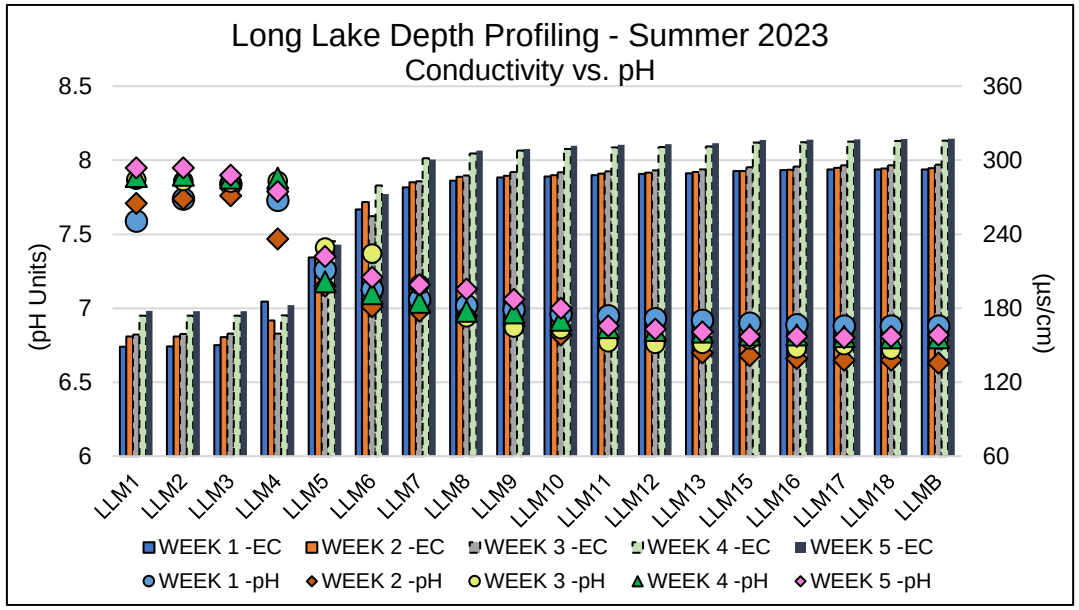

5 in 30 Average Total Manganese vs. Dissolved Oxygen
Long Lake 1 Metre From Bottom
Mn-T (mg/L)
D.O. (mg/L)
4
3.2
2.4
1.6
0.8
0
0
2
4
6
8
10
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
Mn-T
DO-F
WQG - Chronic

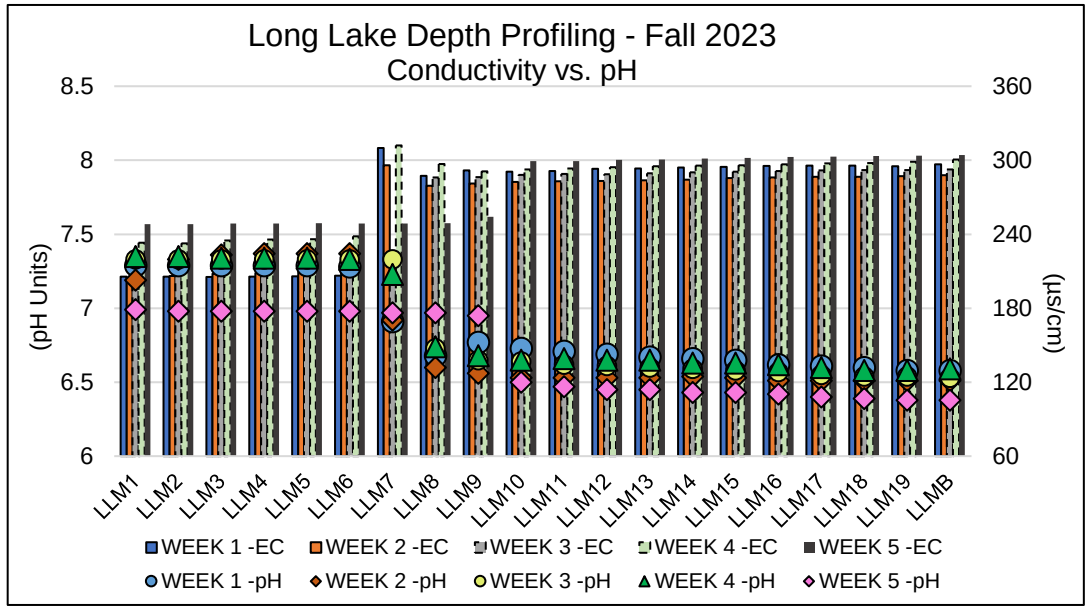

5 in 30 Total Manganese vs. Dissolved Oxygen
Long Lake 1 metre from Bottom
Mn-T (mg/L)
D.O. (mg/L)
3.2
2.4
1.6
0.8
0.0
0
2
4
6
8
10
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
DO-F
Mn-T
WQG-Acute

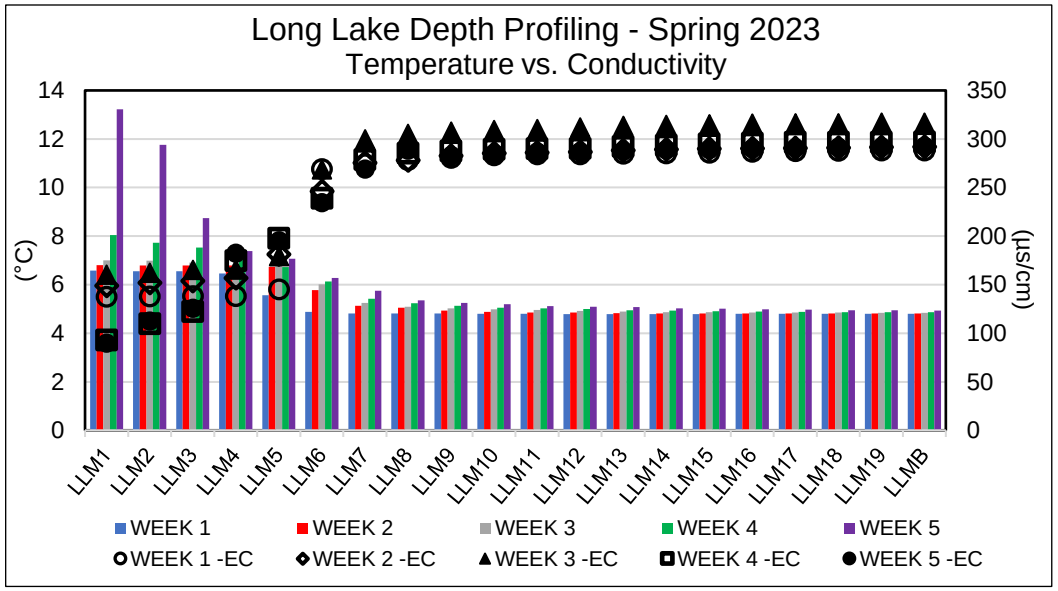

Long Lake 5 in 30 - Manganese, Total (mg/L)
0.16
0.12
0.08
0.04
0.00
WQO-Acute: 0.871 mg/L
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LLM1
LLM4
LLM9

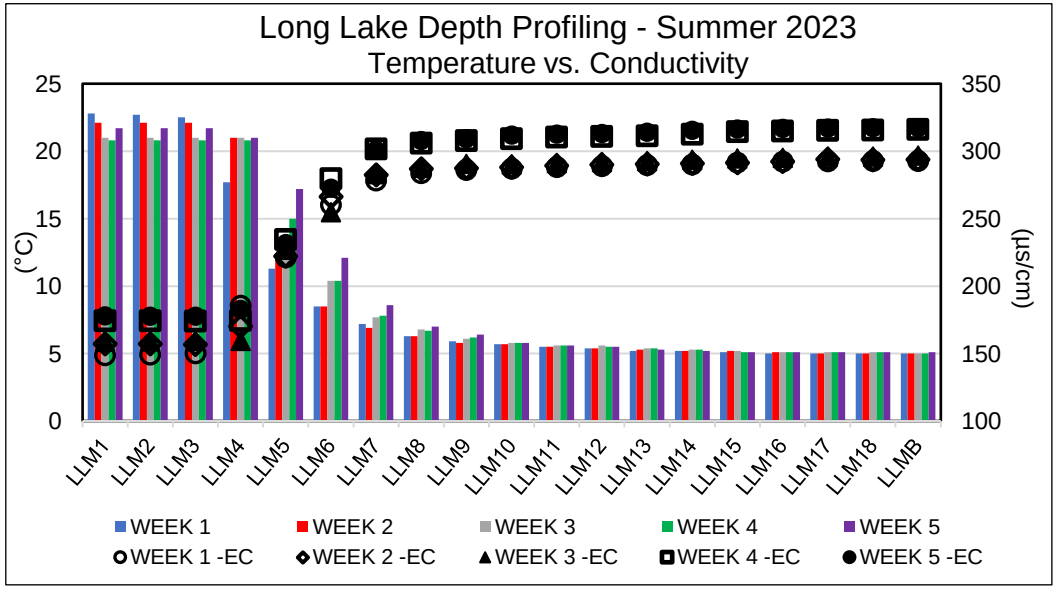

Long Lake 5 in 30 Average - Total Manganese (mg/L)
0.16
0.12
0.08
0.04
0
WQG-Chronic: 0.737 mg/L
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
LLM1
LLM4
LLM9

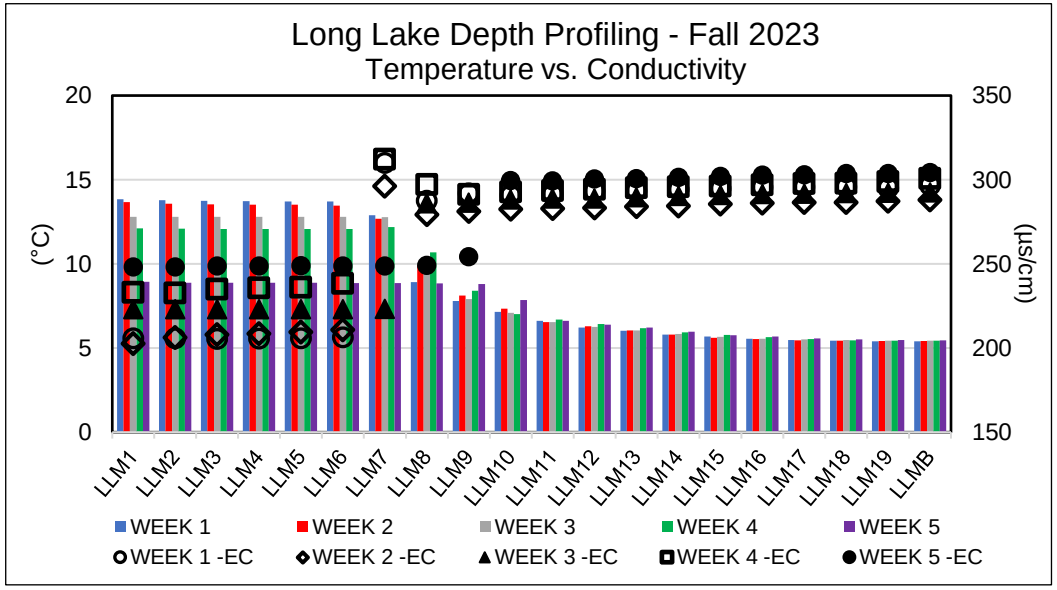

Long Lake Depth Profiling - Spring 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
8.5
8
7.5
7
6.5
6
5.5
360
300
240
180
120
60
0
LLM1 LLM2 LLM3 LLM4 LLM5 LLM6 LLM7 LLM8 LLM9 LLM10 LLM11 LLM12 LLM13 LLM14 LLM15 LLM16 LLM17 LLM18 LLM19 LLMB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

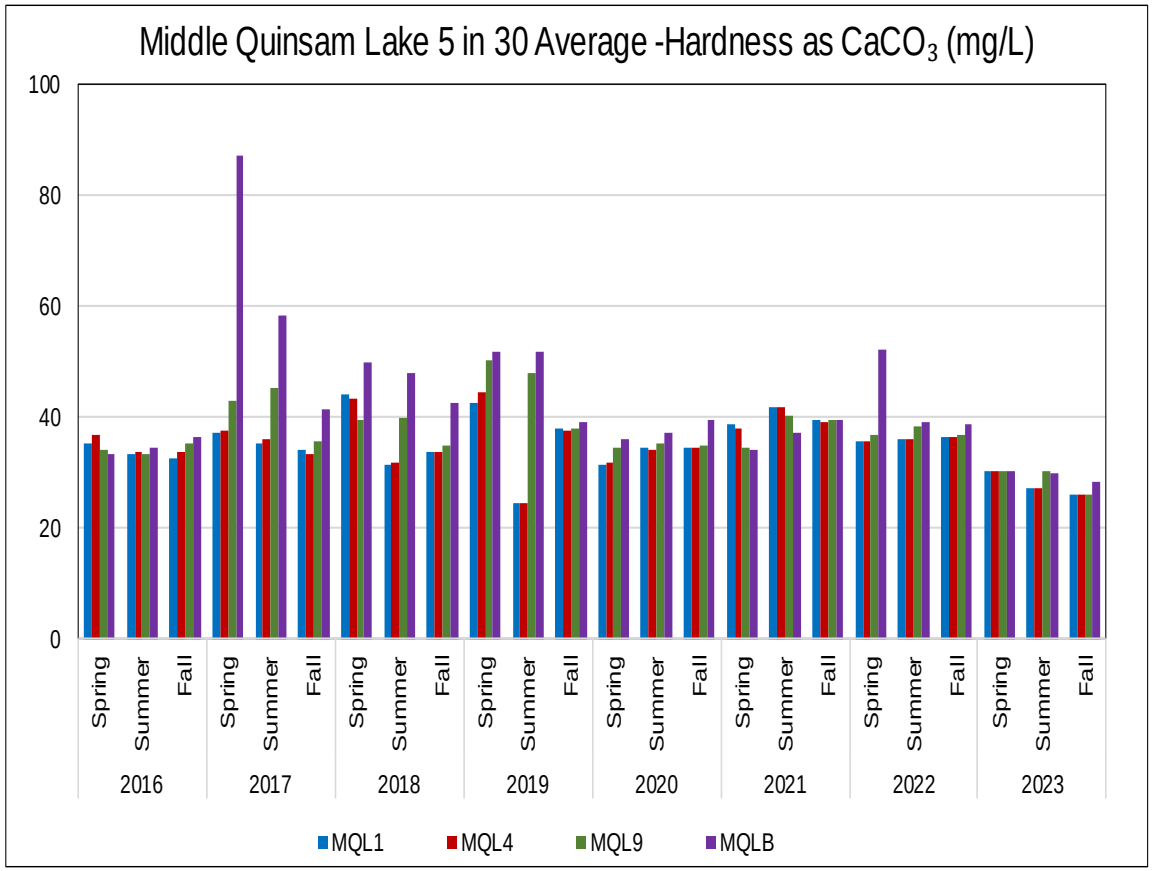

Long Lake Depth Profiling - Summer 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
8.5
8
7.5
7
6.5
6
360
300
240
180
120
60
LLM1 LLM2 LLM3 LLM4 LLM5 LLM6 LLM7 LLM8 LLM9 LLM10 LLM11 LLM12 LLM13 LLM15 LLM16 LLM17 LLM18 LLMB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

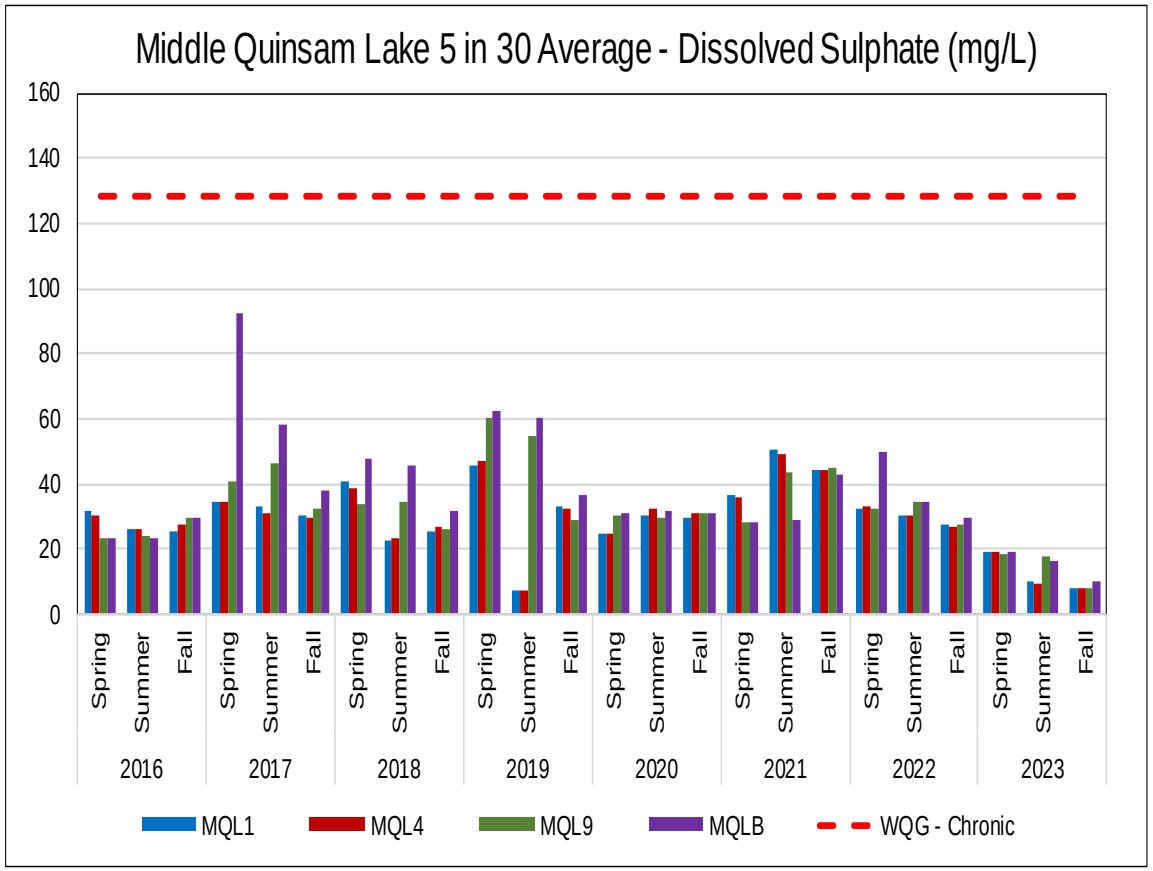

Long Lake Depth Profiling - Fall 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
8.5
8
7.5
7
6.5
6
360
300
240
180
120
60
LLM1 LLM2 LLM3 LLM4 LLM5 LLM6 LLM7 LLM8 LLM9 LLM10 LLM11 LLM12 LLM13 LLM14 LLM15 LLM16 LLM17 LLM18 LLM19 LLMB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

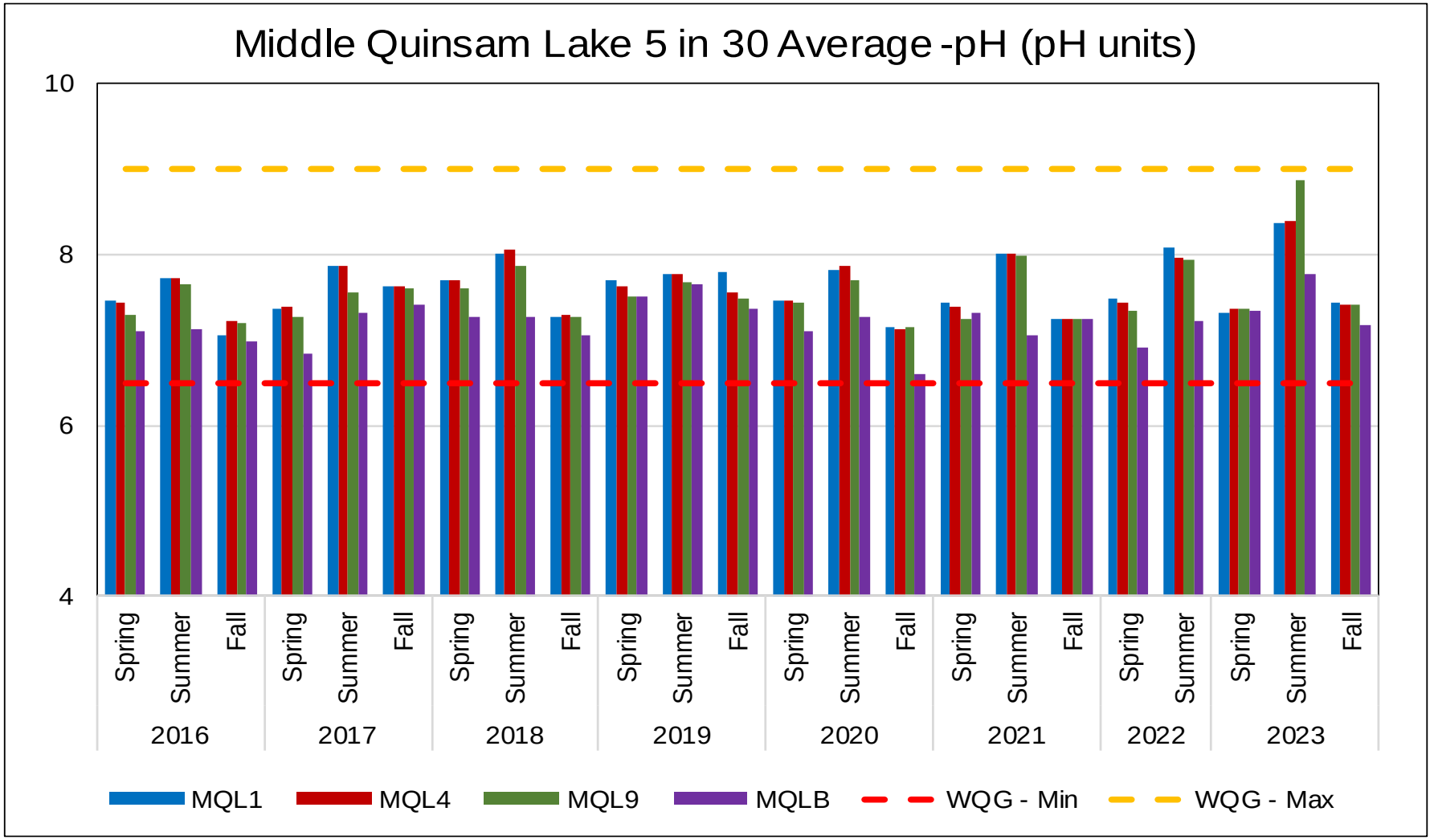

Long Lake Depth Profiling - Spring 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
LLM1 LLM2 LLM3 LLM4 LLM5 LLM6 LLM7 LLM8 LLM9 LLM10 LLM11 LLM12 LLM13 LLM14 LLM15 LLM16 LLM17 LLM18 LLM19 LLMB
WEEK 1 WEEK 2 WEEK 3 WEEK 4 WEEK 5
WEEK 1 -EC WEEK 2 -EC WEEK 3 -EC WEEK 4 -EC WEEK 5 -EC

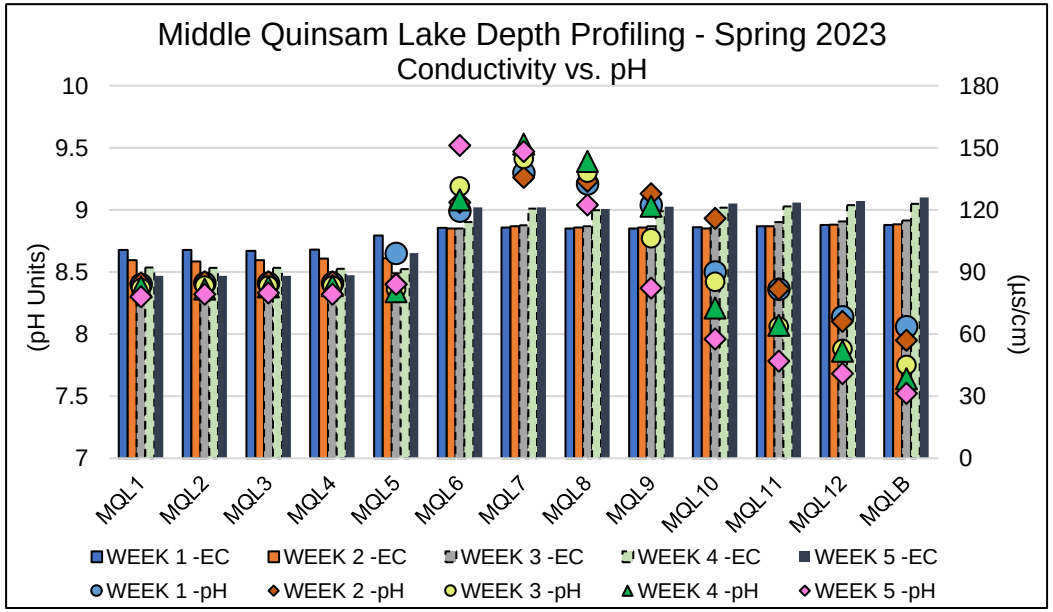

Long Lake Depth Profiling - Summer 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
LLM1 LLM2 LLM3 LLM4 LLM5 LLM6 LLM7 LLM8 LLM9 LLM10 LLM11 LLM12 LLM13 LLM14 LLM15 LLM16 LLM17 LLM18 LLMB
WEEK 1 WEEK 2 WEEK 3 WEEK 4 WEEK 5
WEEK 1 -EC WEEK 2 -EC WEEK 3 -EC WEEK 4 -EC WEEK 5 -EC

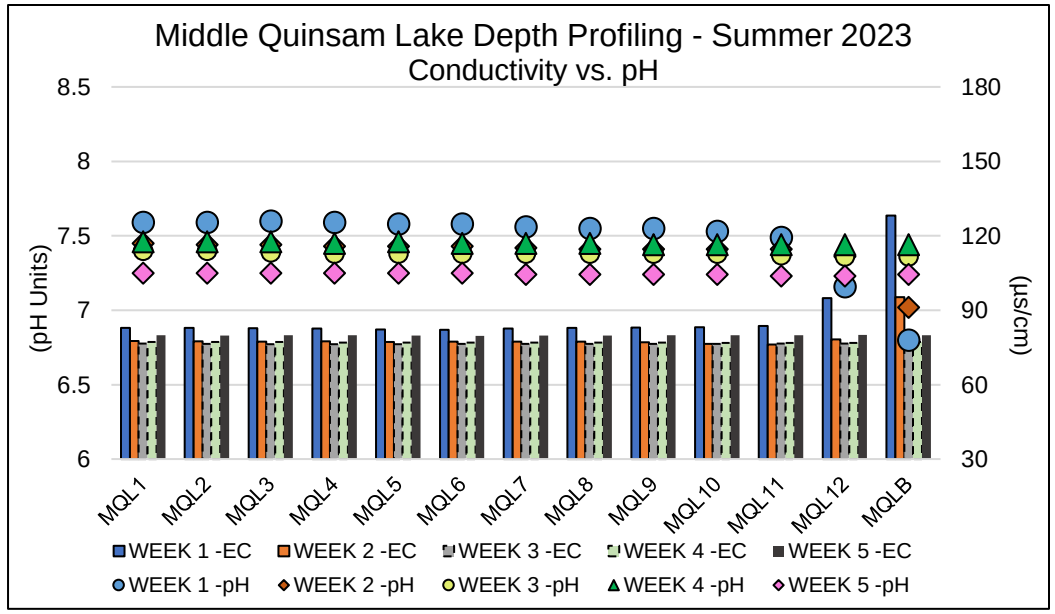

Long Lake Depth Profiling - Fall 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
LLM1 LLM2 LLM3 LLM4 LLM5 LLM6 LLM7 LLM8 LLM9 LLM10 LLM11 LLM12 LLM13 LLM14 LLM15 LLM16 LLM17 LLM18 LLM19 LLMB
WEEK 1 WEEK 2 WEEK 3 WEEK 4 WEEK 5
WEEK 1 -EC WEEK 2 -EC WEEK 3 -EC WEEK 4 -EC WEEK 5 -EC

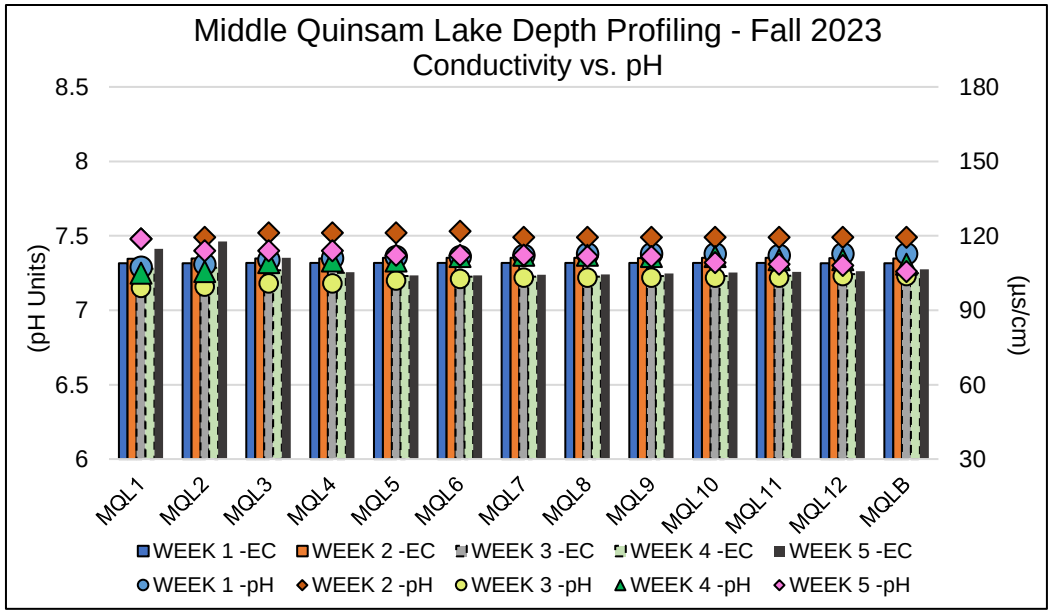

Middle Quinsam Lake 5 in 30 Average -Hardness as CaCO3 (mg/L)
100
80
60
40
20
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
MQL1
MQL4
MQL9
MQLB

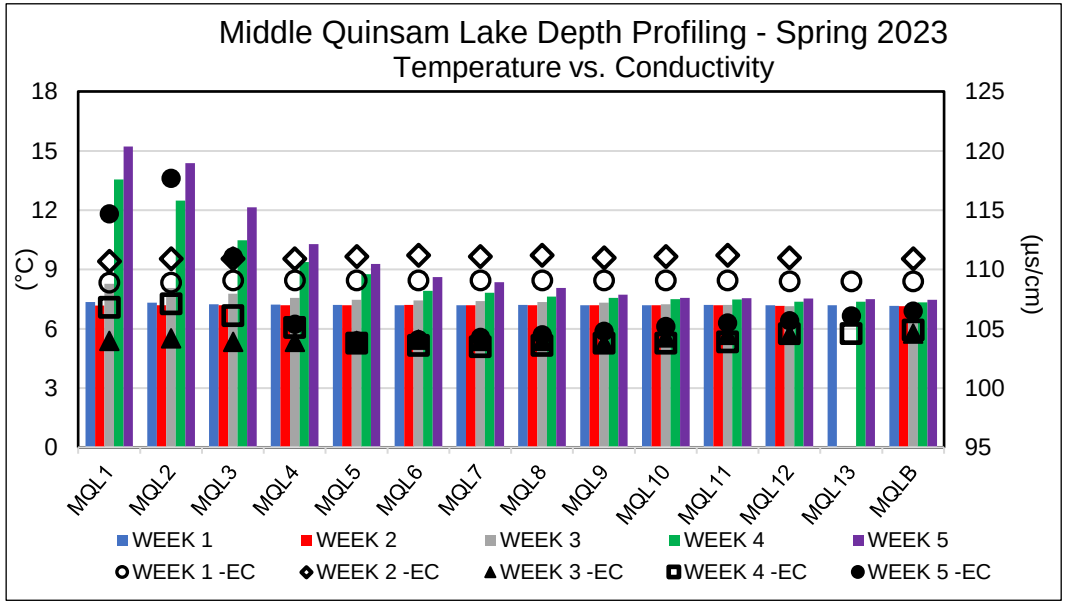

Middle Quinsam Lake 5 in 30 Average - Dissolved Sulphate (mg/L)
160
140
120
100
80
60
40
20
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
MQL1
MQL4
MQL9
MQLB
WQG - Chronic

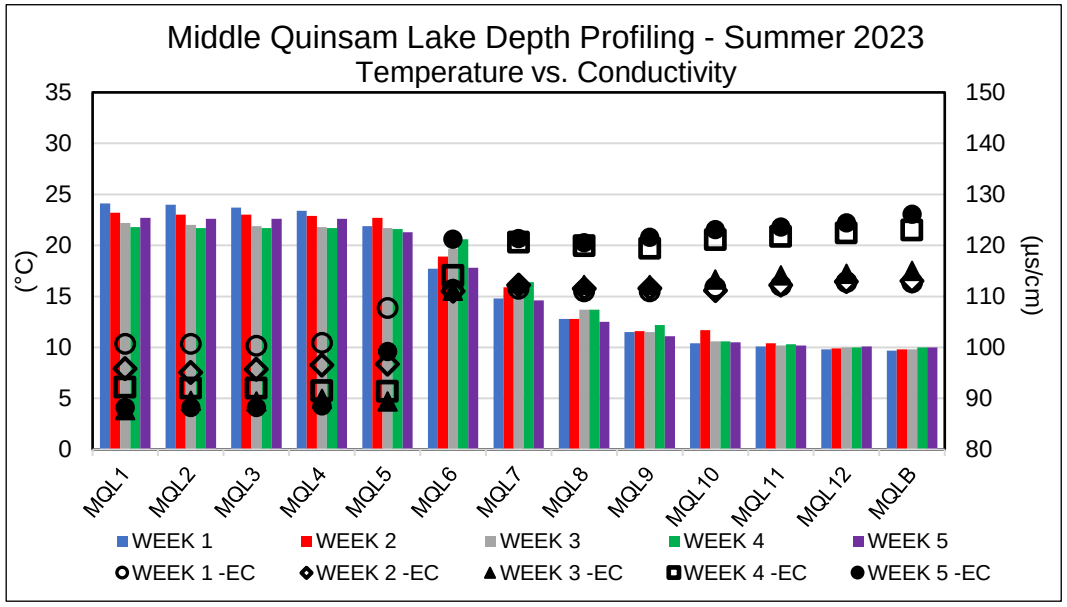

Middle Quinsam Lake 5 in 30 Average -pH (pH units)
10
8
6
4
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
MQL1
MQL4
MQL9
MQLB
WQG - Min
WQG - Max

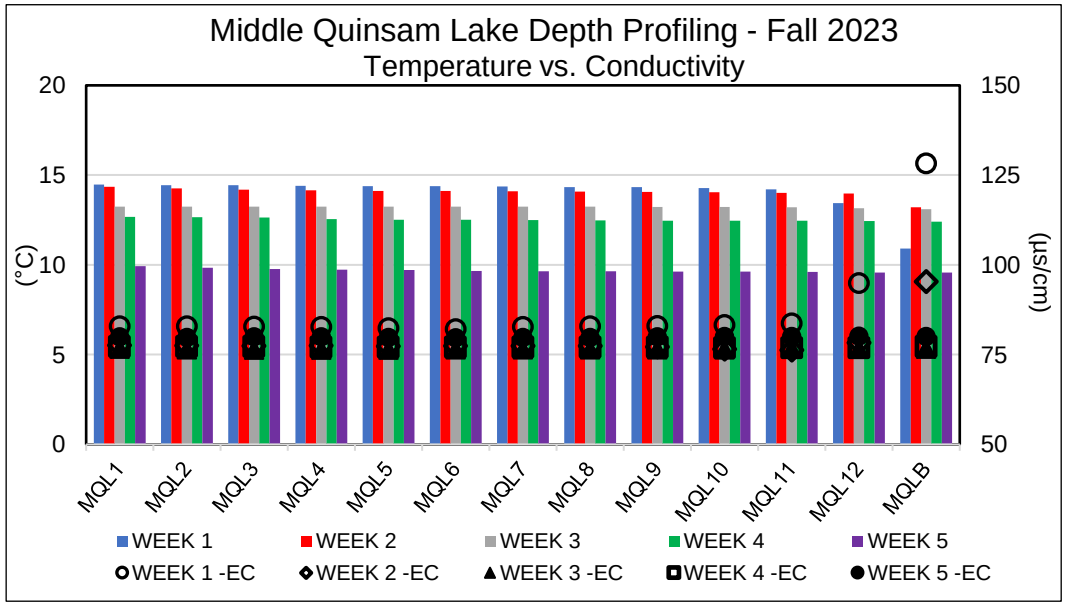

Middle Quinsam Lake Depth Profiling - Spring 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
10
9.5
9
8.5
8
7.5
7
180
150
120
90
60
30
0
MQL1
MQL2
MQL3
MQL4
MQL5
MQL6
MQL7
MQL8
MQL9
MQL10
MQL11
MQL12
MQLB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

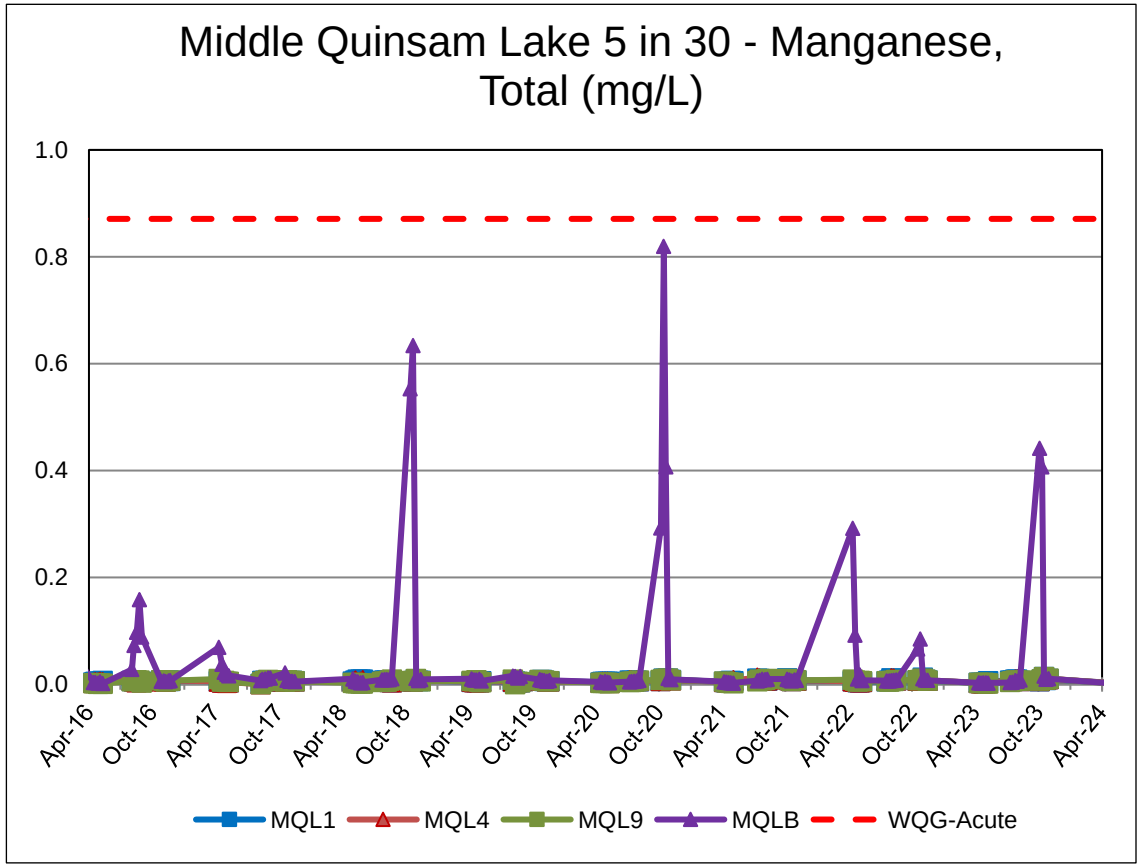

Middle Quinsam Lake Depth Profiling - Summer 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
8.5
8
7.5
7
6.5
6
180
150
120
90
60
30
MQL1
MQL2
MQL3
MQL4
MQL5
MQL6
MQL7
MQL8
MQL9
MQL10
MQL11
MQL12
MQLB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

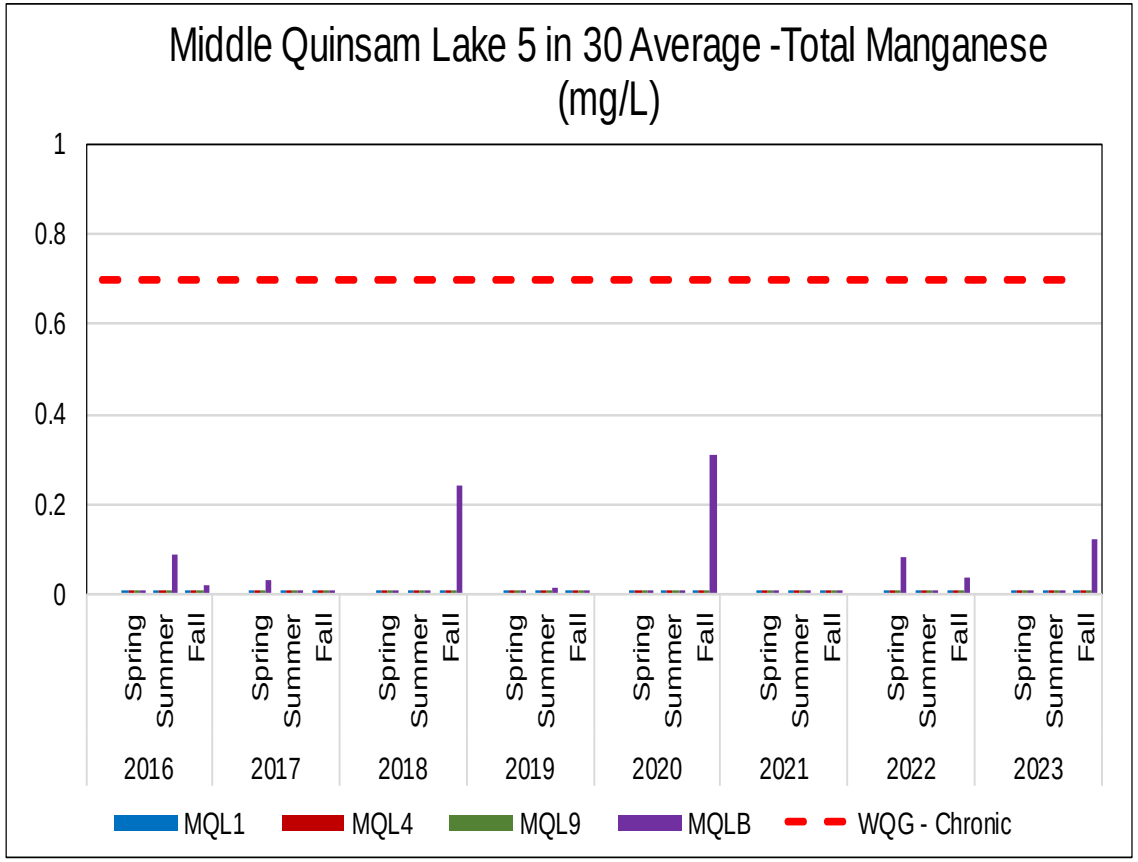

Middle Quinsam Lake Depth Profiling - Fall 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
8.5
8
7.5
7
6.5
6
180
150
120
90
60
30
MQL1
MQL2
MQL3
MQL4
MQL5
MQL6
MQL7
MQL8
MQL9
MQL10
MQL11
MQL12
MQLB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

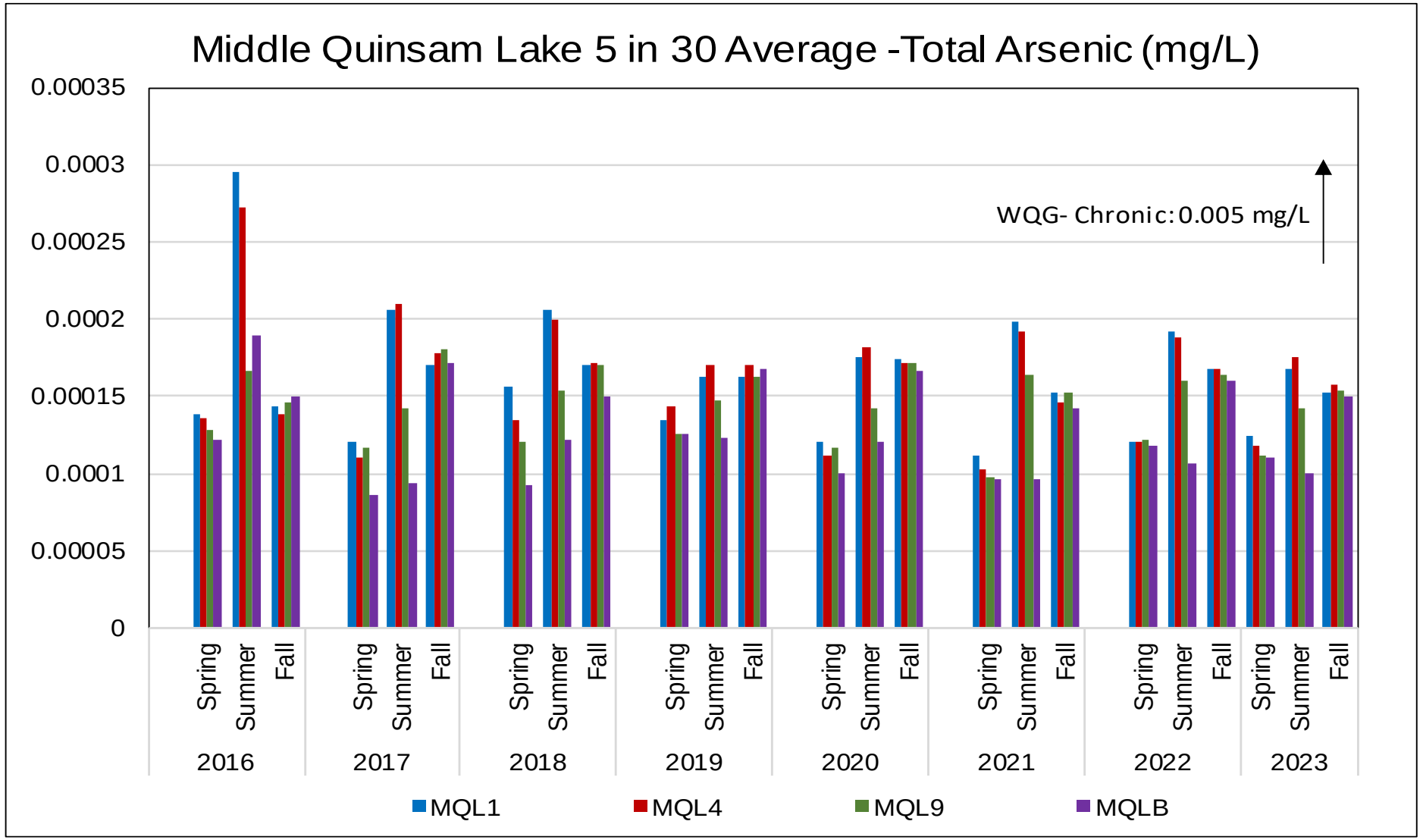

Middle Quinsam Lake Depth Profiling - Spring 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
MQL1
MQL2
MQL3
MQL4
MQL5
MQL6
MQL7
MQL8
MQL9
MQL10
MQL11
MQL12
MQL13
MQLB
WEEK 1
WEEK 2
WEEK 3
WEEK 4
WEEK 5
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC

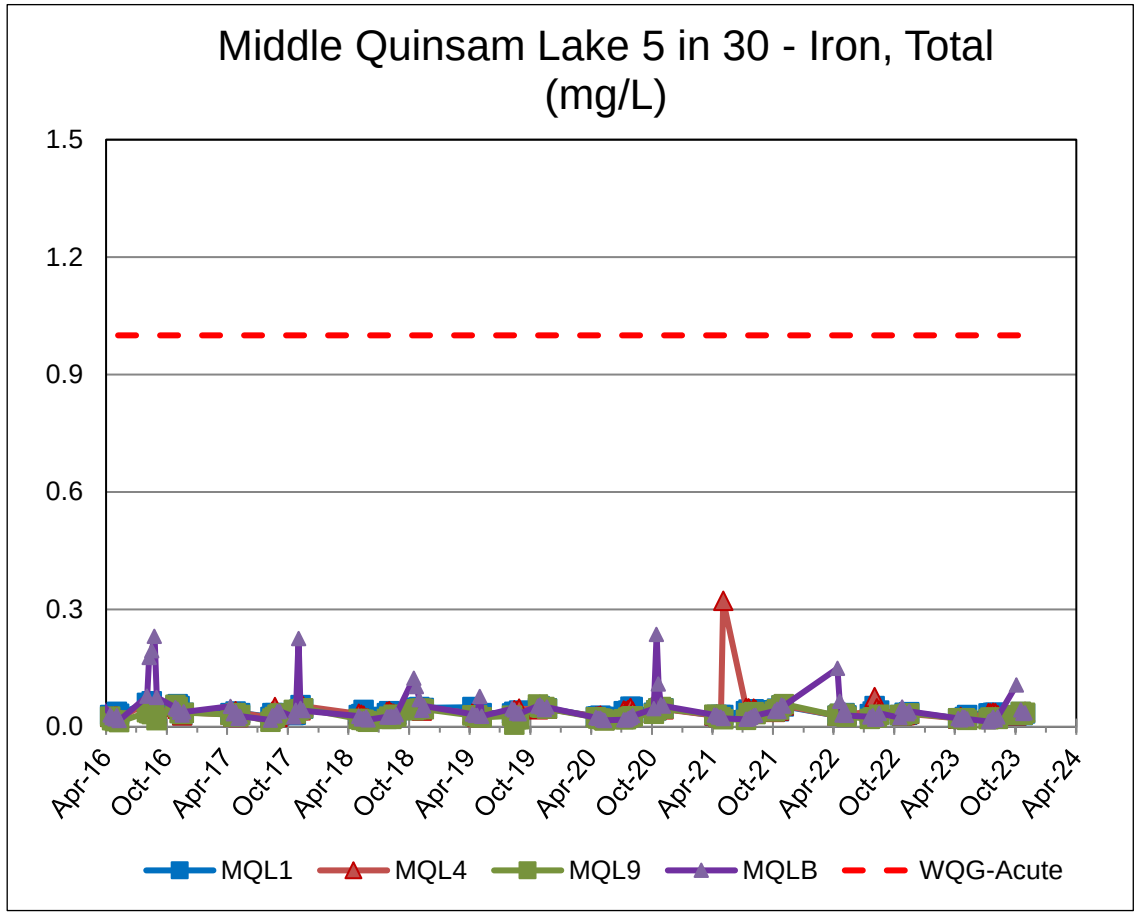

Middle Quinsam Lake Depth Profiling - Summer 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
MQL1
MQL2
MQL3
MQL4
MQL5
MQL6
MQL7
MQL8
MQL9
MQL10
MQL11
MQL12
MQLB
WEEK 1
WEEK 2
WEEK 3
WEEK 4
WEEK 5
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC

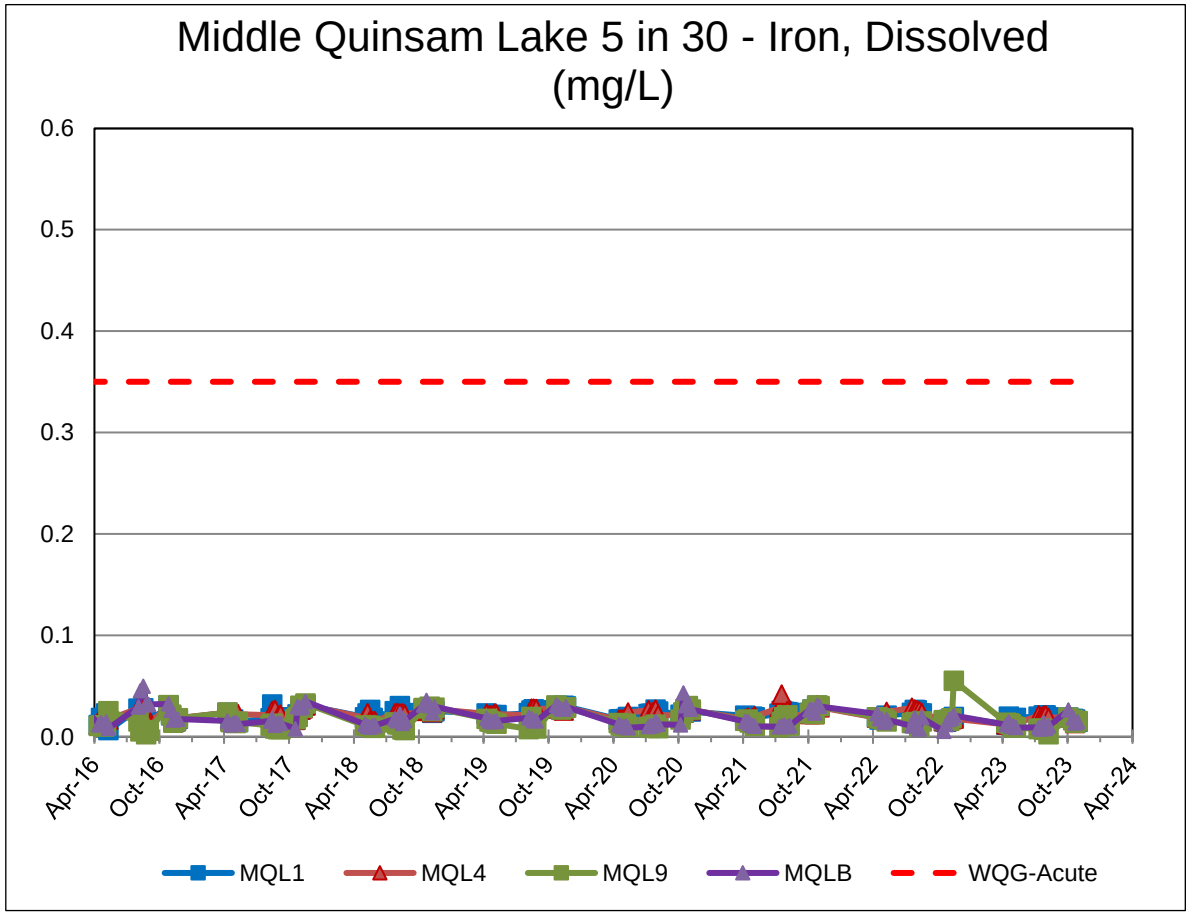

Middle Quinsam Lake Depth Profiling - Fall 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
MQL1
MQL2
MQL3
MQL4
MQL5
MQL6
MQL7
MQL8
MQL9
MQL10
MQL11
MQL12
MQLB
WEEK 1
WEEK 2
WEEK 3
WEEK 4
WEEK 5
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC

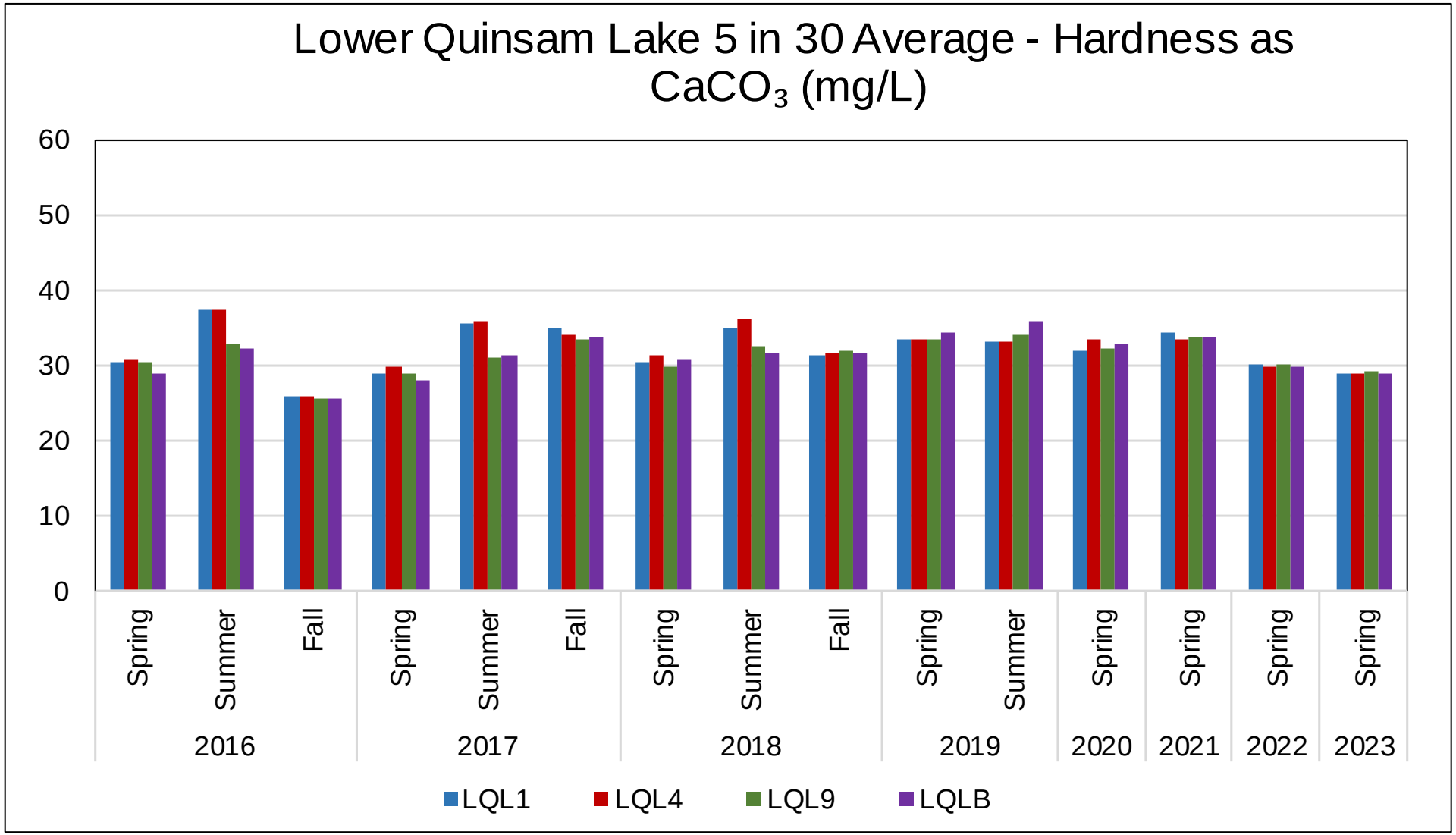

Middle Quinsam Lake 5 in 30 - Manganese, Total (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
MQL1
MQL4
MQL9
MQLB
WQG-Acute

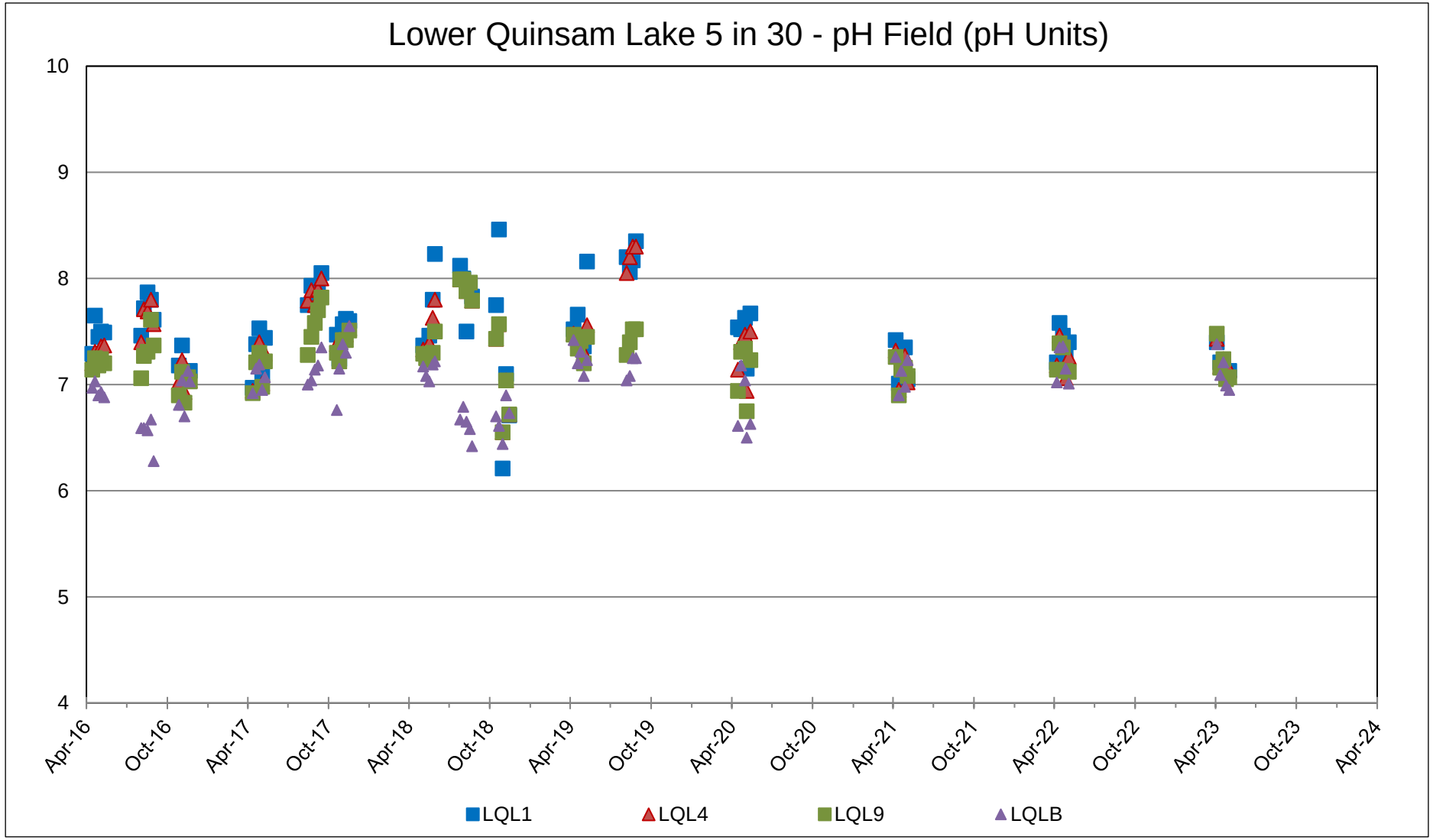

Middle Quinsam Lake 5 in 30 Average -Total Manganese (mg/L)
1
0.8
0.6
0.4
0.2
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
MQL1
MQL4
MQL9
MQLB
WQG - Chronic

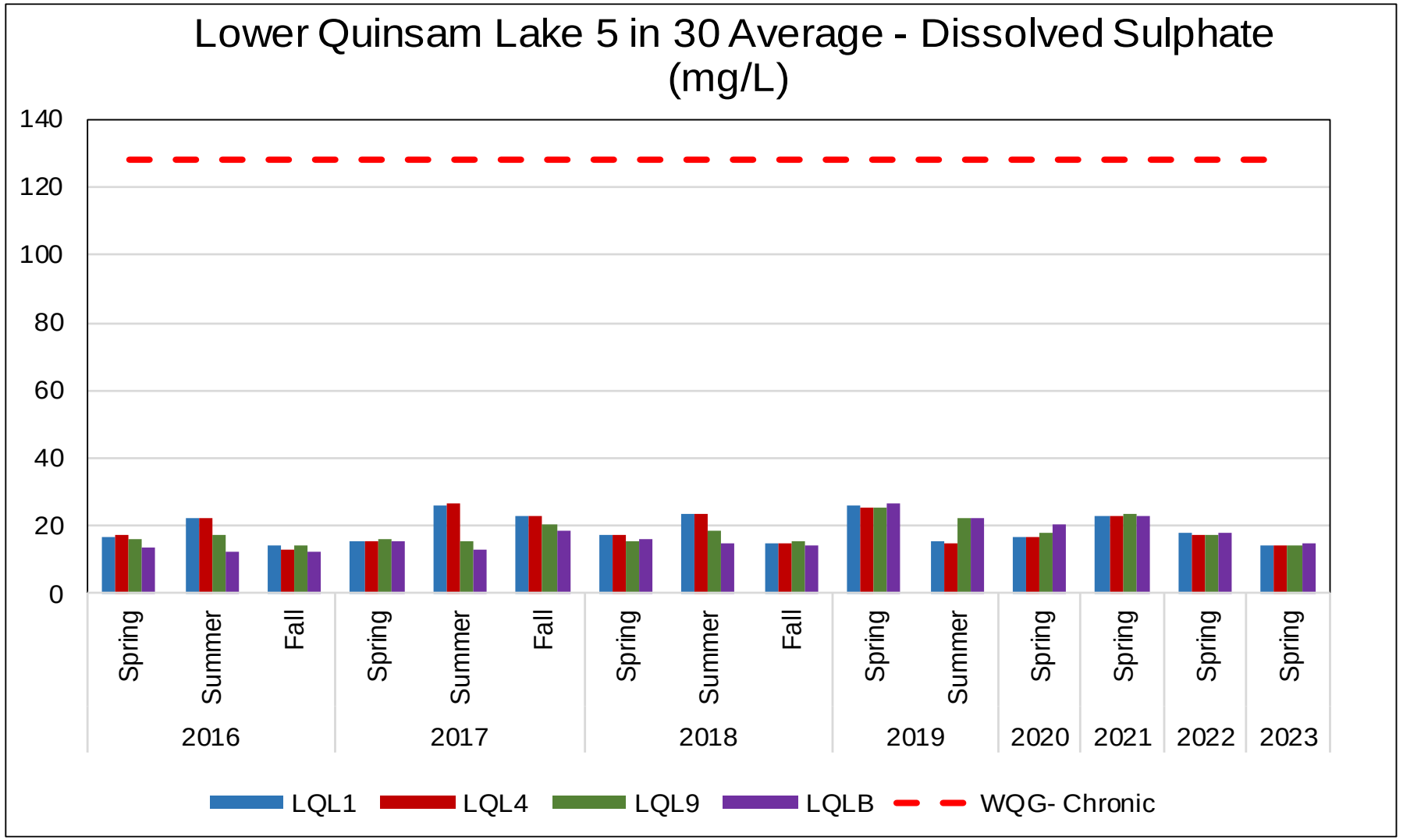

Middle Quinsam Lake 5 in 30 Average -Total Arsenic (mg/L)
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
WQG- Chronic: 0.005 mg/L
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
MQL1
MQL4
MQL9
MQLB

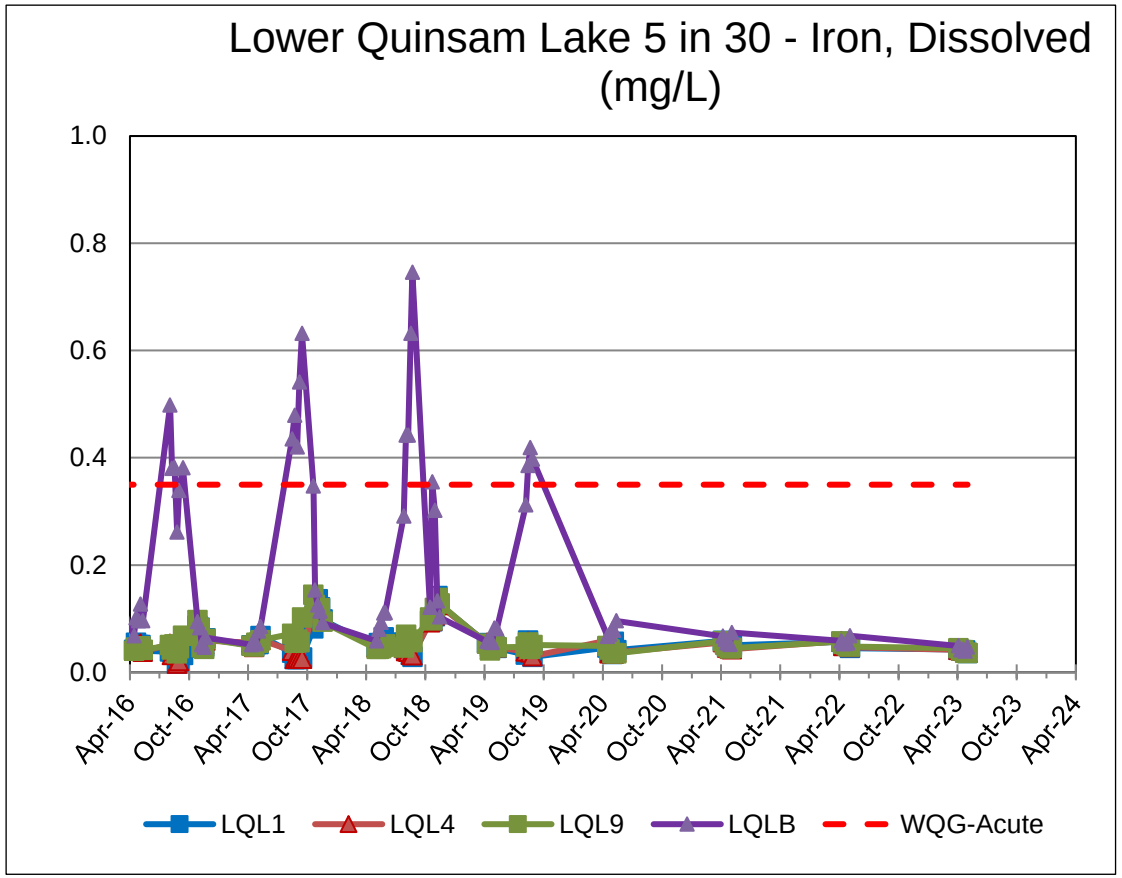

Middle Quinsam Lake 5 in 30 - Iron, Total (mg/L)
1.5
1.2
0.9
0.6
0.3
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
MQL1
MQL4
MQL9
MQLB
WQG-Acute

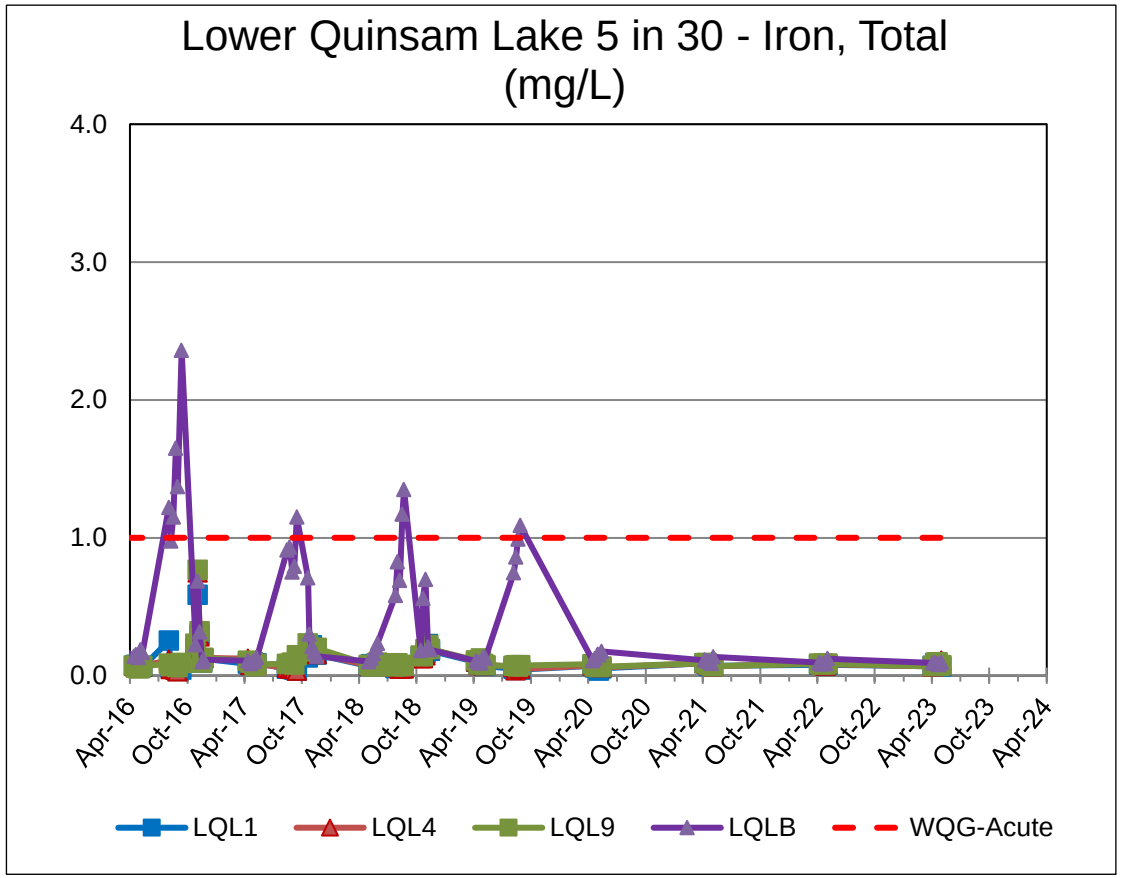

Middle Quinsam Lake 5 in 30 - Iron, Dissolved (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
MQL1
MQL4
MQL9
MQLB
WQG-Acute

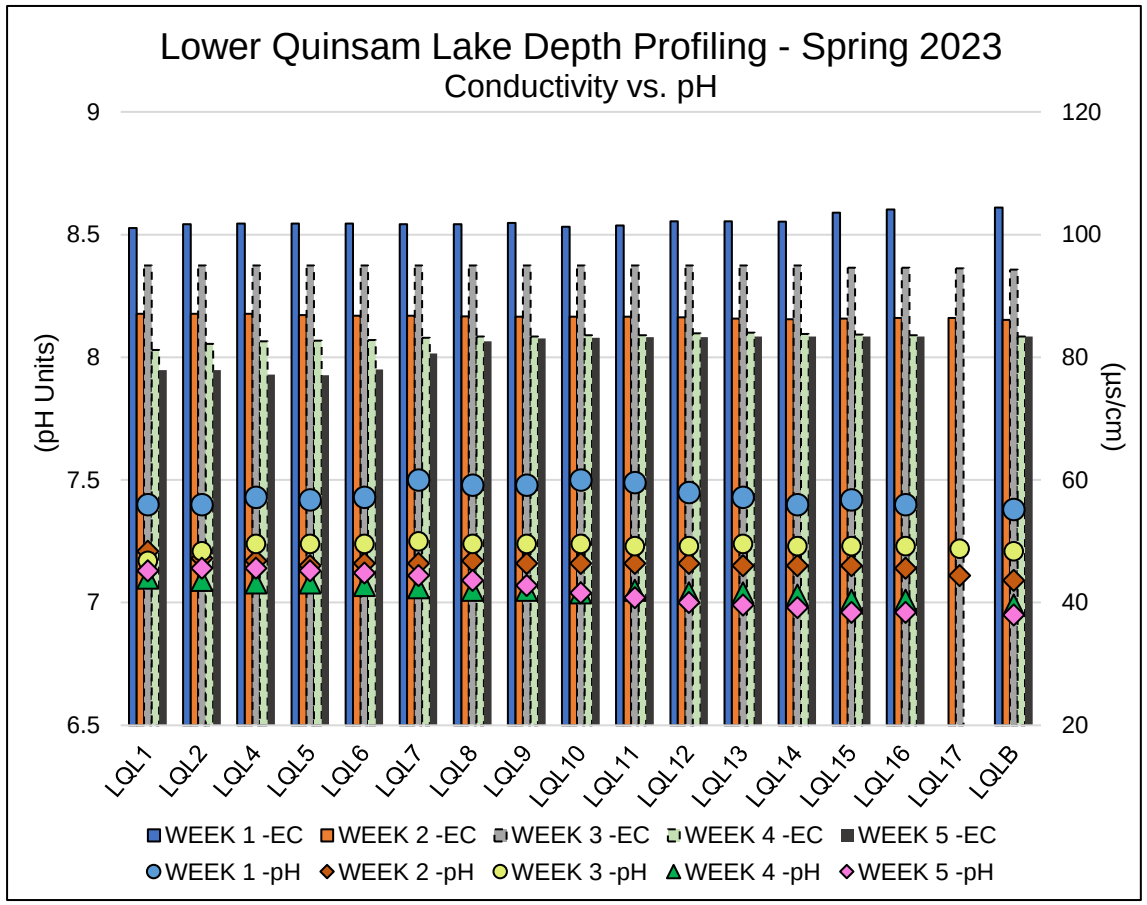

Lower Quinsam Lake 5 in 30 Average - Hardness as $CaCO_3$ (mg/L)
60
50
40
30
20
10
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
LQL1
LQL4
LQL9
LQLB

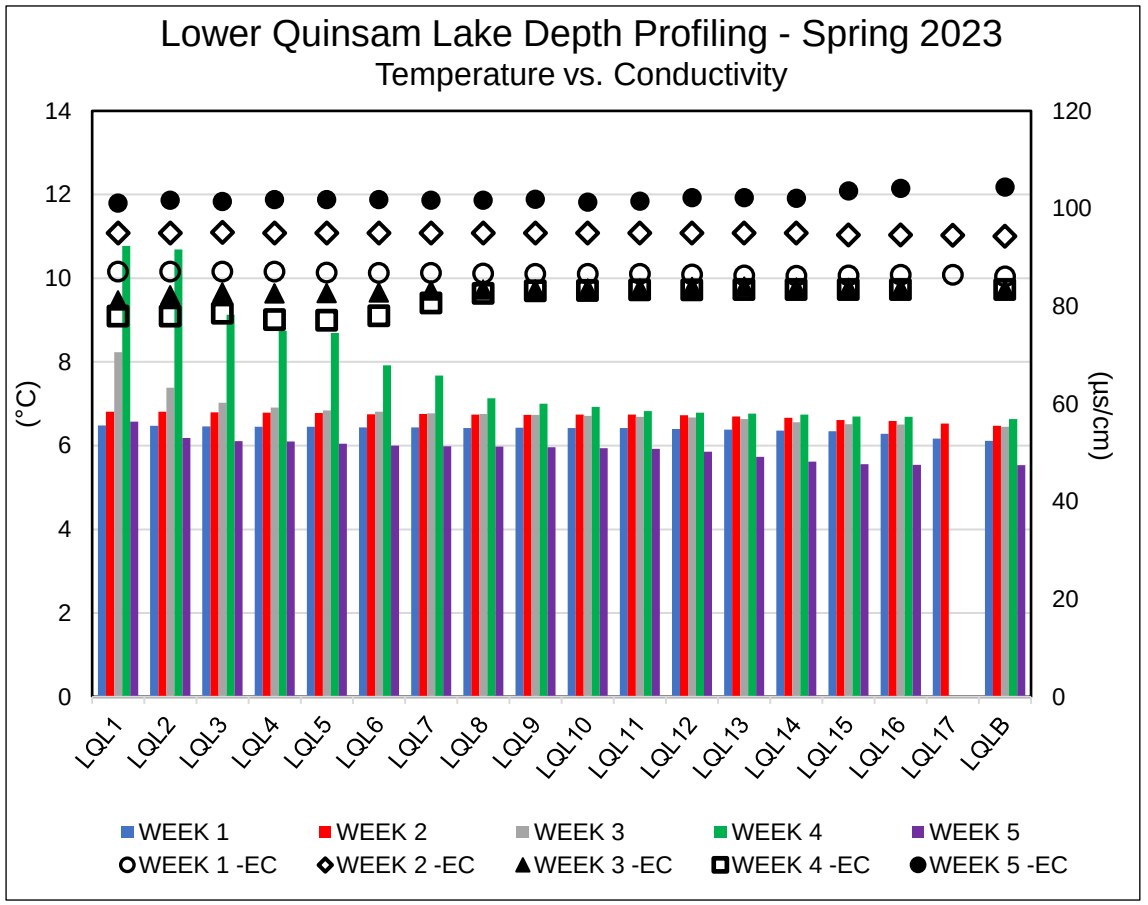

Lower Quinsam Lake 5 in 30 - pH Field (pH Units)
10
9
8
7
6
5
4
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LQL1
LQL4
LQL9
LQLB

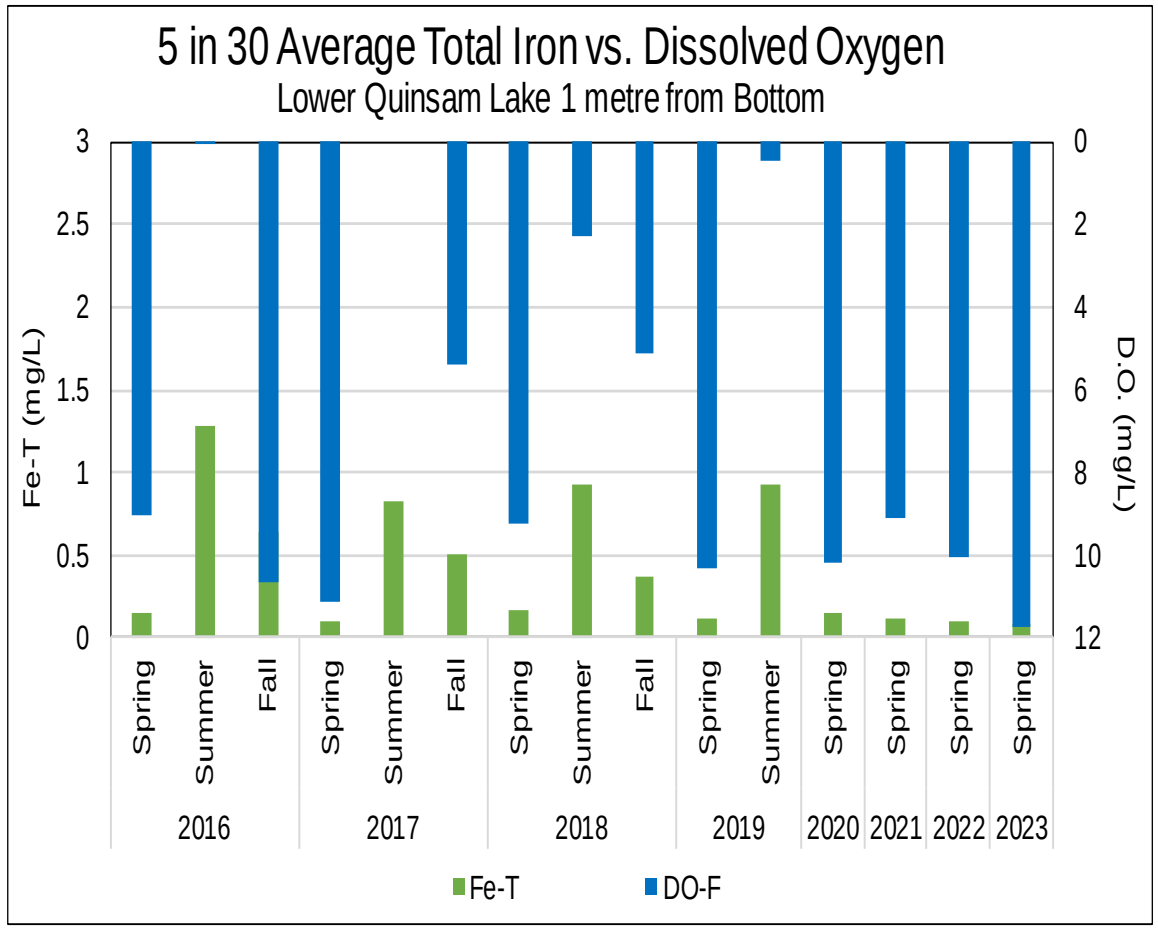

Lower Quinsam Lake 5 in 30 Average - Dissolved Sulphate (mg/L)
140
120
100
80
60
40
20
0
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
LQL1
LQL4
LQL9
LQLB
WQG- Chronic

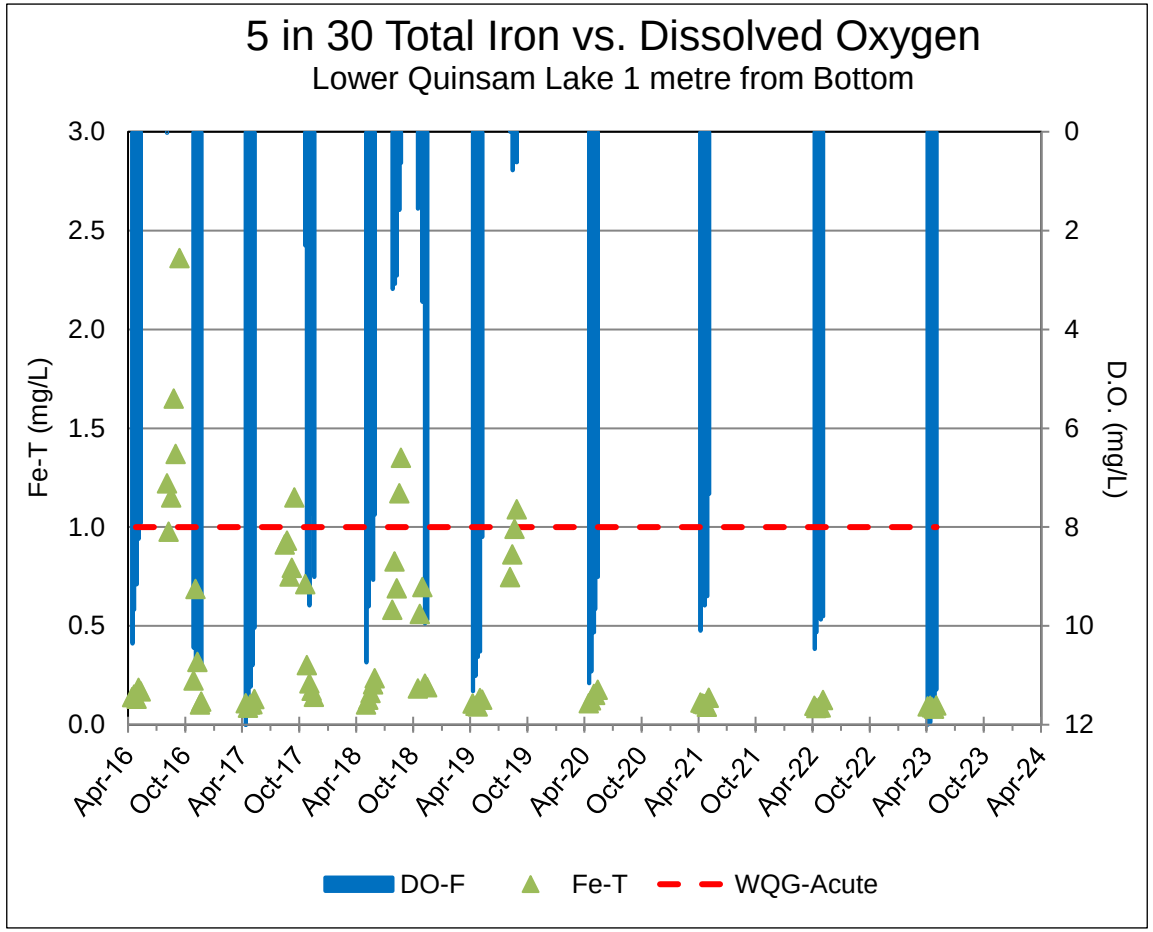

Lower Quinsam Lake 5 in 30 - Iron, Dissolved (mg/L)
1.0
0.8
0.6
0.4
0.2
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LQL1
LQL4
LQL9
LQLB
WQG-Acute

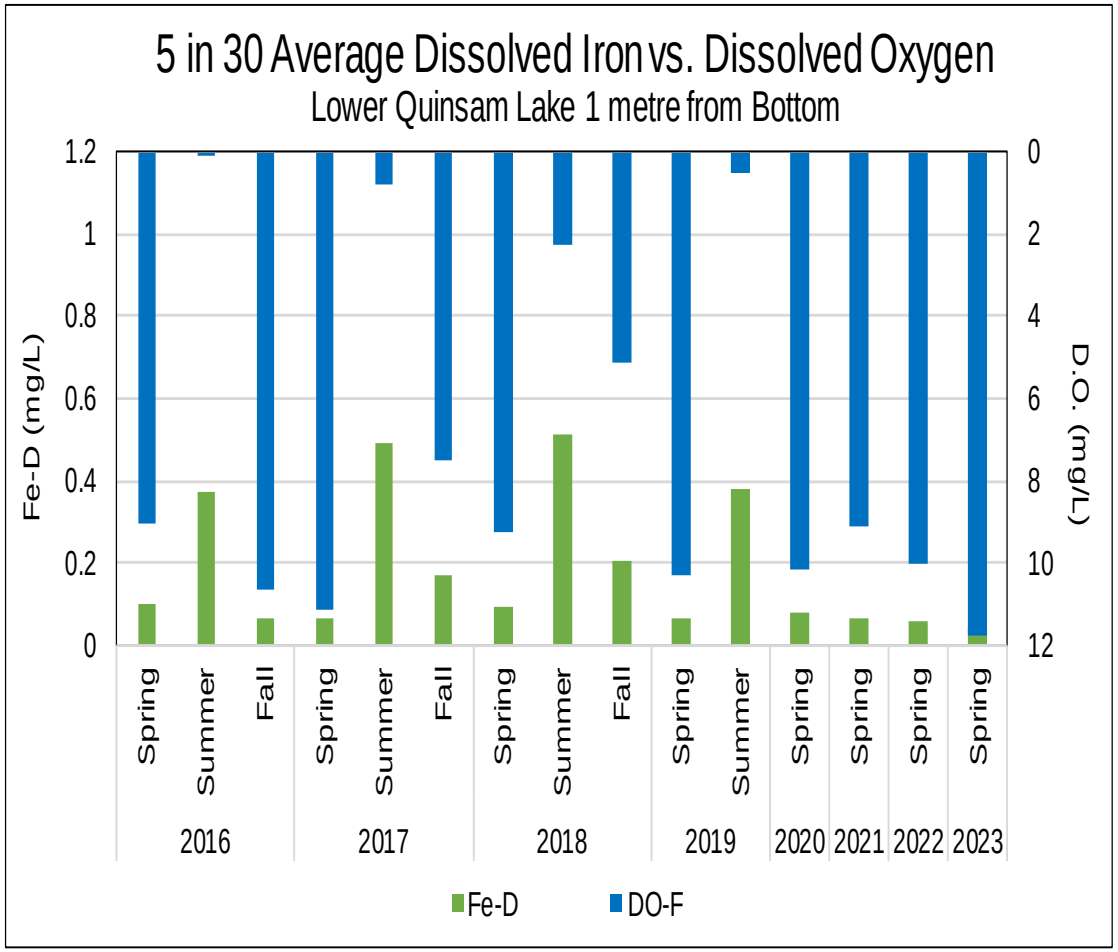

Lower Quinsam Lake 5 in 30 - Iron, Total (mg/L)
4.0
3.0
2.0
1.0
0.0
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
LQL1
LQL4
LQL9
LQLB
WQG-Acute

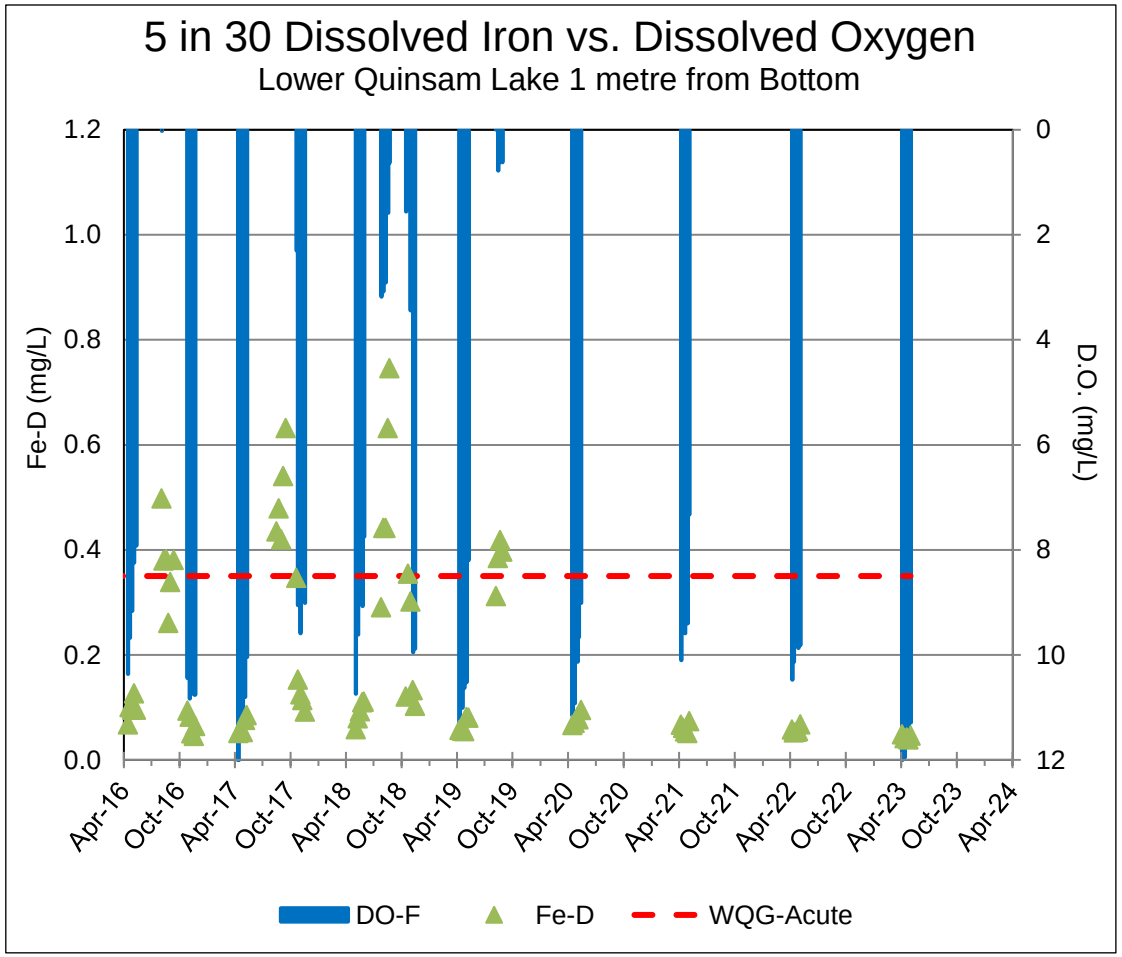

Lower Quinsam Lake Depth Profiling - Spring 2023
Conductivity vs. pH
(pH Units)
(µs/cm)
9
8.5
8
7.5
7
6.5
120
100
80
60
40
20
LQL1
LQL2
LQL4
LQL5
LQL6
LQL7
LQL8
LQL9
LQL10
LQL11
LQL12
LQL13
LQL14
LQL15
LQL16
LQL17
LQLB
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC
WEEK 1 -pH
WEEK 2 -pH
WEEK 3 -pH
WEEK 4 -pH
WEEK 5 -pH

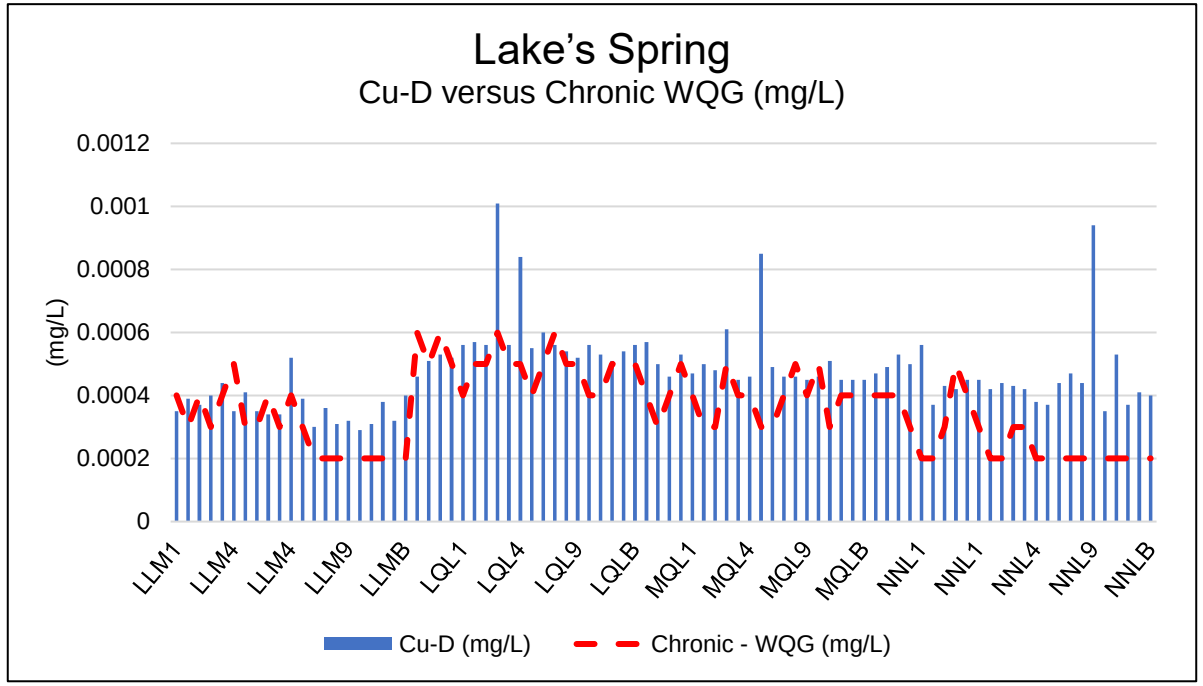

Lower Quinsam Lake Depth Profiling - Spring 2023
Temperature vs. Conductivity
(°C)
(µs/cm)
14
12
10
8
6
4
2
0
120
100
80
60
40
20
0
LQL1
LQL2
LQL3
LQL4
LQL5
LQL6
LQL7
LQL8
LQL9
LQL10
LQL11
LQL12
LQL13
LQL14
LQL15
LQL16
LQL17
LQLB
WEEK 1
WEEK 2
WEEK 3
WEEK 4
WEEK 5
WEEK 1 -EC
WEEK 2 -EC
WEEK 3 -EC
WEEK 4 -EC
WEEK 5 -EC

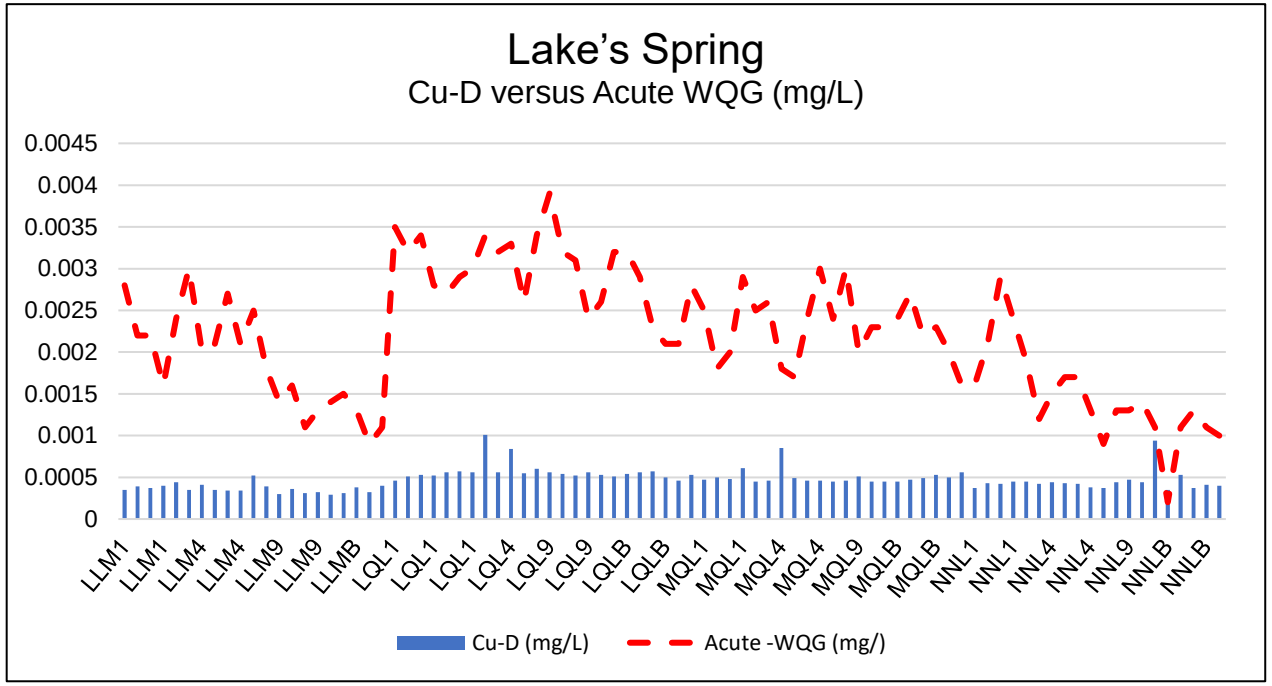

5 in 30 Average Total Iron vs. Dissolved Oxygen
Lower Quinsam Lake 1 metre from Bottom
Fe-T (mg/L)
D.O. (mg/L)
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
10
12
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
Fe-T
DO-F

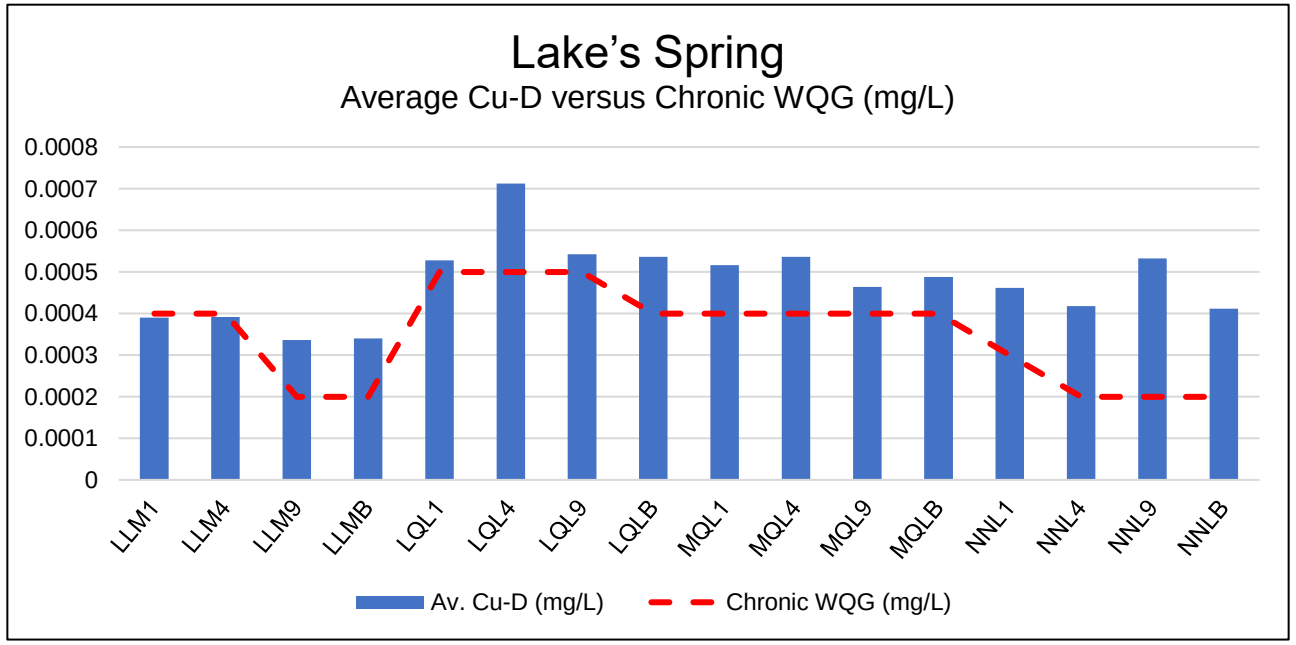

5 in 30 Total Iron vs. Dissolved Oxygen
Lower Quinsam Lake 1 metre from Bottom
Fe-T (mg/L)
D.O. (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
DO-F
Fe-T
WQG-Acute

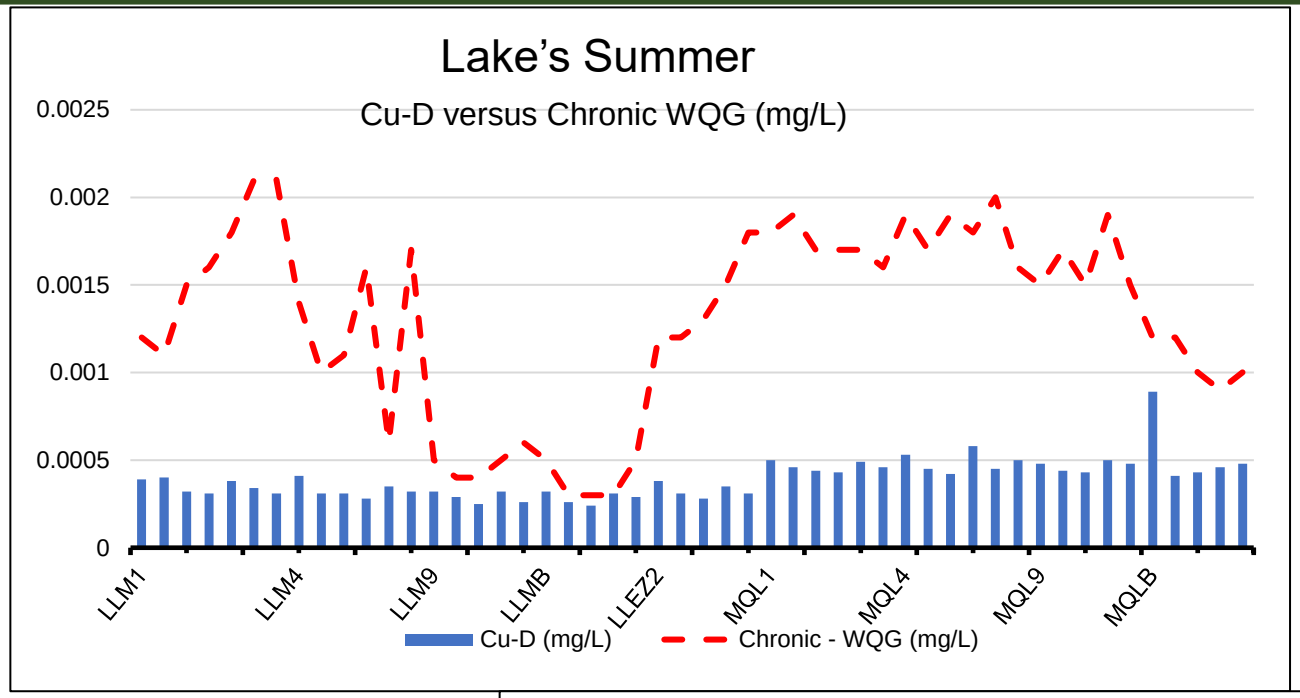

5 in 30 Average Dissolved Iron vs. Dissolved Oxygen
Lower Quinsam Lake 1 metre from Bottom
Fe-D (mg/L)
D.O. (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
Fe-D
DO-F

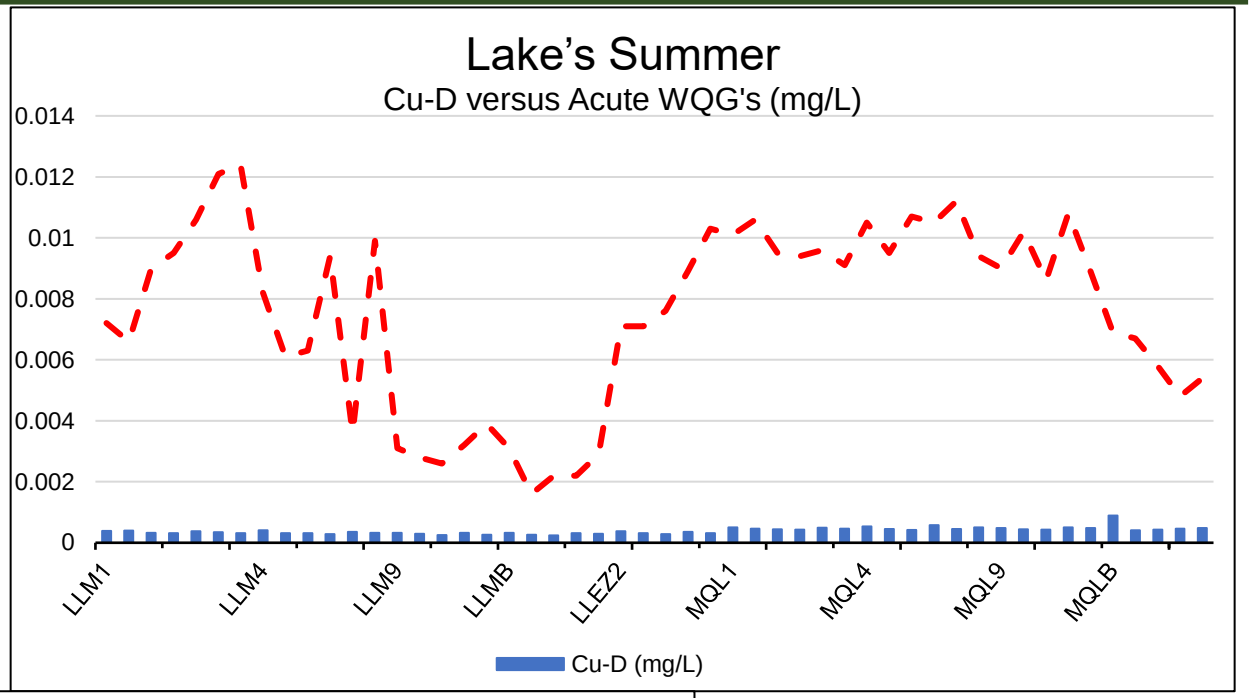

5 in 30 Dissolved Iron vs. Dissolved Oxygen
Lower Quinsam Lake 1 metre from Bottom
Fe-D (mg/L)
D.O. (mg/L)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10
12
Apr-16
Oct-16
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
DO-F
Fe-D
WQG-Acute

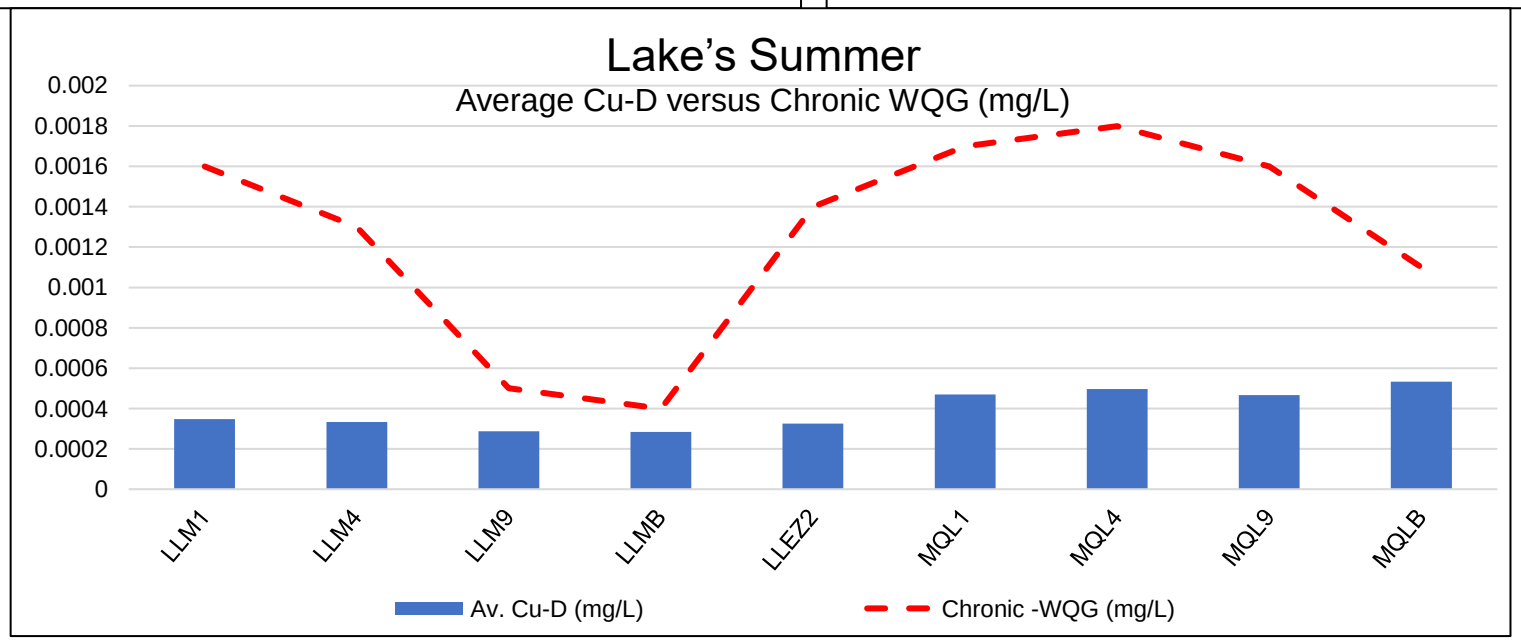

Lake's Spring
Cu-D versus Chronic WQG (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
(mg/L)
LLM1 LLM4 LLM4 LLM9 LLMB LQL1 LQL4 LQL9 LQLB MQL1 MQL4 MQL9 MQLB NNL1 NNL1 NNL4 NNL9 NNLB
Cu-D (mg/L)
Chronic - WQG (mg/L)

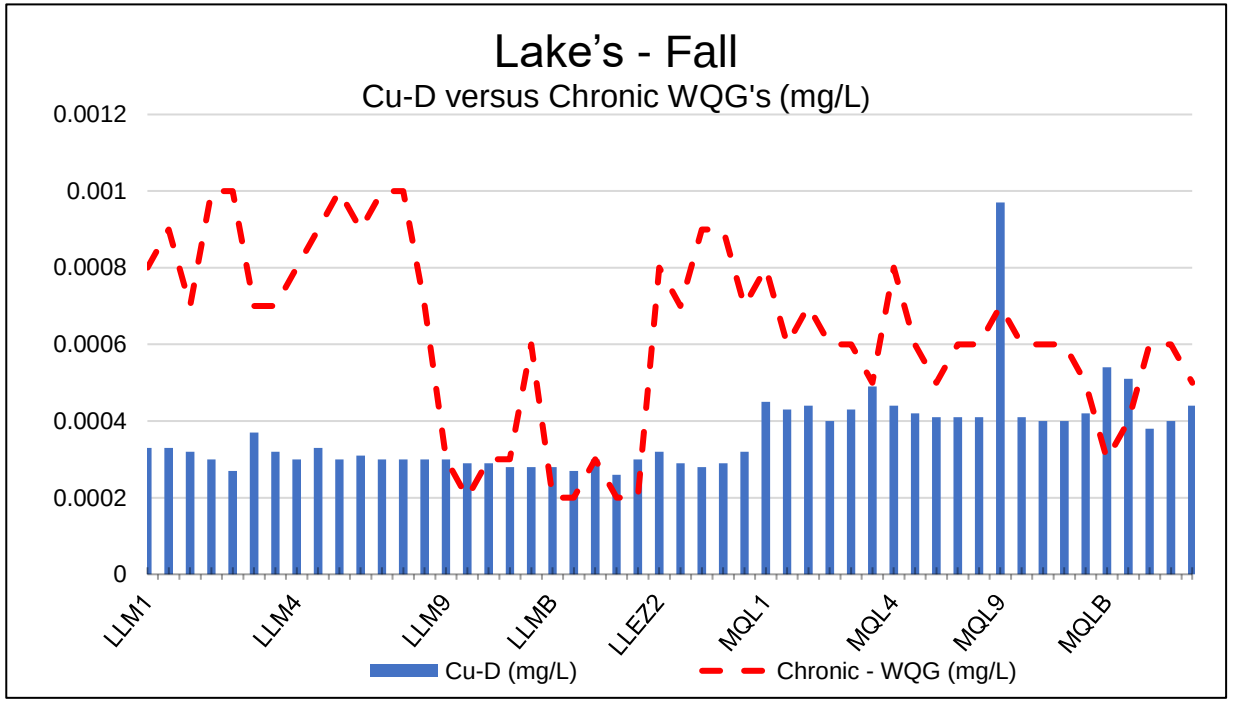

Lake's Spring
Cu-D versus Acute WQG (mg/L)
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
LLM1 LLM1 LLM4 LLM4 LLM9 LLM9 LLMB LQL1 LQL1 LQL1 LQL4 LQL9 LQL9 LQLB LQLB MQL1 MQL1 MQL4 MQL4 MQL9 MQLB MQLB NNL1 NNL1 NNL4 NNL4 NNL9 NNLB NNLB
Cu-D (mg/L)
Acute -WQG (mg/)

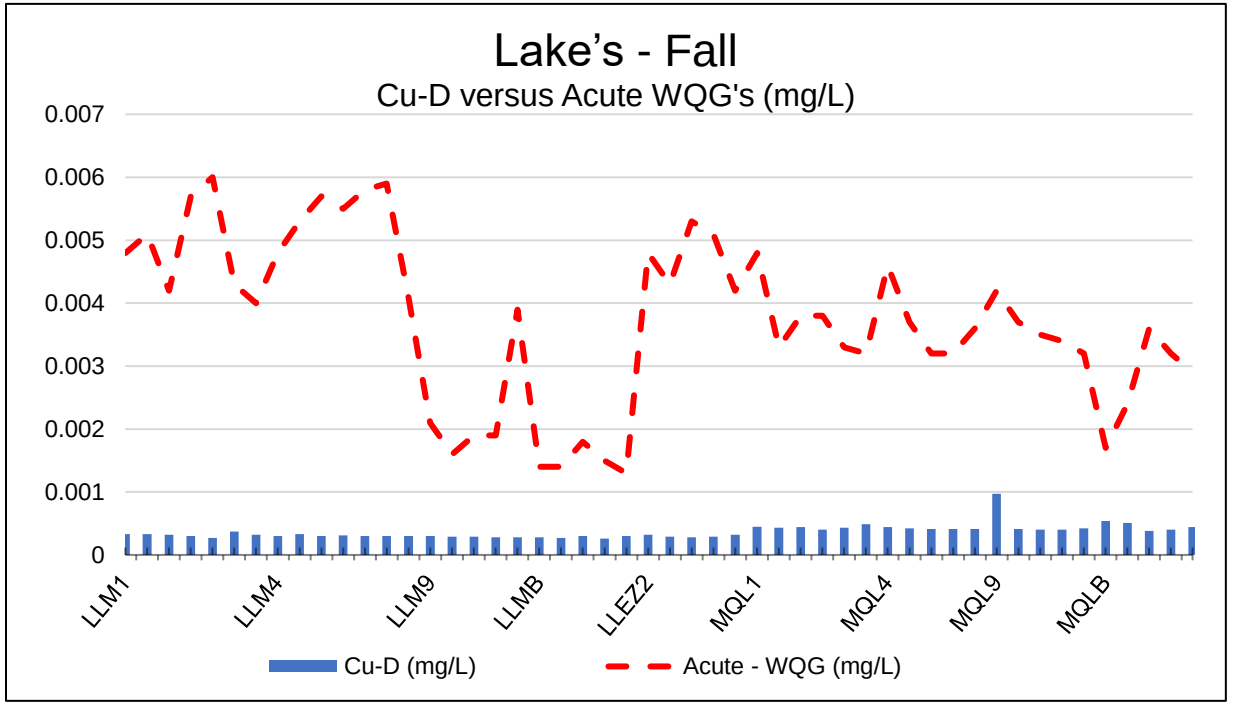

Lake's Spring
Average Cu-D versus Chronic WQG (mg/L)
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
LLM1 LLM4 LLM9 LLMB LQL1 LQL4 LQL9 LQLB MQL1 MQL4 MQL9 MQLB NNL1 NNL4 NNL9 NNLB
Av. Cu-D (mg/L)
Chronic WQG (mg/L)

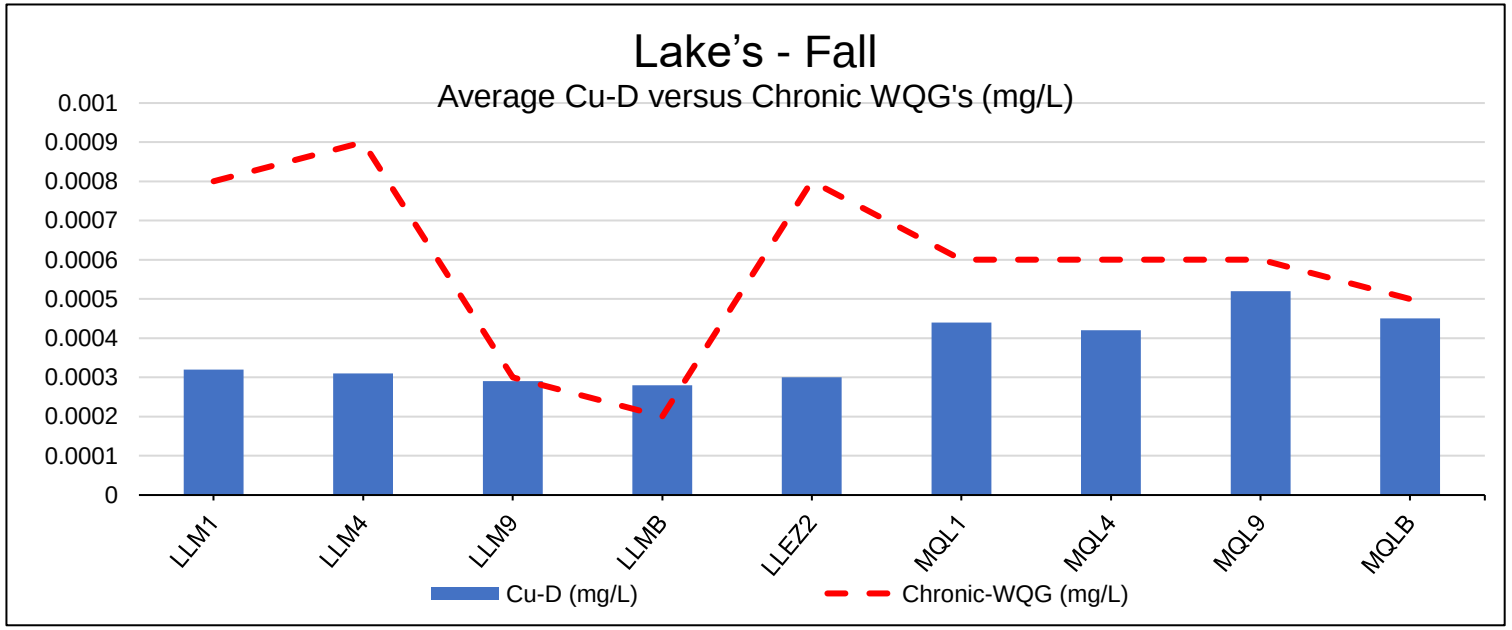

Lake's Summer
Cu-D versus Chronic WQG (mg/L)
0.0025
0.002
0.0015
0.001
0.0005
0
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
Cu-D (mg/L)
Chronic - WQG (mg/L)

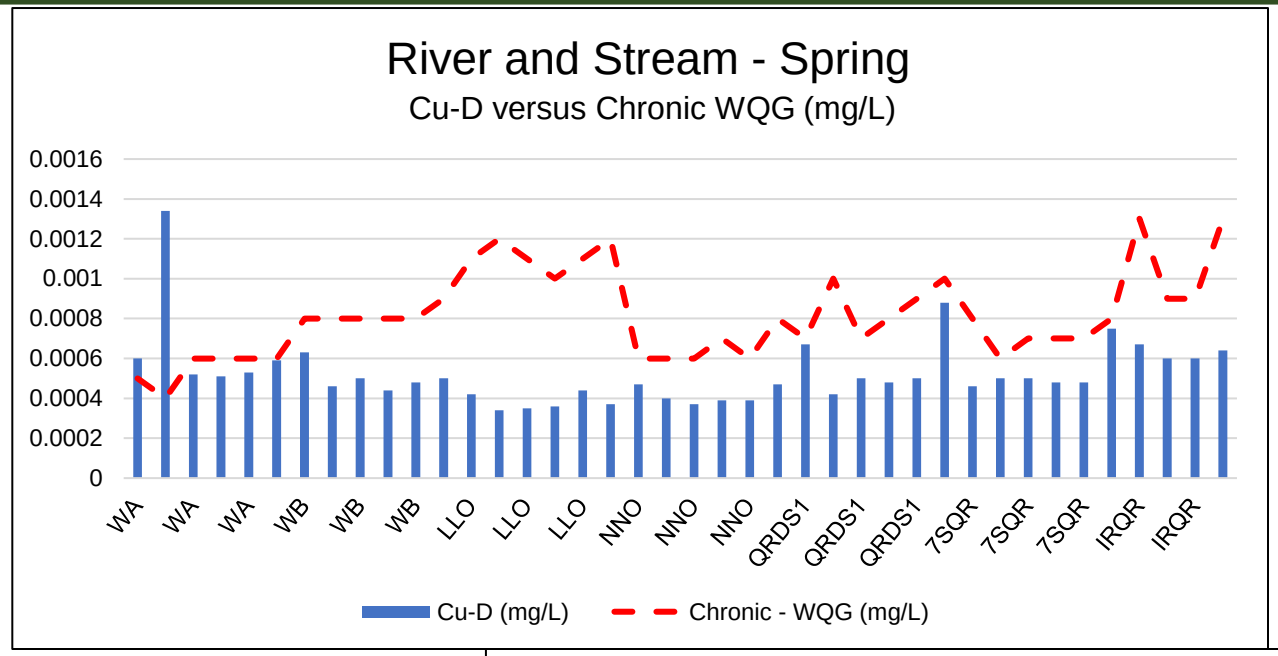

Lake's Summer
Cu-D versus Acute WQG's (mg/L)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
Cu-D (mg/L)

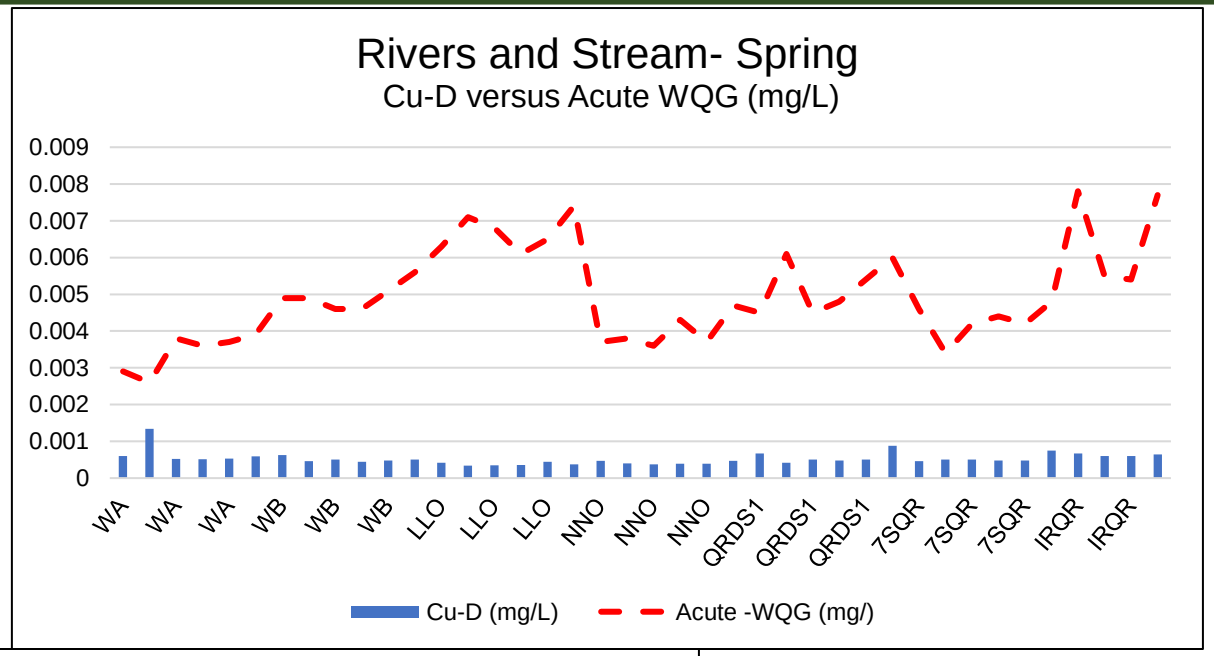

Lake's Summer
Average Cu-D versus Chronic WQG (mg/L)
0.002
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
Av. Cu-D (mg/L)
Chronic -WQG (mg/L)

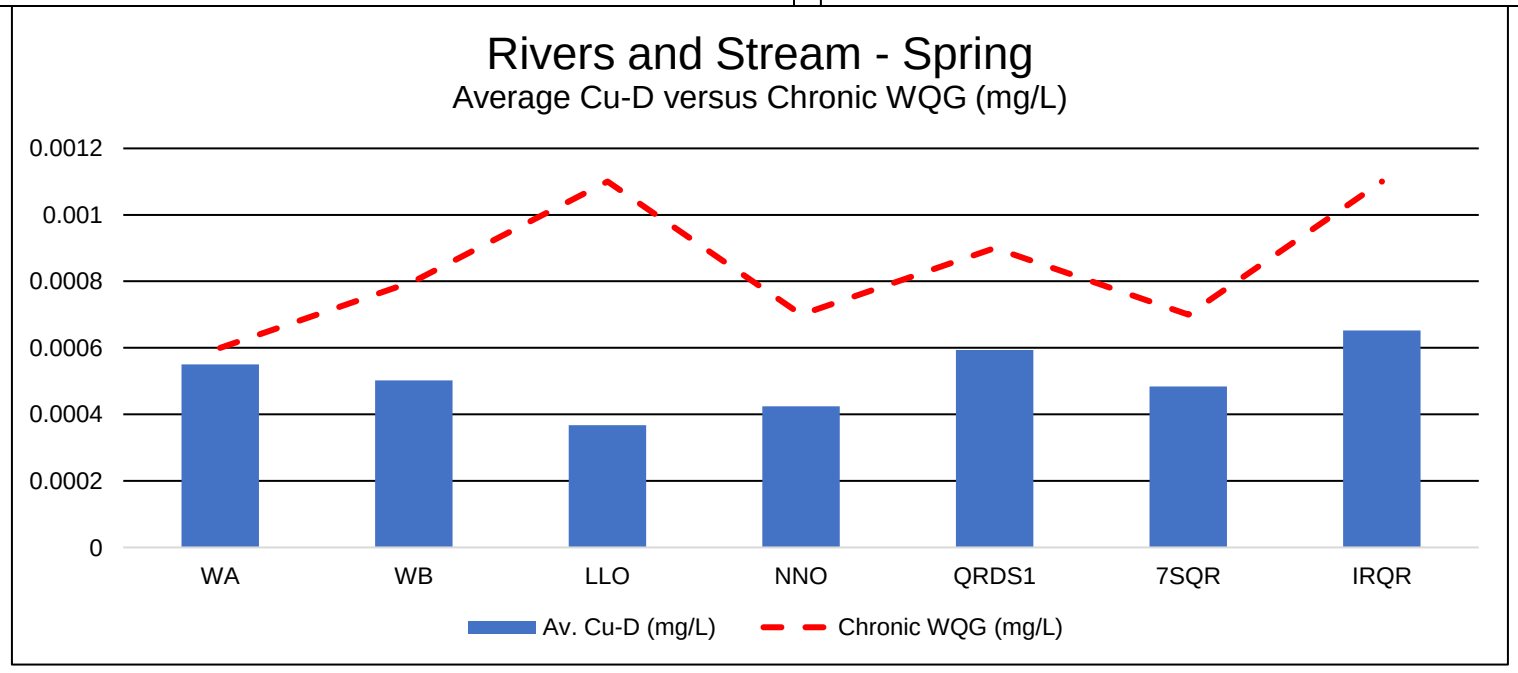

Lake's - Fall
Cu-D versus Chronic WQG's (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
Cu-D (mg/L)
Chronic - WQG (mg/L)

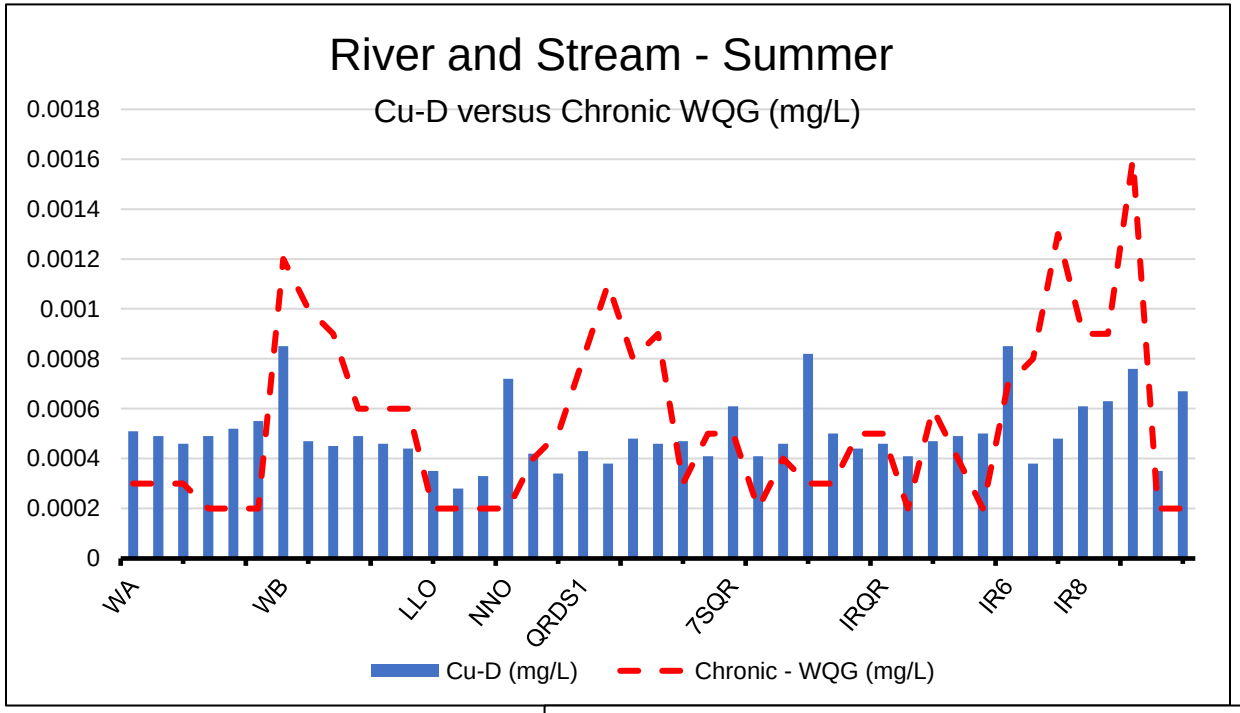

Lake's - Fall
Cu-D versus Acute WQG's (mg/L)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
Cu-D (mg/L)
Acute - WQG (mg/L)

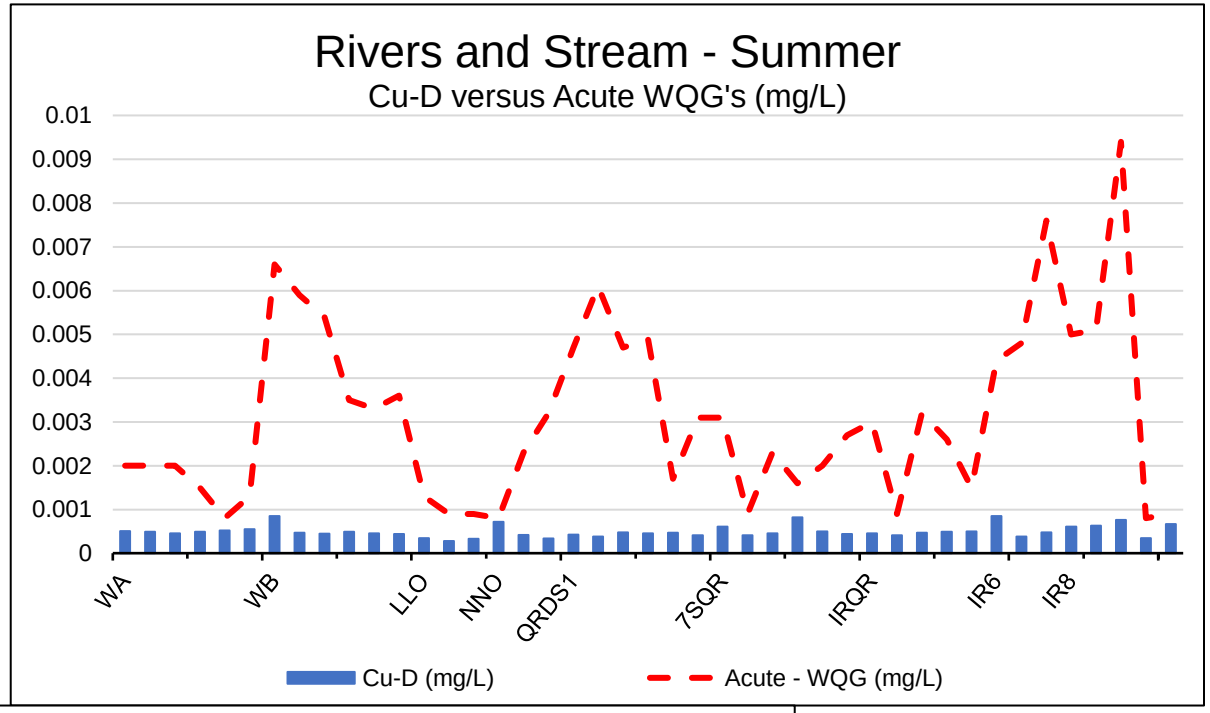

Lake's - Fall
Average Cu-D versus Chronic WQG's (mg/L)
0.001
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
Cu-D (mg/L)
Chronic-WQG (mg/L)

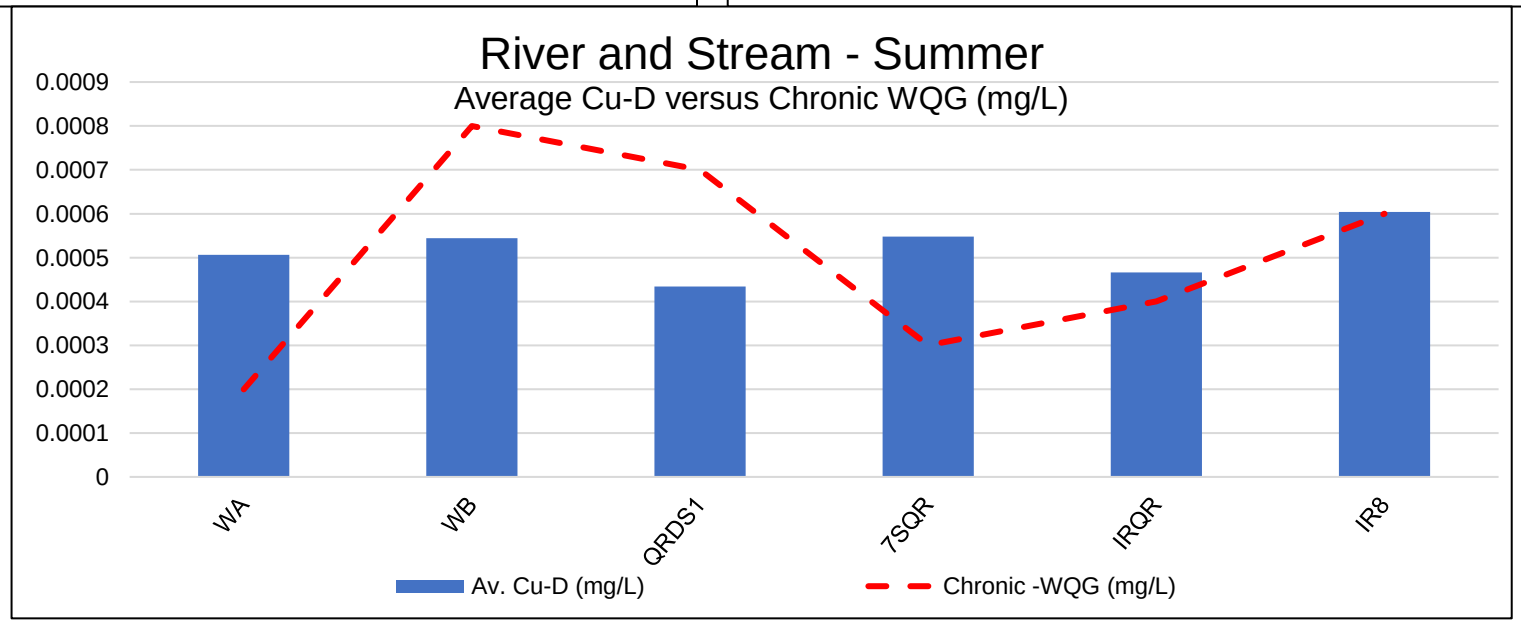

River and Stream - Spring
Cu-D versus Chronic WQG (mg/L)
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
WA WA WA WB WB WB LLO LLO LLO NNO NNO NNO QRDS1 QRDS1 QRDS1 7SQR 7SQR 7SQR IRQR IRQR
Cu-D (mg/L)
Chronic - WQG (mg/L)

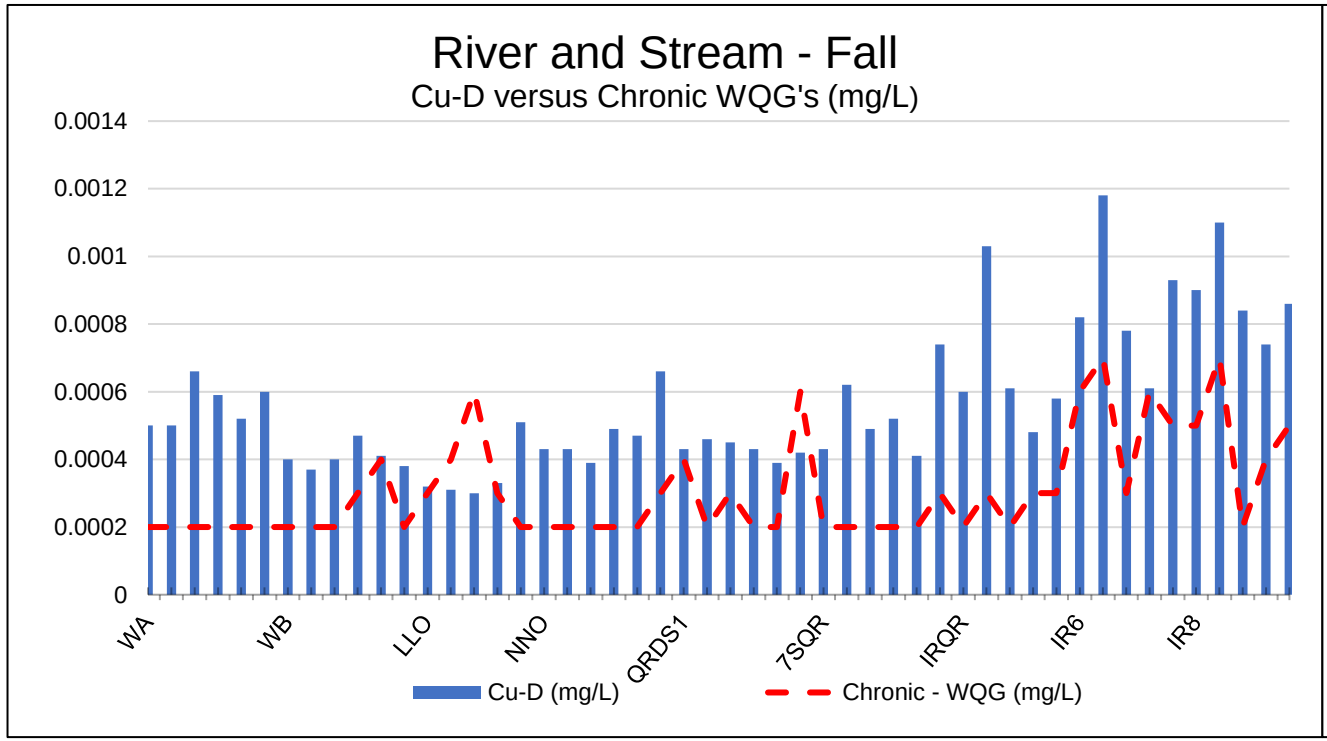

Rivers and Stream- Spring
Cu-D versus Acute WQG (mg/L)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
WA WA WA WB WB WB LLO LLO LLO NNO NNO NNO QRDS1 QRDS1 QRDS1 7SQR 7SQR 7SQR IRQR IRQR
Cu-D (mg/L)
Acute -WQG (mg/)

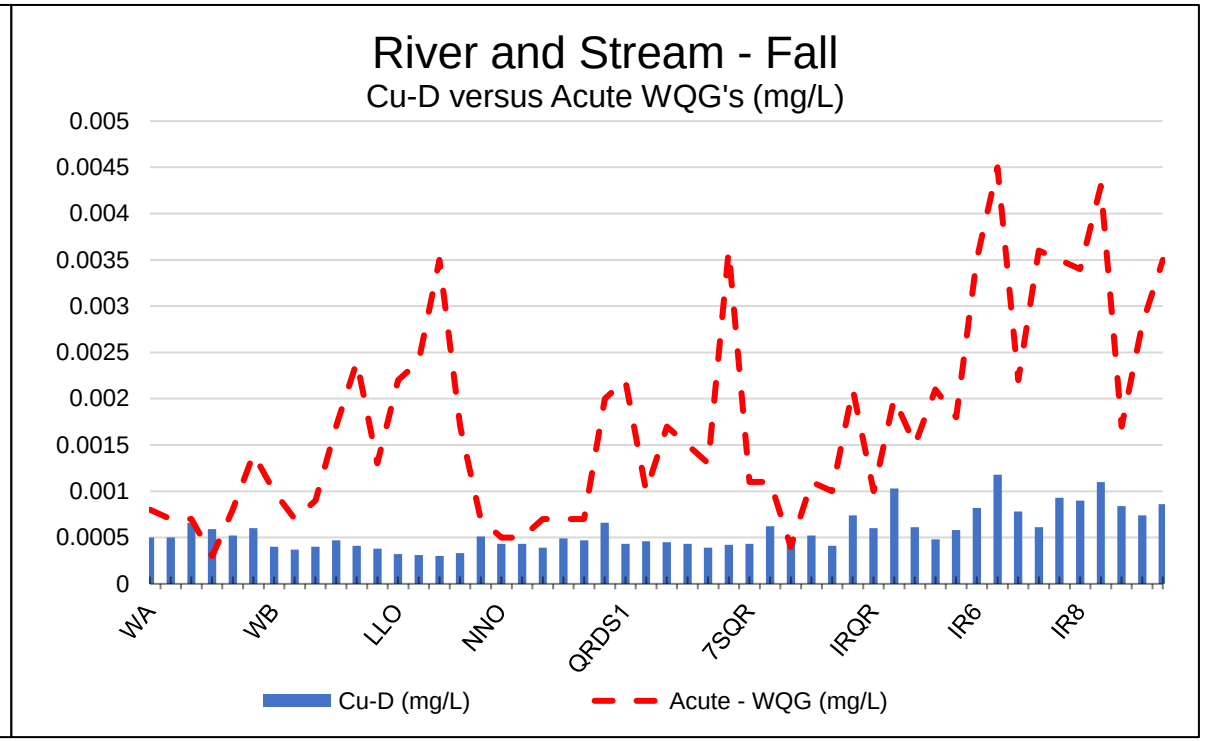

Rivers and Stream - Spring
Average Cu-D versus Chronic WQG (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
WA WB LLO NNO QRDS1 7SQR IRQR
Av. Cu-D (mg/L)
Chronic WQG (mg/L)

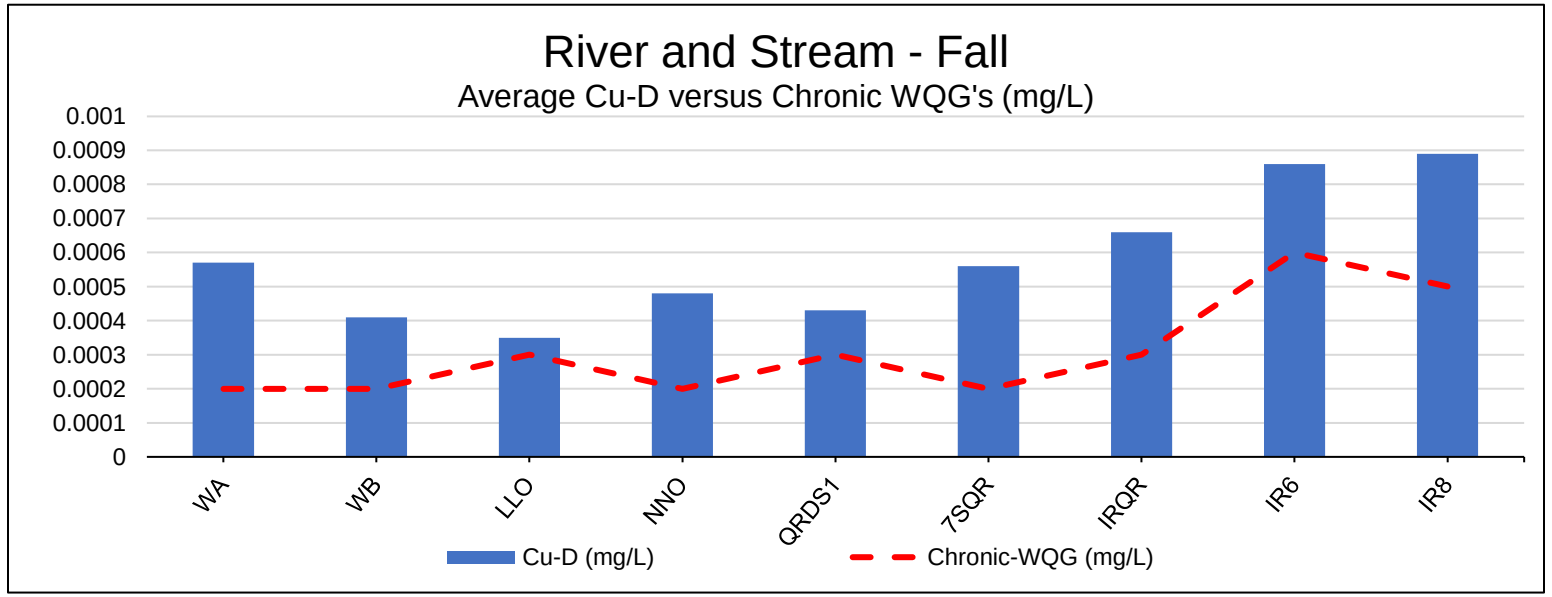

River and Stream - Summer
Cu-D versus Chronic WQG (mg/L)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
WA
WB
LLO
NNO
QRDS1
7SQR
IRQR
IR6
IR8
Cu-D (mg/L)
Chronic - WQG (mg/L)

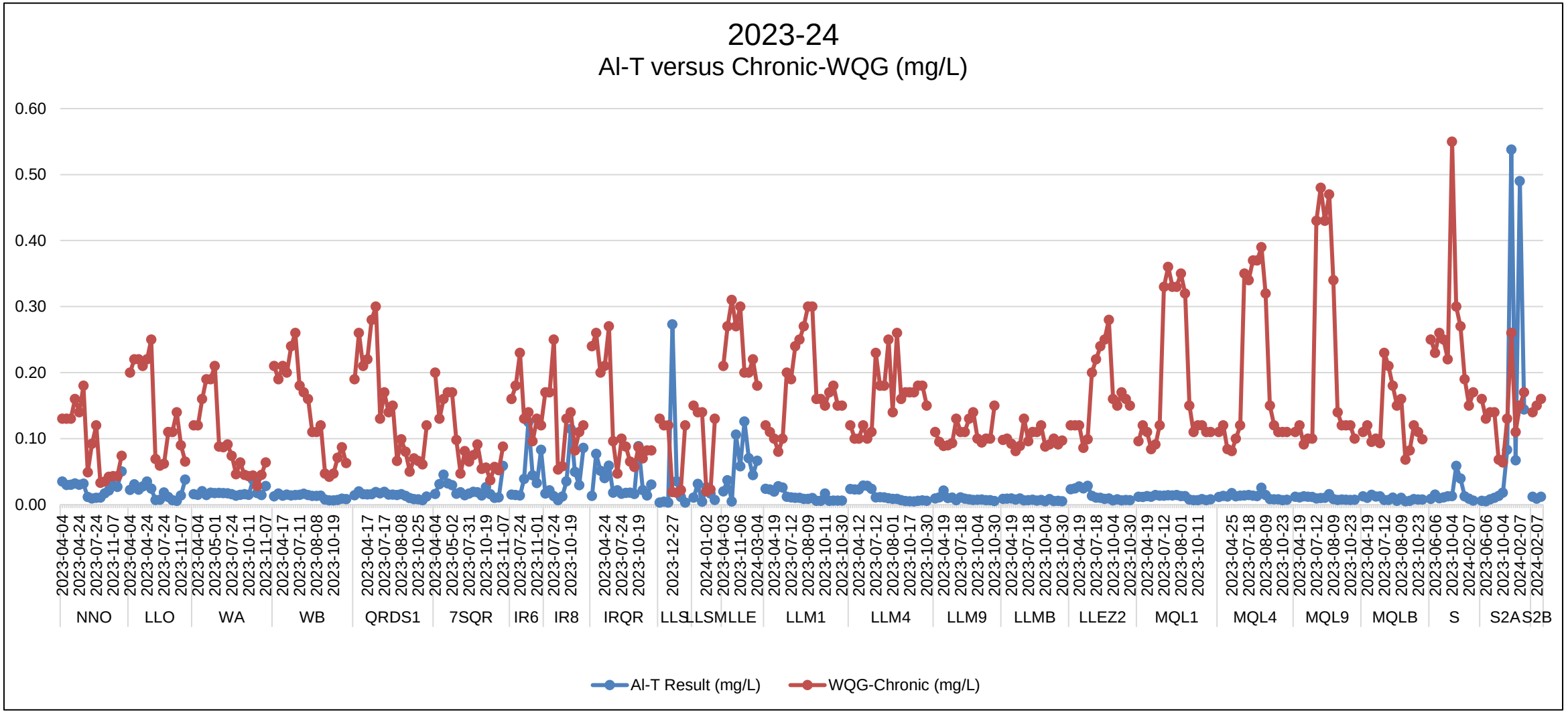

Rivers and Stream - Summer
Cu-D versus Acute WQG's (mg/L)
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
WA
WB
LLO
NNO
QRDS1
7SQR
IRQR
IR6
IR8
Cu-D (mg/L)
Acute - WQG (mg/L)

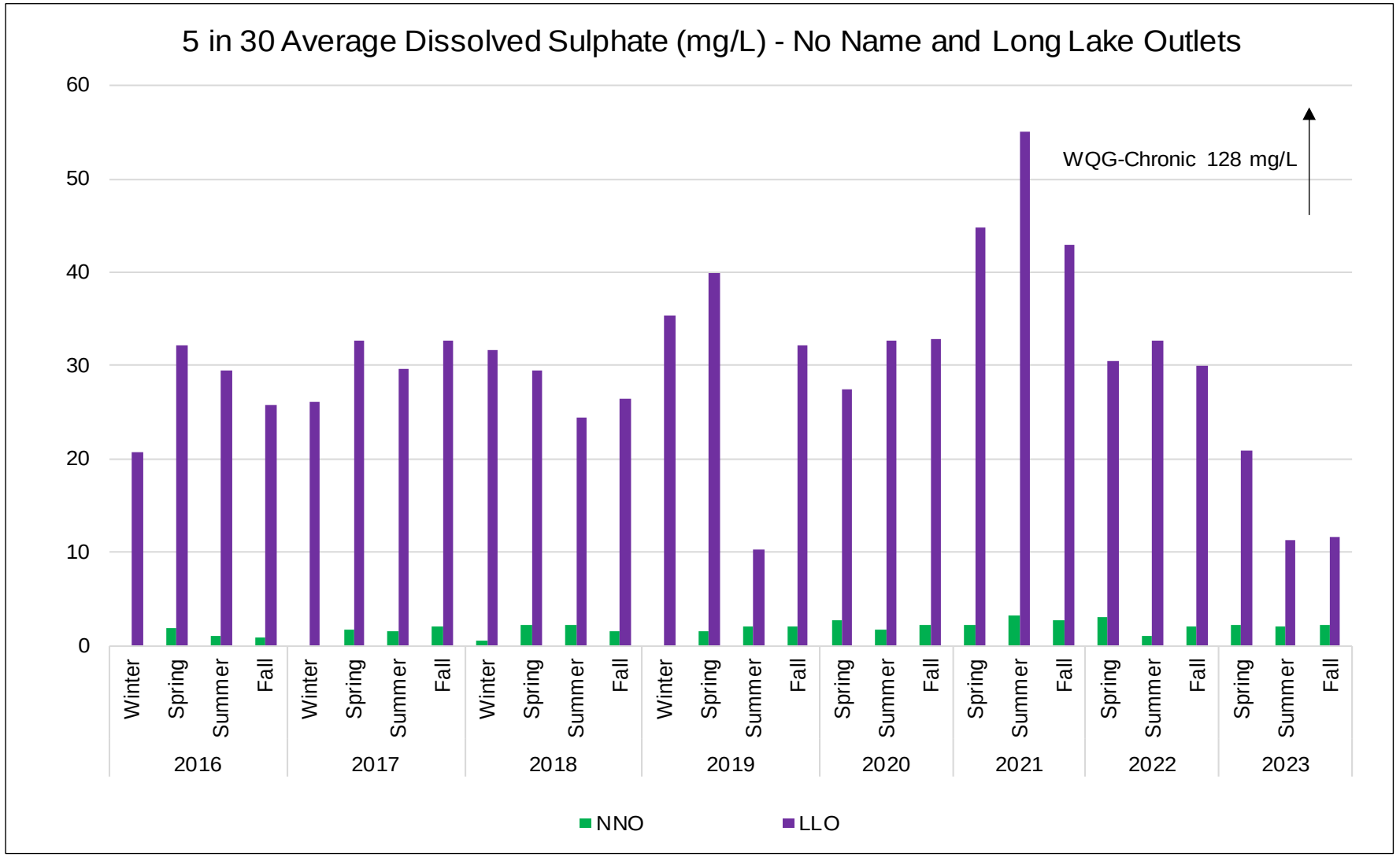

River and Stream - Summer
Average Cu-D versus Chronic WQG (mg/L)
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
WA
WB
QRDS1
7SQR
IRQR
IR8
Av. Cu-D (mg/L)
Chronic -WQG (mg/L)

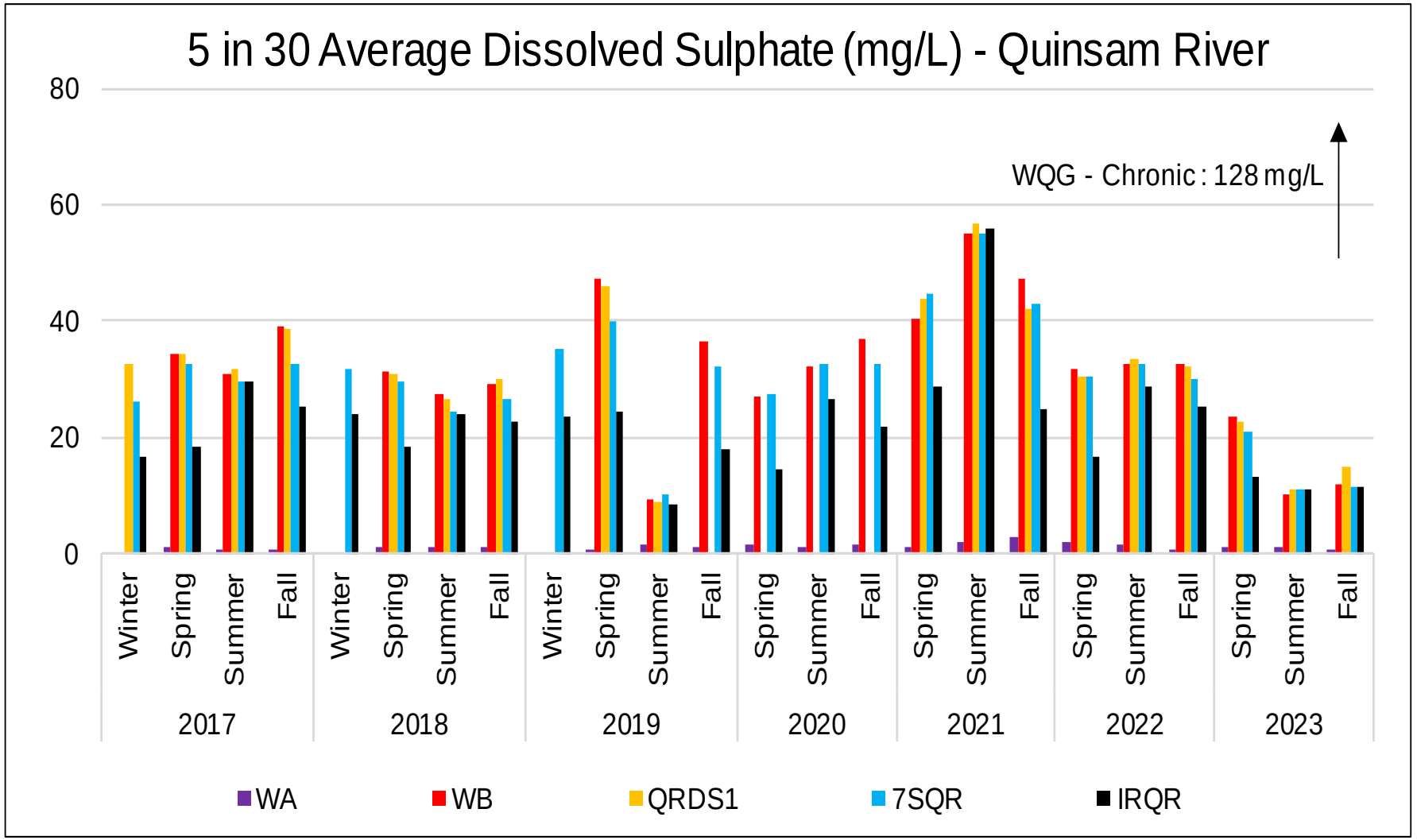

River and Stream - Fall
Cu-D versus Chronic WQG's (mg/L)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
WA
WB
LLO
NNO
QRDS1
7SQR
IRQR
IR6
IR8
Cu-D (mg/L)
Chronic - WQG (mg/L)

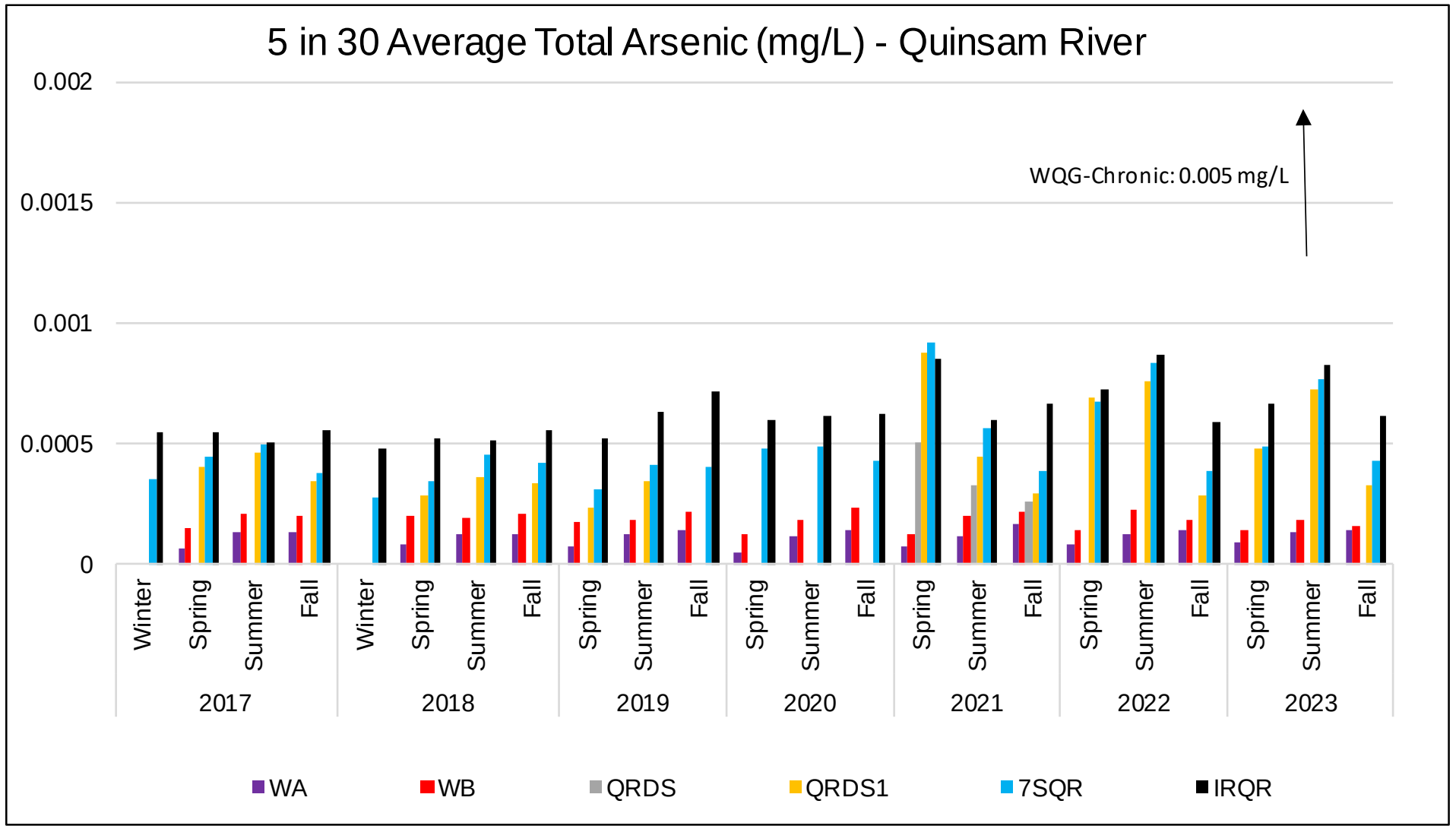

River and Stream - Fall
Cu-D versus Acute WQG's (mg/L)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
WA
WB
LLO
NNO
QRDS1
7SQR
IRQR
IR6
IR8
Cu-D (mg/L)
Acute - WQG (mg/L)

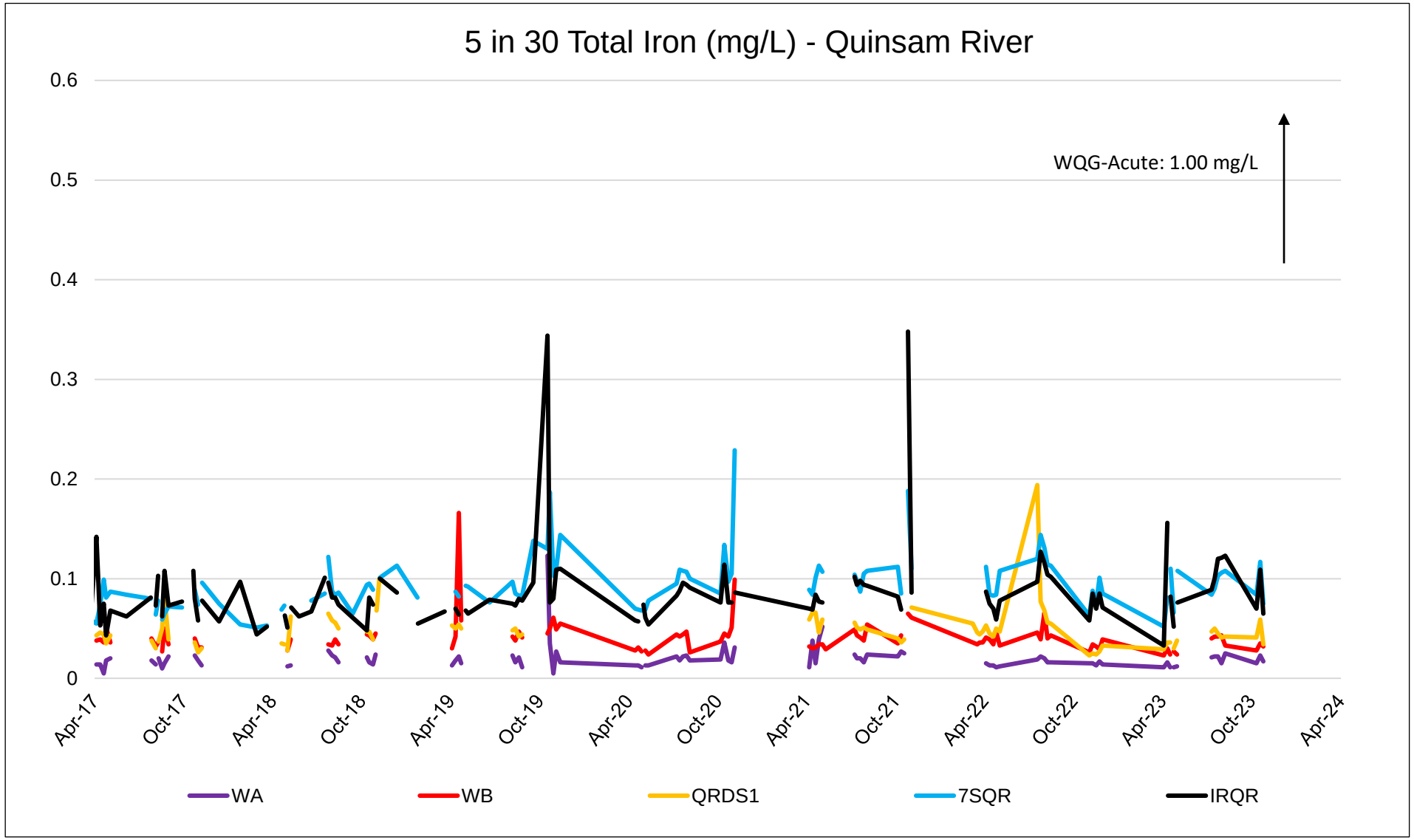

River and Stream - Fall
Average Cu-D versus Chronic WQG's (mg/L)
0.001
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
WA
WB
LLO
NNO
QRDS1
7SQR
IRQR
IR6
IR8
Cu-D (mg/L)
Chronic-WQG (mg/L)

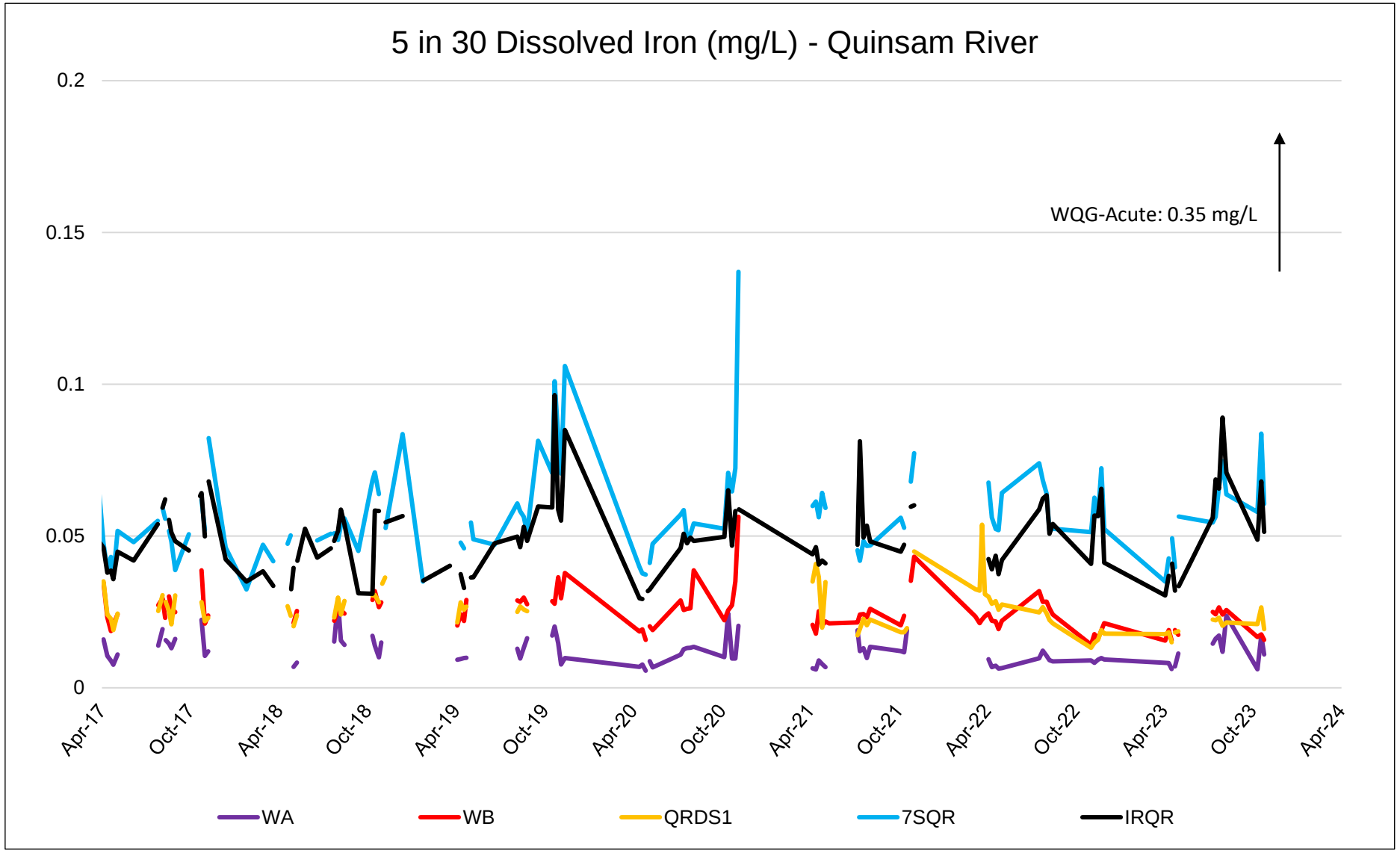

2023-24
Al-T versus Chronic-WQG (mg/L)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
NNO
LLO
WA
WB
QRDS1
7SQR
IR6
IR8
IRQR
LLS
LLSM
LLE
LLM1
LLM4
LLM9
LLMB
LLEZ2
MQL1
MQL4
MQL9
MQLB
S
S2A
S2B
Al-T Result (mg/L)
WQG-Chronic (mg/L)

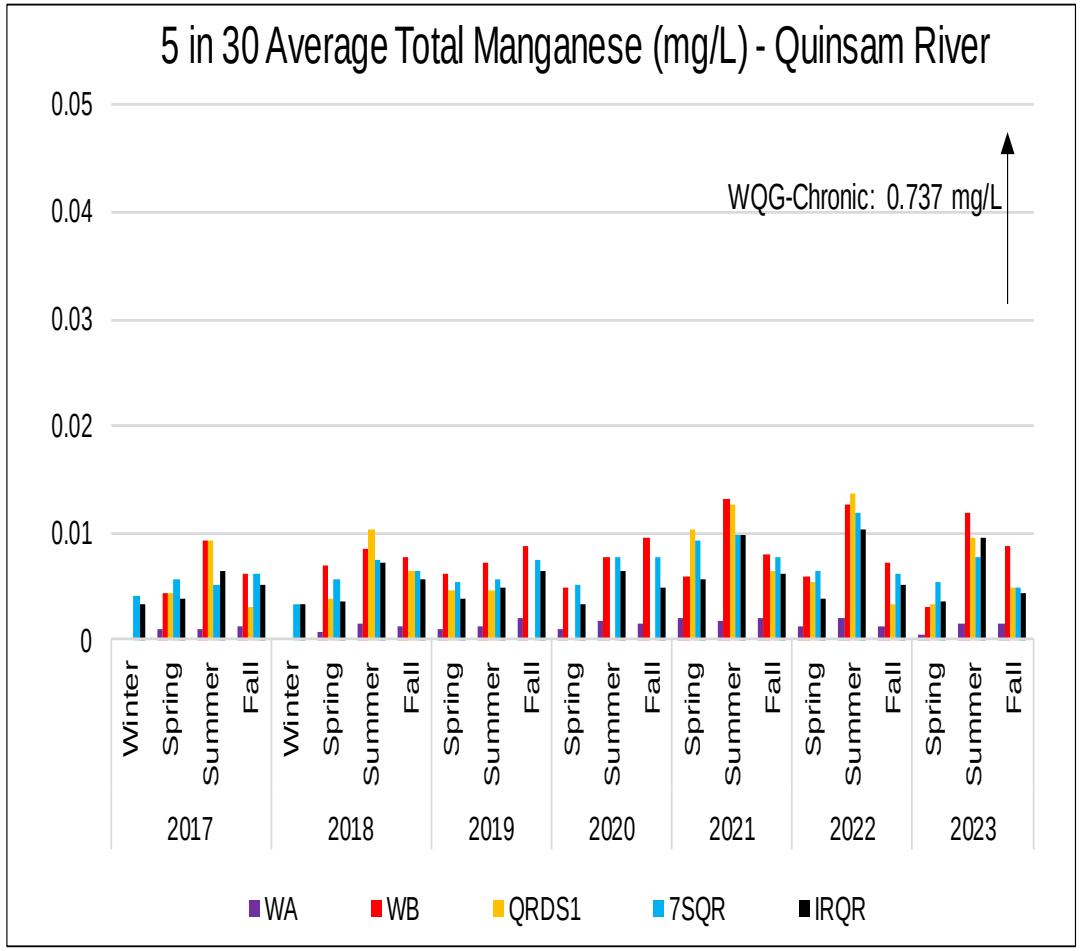

5 in 30 Average Dissolved Sulphate (mg/L) - No Name and Long Lake Outlets
60
50
40
30
20
10
0
WQG-Chronic 128 mg/L
Winter
Spring
Summer
Fall
2016
2017
2018
2019
2020
2021
2022
2023
NNO
LLO

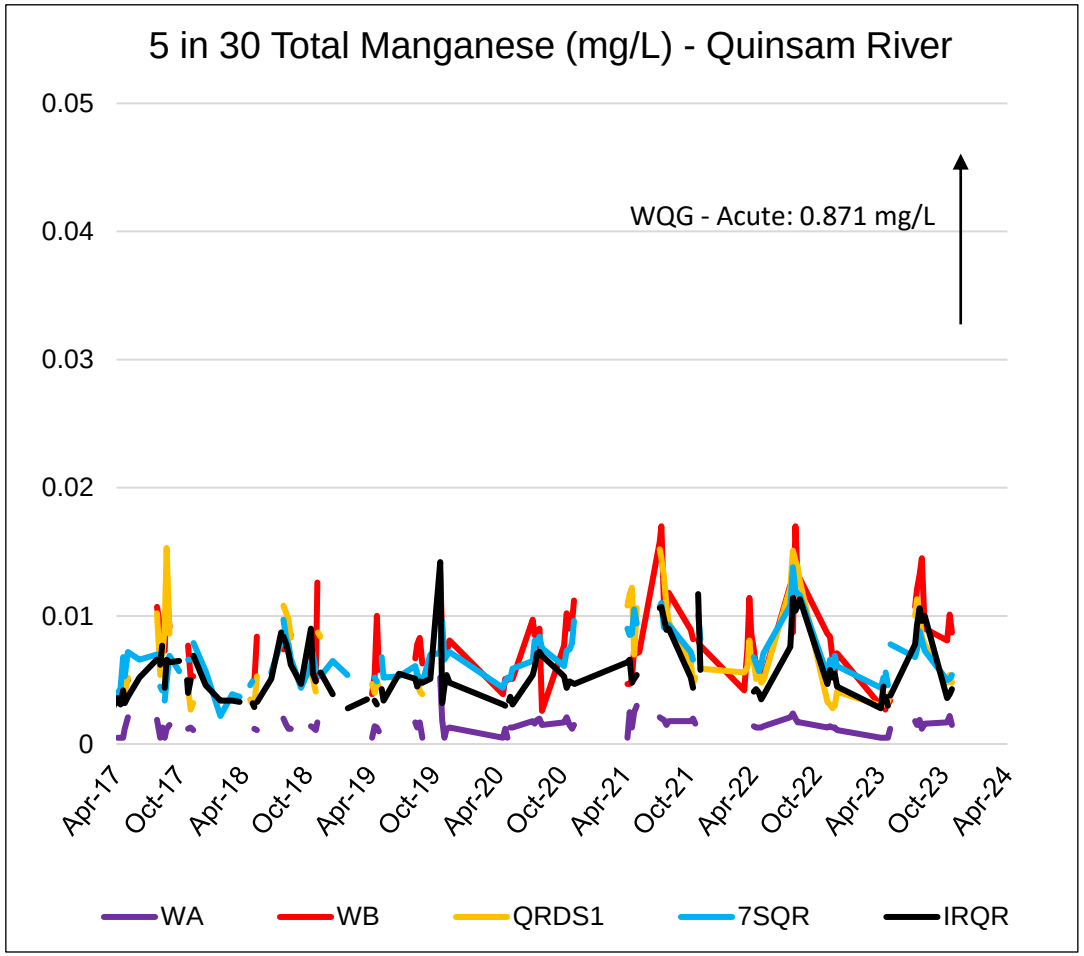

5 in 30 Average Dissolved Sulphate (mg/L) - Quinsam River
80
60
40
20
0
WQG - Chronic : 128 mg/L
Winter
Spring
Summer
Fall
2017
2018
2019
2020
2021
2022
2023
WA
WB
QRDS1
7SQR
IRQR

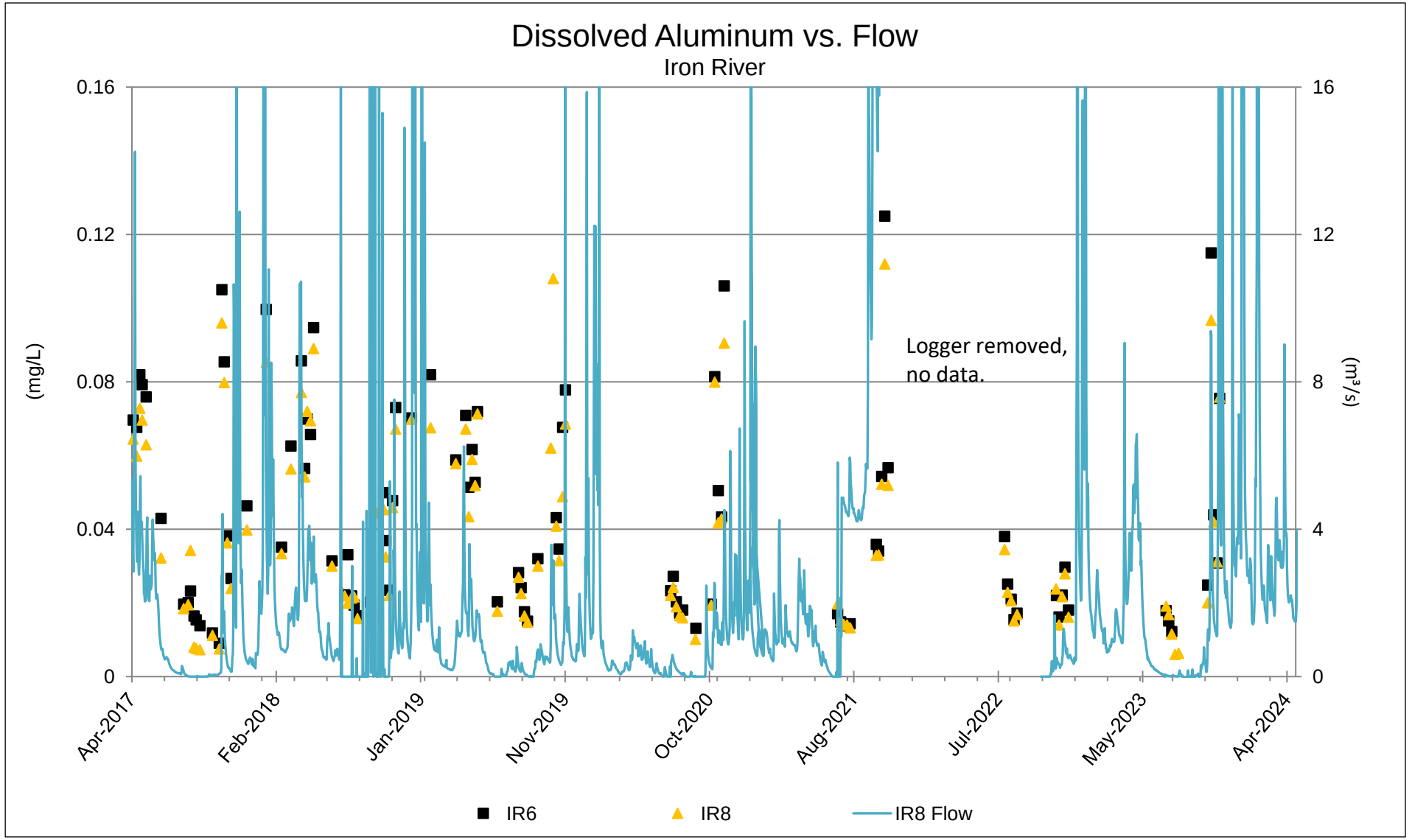

5 in 30 Average Total Arsenic (mg/L) - Quinsam River
0.002
0.0015
0.001
0.0005
0
WQG-Chronic: 0.005 mg/L
Winter
Spring
Summer
Fall
2017
2018
2019
2020
2021
2022
2023
WA
WB
QRDS
QRDS1
7SQR
IRQR

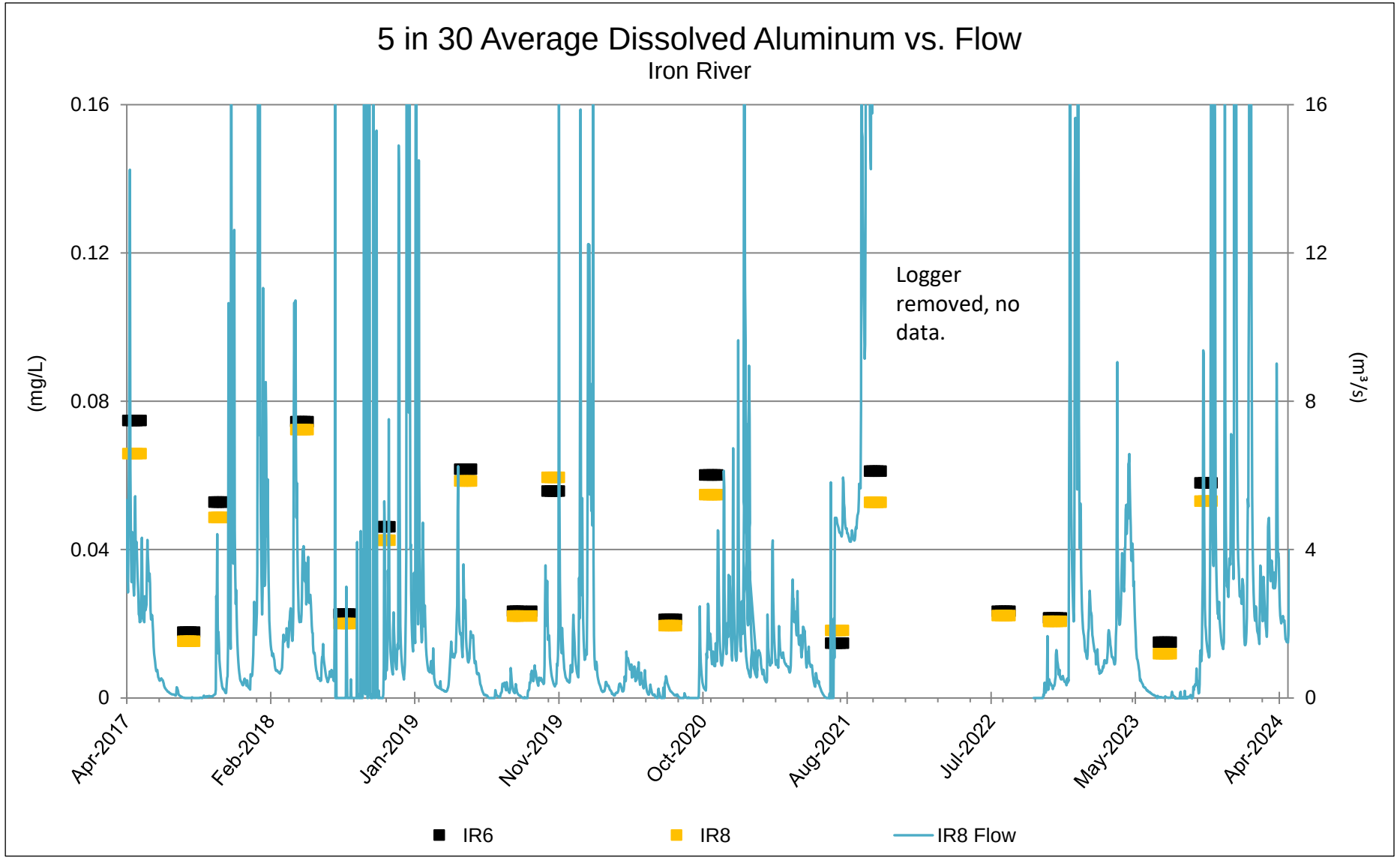

5 in 30 Total Iron (mg/L) - Quinsam River
0.6
0.5
0.4
0.3
0.2
0.1
0
WQG-Acute: 1.00 mg/L
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
WA
WB
QRDS1
7SQR
IRQR

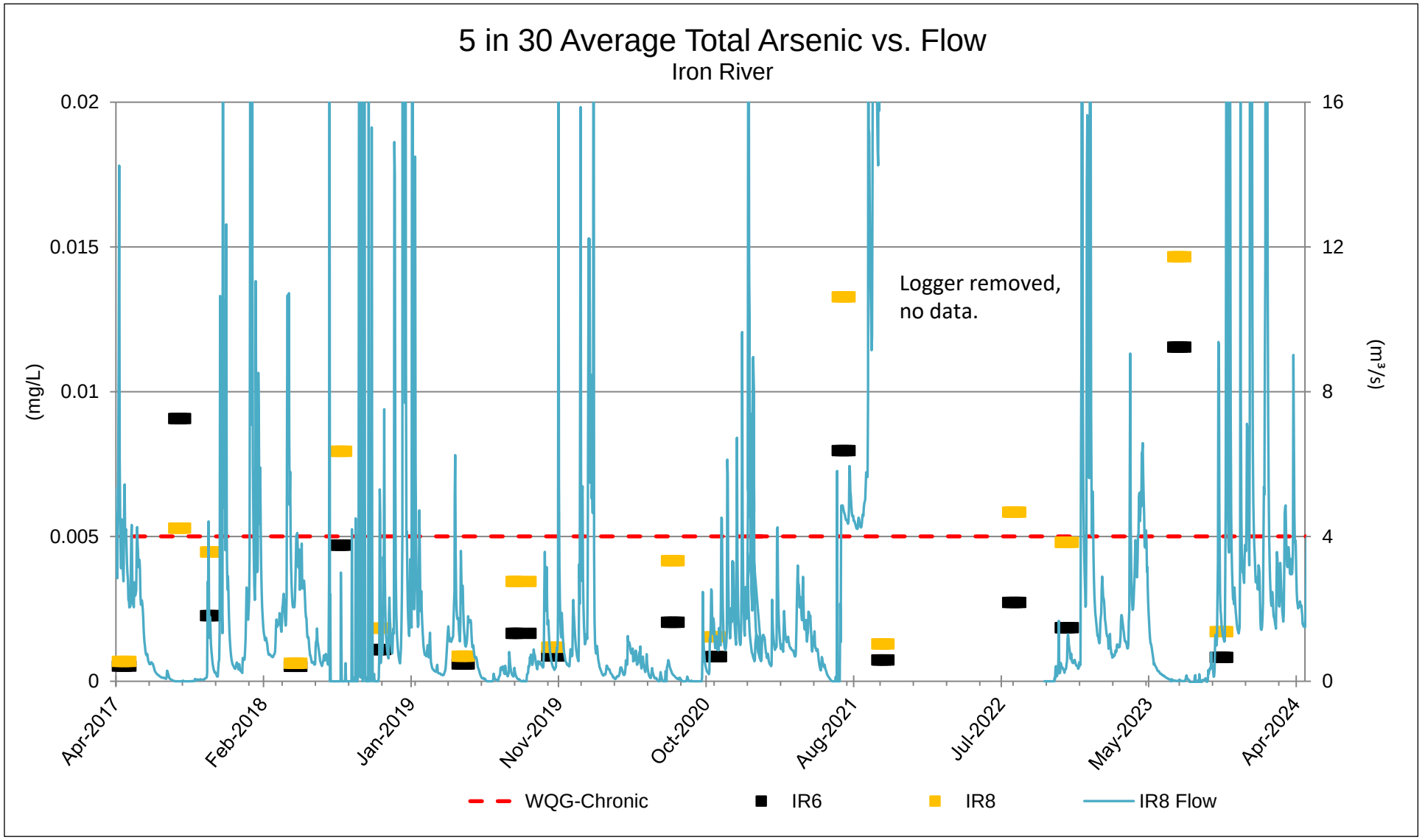

5 in 30 Dissolved Iron (mg/L) - Quinsam River
0.2
0.15
0.1
0.05
0
WQG-Acute: 0.35 mg/L
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
WA
WB
QRDS1
7SQR
IRQR

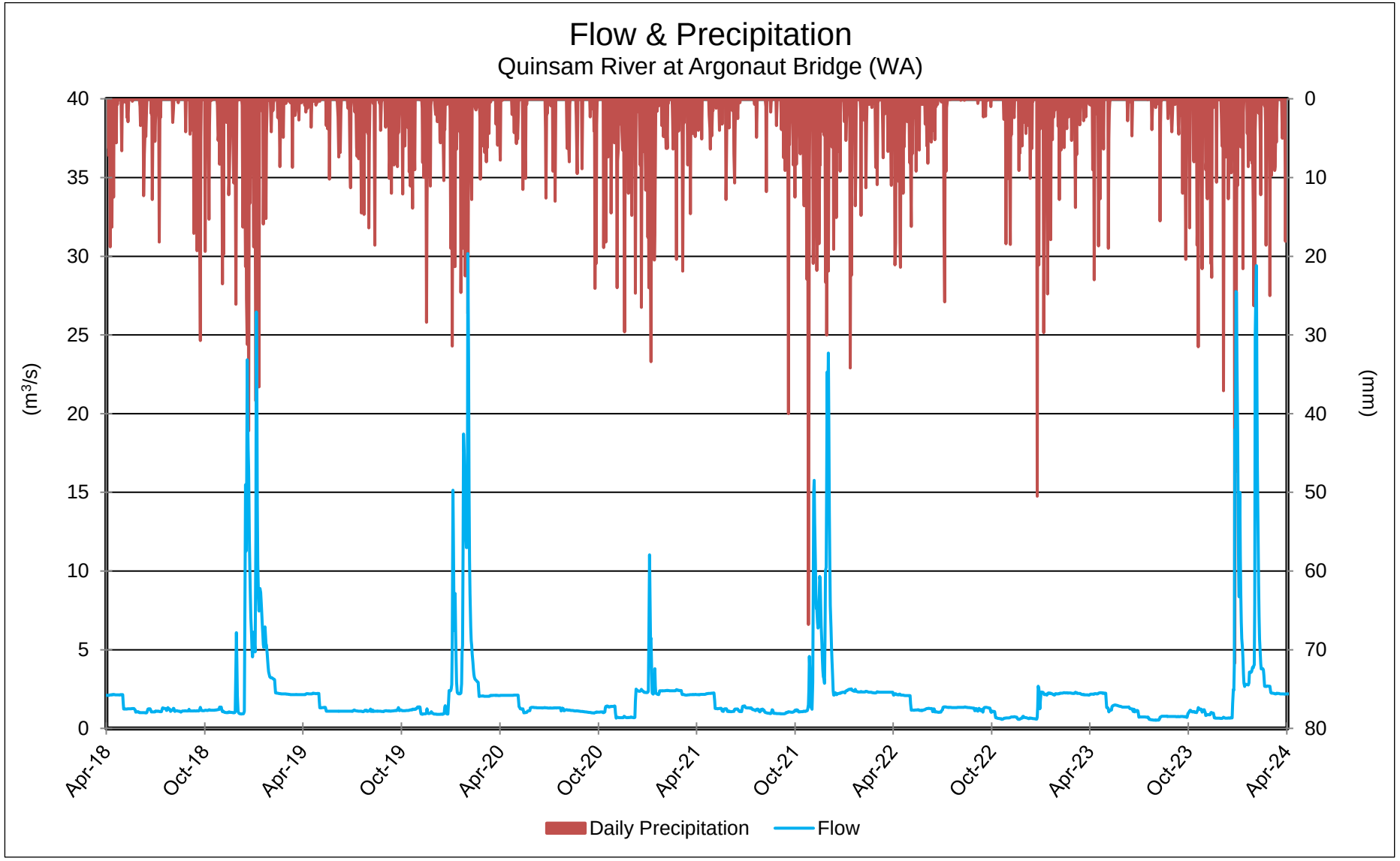

5 in 30 Average Total Manganese (mg/L) - Quinsam River
0.05
0.04
0.03
0.02
0.01
0
WQG-Chronic: 0.737 mg/L
Winter
Spring
Summer
Fall
2017
2018
2019
2020
2021
2022
2023
WA
WB
QRDS1
7SQR
IRQR

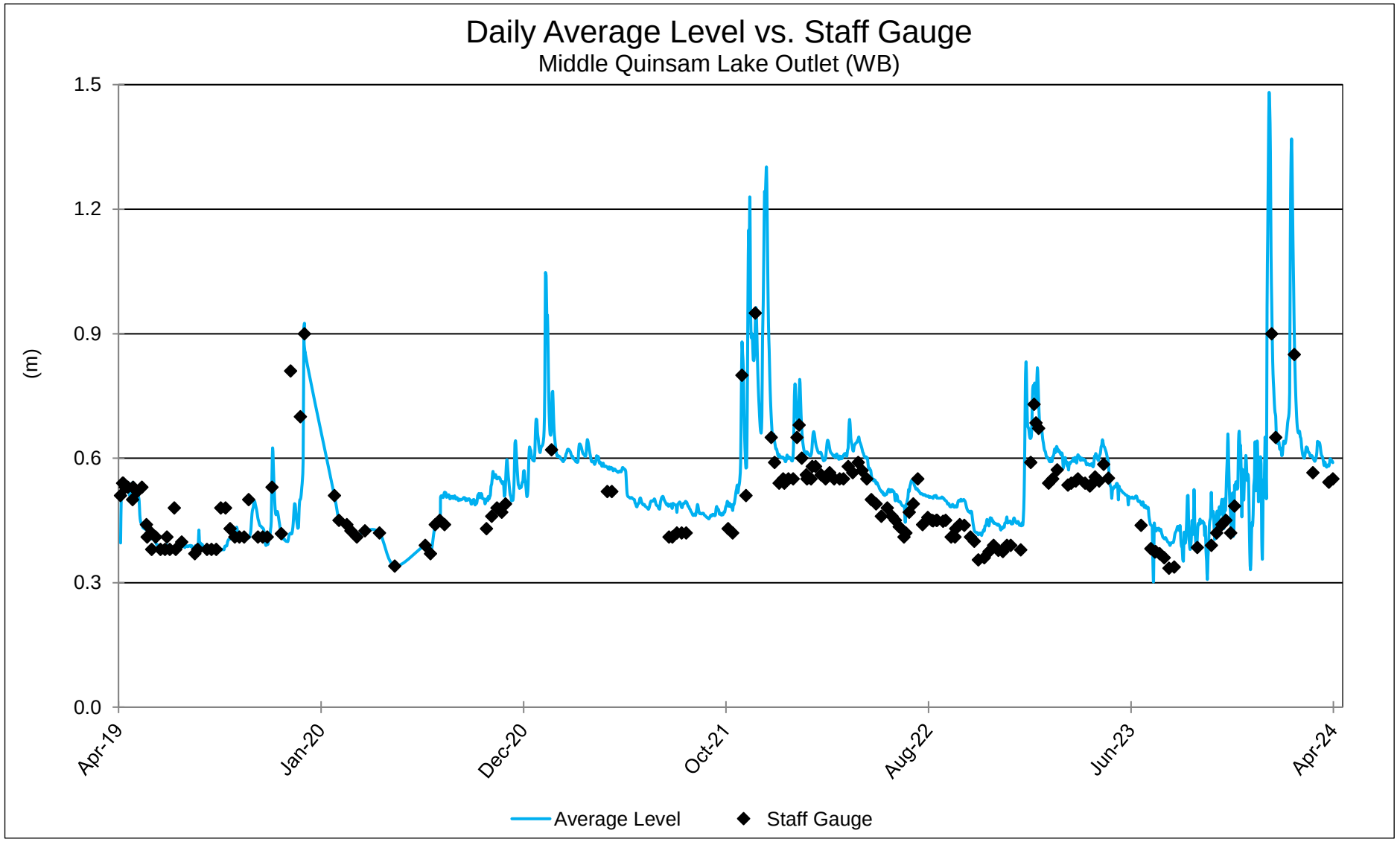

5 in 30 Total Manganese (mg/L) - Quinsam River
0.05
0.04
0.03
0.02
0.01
0
WQG - Acute: 0.871 mg/L
Apr-17
Oct-17
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
WA
WB
QRDS1
7SQR
IRQR

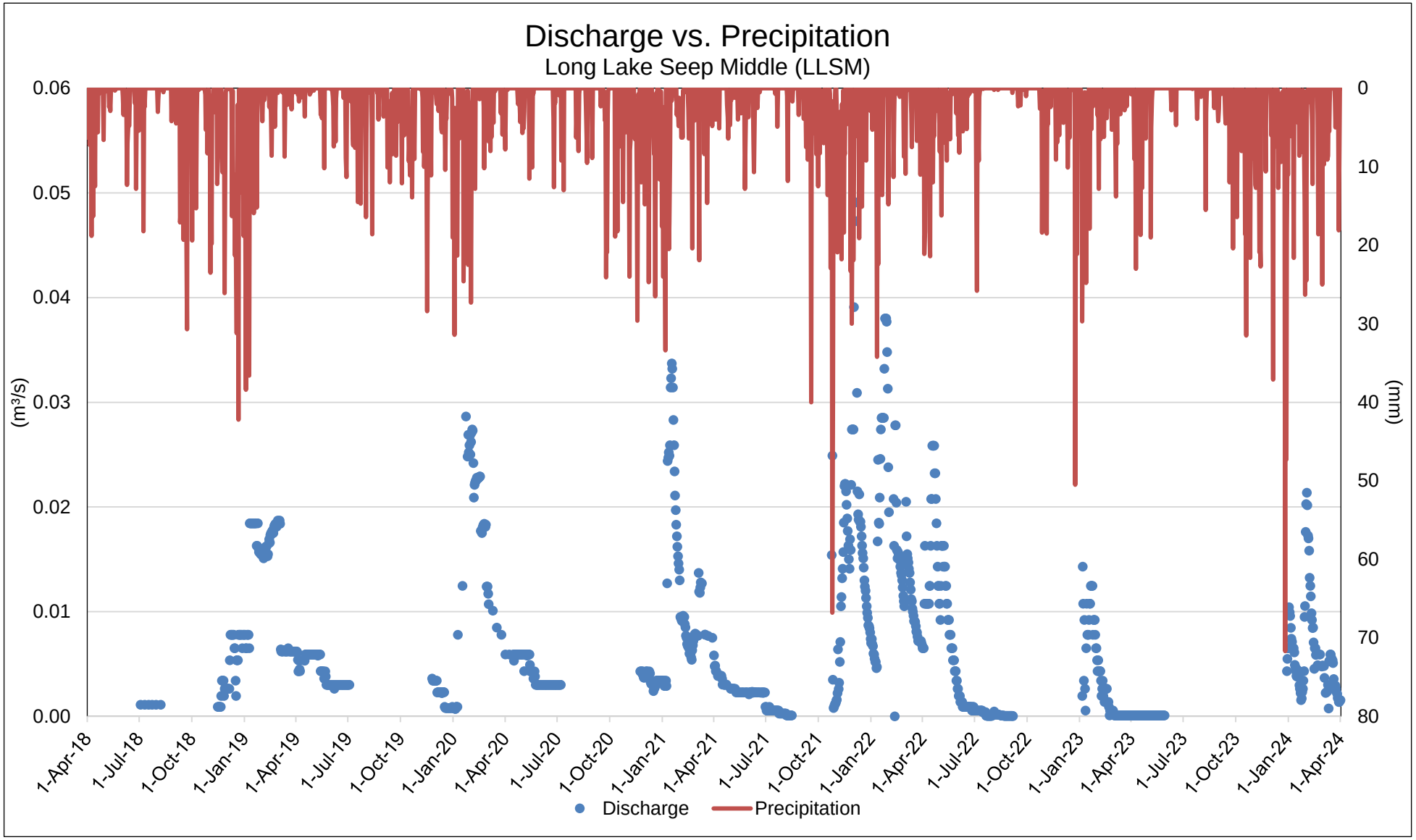

Dissolved Aluminum vs. Flow
Iron River
(mg/L)
(m³/s)
0.16
0.12
0.08
0.04
0
16
12
8
4
0
Logger removed,
no data.
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
IR6
IR8
IR8 Flow

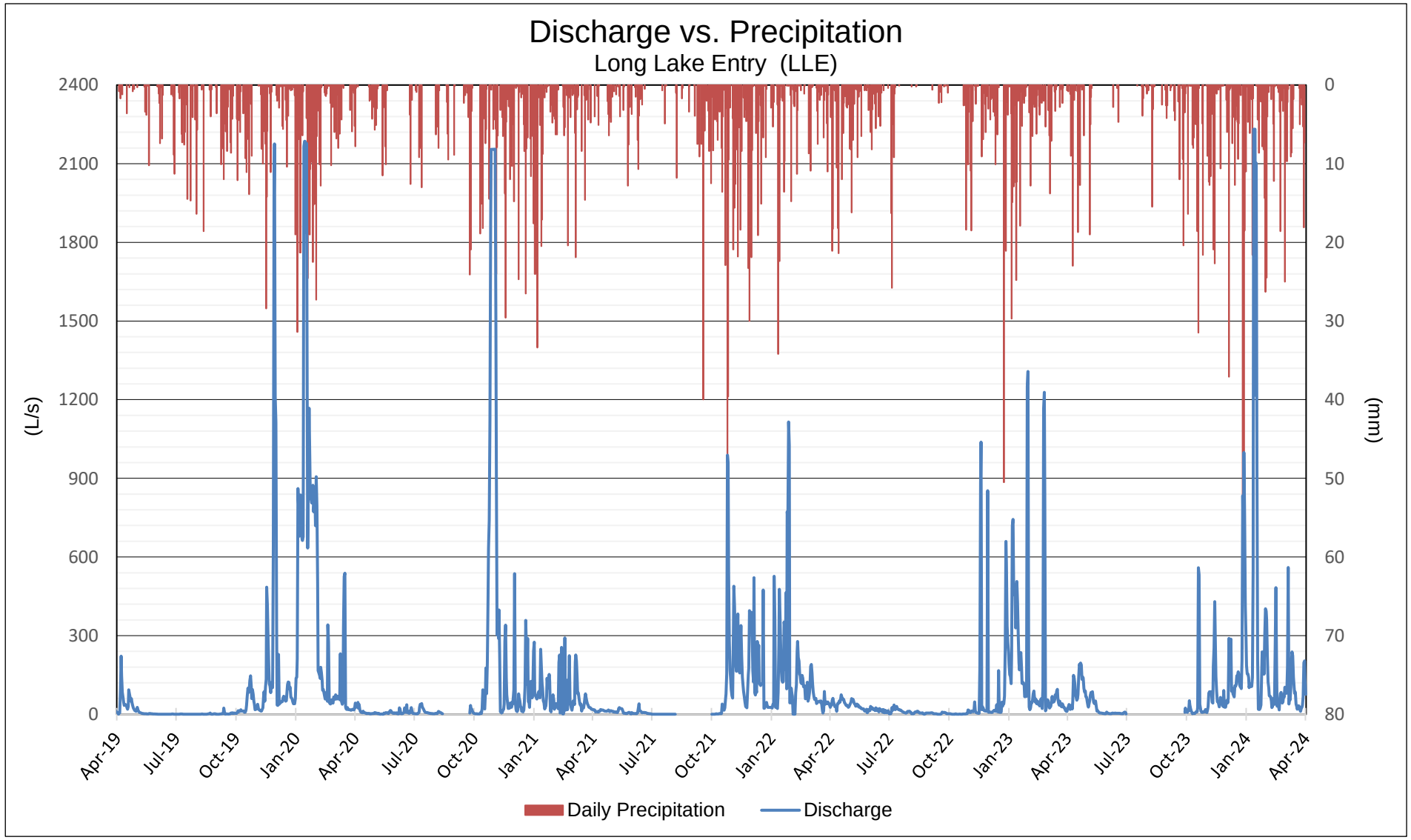

5 in 30 Average Dissolved Aluminum vs. Flow
Iron River
(mg/L)
(m³/s)
0.16
0.12
0.08
0.04
0
16
12
8
4
0
Logger removed, no data.
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
IR6
IR8
IR8 Flow

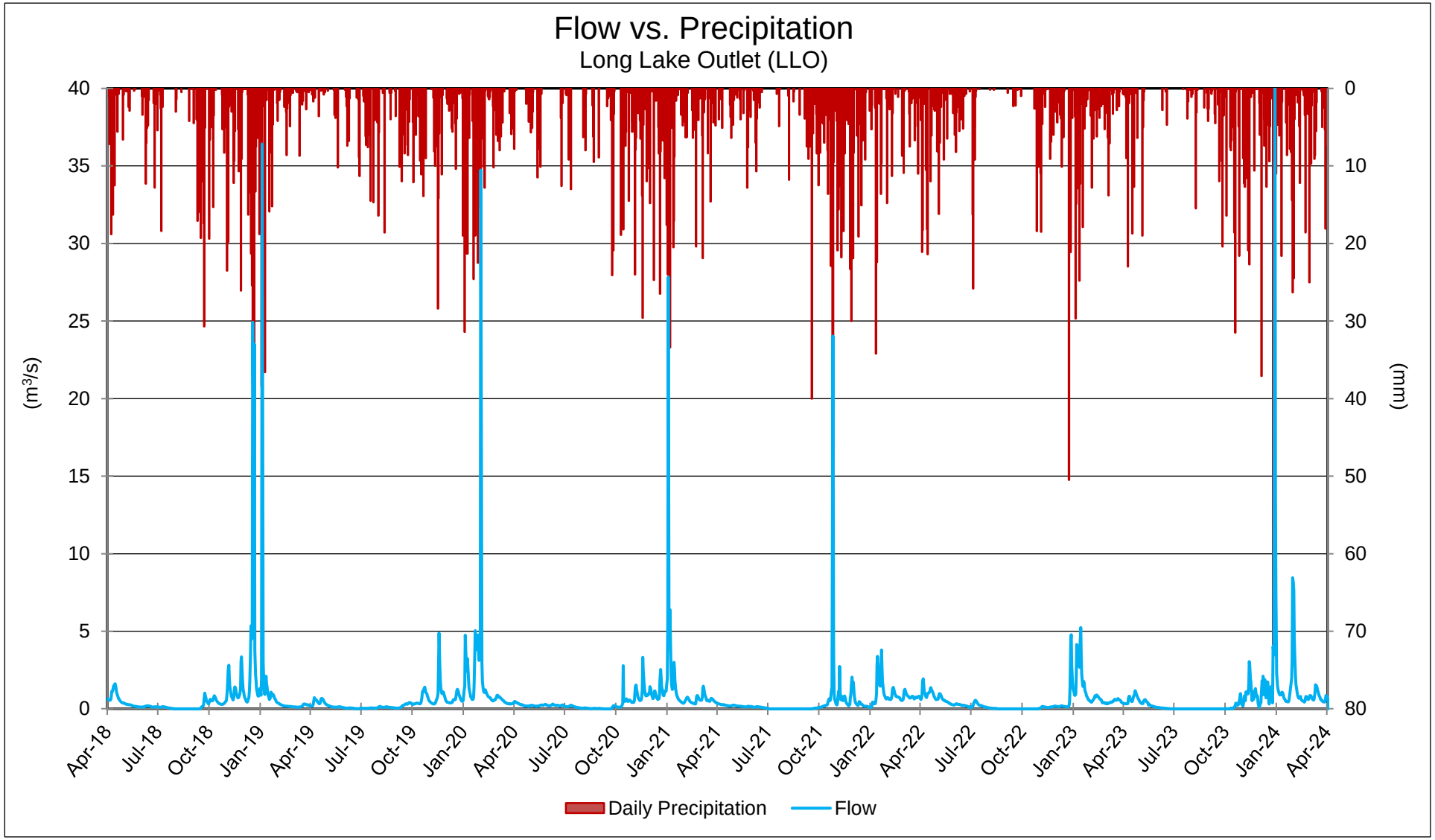

5 in 30 Average Total Arsenic vs. Flow
Iron River
0.02
0.015
0.01
0.005
0
(mg/L)
16
12
8
4
0
(m³/s)
Logger removed,
no data.
Apr-2017
Feb-2018
Jan-2019
Nov-2019
Oct-2020
Aug-2021
Jul-2022
May-2023
Apr-2024
WQG-Chronic
IR6
IR8
IR8 Flow

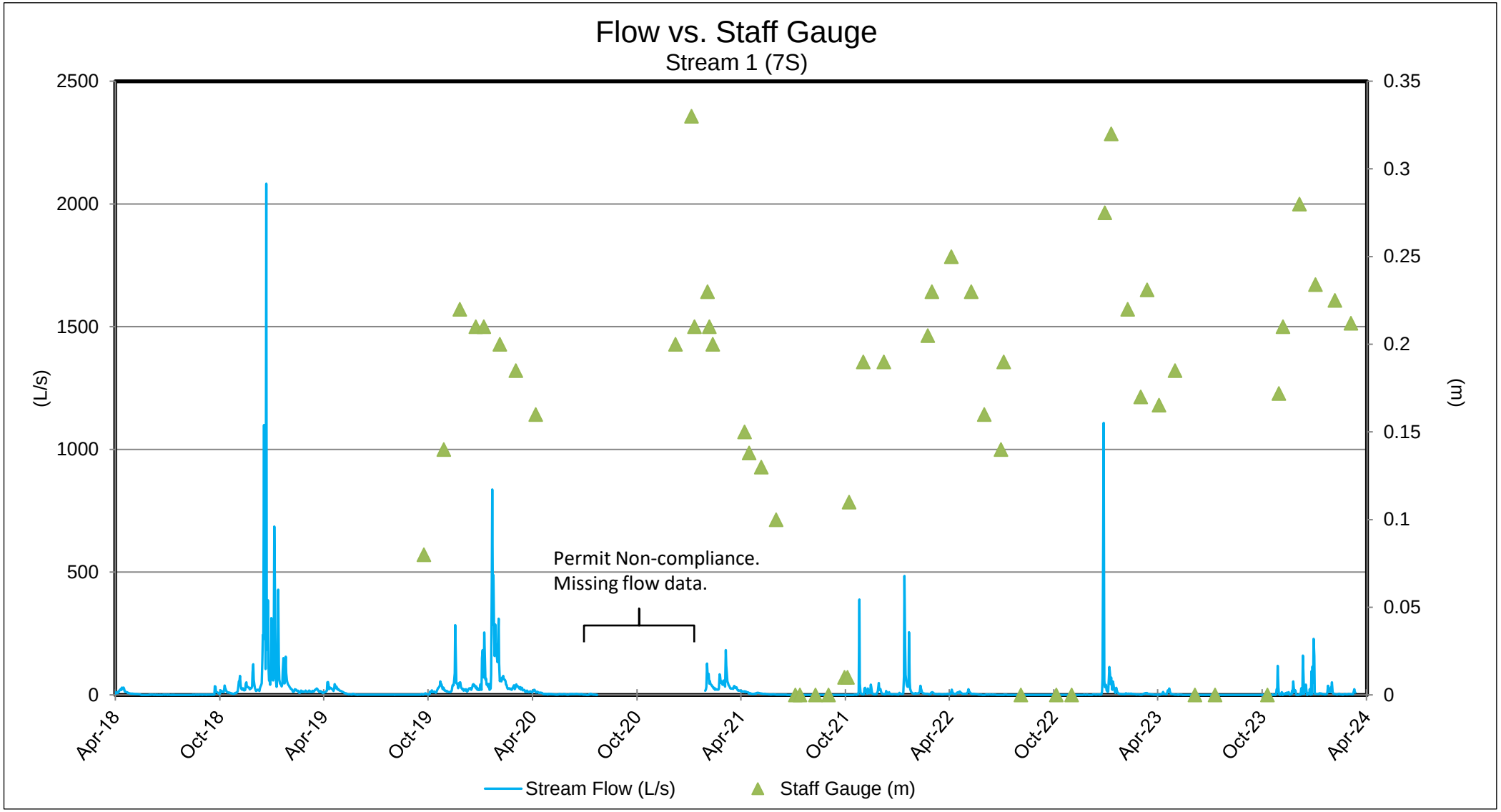

Flow & Precipitation
Quinsam River at Argonaut Bridge (WA)
(m³/s)
(mm)
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Daily Precipitation
Flow

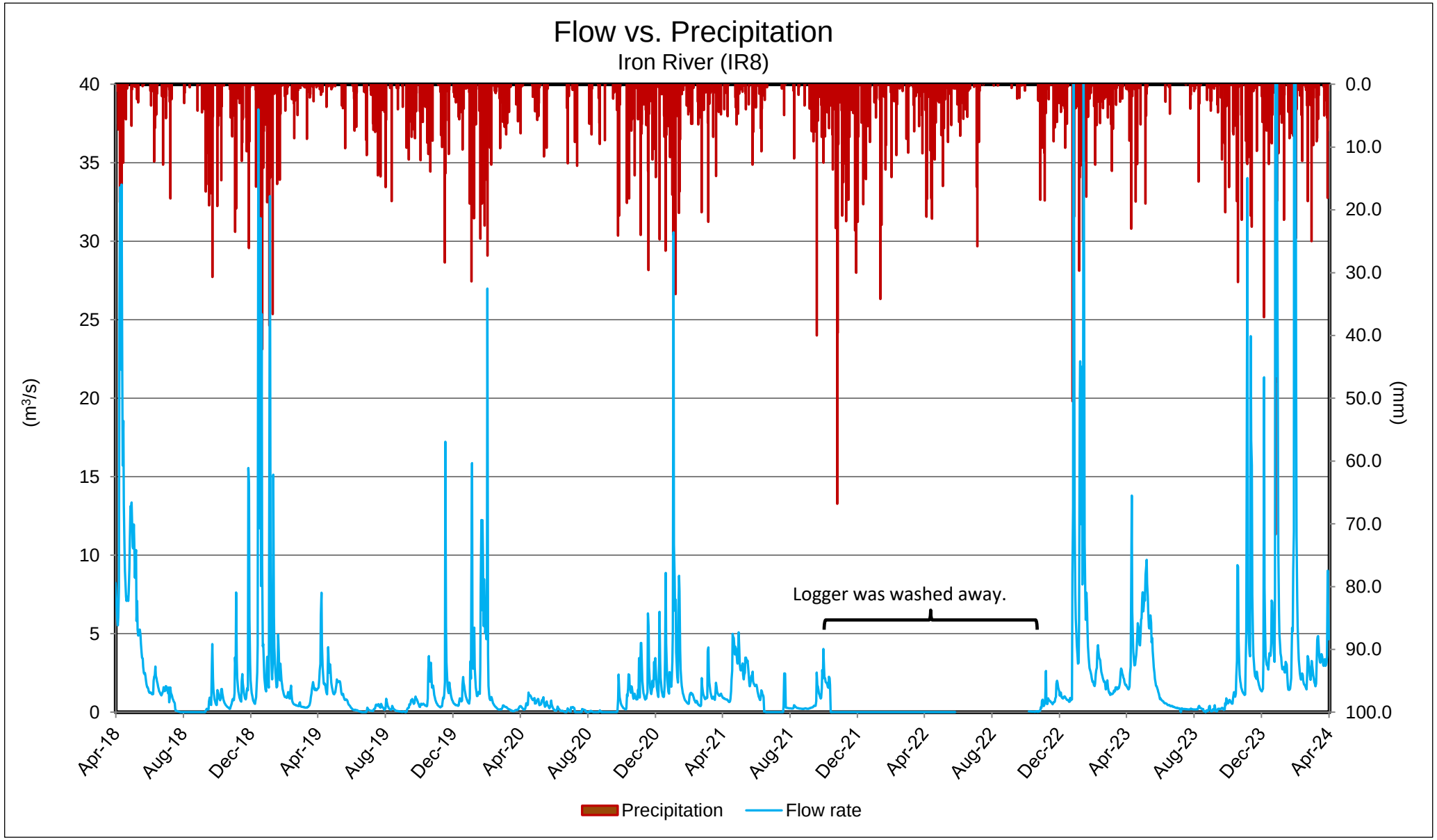

Daily Average Level vs. Staff Gauge
Middle Quinsam Lake Outlet (WB)
1.5
1.2
0.9
0.6
0.3
0.0
(m)
Apr-19
Jan-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
Average Level
Staff Gauge

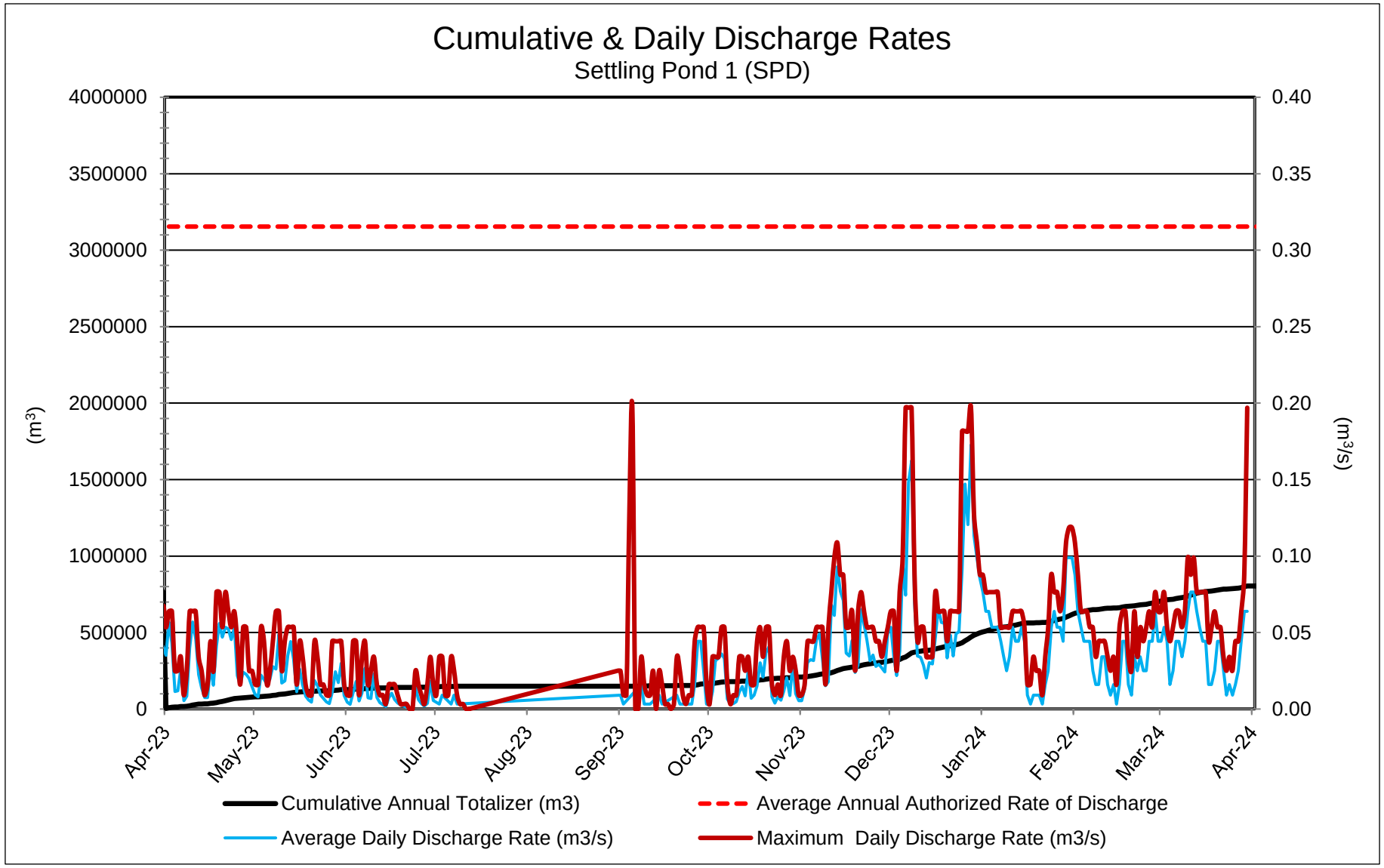

Discharge vs. Precipitation
Long Lake Seep Middle (LLSM)
(m³/s)
(mm)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
10
20
30
40
50
60
70
80
1-Apr-18
1-Jul-18
1-Oct-18
1-Jan-19
1-Apr-19
1-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
1-Oct-20
1-Jan-21
1-Apr-21
1-Jul-21
1-Oct-21
1-Jan-22
1-Apr-22
1-Jul-22
1-Oct-22
1-Jan-23
1-Apr-23
1-Jul-23
1-Oct-23
1-Jan-24
1-Apr-24
Discharge
Precipitation

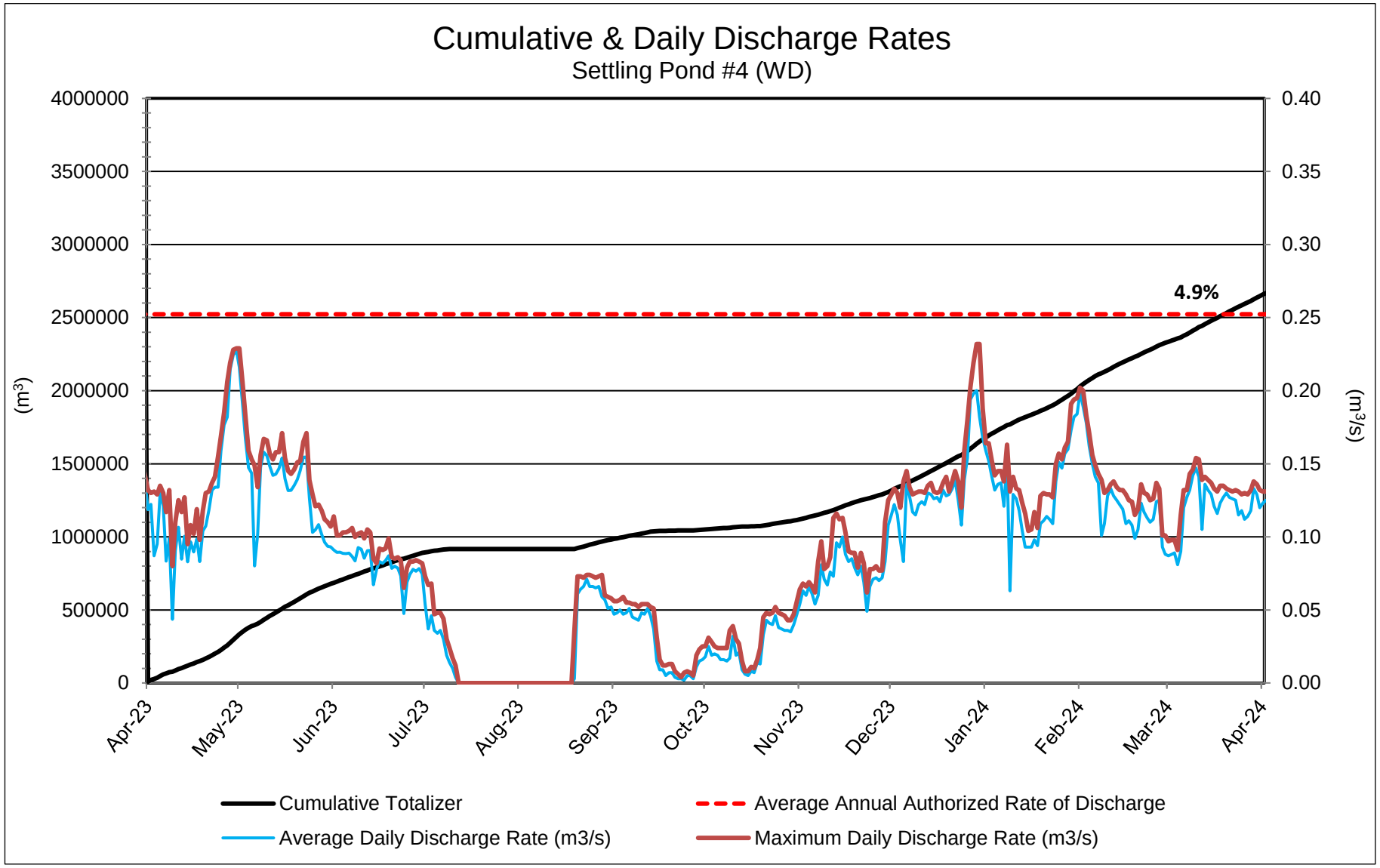

Discharge vs. Precipitation
Long Lake Entry (LLE)
(L/s)
(mm)
2400
2100
1800
1500
1200
900
600
300
0
0
10
20
30
40
50
60
70
80
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
Oct-23
Jan-24
Apr-24
Daily Precipitation
Discharge

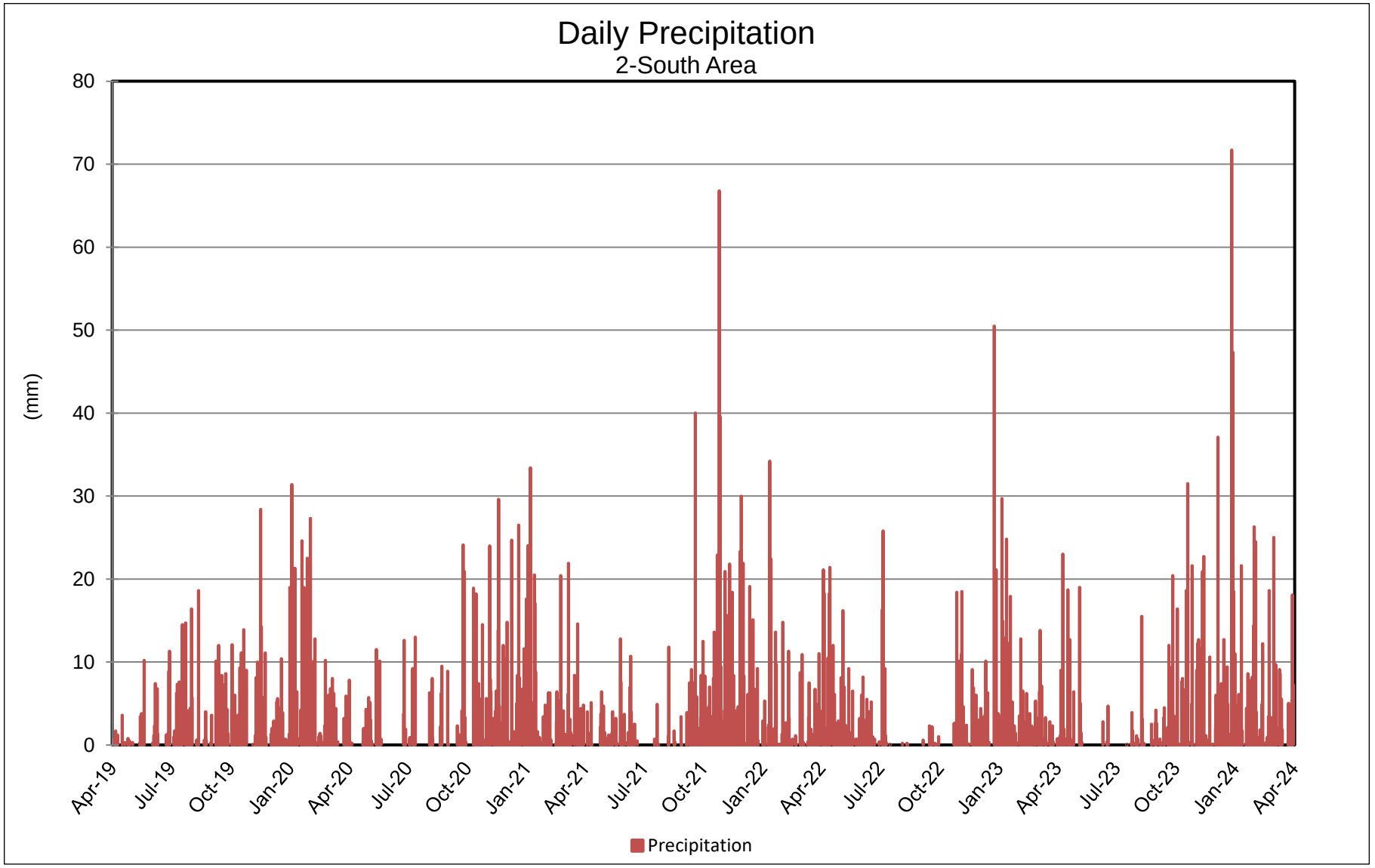

Flow vs. Precipitation
Long Lake Outlet (LLO)
(m³/s)
(mm)
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
Oct-23
Jan-24
Apr-24
Daily Precipitation
Flow

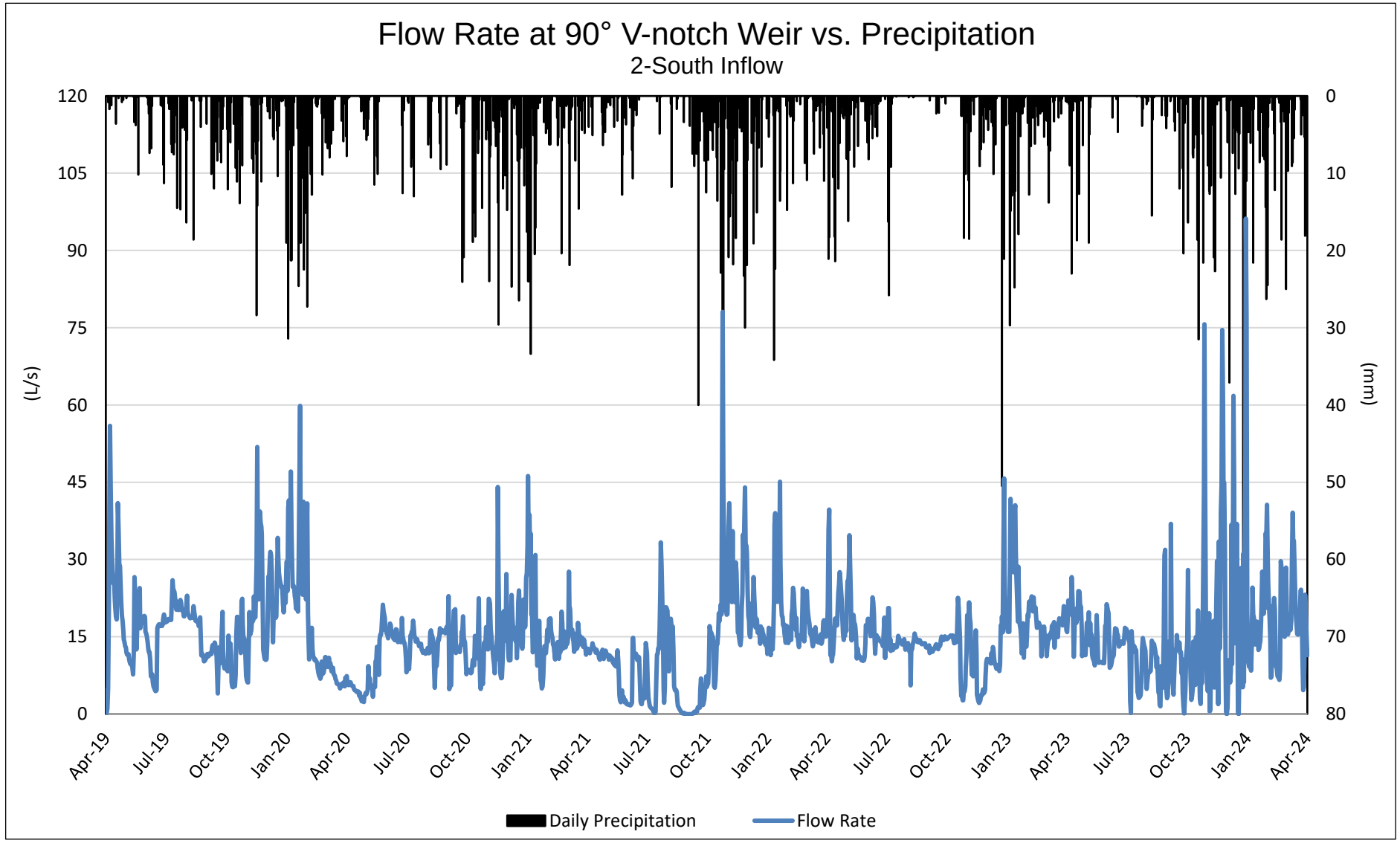

Flow vs. Staff Gauge
Stream 1 (7S)
2500
2000
1500
1000
500
0
(L/s)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
(m)
Permit Non-compliance.
Missing flow data.
Apr-18
Oct-18
Apr-19
Oct-19
Apr-20
Oct-20
Apr-21
Oct-21
Apr-22
Oct-22
Apr-23
Oct-23
Apr-24
Stream Flow (L/s)
Staff Gauge (m)

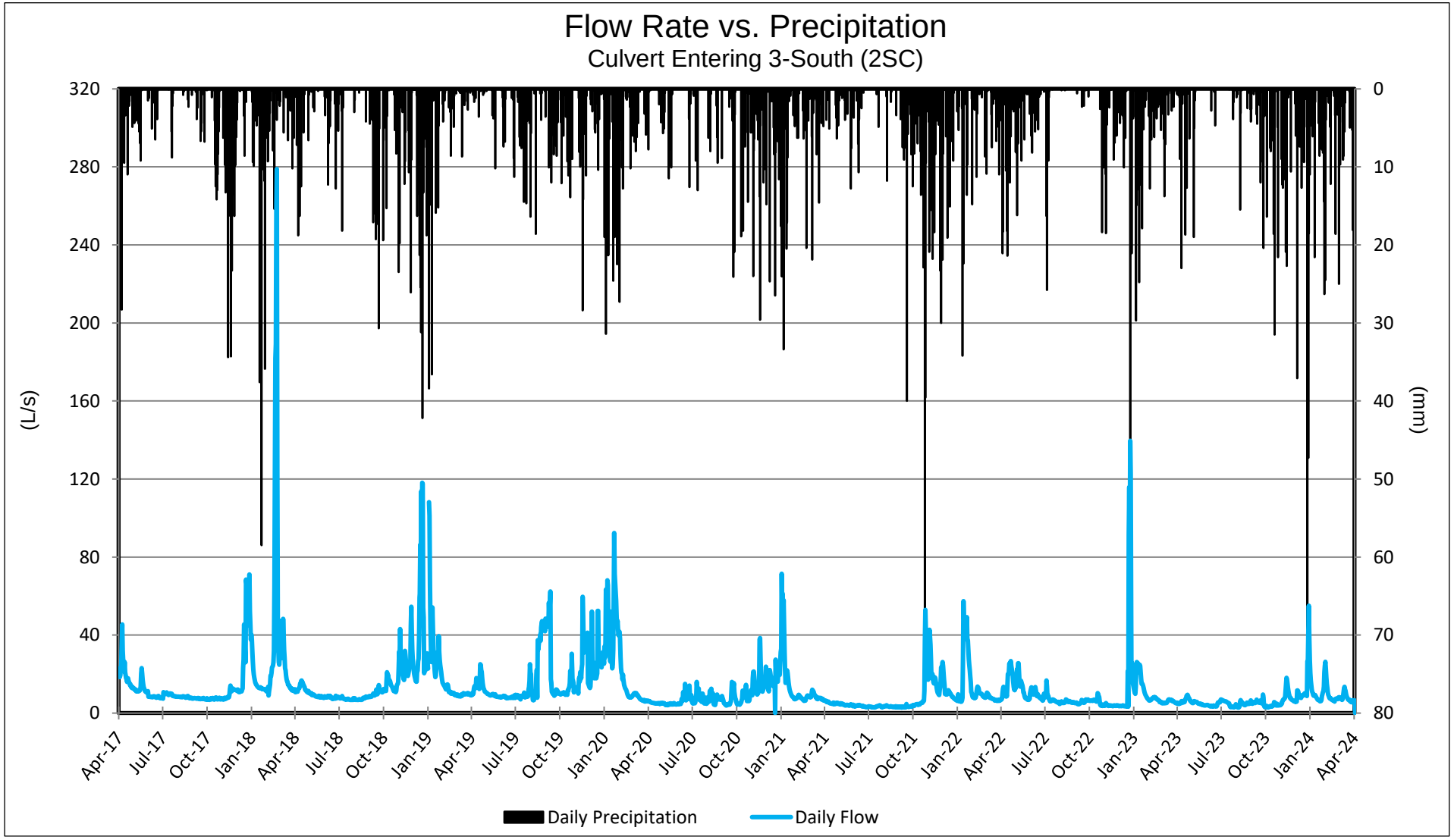

Flow vs. Precipitation
Iron River (IR8)
(m³/s)
(mm)
40
35
30
25
20
15
10
5
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Logger was washed away.
Apr-18
Aug-18
Dec-18
Apr-19
Aug-19
Dec-19
Apr-20
Aug-20
Dec-20
Apr-21
Aug-21
Dec-21
Apr-22
Aug-22
Dec-22
Apr-23
Aug-23
Dec-23
Apr-24
Precipitation
Flow rate

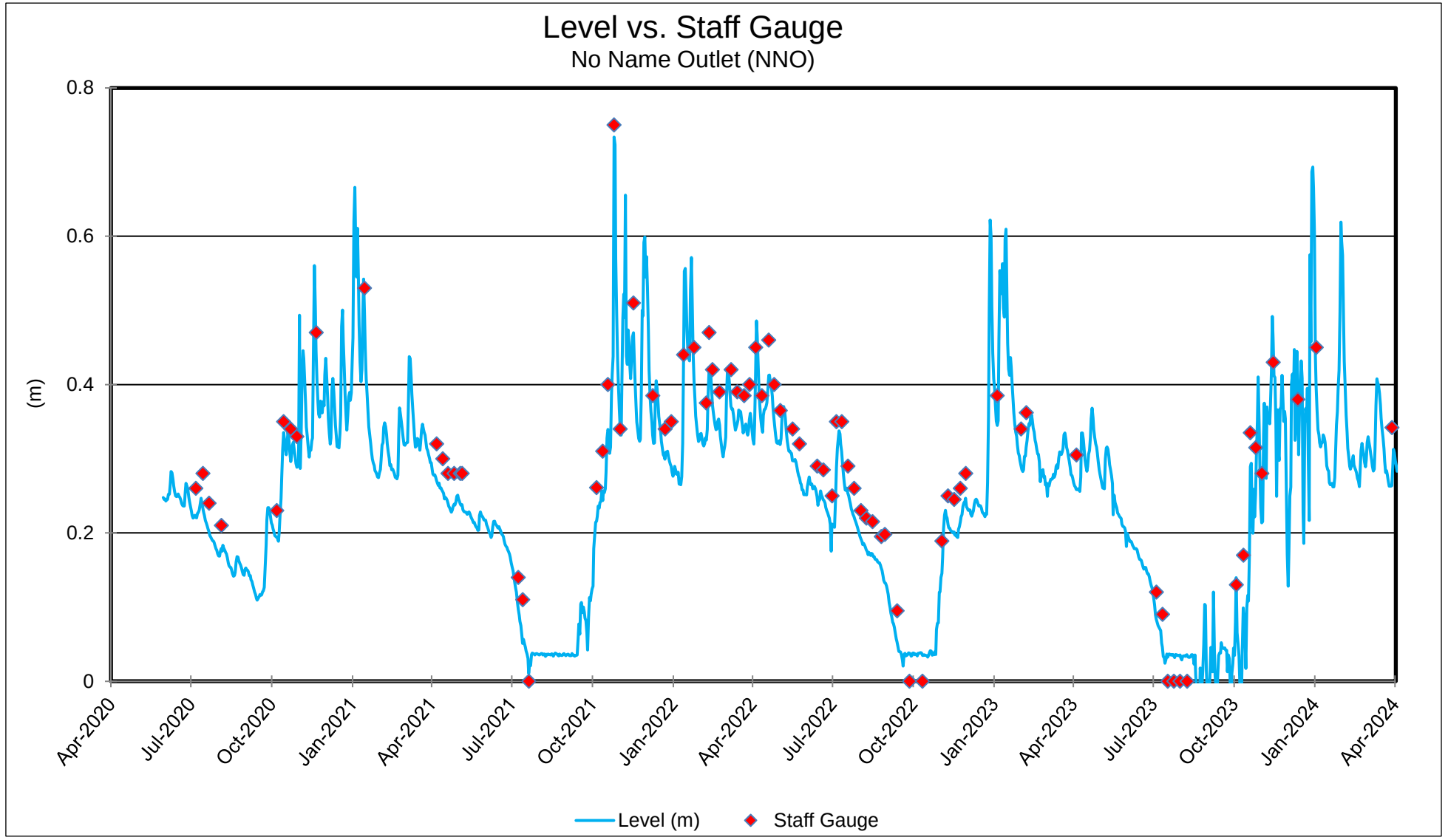

Cumulative & Daily Discharge Rates
Settling Pond 1 (SPD)
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
(m³)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
(m³/s)
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
Cumulative Annual Totalizer (m3)
Average Annual Authorized Rate of Discharge
Average Daily Discharge Rate (m3/s)
Maximum Daily Discharge Rate (m3/s)

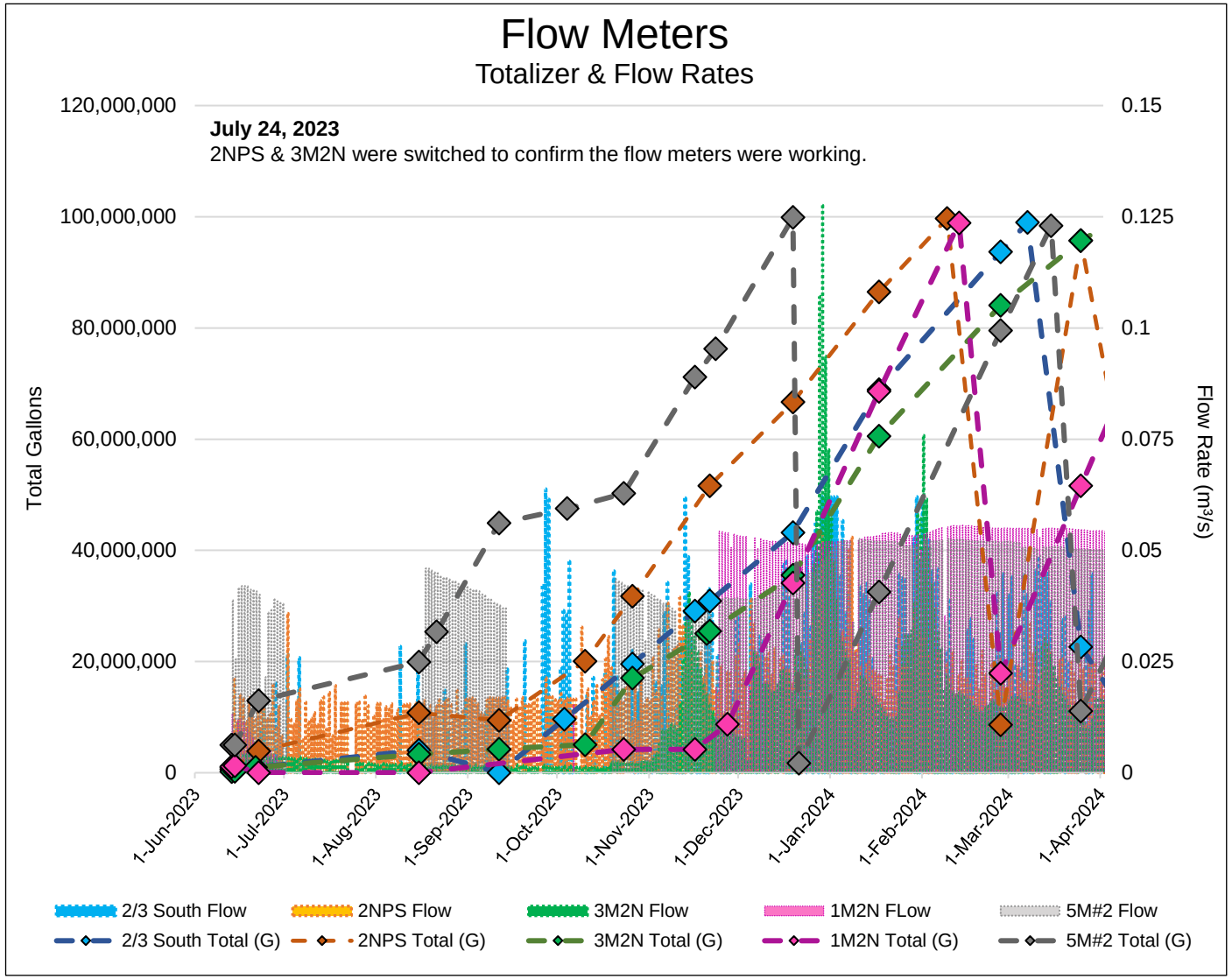

Cumulative & Daily Discharge Rates
Settling Pond #4 (WD)
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
(m³)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
(m³/s)
4.9%
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
Cumulative Totalizer
Average Annual Authorized Rate of Discharge
Average Daily Discharge Rate (m3/s)
Maximum Daily Discharge Rate (m3/s)

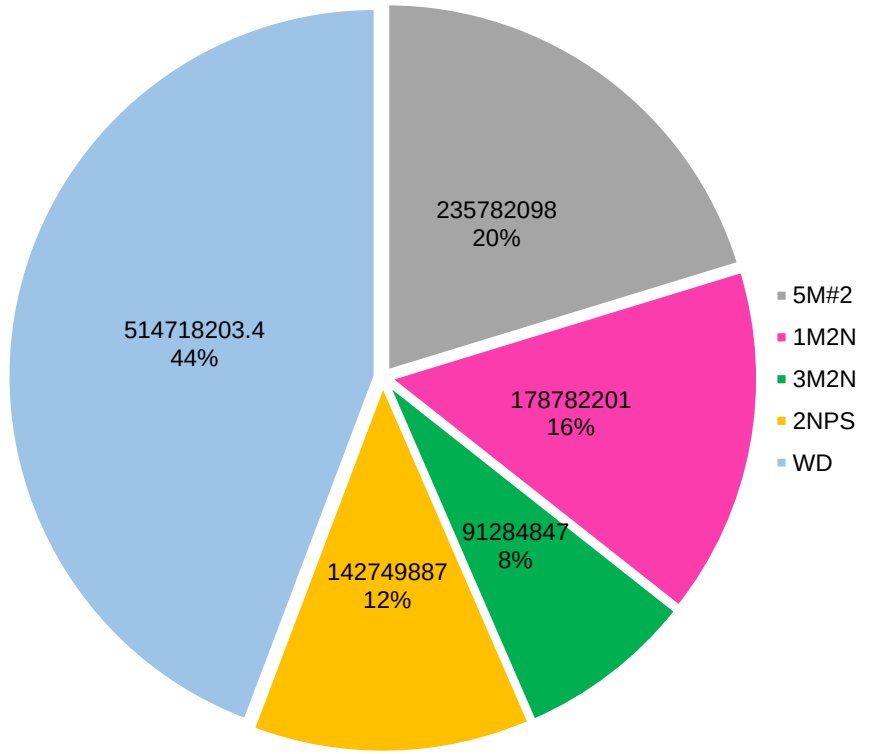

Daily Precipitation
2-South Area
(mm)
80
70
60
50
40
30
20
10
0
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
Oct-23
Jan-24
Apr-24
Precipitation


Flow Rate at 90° V-notch Weir vs. Precipitation
2-South Inflow
(L/s)
(mm)
120
105
90
75
60
45
30
15
0
0
10
20
30
40
50
60
70
80
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
Oct-23
Jan-24
Apr-24
Daily Precipitation
Flow Rate


Flow Rate vs. Precipitation
Culvert Entering 3-South (2SC)
(L/s)
(mm)
320
280
240
200
160
120
80
40
0
0
10
20
30
40
50
60
70
80
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
Apr-23
Jul-23
Oct-23
Jan-24
Apr-24
Daily Precipitation
Daily Flow


Level vs. Staff Gauge
No Name Outlet (NNO)
(m)
0.8
0.6
0.4
0.2
0
Apr-2020
Jul-2020
Oct-2020
Jan-2021
Apr-2021
Jul-2021
Oct-2021
Jan-2022
Apr-2022
Jul-2022
Oct-2022
Jan-2023
Apr-2023
Jul-2023
Oct-2023
Jan-2024
Apr-2024
Level (m)
Staff Gauge


Flow Meters
Totalizer & Flow Rates
July 24, 2023
2NPS & 3M2N were switched to confirm the flow meters were working.
Total Gallons
Flow Rate (m³/s)
120,000,000
100,000,000
80,000,000
60,000,000
40,000,000
20,000,000
0
0.15
0.125
0.1
0.075
0.05
0.025
0
1-Jun-2023
1-Jul-2023
1-Aug-2023
1-Sep-2023
1-Oct-2023
1-Nov-2023
1-Dec-2023
1-Jan-2024
1-Feb-2024
1-Mar-2024
1-Apr-2024
2/3 South Flow
2NPS Flow
3M2N Flow
1M2N FLow
5M#2 Flow
2/3 South Total (G)
2NPS Total (G)
3M2N Total (G)
1M2N Total (G)
5M#2 Total (G)


Volume of Discharge Breakdown
Totalized Value in Gallons & Percentage
235782098
20%
178782201
16%
91284847
8%
142749887
12%
514718203.4
44%
5M#2
1M2N
3M2N
2NPS
WD

Appendix III

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Client : 13210 The Bowra Group Inc., Contractor for Province of BC as MEMPR Representative Job Number: C390963

Client Project Name & Number: RAINBOW TROUT PE:7008

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : SPD

Description:	Clear and colourless			Sample Number:	CDX596-01
Sample Collected:	Nov 06, 2023	Sampling Method :	Grab	Site Collection:	N/A
Sample Collected By:	Cassandre Cyr	Volume Received:	8 x OTHP	Avg Temp Arrival:	7 °C Storage: 2-6°C
Sample Received:	Nov 07, 2023 10:52 AM	pH:	7.7	Dissolved Oxygen:	10.4 mg/L
Analysis Start :	Nov 08, 2023 12:35 PM	Temperature :	15 °C	Sample Conductance:	1020 µS/cm

Concentration	Temperature (°C)	Temperature (°C)	Dissolved Oxygen (mg/L)		pH	pH	Conductivity (uS/cm)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)
% vol/vol	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	96 hrs	96 hrs
0	14	15	10.3	9.8	7.7	7.8	59	0	0	0
100	15	15	10.2	9.6	7.8	8.0	1020	0	0	0

Comments : All fish appeared and behaved normally during the test.

Culture/Control/Dilution Water Burnaby Municipal Dechlorinated Water

Hardness: 27 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	60 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	15 L	Vessel Volume :	20L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Aqua Farm

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.4 ± 0.1 g	Length (Mean) +- SD :	3.66 ± 0.31 cm
Culture Water Renewal :	≥ 1L/min/kg fish	Weight (Range) :	0.2 – 0.5 g	Length (Range) :	3.20 – 4.20 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Zinc Test Date: Nov 05, 2023

Test Endpoint 96 hrs LC50 (95% confidence interval) : 0.12 (0.11, 0.14)mg/L Statistical Method : Untrimmed Spearman-Kärber

Historical Mean LC50 (warning limits) : 0.19 (0.10, 0.37) mg/L Concentration : 0,0.04,0.08,0.16,0.32,0.64 mg/L

Test Method BV Lab's BBY2SOP-00004 is based on the latest version of EPS 1/RM9 and EPS 1 /RM13.

Method Deviations : None.

Note: The results contained in this report refer only to the testing of the sample submitted. Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation, including the toxicity parameters reported herein. The conductivity, dissolved oxygen and pH data contained within the toxicity report are provided for information purposes and are not individually accredited parameters. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Mustaffa Hamad, Navpreet Shergill, Sebastian Leroux

Verified By : Navpreet Shergill, Scientist Date: Nov 22, 2023 08:15 AM

RESULTS OF RAINBOW TROUT SINGLE CONCENTRATION-100%

Client : 13210 The Bowra Group Inc., Contractor for Province of BC as MEMPR Representative Job Number: C390963

Client Project Name & Number: RAINBOW TROUT PE:7008

Test Result:

96 hrs Mortality % 0 Statistical Method: Visual

Sample Name : WD

Description:	Clear and colourless			Sample Number:	CDX595-01
Sample Collected:	Nov 06, 2023	Sampling Method :	Grab	Site Collection:	N/A
Sample Collected By:	Cassandre Cyr	Volume Received:	5 x OTHP	Avg Temp Arrival:	7 °C Storage: 2-6°C
Sample Received:	Nov 07, 2023 10:52 AM	pH:	7.8	Dissolved Oxygen:	10.1 mg/L
Analysis Start :	Nov 08, 2023 12:00 PM	Temperature :	15 °C	Sample Conductance:	1360 µS/cm

Concentration	Temperature (°C)	Temperature (°C)	Dissolved Oxygen (mg/L)		pH	pH	Conductivity (uS/cm)	Mortality (#)	Mortality (%)	Atypical Behaviour (#)
% vol/vol	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	96 hrs	96 hrs
0	14	15	10.3	9.9	7.7	7.6	59	0	0	0
100	15	15	10.1	9.9	7.9	8.5	1359	0	0	0

Comments : All fish appeared and behaved normally during the test.

Culture/Control/Dilution Water Burnaby Municipal Dechlorinated Water

Hardness: 27 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	30 min.	Rate of Aeration	6.5±1 mL/min/L
Test Volume :	15 L	Vessel Volume :	20L	Test pH Adjusted:	No
Loading Density :	0.2 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Aqua Farm

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.3 ± 0.1 g	Length (Mean) +- SD :	3.37 ± 0.32 cm
Culture Water Renewal :	≥ 1L/min/kg fish	Weight (Range) :	0.2 – 0.4 g	Length (Range) :	2.60 – 3.70 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%
Feeding rate and frequency :	daily: 1-5% biomass of trout.			Acclimation Time:	>14 days

Reference chemical: Zinc Test Date: Nov 05, 2023

Test Endpoint 96 hrs LC50 (95% confidence interval) : 0.12 (0.11, 0.14)mg/L Statistical Method : Untrimmed Spearman-Kärber

Historical Mean LC50 (warning limits) : 0.19 (0.10, 0.37) mg/L Concentration : 0,0.04,0.08,0.16,0.32,0.64 mg/L

Test Method BV Lab's BBY2SOP-00004 is based on the latest version of EPS 1/RM9 and EPS 1 /RM13.

Method Deviations : None.

Note: The results contained in this report refer only to the testing of the sample submitted. Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation, including the toxicity parameters reported herein. The conductivity, dissolved oxygen and pH data contained within the toxicity report are provided for information purposes and are not individually accredited parameters. This report may not be reproduced, except in its entirety, without the written approval of the laboratory.

Analyst : Mustaffa Hamad, Navpreet Shergill, Sebastian Leroux

Verified By : Navpreet Shergill, Scientist Date: Nov 22, 2023 08:11 AM

Appendix IV

Stantec Consulting Ltd.
500-4730 Kingsway
Burnaby, BC V5H 0C6

July 20, 2023

123221643

Attention: Atikin Hehn
Bureau Veritas Laboratory
4606 Canada Way
Burnaby, BC V5G 1K5

Dear Atikin,

Reference: Quinsam Lakes Phytoplankton, May 2023 (Sample Reference BPU302-07, BPU307-07, BPU341-07, BPU342-07, BPU324-07; Job Numbers C331138, C331139, C331142, C331145)

Introduction

Quinsam Coal Ltd. collects water samples from the Quinsam Lakes system during the growing season to meet long-term water quality monitoring requirements as per the effluent discharge permit issued by the Ministry of Environment and Climate Change Strategy. From 1994 through 2013, the permit required sampling at depths of 1 m, 4 m and 9 m in April through September for Long Lake and Middle Quinsam Lake, with No Name Lake added to the program in June 2012 and Lower Quinsam Lake added in 2013. In 2014 the permit was revised, limiting sampling to surface water (1.0 m depth) three times per year (spring, late summer, fall overturn). Attachment A contains the long-term dataset.

Samples are collected by Quinsam Coal and submitted to Stantec Consulting Ltd. for phytoplankton taxonomic analysis, as part of ongoing monitoring requirements. Some months, an additional sample is taken as a field replicate for quality assurance/quality control. This brief report provides information about samples collected in May 2023 from Long Lake, No Name Lake, Middle Quinsam Lake, and Lower Quinsam Lake. Attachment B contains the results for May 2023. Attachment C contains copies of the chain of custody forms for May.

Methods

Sub-samples (27 mL) of preserved lake water were settled and examined at 100 X, 400 X and 1,000 X magnifications using a Zeiss inverted microscope. Counting effort is defined as at least 100 organisms of the predominant species at 400 X, up to 200 fields at 1,000 X, and a half or whole sub-sample at 100 X.

Reference: **Quinsam Lakes Phytoplankton, May 2023 (Sample Reference BPU302-07, BPU307-07, BPU341-07, BPU342-07, BPU324-07; Job Numbers C331138, C331139, C331142, C331145)**

Results

Abundance

Abundance data for 1993 to 2022 are summarized in Attachment A and detailed taxonomic results for May 2023 are presented in Attachment B. Total abundance in the May samples is shown in Table 1. Total abundance for May ranged from 1,100 cells/mL (Middle Quinsam Lake) to 2,800 cells/mL (Long Lake). These numbers are in the range reported historically.

Table 1 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2023

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May 3 and May 4	2,800	2,700	170	2.0
Middle Quinsam		1,100	940	120	1.1
No Name		1,900	1,800	160	0.5
Lower Quinsam		1,300	1,100	180	22
Lower Quinsam (replicate)		1,200	1,100	120	7.0

Species Composition

Species composition data for the May 2023 samples are contained in Attachment B. The most abundant phytoplankton in the four lakes were the very small (less than or equal to 5 µm) chrysoflagellates (*Ochromonas* spp. and *Chromulina* spp.). Although these ultra-nanoplankton species were very abundant numerically, they usually contribute little to algal biomass.

The most abundant of the larger algae were the chrysophyte *Ochromonas* spp. (predominant in the four lakes), cryptophyte *Rhodomonas minuta* (common in Long Lake and No Name Lake), and chrysophyte *Dinobryon cylindricum* and diatom *Cyclotella glomerata* (common in Lower Quinsam Lake).

The May 2023 samples were similar in composition and abundance to samples collected during the spring in recent years.

Comparison of Replicate Samples

Two replicate samples were collected from 1 m depth in Lower Quinsam Lake. Percent difference in the duplicate samples was calculated. A difference of up to 10% can be expected for a total cell count of 400 organisms, for repeat sampling from the same bottle; higher percent difference can be expected when separate grabs are used for the replicates, as was done here.

In Lower Quinsam Lake, total abundance was 1,300 cells/mL in one sample and 1,200 cells/mL in the other sample, with a difference of 11%. The replicate samples differed slightly in abundance of common species such as *Dinobryon cylindricum*. Abundance was similar in the two samples (with reasonable inter-sample reproducibility, given that the samples were taken from different bottles).

Reference: **Quinsam Lakes Phytoplankton, May 2023 (Sample Reference BPU302-07, BPU307-07, BPU341-07, BPU342-07, BPU324-07; Job Numbers C331138, C331139, C331142, C331145)**

Closure

We trust this information meets your present requirements. Should you have any questions or require additional information, please contact the undersigned.

Regards,

Stantec Consulting Ltd.

Karen Munro
Digitally signed by Karen Munro
Date: 2023.07.21 13:52:36 -07'00'

Digitally signed by Sandra Nelson
Date: 2023.07.23 21:17:07 -07'00'

Karen Munro M.Sc., P.R.Bio.
Senior Aquatic Scientist
Phone: (604) 436-3014
Karen.Munro@stantec.com

Sandra Nelson M.Sc., R.P.Bio.
Senior Aquatic Biologist
Phone: (778) 311-0217
Sandra.Nelson@stantec.com

Attachments: Attachment A: Historical Abundance Data: Quinsam Lakes System, 1993–2022
Attachment B: Species Composition Data: May 2023
Attachment C: Chain of Custody: May 2023

ATTACHMENT 2

Species Composition Data: May, 2023

Quinsam Lake Phytoplankton - 3 May 2023
Long Lake 1 m (BPU302-07, Job C331138)
27 ml sample settled

Total Cells Counted	**326**
Total Cells Per mL	**2,800**

	Number Counted	Cells per mL
1000X magnification - 25 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-A13 um)	48	1728
Ochromonas/Chromulina spp. (4-5 um)	15	540
Ochromonas/Chromulina spp. (6-7 um)	3	108
Pseudokephyrion sp.	4	144
Chrysochromulina cf. parva	3	108
CHLOROPHYCEAE		
Oocystis sp. (5 um x 3 um)	1	36
TOTAL	**74**	**2664**
400X magnification - 2 strips		
CHRYSOPHYCEAE		
Dinobryon sp.	6	5
Mallomonas spp.	2	2
Mallomonas cf. akrokomas		0
Ochromonas spp. (8-10 um)	117	99
unidentified cyst	4	3
BACILLARIOPHYCEAE		
Cyclotella cf. stelligera/ocellata	3	3
Melosira italica (fil)	1	1
Navicula sp. (40 um)	1	1
CHLOROPHYCEAE		
Dictyosphaerium pulchellum (cols)	2	2
CRYPTOPHYCEAE		
Cryptomonas spp.	3	3
Rhodomonas minuta	62	53
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	2	2
TOTAL	**203**	**173**
100X magnification - whole sample		
BACILLARIOPHYCEAE		
Eunotia sp. (long)	1	0.04
Synedra radians	28	1.1
Synedra ulna	2	0.1
Synedra sp. (small)	6	0.2
CHLOROPHYCEAE		
Closterium sp.	1	0.04
Elakatothrix gelatinosa (cols)	11	0.4
TOTAL	**49**	**2.0**

Quinsam Lake Phytoplankton - 3 May 2023
Middle Quinsam Lake 1 m (BPU324-07, Job C331142)
27 ml sample settled

Total Cells Counted	**272**
Total Cells Per mL	**1,100**

	Number Counted	Cells per mL
1000X magnification - 100 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-3 um)	44	396
Ochromonas/Chromulina spp. (4-5 um)	28	252
Ochromonas/Chromulina spp. (6-7 um)	24	216
Pseudokephyrion sp.	8	72
TOTAL	**104**	**936**
400X magnification - 2 strips		
CHRYSOPHYCEAE		
Dinobryon cyst	1	1
Dinobryon sp.	1	1
Ochromonas spp. (8-10 um)	106	90
BACILLARIOPHYCEAE		
Cyclotella glomerata (cells + cols)	4	3
Melosira italica (fil)	1	1
CHLOROPHYCEAE		
Staurastrum sp.	1	1
Oocystis sp. (cells)	3	3
Tetraedron minimum	3	3
CRYPTOPHYCEAE		
Cryptomonas spp.	5	4
Rhodomonas minuta	15	13
TOTAL	**140**	**119**
100X magnification - whole sample		
CHRYSOPHYCEAE		
Dinobryon cylindricum (2 cols, 5 cells)	5	0.2
BACILLARIOPHYCEAE		
Synedra radians	15	0.6
Synedra ulna	1	0.04
Synedra sp. (small)	4	0.2
Tabellaria fenestrata (1 col, 3 cells)	3	0.1
TOTAL	**28**	**1.1**

Quinsam Lake Phytoplankton - 3 May 2023
No Name Lake 1 m (BPU307-07, Job C331139)
27 ml sample settled

Total Cells Counted	**304**
Total Cells Per mL	**1,900**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-A13 um)	52	936
Ochromonas/Chromulina spp. (4-5 um)	24	432
Ochromonas/Chromulina spp. (6-7 um)	16	288
Pseudokephyrion sp.	6	108
TOTAL	**98**	**1764**
400X magnification - 2 strips		
CHRYSOPHYCEAE		
Diceras chodati	7	6
Dinobryon sp. (cyst)	9	8
Mallomonas spp.	10	9
Ochromonas spp. (8-10 um)	110	94
unidentified cyst	8	7
BACILLARIOPHYCEAE		
Achnanthes sp.	1	1
Melosira italica (fil)	1	1
CHLOROPHYCEAE		
Gloeocystis sp. (cells)	4	3
Oocystis sp. (cells + cols)	1	1
CRYPTOPHYCEAE		
Cryptomonas spp.	11	9
Rhodomonas minuta	32	27
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	1	1
TOTAL	**194**	**165**
100X magnification - whole sample		
BACILLARIOPHYCEAE		
Synedra radians	1	0.04
Synedra sp. (small)	2	0.1
Tabellaria fenestrata	1	0.04
CHLOROPHYCEAE		
Elakatothrix gelatinose (cols)	8	0.3
Mougeotia sp. (1 fil, 2 cells)	2	0.1
TOTAL	**12**	**0.5**

Quinsam Lake Phytoplankton - 4 May 2023
Lower Quinsam Lake 1 m (BPU341-07, Job C331145)
27 ml sample settled

Total Cells Counted	**552**
Total Cells Per mL	**1,300**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-3 um)	33	594
Ochromonas/Chromulina spp. (4-5 um)	15	270
Ochromonas/Chromulina spp. (6-7 um)	9	162
Pseudokephyrion sp.	4	72
Chrysochromulina parva	1	18
TOTAL	**62**	**1116**
400X magnification - 2 strips		
CHRYSOPHYCEAE		
Dinobryon sp.	5	4
Ochromonas spp. (8-10 um)	105	89
BACILLARIOPHYCEAE		
Cyclotella glomerata (cells + cols)	37	31
Cyclotella cf. stelligera/ocellata	16	14
CHLOROPHYCEAE		
Gloeocystis sp. (cols + cells)	3	3
Scenedesmus sp. (col)	1	1
Tetraedron minimum	10	9
DINOPHYCEAE		
Gymnodinium sp.	5	4
CRYPTOPHYCEAE		
Cryptomonas spp.	13	11
Rhodomonas minuta	15	13
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	1	1
TOTAL	**211**	**179**
100X magnification - half sample		
CHRYSOPHYCEAE		
Dinobryon cylindricum (32 cols, 231 cells)	231	18.5
BACILLARIOPHYCEAE		
Diatoma tenue (2 col, 13 cells)	13	1.0
Synedra ulna	3	0.2
Synedra radians	27	2.2
Synedra sp. (small)	3	0.2
CHLOROPHYCEAE		
Botryococcus braunii (col)	1	0.1
Elakatothrix gelatinosa (col)	1	0.1
TOTAL	**279**	**22**

Quinsam Lake Phytoplankton - 4 May 2023
Lower Quinsam Lake 1 m (BPU342-07, Job C331145)
27 ml sample settled

Total Cells Counted	**360**
Total Cells Per mL	**1,200**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-3 um)	24	432
Ochromonas/Chromulina spp. (4-5 um)	24	432
Ochromonas/Chromulina spp. (6-7 um)	9	162
Pseudokephyrion sp.	4	72
TOTAL	**61**	**1098**
400X magnification - 3 strips		
CHRYSOPHYCEAE		
Dinobryon sp.	2	1
Dinobryon cyst	1	1
Ochromonas spp. (8-10 um)	117	66
BACILLARIOPHYCEAE		
Achnanthes sp.	1	1
Cyclotella glomerata (cells + cols)	14	8
Cyclotella cf. stelligera/ocellata	13	7
Melosira italica (fil)	1	1
Navicula sp. (40 um)	1	1
CHLOROPHYCEAE		
Gloeocystis sp. (cols + cells)	2	1
Tetraedron minimum	3	2
DINOPHYCEAE		
Gymnodinium sp.	3	2
CRYPTOPHYCEAE		
Cryptomonas spp.	28	16
Rhodomonas minuta	25	14
TOTAL	**211**	**120**
100X magnification - half sample		
CHRYSOPHYCEAE		
Dinobryon cylindricum (9 cols, 62 cells)	62	5.0
BACILLARIOPHYCEAE		
Synedra ulna	1	0.1
Synedra radians	20	1.6
Synedra sp. (small)	4	0.3
CHLOROPHYCEAE		
Closterium sp.	1	0.1
TOTAL	**88**	**7.0**

Stantec Consulting Ltd.
500-4730 Kingsway
Burnaby, BC V5H 0C6

October 4, 2023

123221643

Attention: Atikin Hehn
Bureau Veritas Laboratory
4606 Canada Way
Burnaby, BC V5G 1K5

Dear Atikin,

Reference: Quinsam Lakes Phytoplankton, July 2023 (Sample Reference BUY008-01, Buy007-02, BUY067-01; Job Numbers C354748, C354752)

Introduction

Quinsam Coal Ltd. collects water samples from the Quinsam Lakes system during the growing season to meet long-term water quality monitoring requirements as per the effluent discharge permit issued by the Ministry of Environment and Climate Change Strategy. From 1994 through 2013, the permit required sampling at depths of 1 m, 4 m and 9 m in April through September for Long Lake and Middle Quinsam Lake, with No Name Lake added to the program in June 2012 and Lower Quinsam Lake added in 2013. In 2014 the permit was revised, limiting sampling to surface water (1.0 m depth) three times per year (spring, late summer, fall overturn). Attachment A contains the long-term dataset.

Samples are collected by Quinsam Coal and submitted to Stantec Consulting Ltd. for phytoplankton taxonomic analysis, as part of ongoing monitoring requirements. Some months, an additional sample is taken as a field replicate for quality assurance/quality control. This brief report provides information about samples collected in July 2023 from Long Lake and Middle Quinsam Lake, and presents the summary results from May 2023. Attachment B contains the results for July 2023. Attachment C contains copies of the chain of custody forms for July.

Methods

Sub-samples (27 mL) of preserved lake water were settled and examined at 100 X, 400 X and 1,000 X magnifications using a Zeiss inverted microscope. Counting effort is defined as at least 100 organisms of the predominant species at 400 X, up to 200 fields at 1,000 X, and a half or whole sub-sample at 100 X.

Reference: **Quinsam Lakes Phytoplankton, July 2023 (Sample Reference BUY008-01, Buy007-02, BUY067-01; Job Numbers C354748, C354752)**

Results

Abundance

Total abundance in the May and July samples is shown in Table 1. Total abundance for July ranged from 870 cells/mL (Long Lake) to 1,200 cells/mL (Middle Quinsam Lake). These numbers are in the range reported historically.

Table 1 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2023

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May 3 and May 4	2,800	2,700	170	2.0
Middle Quinsam		1,100	940	120	1.1
No Name		1,900	1,800	160	0.5
Lower Quinsam		1,300	1,100	180	22
Lower Quinsam (replicate)		1,200	1,100	120	7.0
Long	18 July	960	850	120	1.1
Long (replicate)		870	740	130	2.3
Middle Quinsam		1,200	530	710	0.3

Species Composition

Species composition data for the July 2023 samples are contained in Attachment B. The most abundant phytoplankton in Long Lake were the very small (less than or equal to 5 µm) chrysoflagellates (*Ochromonas* spp. and *Chromulina* spp.). Although these ultra-nanoplankton species were very abundant numerically, they usually contribute little to algal biomass. These were not the most abundant taxa in Middle Quinsam Lake; *Dictosphaerium pulchellum* was predominant.

In Long Lake, the most abundant of the larger algae were the cryptophytes *Cryptomonas* spp. and *Rhodomonas minuta*, with the chrysophyte *Ochromonas* spp. common. In Middle Quinsam Lake, the colonial chlorophyte *Dictyosphaerium pulchellum* was predominant and small chrysophytes and *Ochromonas* spp. were common.

The July 2023 samples were similar in composition and abundance to samples collected during the summer in recent years.

Comparison of Replicate Samples

Two replicate samples were collected from 1 m depth in Long Lake. Percent difference in the duplicate samples was calculated. A difference of up to 10% can be expected for a total cell count of 400 organisms, for repeat sampling from the same bottle; higher percent difference can be expected when separate grabs are used for the replicates, as was done here.

Reference: **Quinsam Lakes Phytoplankton, July 2023 (Sample Reference BUY008-01, Buy007-02, BUY067-01; Job Numbers C354748, C354752)**

In Long Lake, total abundance was 870 cells/mL in one sample and 960 cells/mL in the other sample, with a difference of 5%. The replicate samples differed slightly in abundance of common species such as *Cryptomonas* spp. Abundance was similar in the two samples (with reasonable inter-sample reproducibility, given that the samples were taken from different bottles).

Closure

We trust this information meets your present requirements. Should you have any questions or require additional information, please contact the undersigned.

Regards,

Stantec Consulting Ltd.

Karen Munro M.Sc., R.P.Bio.
Senior Aquatic Scientist
Phone: (604) 436-3014
Karen.Munro@stantec.com

Sandra Nelson M.Sc., R.P.Bio.
Senior Aquatic Biologist
Phone: (778) 311-0217
Sandra.Nelson@stantec.com

Attachments: Attachment A: Historical Abundance Data: Quinsam Lakes System, 1993–2022
Attachment B: Species Composition Data: July 2023
Attachment C: Chain of Custody: July 2023

ATTACHMENT 2

Species Composition Data: July, 2023

Quinsam Lake Phytoplankton - 18 July 2023
Long Lake 1 m (BUY008-02, Job C354748)
27 ml sample settled

Total Cells Counted	**348**
Total Cells Per mL	**960**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-A13 um)	25	450
Ochromonas/Chromulina spp. (4-5 um)	15	270
Ochromonas/Chromulina spp. (6-7 um)	3	54
Pseudokephyrion sp.	1	18
CHLOROPHYCEAE		0
Oocystis sp. (5 um x 3 um)	3	54
TOTAL	**47**	**846**
400X magnification - 4 strips		
CHRYSOPHYCEAE		
Dinobryon sp.	1	0.4
Mallomonas spp.	3	1
Ochromonas spp. (8-10 um)	56	24
BACILLARIOPHYCEAE		
Cyclotella cf. stelligera/ocellata	11	5
Melosira italica (fil)	8	3
CHLOROPHYCEAE		
Coelastrum sp. (col)	1	0.4
Dictyosphaerium pulchellum (cols)	10	4
Gloeocystis sp. (cells + cols)	3	1
Nephrocytium sp. (cells)	15	6
Oocystis sp. (cells + cols)	5	2
Schroederia setigera	2	1
DINOPHYCEAE		
Gymnodinium sp.	1	0.4
CRYPTOPHYCEAE		
Cryptomonas spp.	95	40
Rhodomonas minuta	61	26
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	1	0.4
TOTAL	**273**	**116**
100X magnification - whole sample		
CHRYSOPHYCEAE		
Dinobryon bavaricum (cells)	1	0.04
Dinobryon cylindricum (cells)	14	0.56
BACILLARIOPHYCEAE		
Navicula sp. (75 um)	1	0.04
Synedra radians	5	0.2
CHLOROPHYCEAE		
Elakatothrix gelatinosa (cols)	3	0.1
CYANOPHYCEAE		0.0
Anabaena flos-aquae (4 fil, 80 cells)	4	0.2
TOTAL	**28**	**1.1**

Quinsam Lake Phytoplankton - 18 July 2023
Long Lake 1 m Replicate (BUY008-01, Job C354748)
27 ml sample settled

Total Cells Counted	**408**
Total Cells Per mL	**870**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-A13 um)	21	378
Ochromonas/Chromulina spp. (4-5 um)	16	288
Ochromonas/Chromulina spp. (6-7 um)	1	18
Pseudokephyrion sp.	1	18
Chrysochromulina parva	1	18
CHLOROPHYCEAE		0
Oocystis sp. (5 um x 3 um)	1	18
TOTAL	**41**	**738**
400X magnification - 4 strips		
CHRYSOPHYCEAE		
Dinobryon sp.	3	1.3
Mallomonas spp.	6	3
Ochromonas spp. (8-10 um)	62	26
BACILLARIOPHYCEAE		
Cyclotella cf. stelligera/ocellata	10	4
Melosira italica (fil)	5	2
CHLOROPHYCEAE		
Coelastrum sp. (col)	2	0.9
Dictyosphaerium pulchellum (cols)	13	6
Gloeocystis sp. (cells + cols)	16	7
Nephrocytium sp. (cells)	26	11
Oocystis sp. (cells + cols)	7	3
Scenedesmus sp. (cols)	3	1
Schroederia setigera	3	1
DINOPHYCEAE		
Peridinium sp.	1	0.4
CRYPTOPHYCEAE		
Cryptomonas spp.	63	27
Rhodomonas minuta	81	34
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	7	3.0
TOTAL	**308**	**131**
100X magnification - whole sample		
CHRYSOPHYCEAE		
Dinobryon bavaricum (cells)	1	0.04
Dinobryon cylindricum (cells)	32	1.3
BACILLARIOPHYCEAE		
Synedra radians	4	0.2
CHLOROPHYCEAE		
Elakatothrix gelatinosa (cols)	7	0.3
Mougeotia sp. (1 fil, 2 cells)	2	
CYANOPHYCEAE		0.00
Anabaena flos-aquae (12 fil, 250 cells)	12	0.5
Oscillatoria sp. (1 fil, 1000 um long)	1	0.04
TOTAL	**59**	**2.3**

Quinsam Lake Phytoplankton - 3 May 2023
Middle Quinsam Lake 1 m (BUY067-01, Job C354752)
27 ml sample settled

Total Cells Counted	**486**
Total Cells Per mL	**1,200**

	Number Counted	Cells per mL
1000X magnification - 100 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-3 um)	18	162
Ochromonas/Chromulina spp. (4-5 um)	16	144
Ochromonas/Chromulina spp. (6-7 um)	6	54
Chrysochromulina parva	1	9
CHLOROPHYCEAE		
Oocystis sp. (5 um x 3 um)	18	162
TOTAL	**59**	**531**
400X magnification - 1 strip		
CHRYSOPHYCEAE		
Ochromonas spp. (8-10 um)	43	73
CHLOROPHYCEAE		
Dictyosphaerium pulchellum (cols)	335	570
Oocystis sp. (cells)	4	7
Scenedesmus sp. (col)	1	2
Schroederia setigara	1	2
DINOPHYCEAE		
Gymnodinium sp.	1	2
Peeridinium sp.	1	2
CRYPTOPHYCEAE		
Cryptomonas spp.	22	37
Rhodomonas minuta	12	20
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	4	7
Rhabdoderma sp. (2 col)	2	3
TOTAL	**420**	**714**
100X magnification - whole sample		
BACILLARIOPHYCEAE		
Navicula sp. (100 um)	1	0.04
Synedra radians	2	0.1
CHLOROPHYCEAE		
Botryococcopsis (col)	1	0.04
Euastrum sp.	1	0.04
Quadrigula chodatii (1 col, 4 cells)	1	0.04
CYANOPHYCEAE		
Anabaena flos-aquae (1 fil, 20 cells)	1	0.04
TOTAL	**7**	**0.3**

Stantec Consulting Ltd.
500-4730 Kingsway
Burnaby, BC V5H 0C6

December 1, 2023

123221643

Attention: Atikin Hehn
Bureau Veritas Laboratory
4606 Canada Way
Burnaby, BC V5G 1K5

Dear Atikin,

Reference: Quinsam Lakes Phytoplankton, October 2023 (Sample Reference CBQ646-07, CBQ741-07, and CBQ742-07; Job Numbers C382604 and C382615)

Introduction

Quinsam Coal Ltd. collects water samples from the Quinsam Lakes system during the growing season to meet long-term water quality monitoring requirements as per the effluent discharge permit issued by the Ministry of Environment and Climate Change Strategy. From 1994 through 2013, the permit required sampling at depths of 1 m, 4 m and 9 m in April through September for Long Lake and Middle Quinsam Lake, with No Name Lake added to the program in June 2012 and Lower Quinsam Lake added in 2013. In 2014 the permit was revised, limiting sampling to surface water (1.0 m depth) three times per year (spring, late summer, fall overturn). Attachment A contains the long-term dataset.

Samples are collected by Quinsam Coal and submitted to Stantec Consulting Ltd. for phytoplankton taxonomic analysis, as part of ongoing monitoring requirements. Some months, an additional sample is taken as a field replicate for quality assurance/quality control. This brief report provides information about samples collected in October 2023 from Long Lake and Middle Quinsam Lake and presents the summary results from May and July 2023. Attachment B contains the results for October 2023. Attachment C contains copies of the chain of custody forms for October.

Methods

Sub-samples (27 mL) of preserved lake water were settled and examined at 100 X, 400 X, and 1,000 X magnifications using a Zeiss inverted microscope. Counting effort is defined as at least 100 organisms of the predominant species at 400 X, up to 200 fields at 1,000 X, and either a half or whole sub-sample at 100 X, depending on abundance at the various magnifications.

Reference: **Quinsam Lakes Phytoplankton, October 2023 (Sample Reference CBQ646-07, CBQ741-07, and CBQ742-07; Job Numbers C382604 and C382615)**

Results

Abundance

Total abundance in the May, July, and October samples is shown in Table 1. Total abundance for October ranged from 1,100 cells/mL (Long Lake) to 1,400 cells/mL (Middle Quinsam Lake replicate). These numbers are in the range reported historically.

Table 1 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2023

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May 3 and May 4	2,800	2,700	170	2.0
Middle Quinsam		1,100	940	120	1.1
No Name		1,900	1,800	160	0.5
Lower Quinsam		1,300	1,100	180	22
Lower Quinsam (replicate)		1,200	1,100	120	7.0
Long	18 July	960	850	120	1.1
Long (replicate)		870	740	130	2.3
Middle Quinsam		1,200	530	710	0.3
Long	10 October	1,100	990	140	6.7
Middle Quinsam		1,300	1,200	150	25
Middle Quinsam (replicate)		1,400	1,200	140	28

Species Composition

Species composition data for the October 2023 samples are contained in Attachment B. The most abundant phytoplankton in Long Lake and Middle Quinsam Lake were the very small (less than or equal to 5 µm) chrysoflagellates (*Ochromonas* spp. and *Chromulina* spp.). Although these ultra-nanoplankton species were very abundant numerically, they usually contribute little to algal biomass.

In both Long Lake and Middle Quinsam Lake, the most abundant of the larger algae were the chrysophytes *Ochromonas* spp., with the chrysophyte *Dinobryon cylindricum* and the cryptophytes *Cryptomonas* spp. and *Rhodomonas minuta* common. In Long Lake, the chrysophyte *Mallomonas* cf. *akrokomas* was also common.

The October 2023 samples were similar in composition and abundance to samples collected during the autumn in recent years.

Reference: **Quinsam Lakes Phytoplankton, October 2023 (Sample Reference CBQ646-07, CBQ741-07, and CBQ742-07; Job Numbers C382604 and C382615)**

Comparison of Replicate Samples

Two replicate samples were collected from 1 m depth in Middle Quinsam Lake. Percent difference in the duplicate samples was calculated. A difference of up to 10% can be expected for a total cell count of 400 organisms, for repeat sampling from the same bottle; higher percent difference can be expected when separate grabs are used for the replicates, as was done here.

In Middle Quinsam Lake, total abundance was 1,300 cells/mL in one sample and 1,400 cells/mL in the other sample, with a difference of 7%. Abundance and taxonomic composition was similar in the two samples (with reasonable inter-sample reproducibility, given that the samples were taken from different bottles).

Closure

We trust this information meets your present requirements. Should you have any questions or require additional information, please contact the undersigned.

Regards,

Stantec Consulting Ltd.

Karen Munro

Digitally signed by Karen Munro
Date: 2023.12.01 12:03:06 -08'00'

Digitally signed by Nelson, Sandra
Date: 2023.12.01 12:22:19 -08'00'

Karen Munro M.Sc., R.P.Bio.
Senior Aquatic Scientist
Phone: (604) 436-3014
Karen.Munro@stantec.com

Sandra Nelson M.Sc., R.P.Bio.
Senior Aquatic Biologist
Phone: (778) 311-0217
Sandra.Nelson@stantec.com

Attachments: A: Historical Abundance Data: Quinsam Lakes System, 1993–2022
B: Species Composition Data: October 2023
C: Chain of Custody: October 2023

Reference: **Quinsam Lakes Phytoplankton, October 2023 (Sample Reference CBQ646-07, CBQ741-07, and CBQ742-07; Job Numbers C382604 and C382615)**

Attachment A Historical Abundance Data: Quinsam Lakes System, 1993–2022

Table 1-1 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1993 and 1994

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
1993 October	LLM1	2,300	1,800	530	
	LLM3	3,000	2,400	550	
	LLMB	610	420	190	
1994 May	LL1R	10,000	8,800	1,200	
	LL3R	5,000	3,800	1,200	
	LL9R	4,000	3,200	800	
1994 June	LL0	1,400	1,200	250	
	LL1	1,000	790	220	
	LL4	1,500	1,200	320	
	LL9	2,500	1,900	580	
	LLB	830	440	390	
1994 July	LL1	2,100	1,900	180	
	LL4	1900	1700	250	
	LL9	1,500	1,100	400	
1994 August	LL1	1,700	1,400	290	
	LL4	1,000	850	200	
	LL9	900	780	150	
1994 September	LL1	900	620	250	
	LL4	2,300	2,000	260	
	LL9	2,100	1,700	350	

Table 1-2 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1995

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	3,100	2,700	340	
	LL4	3,300	2,900	350	
	LL9	1,300	1,100	280	
May	LL1	5,400	4,900	570	
	LL4	4,800	4,100	700	
	LL9	1,500	1,000	500	
June	LL1	2,100	1,800	300	
	LL4	2,600	2,100	500	
	LL9	7,400	6,600	850	
July	LL1	2,000	1,700	300	
	LL4	1,900	1,650	350	
	LL9	1,500	1,200	300	
August	LL1	1,100	960	180	
	LL4	1,300	1,100	240	
	LL9	1,900	1,700	210	
September	LL1	2,900	2,800	170	
	LL4	3,400	3,100	330	
	LL9	1,900	1,600	280	

Table 1-3 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1996

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	4,600	4,200	340	
	LL4	6,000	5,600	380	
	LL9	1,100	960	160	
May	LL1	2,200	1,600	600	31
	LL4	2,200	1,700	540	16
	LL9	1,700	1,400	290	26
June	LL1	2,100	1,600	440	4
	LL4	1,600	1,300	340	2
	LL9	1,600	1,100	500	9
July	LL1	2,400	2,300	140	1
	LL4	3,200	3,000	200	3
	LL9	No sample			
August	LL1	2,100	1,900	160	1
	LL4	2,200	1,800	390	37
	LL9	1,700	1,500	200	10
September	LL1	1,900	1,600	230	82
	LL4	2,200	1,800	300	145
	LL9	2,100	1,800	220	38
April	MQ1	No sample			
	MQ4	No sample			
	MQ9	No sample			
May	MQ1	2,000	1,700	230	11
	MQ4	1,100	930	180	7
	MQ9	2,200	1,800	430	1
June	MQ1	2,700	2,500	150	3
	MQ4	2,600	2,400	210	7
	MQ9	1,200	1,000	190	1
July	MQ1	2,400	2,100	335	24
	MQ4	1,900	1,400	380	130
	MQ9	1,200	860	320	29
August	MQ1	2,800	2,500	280	17
	MQ4	1,800	1,500	310	18
	MQ9	2,300	1,900	390	21
September	MQ1	1,700	1,300	270	5
	MQ4	900	560	350	0.6
	MQ9	1,200	1,100	190	0.7

Table 1-4 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1997

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
early May	LL1	3,200	2,800	340	12
	LL4	4,300	4,000	300	32
	LL9	1,700	1,600	140	5
late May[1]	LL1	3,000	2,600	370	61
	LL4	4,900	4,200	620	100
	LL9	4,700	4,000	730	44
June[2]	LL1	1,500	1,100	340	2
	LL4	1,200	1,000	240	1
	LL9	3,900	2,700	1,200	50
July	LL1	2,400	2,300	110	0
	LL4	1,700	1,500	170	0.1
	LL9	480	390	80	2
August	LL1	1,900	1,700	230	0.2
	LL4	880	740	140	0.6
	LL9	1,000	870	93	1.4
September	LL1	1,000	870	140	0.6
	LL4	2,000	1,800	270	0.3
	LL9	700	490	210	0.8
early May	MQ1	1,700	1,400	270	2
	MQ4	1,600	1,400	240	2
	MQ9	2,500	2,300	240	2
late May	MQ1	1,200	1,000	150	0.4
	MQ4	1,600	1,300	280	1
	MQ9	1,200	1,000	190	0.2
June	MQ1	1,900	1,700	140	1
	MQ4	2,500	2,400	130	1
	MQ9	1,400	1,200	200	1
July	MQ1	2,400	2,300	130	0.3
	MQ4	1,500	1,400	110	0.1
	MQ9	890	640	260	0.6
August	MQ1	2,100	1,900	220	0.8
	MQ4	1,500	1,300	190	1.4
	MQ9	1,000	760	240	1.6
September	MQ1	800	640	170	1.3
	MQ4	900	620	280	6.4
	MQ9	650	370	280	1.5

NOTES:
1. Recalculated counting *Synedra radians* at 400X rather than 100X
2. Recalculated counting *Synedra radians* at 400X rather than 100X & *Cyclotella glomerata* at 1,000X rather than 400X

Table 1-5 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1998

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	2,800	2,600	210	12
	LL4	4,100	3,700	390	12
	LL9	1,600	1,100	500	10
May[1]	LL1	2,000	1,500	430	76
	LL4	1,600	1,100	480	85
	LL9	2,100	1,500	630	20
June	LL1	5,700	5,600	140	0.3
	LL4	7,100	6,900	210	0.3
	LL9	3,300	1,700	1,600	4
July	LL1	1,200	1,100	130	10
	LL4	740	560	170	8
	LL9	760	130	630	5
August	LL1	1,900	1,700	190	2
	LL4	2,200	2,000	230	2
	LL9	1,900	1,600	220	5
September	LL1	5,000	4,900	130	2
	LL4	3,500	3,300	150	2
	LL9	2,200	2,000	220	5
April	MQ1	2,200	1,900	250	3
	MQ4	1,900	1,600	260	3
	MQ9	3,100	2,700	460	2
May	MQ1	2,500	2,300	210	1
	MQ4	2,600	2,400	180	2
	MQ9	2,100	1,700	480	0.4
June	MQ1	1,900	1,700	180	1
	MQ4	1,600	1,400	200	1
	MQ9	1,300	1,000	310	0.4
July	MQ1	1,500	1,400	120	19
	MQ4	1,800	1,600	150	35
	MQ9	1,300	1,100	190	25
August	MQ1	1,900	1,700	250	12
	MQ4	1,300	950	350	10
	MQ9	1,400	890	490	12
September	MQ1	2,000	1,800	200	11
	MQ4	2,700	2,500	220	7
	MQ9	2,100	1,900	230	10

NOTE:
1. Recalculated for counting *Synedra radians* at 400X rather than 100X

Table 1-6 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 1999

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	3,800	3,500	310	9
	LL4	6,800	6,200	560	17
	LL9	3,000	2,600	410	10
May	LL1	No sample			
	LL4	No sample			
	LL9	No sample			
early July	LL1	1,100	910	150	2
	LL4	1,400	1,200	150	1
	LL9	1,300	1,200	100	1
late July	LL1	1,100	870	200	1
	LL4	2,000	1,800	280	1
	LL9	1,000	860	130	1
August	LL1	2,700	2,500	180	2
	LL4	2,800	2,600	170	6
	LL9	3,000	2,800	170	4
September	LL1	3,700	3,500	230	12
	LL4	5,000	4,700	290	17
	LL9	4,000	3,700	290	3
April	MQ1	2,300	1,600	220	430
	MQ4	2,200	1,800	200	230
	MQ9	2,700	1,900	600	190
May	MQ1	No sample			
	MQ4	No sample			
	MQ9	No sample			
early July	MQ1	790	700	90	0.4
	MQ4	770	620	150	0.5
	MQ9	1,100	1,000	130	0.3
late July	MQ1	2,700	2,600	110	0.2
	MQ4	2,100	1,900	220	0.8
	MQ9	620	420	190	0.3
August	MQ1	2,100	2,000	140	6
	MQ4	1,100	980	110	4
	MQ9	1,100	1,000	120	9
September	MQ1	1,300	1,100	190	14
	MQ4	1,500	1,300	190	9
	MQ9	760	540	210	10

Table 1-7 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2000

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	2,100	1,600	450	33
	LL4	2,500	1,800	700	68
	LL9	1,300	590	740	6.8
May	LL1	3,300	2,800	530	17
	LL4	3,000	2,600	320	15
	LL9	2,000	1,500	490	15
June	LL1	2,900	2,500	390	9.1
	LL4	2,900	2,400	400	19
	LL9	6,400	5,700	730	19
July	LL1	1,600	1,400	130	2.1
	LL4	1,400	1,200	250	1.6
	LL9	1,200	990	250	3.6
August	LL1	1,800	1,600	170	12
	LL4	1,100	940	190	8.2
	LL9	1,500	1,400	130	1.9
September	LL1	2,200	1,900	360	11
	LL4	2,000	1,800	200	9.2
	LL9	1,300	1,100	200	7.2
April	MQ1	1,800	1,300	450	5.9
	MQ4	1,700	1,300	420	1.6
	MQ9	1,500	1,200	280	1.7
May	MQ1	1,800	1,500	290	3
	MQ4	1,600	1,300	290	4.4
	MQ9	1,900	1,600	270	7.6
June	MQ1	2,100	1,900	250	1.4
	MQ4	2,400	2,200	200	2.1
	MQ9	1,800	1,500	380	1.1
July	MQ1	1,300	1,100	210	7.4
	MQ4	2,100	1,800	250	9.6
	MQ9	2,100	1,300	800	22
August	MQ1	1,500	1,200	290	5.8
	MQ4	2,200	1,900	310	7.2
	MQ9	2,400	1,900	500	7.5
September	MQ1	1,800	1,600	200	14
	MQ4	2,100	1,900	250	14
	MQ9	2,000	1,700	220	28

Table 1-8 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2001

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	3,300	2,600	670	19
	LL4	4,400	3,900	830	13
	LL9	1,400	860	490	5
May	LL1	7,700	6,200	1,100	310
	LL4	11,000	10,000	980	100
	LL9	4,600	3,600	670	22
June	LL1	7,800	6,600	1,000	170
	LL4	6,800	5,100	1,500	210
	LL9	3,000	2,400	680	25
July	LL1	3,300	3,100	170	1
	LL4	3,200	3,000	180	1
	LL9	1,600	1,400	160	2
August	LL1	1,300	1,100	180	1
	LL4	1,700	1,500	200	2
	LL9	720	540	170	1
September	LL1	8,200	8,000	270	13
	LL4	8,800	8,600	260	13
	LL9	4,800	4,600	190	1
April	MQ1	3,600	3,200	400	10
	MQ4	3,500	3,200	310	11
	MQ9	5,700	4,900	830	24
May	MQ1	1,900	1,500	360	17
	MQ4	1,800	1,400	370	14
	MQ9	3,800	3,200	600	13
June	MQ1	2,200	1,900	240	2
	MQ4	3,700	3,400	310	2
	MQ9	4,000	3,600	390	4
July	MQ1	2,500	2,300	230	8
	MQ4	2,700	2,400	260	6
	MQ9	1,500	1,200	240	8
August	MQ1	1,800	1,600	190	17
	MQ4	1,900	1,700	180	15
	MQ9	1,800	1,600	160	16
September	MQ1	1,900	1,700	180	24
	MQ4	3,200	2,900	230	37
	MQ9	1,800	1,600	190	43

Table 1-9 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2002

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	5,600	5,100	460	57
	LL4	5,600	5,100	490	40
	LL9	1,300	1,100	220	12
May	LL1	2,600	1,900	710	29
	LL4	2,700	2,000	690	41
	LL9	1,800	1,300	460	37
June	LL1	5,800	5,300	340	140
	LL4	9,200	8,600	450	96
	LL9	3,700	3,000	620	27
July	LL1	2,900	2,700	180	0.3
	LL4	2,400	2,200	160	0.6
	LL9	3,900	3,300	560	41.2
August	LL1	2,900	2,800	140	7.2
	LL4	2,300	2,200	150	3.2
	LL9	1,500	1,400	130	0.6
September	LL1	3,900	3,700	220	27
	LL4	3,500	3,200	260	31
	LL9	2,500	2,300	210	2.2
April	MQ1	2,000	1,700	360	8.2
	MQ4	1,900	1,600	300	3.6
	MQ9	1,500	1,200	260	4
May	MQ1	1,400	1,100	270	1.1
	MQ4	1,400	1,200	230	1.7
	MQ9	1,400	1,100	330	1.4
June	MQ1	1,000	940	110	1
	MQ4	800	680	120	0.3
	MQ9	60	50	7	0
July	MQ1	1,700	1,300	330	50
	MQ4	1,500	1,100	360	34
	MQ9	940	700	240	5.5
August*	MQ1	1,400	1,200	140	42
	MQ4	1,200	940	180	76
	MQ9	2,600	200	300	275
September	MQ1	1,400	1,200	160	33
	MQ4	2,100	1,900	220	28
	MQ9	1,100	920	160	28

NOTE:
* Recalculated for counting *Cyclotella bodanica* at 400X rather than 100X

Table 1-10 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2003

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	4,800	4,200	560	36
	LL4	3,600	2,900	640	8.6
	LL9	640	450	190	6.9
May	LL1	4,200	3,500	620	25
	LL4	4,600	3,800	800	23
	LL9	1,400	1,100	280	16
June	LL1	2,300	1,600	630	37
	LL4	6,800	6,100	600	43
	LL9	4,500	3,800	680	42
July	LL1	1,600	1,400	240	1
	LL4	2,400	2,100	270	0.5
	LL9	2,900	2,700	250	9.8
August	LL1	2,000	1,800	240	0.8
	LL4	2,200	1,900	250	0.5
	LL9	1,900	1,600	260	0.6
September	LL1	2,600	2,400	290	0.2
	LL4	3,700	3,400	340	1.8
	LL9	1,900	1,600	250	1.9
April	MQ1	3,500	2,900	570	28
	MQ4	3,000	2,400	510	17
	MQ9	2,000	1,600	310	17
May	MQ1	2,900	2,400	350	99
	MQ4	3,000	2,400	480	43
	MQ9	3,000	2,500	560	16
June	MQ1	1,300	1,100	180	6
	MQ4	1,900	1,500	420	21
	MQ9	3,000	2,700	350	16
July	MQ1	2,700	2,600	170	0.5
	MQ4	2,000	1,600	380	1.5
	MQ9	1,400	1,100	240	79
August	MQ1	1,300	1,000	280	43
	MQ4	1,500	1,200	240	44
	MQ9	3,500	2,500	620	338
September	MQ1	2,100	1,900	260	6.5
	MQ4	2,300	2,000	290	23
	MQ9	Not available			

Table 1-11 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2004

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	5,300	4,100	1,200	20
	LL4	3,500	2,600	860	13
	LL9	3,300	2,600	730	9.1
May	LL1	8,000	7,100	860	34
	LL4	6,600	5,300	1,200	36
	LL9	2,800	2,000	770	22
June	LL1	2,900	2,600	270	3.1
	LL4	2,900	2,600	310	5
	LL9	4,900	4,100	730	39
July	LL1	1,600	1,300	280	2.7
	LL4	1,200	1,100	170	2.2
	LL9	1,700	1,400	270	1
August	LL1	1,300	960	350	18
	LL4	1,400	1,000	300	38
	LL9	1,700	1,600	110	27
September	LL1	3,800	3,400	370	27
	LL4	4,300	3,900	350	25
	LL4 - duplicate	3,100	2,800	320	19
	LL9	3,000	2,700	280	12
April	MQ1	1,500	1,120	400	2.2
	MQ4	1,400	1,030	370	5.2
	MQ9	1,500	1,200	340	4.2
May	MQ1	2,300	2,000	310	2.4
	MQ4	1,500	1,200	300	3.6
	MQ9	2,600	2,100	470	2.4
June	MQ1	1,900	1,700	190	34
	MQ4	3,000	2,700	250	48
	MQ9	2,200	1,900	210	123
July*	MQ1	1,200	960	260	6.2
	MQ4	1,700	1,400	260	9.9
	MQ9	1,300	840	340	82
August**	MQ1	2,900	2,600	260	53
	MQ4	3,800	3,500	250	51
	MQ4 - duplicate	2,500	2,200	210	53
September	MQ9	3,900	3,600	260	44
	MQ1	2,300	1,700	550	25
	MQ4	2,100	1,600	420	26
	MQ9	2,500	2,000	520	19

NOTES:
* MQ9 recalculated for counting *Cyclotella bodanica* at 400X rather than 100X
** MQ1, MQ4, MQ9 recalculated for counting *Elakatothrix gelatinosa* colonies at 400X rather than

Table 1-12 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2005

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	2,700	2,100	550	24
	LL4	3,500	2,800	610	29
	LL9	670	460	200	8.5
May	LL1	7,200	6,600	670	55
	LL4	5,700	4,900	850	20
	LL9	1,300	850	440	20
June	LL1	2,700	2,400	300	2.4*
	LL4	2,800	2,500	330	8.3*
	LL9	990	850	130	8.9
July	LL1	1,200	800	400	44*
	LL4	1,700	1,200	460	33*
	LL9	692	540	150	3.5*
August	LL1	1,400	1,100	290	26
	LL4	1,100	810	220	64
	LL9	2,400	1,900	360	73
September	LL1	1,400	1,100	170	170
	LL4	2,300	1,900	220	170
	LL9	1,800	1,200	590	31*
April	MQ1	1,400	1,100	370	8.8
	MQ4	1,900	1,500	400	3.6
	MQ9	1,700	1,300	400	6.6
May	MQ1	1,300	1,000	300	3.4
	MQ4	1,500	1,200	330	3.2
	MQ9	1,300	1,000	340	3.7
June	MQ1	1,700	1,600	150	4.6
	MQ4	1,000	710	270	2.1
	MQ9	1,100	900	200	1.1
July[1]	MQ1	1,100	860	220	14.6
	MQ4	1,100	920	200	11.2
	MQ9	1,400	700	170	489
August[2]	MQ1	1,100	950	170	0.5
	MQ4	1,900	1,600	250	7.1
	MQ9	2,100	1,700	330	89*
September	MQ1	870	710	140	10.7
	MQ4	1,200	1,100	170	20.2
	MQ9	1,400	1,100	180	146

NOTE:
* = Cyclotella bodanica counted at 400X rather than 100X

Table 1-13 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2006

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	> 25 mm (100X)
April	LL1	1,800	1,100	610	1.9*
	LL4	3,200	2,700	520	14.7
	LL9	690	550	135	2.2
May	LL1	2,600	2,000	620	19.7
	LL4	4,900	4,200	640	12.9
	LL9	540	380	160	4.8
June	LL1	860	610	200	39.5
	LL4	2,000	1,800	190	22.2
	LL4 (rep)	1,100	940	190	23.2
	LL9	1,700	1,400	220	17.7
July	LL1	1,300	1,100	160	54.8
	LL4	2,700	2,200	370	165
	LL9	1,700	1,300	350	19.1
August	LL1	2,700	2,500	200	14.3
	LL4	2,600	2,300	220	34.6
	LL9	2,800	2,300	470	23.8
September	LL1	3,800	3,600	160	0.4
	LL4	1,300	1,200	120	2
	LL9	1,800	1,700	130	3.6
April	MQ1	2,200	16,00	240	9.4
	MQ4	2,400	1,900	550	8.6
	MQ9	1,600	1,400	180	8.2
May	MQ1	1,700	1,500	240	10.8
	MQ4	1,700	1,400	320	7.4
	MQ4 (rep)	2,100	1,800	310	11.8
	MQ9	1,900	1,600	280	4.1
June	MQ1	1,900	1,800	130	0.9
	MQ4	1,400	1,200	200	4.4
	MQ9	950	840	110	0.6
July	MQ1	1,100	870	220	42.8
	MQ4	2,000	1,700	260	16.6
	MQ9	2,300	2,100	180	18.8*
August	MQ1	1,500	1,200	280	6.5
	MQ4	2,100	1,800	290	13.3
	MQ9	1,300	880	400	17.0*
September	MQ1	2,500	2,300	200	1.9
	MQ4	2,100	1,800	260	11.8
	MQ9	3,400	2,400	970	1.8*

NOTE:
* *Cyclotella bodanica* (diatom) counted at 400X rather than 100X

Table 1-14 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2007

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)
April	LL1	3,100	2,800	240
	LL4	3,000	2,200	620
	LL9	1,200	910	240
May	LL1	2,600	2,000	540
	LL4	3,300	2,600	670
	LL9	1,300	890	430
June	LL1	2,100	1,600	420
	LL4	2,500	2,000	520
	LL9	1,100	750	300
July	LL1	2,300	2,000	240
	LL4	2,400	2,100	270
	LL9	3,100	3,000	180
August	LL1	1,100	900	240
	LL4	2,300	2,100	150
	LL4 (rep)	2,600	2,400	150
	LL9	570	480	90
September	LL1	2,500	2,200	280
	LL4	1,700	1,400	240
	LL9	420	350	68
April	MQ1	1,700	1,500	230
	MQ4	1,900	1,602	300
	MQ9	1,100	900	200
May	MQ1	1,500	1,300	250
	MQ4	1,800	1,500	320
	MQ9	2,600	2,300	310
June	MQ1	1,500	1,200	300
	MQ4	1,800	1,600	200
	MQ9	1,500	1,200	290
July	MQ1	1,500	1,100	220
	MQ4	1,900	1,500	440*
	MQ9	1,000	860	150
	MQ9 (rep)	1,600	1,400	150
August	MQ1	2,300	2,100	200
	MQ4	1,100	970	160
	MQ9	710	590	120
September	MQ1	1,400	1,100	270
	MQ4	1,500	1,200	290
	MQ9	1,000	690	300

Table 1-15 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2008

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 mm (400X)	>25 mm (100X)	> 25 µm (100X)
April	LL1	2,500	2,070	360	13	30
	LL4	3,100	2,500	540	22	50
	LL9	1,300	1,030	240	6.4	20
May	LL1	3,100	2,840	220	36	20
	LL4	5,300	4,820	430	37	25
	LL9	1,300	1,030	260	11	20
June	LL1	1,000	880	110	40	1
	LL4	960	730	220		8
	LL9 (rep)	1,500	1,060	380*	40	16*
	LL9	1,200	780	380*	10	7*
July	LL1	1,000	970	80	2.1	1
	LL4	1,400	1,300	110	7.8	17
	LL9	2,000	1,500	370	4.2	110
August	LL1	1,100	1,000	50	5.6	1
	LL4	1,400	1,300	50	5.8	11
	LL9	1,100	1,060	40	2.8	9
September	LL1	2,100	1,730	420**	16	2**
	LL4	2,300	1,780	490**	13	3**
	LL9	2,900	2,250	690**	4.4	6**
April	MQ1	2,100	1,850	200	2.8	1
	MQ4	1,700	1,530	200	5.8	3
	MQ9	2,800	2410	400	5	4
May	MQ1	1,000	870	130	2.1	1
	MQ4	1,700	1460	230	1.2	2
	MQ9	1,200	1,000	180	2.7	2
June	MQ1	840	700	140	2.9	0.4
	MQ4	1,300	1,040	240	2.1	1
	MQ9	870	580	280	5.8	0.5
July	MQ1	620	520	90	180	8
	MQ4	500	370	130	7.4	8
	MQ9	870	680	180	3.3	0.5
	MQ9 (rep)	1,000	760	260	0.8	9
August	MQ1	750	660	100	5.8	1
	MQ4	980	860	110	14	6
	MQ9	1,300	990	290		5
September	MQ1	1,500	1,310	160		14
	MQ4	1,100	980	150		3
	MQ9	2,800	2,680	130		10

NOTES:
* *Synedra radians* (diatom) counted at 400X rather than 100X, due to high numbers
** *Asterionella formosa* (diatom) counted at 400X rather than 100X, due to high numbers

Table 1-16 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2009

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	780	480	300	6
	LL4	1,600	1,220	340	4
	LL9	90	60	30	1
May	LL1	6,000	5,150	820	19
	LL4	4,900	4,100	760	10
	LL9	430	290	140	5
June	LL1	1,700	1,370	370	5
	LL4	1,400	1,030	360	12
	LL9	680	340	330	6
July	LL1	2,100	1,900	270	3
	LL4	2,700	2,400	330	4
	LL9	700	340	350	4
August	LL1	3,100	2,900	170	3
	LL4	2,400	2,200	190	15
	LL9	1,700	1,300	370	10
September	LL1	3,700	3,500	220	5
	LL4	2,300	2,100	180	3
	LL9	1,100	950	170	1
April	MQ1	1,400	1,130	250	33
	MQ4	1,300	1,170	160	12
	MQ9	2,300	2,730	520	13
May	MQ1	1,700	1,440	260	3
	MQ4	2,100	1,750	340	5
	MQ9	3,800	3,060	720	18
June	MQ1	1,500	1,360	160	0.1
	MQ4	1,100	990	150	0.2
	MQ9	1,100	940	200	0.8
July	MQ1	1,000	790	190	4
	MQ4	1,300	1,100	220	8
	MQ9	1,200	940	240	5
August	MQ1	610	450	160	0.3
	MQ4	1,300	1,170	170	3
	MQ9	1,600	1,200	390	0.4
September	MQ1	830	670	160	5
	MQ4	1,200	970	170	6
	MQ9	1,400	1,200	240	1

Table 1-17 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2010

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	630	490	140	1.6
	LL4	1,900	1,500	390	3
	LL9	170	100	70	0.4
May	LL1	1,200	940	270	13.4
	LL4	4,500	3,800	650	17
	LL9	530	390	140	0.9
June	LL1	2,400	1,900	500	5.2
	LL4	3,600	3,000	610	11
	LL9	1,500	1,100	400	10.6
July	LL1	2,100	1,900	170	8.7
	LL1 (rep)	1,900	1,700	180	5
	LL4	3,000	2,800	250	2
	LL9	1,900	1,700	210*	0
August	LL1	1,200	990	180	1.5
	LL4	1,600	1,400	190	1
	LL4 (rep)	1,600	1,400	180	2
	LL9	1,800	1,600	170	0
September	LL1	2,100	1,800	260	15.1
	LL4	4,400	4,200	200	5
	LL9	1,200	1,100	130	0.4
April	MQ1	1,700	1,600	100	0.4
	MQ4	1,200	1,100	120	1
	MQ9	800	710	90	2.4
May	MQ1	1,100	990	120	0.9
	MQ4	1,100	960	150	1
	MQ9	1,600	1,330	240	2.9
June	MQ1	2,000	1,700	270	0.9
	MQ4	1,400	1,100	240	1
	MQ9	1,000	850	200	1.1
July	MQ1	1,800	1,500	250	8.7
	MQ1 (rep)	1,400	1,300	170	6
	MQ4	1,500	1,300	180	10
	MQ9	1,600	1,400	180	4
August	MQ1	1,400	1,200	140	7.2
	MQ4	1,000	870	160	5
	MQ4 (rep)	1,100	900	150	5
	MQ9	1,200	1,000	150	8
September	MQ1	1,300	1,000	260	1.3
	MQ4	1,300	1,040	220	3
	MQ9	1,100	900	190	1.7

Table 1-18 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2011

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	1,700	1,400	220	52
	LL4	3,900	3,260	540	80
	LL9	2,200	1,820	340	9
May	LL1	3,600	2,880	720	6
	LL1 (rep)	3,500	2,790	690	6
	LL4	4,900	4,160	700	6
	LL9	1,300	900	350	5
June	LL1	2,100	1,750	330	36
	LL4	2,300	2,050	290	3
	LL9	1,500	1,060	450	4
July	LL1	1,400	1,150	270	3
	LL4	1,800	1,440	350	1
	LL4 (rep)	1,900	1,600	300	0.1
	LL9	1,900	1,550	320	2
August	LL1	2,900	2,500	360	15
	LL4	1,800	1,400	320	27
	LL9	1,500	1,200	280	0.9
September	LL1	1,300	940	380	2.2
	LL4	1,800	1,500	380	0.4
	LL9	960	770	190	0.3
April	MQ1	1,600	1,370	270	7
	MQ4	1,400	1,160	270	6
	MQ9	1,900	1,400	490	3
May	MQ1	1,200	1,050	190	2
	MQ1 (rep)	1,200	1,040	170	3
	MQ4	1,800	1,370	410	4
	MQ9	1,600	670	920	4
June	MQ1	2,000	1,840	150	1
	MQ4	1,500	1,300	200	1
	MQ9	1,700	1,200	520	10
July	MQ1	2,200	2,100	110	0.4
	MQ4	1,600	1,330	230	3
	MQ9	1,000	770	200	1
	MQ9(rep)	1,100	860	200	1
August	MQ1	1,400	1,200	210	4
	MQ4	3,300	3,000	280	0.6
	MQ9	1,200	1,000	200	0.1
September	MQ1	2,300	2,100	190	17.2
	MQ4	2,600	2,400	190	0.2
	MQ9	1,600	1,400	240	9.6

Table 1-19 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2012

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
April	LL1	2,300	1,980	330	5
	LL4	3,200	2,570	590	6
	LL9	1,000	800	190	6
May	LL1	3,000	2,470	470	15
	LL4	2,200	1,640	600	7
	LL9	2,300	2,050	280	7
June	LL1	1,400	1,080	310	3
	LL4	1,700	1,400	320	2
	LL9	980	810	170	2
	LL9 (rep)	1,200	1,020	140	1
July	LL1	1,600	1,390	170	3
	LL4	Sample lost in transit (broken bottle)			
	LL9	880	730	150	2
August	LL1	970	740	210	19
	LL1 (rep)	940	760	170	14
	LL4	1,300	990	250	35
	LL9	380	250	130	0.5
September	LL1	Sample unpreserved – no analysis done			
	LL4	2,800	2,350	480	1
	LL9	Sample unpreserved – no analysis done			
April	MQ1	2,200	2,010	200	3
	MQ4	1,700	1,440	220	3
	MQ9	1,600	1,420	180	5
May	MQ1	1,100	990	140	1
	MQ4	830	680	140	0
	MQ9	1,200	1,000	150	0.2
June	MQ1	2,100	1,920	170	0.4
	MQ4	890	740	150	0.3
	MQ9	1,100	910	200	0.4
	MQ9 (rep)	1,100	920	200	0.5
July	MQ1	1,300	1,210	100	0.4
	MQ4	1,100	1,010	90	10
	MQ9	740	640	100	1
August	MQ1	1,030	860	180	0.8
	MQ1 (rep)	920	720	200	0.2
	MQ4	810	660	140	10
	MQ9	430	340	90	1.6
September	MQ1	900	730	170	0.5
	MQ4	760	650	115	2
	MQ9	580	430	160	0.5
June	NNL1	1,600	1,240	320	0.5
	NNL4	1,000	670	370	0.2
	NNL9	840	700	140	1
	NNL9 (rep)	880	730	160	0.8

Table 1-19 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2012

Date	Sampling Site	Total Abundance	< 5mm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
July	NNL1	1,300	1,000	260	1.2
	NNL4	1,700	1,390	310	1
	NNL9	820	540	280	0.2
August	NNL1	810	660	150	1.6
	NNL1 (rep)	790	590	200	1
	NNL4	1,800	1,350	440	0.8
	NNL9	730	530	195	0.04
September	NNL1	1,530	1,170	360	1.2
	NNL4	1,260	970	290	2
	NNL9	1,740	1530	220	0.2

Table 1-20 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2013

Sampling Site	Date	Depth	< 5mm (1,000X)	< 5 µm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
Long Lake	April	0.5 m	2,300	1,750	530	10
		1 m	3,000	2,470	570	15
	August	0.5 m	1,300	880	455	2
		1.0 m	1,700	1,170	470	15
	October	0.5 m	1,500	1,150	340	12
		1.0 m	1,900	1440	400	14
Middle Quinsam Lake	April	0.5 m	1,350	1,080	270	2
		1.0 m	1,400	1,150	250	2
	August	0.5 m	1,300	1,045	235	7
		1.0 m	1,300	1,010	325	6
		1.0 m (rep)	1,200	990	230	9
	October	0.5 m	1,800	1,440	350	2
		1.0 m	1,900	1,570	290	2
		1.0 m (rep)	1,600	1,310	300	3
No Name Lake	April	0.5 m	1,300	900	370	45
		1.0 m	1,600	1,150	380	36
	August	0.5 m	1,200	880	440	5
		1.0 m	1,500	1,060	455	6
		1.0 m (rep)	1,700	1,315	470	8
	October	0.5 m	1,800	1,310	460	1
		1.0 m	1,600	1,060	540	1
Lower Quinsam Lake	April	0.5 m	1,800	1,420	406	2
		1 m	950	700	245	2
	August	0.5 m	960	810	150	2
		1.0 m	620	460	160	3
	October	0.5 m	1,300	1,040	200	12
		1.0 m	1,300	1,060	230	4

Table 1-21 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2014

Sampling Site	Date	Depth	< 5mm (1,000X)	< 5 µm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
Long Lake	April	1 m	3100	2665	330	86.6
	July	1 m	1700	1170	490	0.9
	October	1 m	1500	1200	290	18.6
Middle Quinsam Lake	April	1 m	1000	840	155	11.4
		1 m replicate	590	480	100	11.7
	July	1 m	3200	2950	240	0.5
	October	1 m	1700	1400	310	3.2
No Name Lake	April	1 m	1600	1260	290	83
	July	1 m	1300	970	310	2.5
		1 m replicate	1200	830	250	3.1
	October	1 m	1600	1400	200	1.7
		1 m replicate	1500	1200	230	2.2
Lower Quinsam Lake	April	1 m	1600	1400	225	7.6
	July	1 m	1200	1010	210	1.8
	October	1 m	2400	2000	350	66

Table 1-22 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2015

Lake	Month	Depth (m)	< 5mm (1,000X)	< 5 µm (1,000X)	5 to 25 µm (400X)	> 25 µm (100X)
Long	April	1	3700	3300	400	15
	July	1	1300	1030	260	6.6
	October	1	2100	1800	230	14.6
Middle Quinsam	April	1	1600	1300	300	2.4
	July	1	2900	1060	1850	2.8
	October	1	1150	920	230	0.3
No Name	April	1	1200	870	350	1.1
	July	1	880	610	260	6.6
	October	1	1350	1000	300	4.3
	October replicate	1	1200	920	280	4.5
Lower Quinsam	April	1	2200	1800	350	28
	April replicate	1	2300	1800	520	18
	July	1	3200	580	2630	3.3
	October	1	1500	1100	330	71

Table 1-23 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2016

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	< 5 µm (1,000 X)	5 to 25 µm (400 X)	> 25 µm (100 X)
Long	April	1,500	1,300	240	5.5
Middle Quinsam		1,100	882	240	2.8
No Name		1,100	864	240	1.8
No Name (replicate)		970	792	180	1.8
Lower Quinsam		1,500	1,200	260	5.4
Long	August	1,200	990	140	22
Middle Quinsam		930	810	116	1.5
No Name		1,800	1,200	500	42
No Name (replicate)		1,900	1,280	595	46
Lower Quinsam		2,400	1,850	578	1.4
Long	November	780	640	140	0.5
Middle Quinsam		610	520	90	3
No Name		650	600	50	0.4
Lower Quinsam		300	250	50	0

Table 1-24 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2017

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	< 5 µm (1,000 X)	5 to 25 µm (400 X)	> 25 µm (100 X)
Long	May	2,700	2,400	340	16.2
Middle Quinsam		1,900	1,500	370	15.4
No Name		1,300	1,000	320	7.9
Lower Quinsam		1,700	1,300	390	1.2
Long	Sept.	1,100	940	200	1.5
Middle Quinsam		980	760	220	0.9
No Name		1,400	860	480	29.8
No Name Replicate		1,500	1,000	450	28.1
Lower Quinsam		1,700	990	600	86.6
Long	Oct.	2,000	1,800	190	0.4
Middle Quinsam		860	770	80	7.5
No Name		1,600	1,370	260	1
No Name Replicate		1,800	1,400	390	4.2
Lower Quinsam		1,300	770	530	14.8

Table 1-25 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2018

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	May	1,500	1,300	150	3.4
Long—duplicate		1,300	1,100	140	4.8
Middle Quinsam		1,000	920	110	0.4
No Name		1,800	1,500	250	0.1
Lower Quinsam		2,700	2,400	320	0.5
Long	August	1,200	1,100	110	1.7
Middle Quinsam		1,600	1,500	180	0.2
No Name		1,400	1,200	270	2
Lower Quinsam		2,300	680	1,600	13
Lower Quinsam—replicate		3,400	1,100	2,300	6.6
Long	November	9,200	2,500	210	6,500
Middle Quinsam		2,100	1,700	360	0.04
No Name		1,600	1,300	300	0.7
Lower Quinsam		1,800	1,500	230	96

Table 1-26 Phytoplankton Abundance (cells/mL) in the Quinsam Lakes System, 2019

Lake	Month	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	1-May	2,400	1,900	430	1
Long (duplicate)		2,100	1,700	420	1.7
Middle Quinsam	2-May	320	260	60	1.2
No Name	1-May	740	440	300	0.1
Lower Quinsam	2-May	600	500	99	1.2
Long	8-May	2,000	1,700	300	0.5
Middle Quinsam		1,000	920	80	0.4
No Name		2,700	2,100	570	0.03
Lower Quinsam		2,100	1,800	310	11.9
Long	30-Jul	2,600	2,300	220	1.3
Middle Quinsam		1,800	1,600	220	0.7
No Name		2,400	2,100	350	4.9
No Name (duplicate)		2,200	1,800	370	9
Lower Quinsam		1,900	1,500	320	1
Long	Oct. 24	2,400	1,900	450	0.7
Middle Quinsam		1,300	1,100	210	0.04

Table 1-27 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2020

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	12-May	3,400	2,800	330	275
Middle Quinsam		1,200	1,150	65	4.2
No Name[1]		4,100	1,600	2,500	0.4
Lower Quinsam	13-May	4,000	3,500	360	95
Long	5-Aug	2,600	2,400	160	13
Middle Quinsam		1,500	1,300	190	0.4
Middle Quinsam replicate		1,400	1,200	200	0.5
Long	7-Oct	3,200	3,000	200	2.6
Long replicate		3,000	2,800	200	1.6
Middle Quinsam		3,000	2,700	250	2.2

NOTE:

1. *Dinobryon* spp. counted at 400X rather than 100X due to high abundance

Table 1-28 Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2021

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	4-May	1,000	920	120	1.7
Long (replicate)		1,200	1,100	120	0.7
Middle Quinsam		2,200	2,100	120	0.1
No Name[1]		1,200	990	220	0.2
Lower Quinsam		1,300	1,100	180	1.8
Long	12-Jul	1,000	830	190	0.9
Long (replicate)		1,000	810	190	0.4
Middle Quinsam		1,400	1000	390	0.2
Long	6-Oct	2,100	1,900	190	0.4
Middle Quinsam		2,200	2,000	200	12.6
Middle Quinsam replicate)		2,200	2,000	230	11.4

NOTE:

1. *Dinobryon* spp. counted at 400X rather than 100X due to high abundance

Table 1-29 **Phytoplankton Abundance (cells/mL) in the Quinsam Lake System, 2022**

Lake	Date	Abundance (cells/mL) at 1 m depth			
		Total	<5 µm (1,000 X)	5 to 25 µm (400 X)	>25 µm (100 X)
Long	April 6/7	1,400	1,300	83	2.4
Middle Quinsam		1,800	1,700	70	0.5
Middle Quinsam (replicate)		1,800	1,700	65	0.5
No Name		1,500	1,400	88	7.8
No Name (replicate)		1,800	1,700	100	4.4
Lower Quinsam		1,600	1,500	54	0.6
Long	May 3/4	1,700	1,500	170	0.9
Middle Quinsam		1,700	1,600	100	0.4
No Name		1,400	1,300	160	0.3
Lower Quinsam		1,700	1,600	180	1.6
Long	20-Jul	1,300	1,100	200	0.4
Middle Quinsam		1,400	1,200	250	1.3
Middle Quinsam (replicate)		1,200	1,000	200	0.2
Long (SEE NOTE)	12-Oct	1,700	1,500	170	2
Long (replicate) (SEE NOTE)		1,500	1,300	180	0.1
Middle Quinsam		1,000	900	120	2

NOTE:
It is possible that results for the two October Long Lake samples were affected by an issue with the laboratory. Subsamples of the preserved sample had been removed for chemical analysis, and it is not known whether the sample mixing methods prior to subsampling were the same as are followed for the phytoplankton samples.

Reference: **Quinsam Lakes Phytoplankton, October 2023 (Sample Reference CBQ646-07, CBQ741-07, and CBQ742-07; Job Numbers C382604 and C382615)**

Attachment B Species Composition Data: October 2023

Quinsam Lake Phytoplankton - 10 October 2023
Long Lake 1 m (CBQ646-07, Job C382604)
27 ml sample settled

Total Cells Counted	**474**
Total Cells Per mL	**1,100**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-A13 um)	33	594
Ochromonas/Chromulina spp. (4-5 um)	12	216
Ochromonas/Chromulina spp. (6-7 um)	6	108
Pseudokephyrion sp.	3	54
CHLOROPHYCEAE		
Oocystis sp. (5 um x 3 um)	1	18
TOTAL	**55**	**990**
400X magnification - 3 strips		
CHRYSOPHYCEAE		
Dinobryon sp.	4	2
Mallomonas cf. akrokomas	39	22
Ochromonas spp. (8-10 um)	102	58
BACILLARIOPHYCEAE		
Cyclotella glomerata (cells + cols)	2	1
Cyclotella cf. stelligera/ocellata	1	1
Melosira italica (fil)	12	7
CHLOROPHYCEAE		
Dictyosphaerium pulchellum (cols)	1	1
Gloeocystis sp. (cells + cols)	7	4
Nephrocytium sp. (cells)	11	6
Oocystis sp. (cells + cols)	2	1
Scenedesmus sp. (cols)	4	2
Schroederia setigera	1	1
CRYPTOPHYCEAE		
Cryptomonas spp.	33	19
Rhodomonas minuta	30	17
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	2	1
TOTAL	**251**	**142**
100X magnification - whole sample		
CHRYSOPHYCEAE		
Dinobryon cylindricum (90 cols, 102 cells)	102	4.08
BACILLARIOPHYCEAE		
Navicula sp. (50 um)	1	0.04
Synedra radians	1	0.04
Synedra ulna	3	0.1
CHLOROPHYCEAE		0.0
Botryococcus braunii (cols)	4	0.2
Elakatothrix gelatinosa (cols)	4	0.2
Quadrigula chodati (col)	1	0.04
CYANOPHYCEAE		
Anabaena sp. (1 fil, 300 um)	1	0.04
Chroococcus cf. prescottii (cols)	51	2.04
TOTAL	**168**	**6.7**

Quinsam Lake Phytoplankton - 10 October 2023
Middle Quinsam Lake 1 m (CBQ741-07, Job C382615)
27 ml sample settled

Total Cells Counted	**648**
Total Cells Per mL	**1,300**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-3 um)	35	630
Ochromonas/Chromulina spp. (4-5 um)	21	378
Ochromonas/Chromulina spp. (6-7 um)	8	144
Pseudokephyrion sp.	1	18
TOTAL	**65**	**1170**
400X magnification - 3 strips		
CHRYSOPHYCEAE		
Dinobryon cylindricum (cysts)	12	7
Mallomonas cf. akrokomas	3	2
Ochromonas spp. (8-10 um)	109	62
BACILLARIOPHYCEAE		
Cyclotella glomerata (cells + cols)	2	1
Cyclotella cf. stelligera/ocellata	7	4
Cyclotella bodanica	7	4
CHLOROPHYCEAE		
Botryococcus braunii (cells)	2	1
Dictyosphaerium pulchellum (cols)	1	1
Gloeocystis sp. (cells + cols)	4	2
Nephrocytium sp. (cells)	1	1
Oocystis sp. (cells)	4	2
CRYPTOPHYCEAE		
Cryptomonas spp.	40	23
Rhodomonas minuta	79	45
TOTAL	**271**	**154**
100X magnification - half sample		
CHRYSOPHYCEAE		
Dinobryon cylindricum (122 cols, 310 cells)	310	24.8
BACILLARIOPHYCEAE		
Synedra radians	2	0.2
TOTAL	**312**	**25**

Quinsam Lake Phytoplankton - 10 October 2023
Middle Quinsam Lake 1 m (CBQ742-07, Job C382615)
27 ml sample settled

Total Cells Counted	**663**
Total Cells Per mL	**1,400**

	Number Counted	Cells per mL
1000X magnification - 50 fields		
CHRYSOPHYCEAE		
Ochromonas/Chromulina spp. (2-3 um)	37	666
Ochromonas/Chromulina spp. (4-5 um)	20	360
Ochromonas/Chromulina spp. (6-7 um)	3	54
Pseudokephyrion sp.	3	54
CHLOROPHYCEAE		
Oocystis sp. (5 um x 3 um)	5	90
TOTAL	**68**	**1224**
400X magnification - 3 strips		
CHRYSOPHYCEAE		
Dinobryon cylindricum (cysts)	10	6
Dinobryon sp. (cells)	3	2
Mallomonas cf. akrokomas	3	2
Ochromonas spp. (8-10 um)	102	58
BACILLARIOPHYCEAE		
Achnanthes spp.	5	3
Cyclotella glomerata (cells + cols)	3	2
Cyclotella cf. stelligera/ocellata	5	3
Cyclotella bodanica	6	3
Navicula sp. (25 um)	1	1
Tabellaria flocculosa (cells)	2	1
CHLOROPHYCEAE		
Dictyosphaerium pulchellum (cols)	1	1
Oocystis sp. (cells)	5	3
Scenedesmus sp. (cols)	2	1
Schroederia setigera	1	1
CRYPTOPHYCEAE		
Cryptomonas spp.	27	15
Rhodomonas minuta	63	36
CYANOPHYCEAE		
Dactylococcopsis acicularis (cols)	2	1
TOTAL	**241**	**137**
100X magnification - half sample		
CHRYSOPHYCEAE		
Dinobryon cylindricum (133 cols, 352 cells)	352	28.2
BACILLARIOPHYCEAE		
Synedra radians	2	0.2
TOTAL	**354**	**28**

Appendix V

Report Date: February 15, 2024

File: 7008

Report Number: 208197

Quinsam Coal Corporation
950-1090 West Georgia Street
Vancouver BC V6E 3V7

Dear Quinsam Coal Corporation,

Re: An Administrative Penalty Referral

On January 18, 2024, Ministry of Environment and Climate Change Strategy (Ministry/ENV) Officer Ben McKinnon conducted an onsite inspection of Quinsam Coal Corporation's (QCC) coal mine, an underground coal mine (the Site) located at 5800 Argonaut Main, Campbell River, BC, to verify compliance with Environmental Management Act (EMA) Permit 7008 (the Permit). The Permit authorizes the discharge of effluent from a coal mining operation and coal preparation plant to the land with overland flows draining to Middle Quinsam Lake, Long Lake, Iron River, and Quinsam River, subject to the conditions of the Permit. The Permit was issued on December 23,1987, and most recently amended on September 2, 2020. Present during the inspection was Travis Kurinka (Senior Environmental Protection Officer, Ministry) and Kathleen Russell (Environment Coordinator, QCC).

A Split Sample Audit was conducted on the discharge from settling pond one (E218582) at the time of the inspection. This Split Sample Audit consists of a comparison of the permittee's and Ministry's sampling and analytical procedures and results collected from a homogenized sample. The audit is conducted to provide further validity to the monitoring data provided by the permittee, beyond that of their own QA/QC program. The results of this Audit have not yet been assessed at the time of writing this report, and will be communicated at a future date.

For your information, this inspection record is being referred for an Administrative Penalty.

Inspection Details:

The Inspection Period for this report is from April 1, 2022, to March 31, 2023 (Inspection Period), and included review of the following documents:

- Quinsam Coal Corporation Quarterly Report (April - June 2022), submitted to the Ministry on July 30, 2022 (Q1 Report)*;
- Quinsam Coal Corporation - Q2 (July - September 2022) Report, submitted to the Ministry on October 31, 2022 (Q2 Report)*;
- PE: 7008 Quarter 3 Report (October - December 2022), submitted to the Ministry on January 30, 2023 (Q3 Report)*;
- PE: 7008 Quarter 4 Report 2023 (January through March 2023) Report, submitted to the Ministry on April 27, 2023 (Q4 Report)*;

*These reports will be collectively referred to as the Quarterly Reports

- PE: 7008 Quinsam Coal Annual Water Quality Monitoring Report 2022-2023, dated June 2023 and submitted to the Ministry on June 29, 2023 (2022-2023 Annual Report);
- Non-Compliance Reports (NCRs) submitted for the inspection period;
- Dangerous Goods Incident Reports (DGIRs) submitted for the inspection period;
- 2021 Environmental Procedures Manual (EMP), dated March 2022, Prepared by Quinsam Coal Corporation.

Ministry of Environment and Climate Change Strategy

Compliance and Environmental Enforcement Branch

Mailing Address:
3rd Floor
2975 Jutland Road
Victoria BC V8W 9M1

Telephone: 250 387 3205
Facsimile: 250 356 9836
Website: www.gov.bc.ca/env

Compliance Assessment

Below are the requirements that were assessed for compliance during this inspection, as well as the associated details/findings and any actions required.

Requirement Description:

1. AUTHORISED DISCHARGES, 1.1, 1.1.1

1.1.1: This subsection applies to the discharge of effluent from the NORTH COAL MINING OPERATION AND COAL PREPARATION PLANT as shown on attached Site Plan A. The site reference number for this discharge is E207409. 1.1.1 The maximum and average authorised rates of discharge are 0.32 m3/s and 0.08 m3/s respectively. The authorised discharge period is 365 d/a.

Details/Findings:

Review of Table 25 in Appendix I of the 2022-2023 Annual Report determined that the reported maximum rate of discharge authorized by this section of the Permit was not exceeded during the Inspection Period. However, review of section 6.1.1 of the 2022-2023 Annual Report determined the reported annual average rate of discharge for the 2022-2023 reporting year (April 1, 2022 to March 31, 2023) for E207409 was 0.094 m3/s, which exceeds the average authorized rate of 0.08 m3/s for the discharge period. Therefore, QCC is not in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

Out

Requirement Description:

1. AUTHORISED DISCHARGES, 1.1, 1.1.2

1.1.2: This subsection applies to the discharge of effluent from the NORTH COAL MINING OPERATION AND COAL PREPARATION PLANT as shown on attached Site Plan A. The site reference number for this discharge is E207409. 1.1.2 The characteristics of the discharge shall not exceed: Parameters: Total Suspended Solids (daily composite), Limit: 25, Unit: mg/L; Total Suspended Solids (hourly composite), Limit: 35, Unit: mg/L; pH, Limit: 6.0 - 8.5, Unit: - ; Ammonia (as N) , Limit: 1.0, Unit: mg/L; Phosphorus (as P) (asterisk - see NOTE 1), Limit: 0.03, Unit: mg/L; NOTE 1: Dissolved; Oil and Grease (total), Limit: 5, Unit: mg/L; Aluminum (asterisk - see NOTE 1), Limit: 0.5, Unit: mg/L; NOTE 1: Dissolved; Copper (asterisk - see NOTE 1), Limit: 0.02, Unit: mg/L; NOTE 1: Dissolved; Iron (asterisk - see NOTE 1), Limit: 0.3, Unit: mg/L; NOTE 1: Dissolved; Lead (asterisk - see NOTE 1), Limit: 0.05, Unit: mg/L; NOTE 1: Dissolved; Zinc (asterisk - see NOTE 1), Limit: 0.1, Unit: mg/L; NOTE 1: Dissolved; Rainbow Trout Bioassay (Oncorhynchus mykiss), Limit: (double asterisk - see NOTE 2), Unit: - ; NOTE 2: No mortalities at 100 percent effluent concentration after 96 hours.

Details/Findings:

Review of Table 5 in Appendix I of the 2022-2023 Annual Report determined that all reported data was within the Permit limits stipulated in this section of the Permit. Review of Appendix III of the 2022-2023 Annual Report determined that all reported rainbow trout bioassays had no mortalities at 100 percent effluent concentration after 96 hours. However, as reported in Table 2 in Appendix I of the 2022-2023 Annual Report, Total Suspended Solids (TSS) monitoring was conducted via grab sample instead of a composite sample from October 1 to November 16, 2022. QCC reported via email on January 16, 2024, that this monitoring was missed due to a misinterpretation by QCC of the November 1st, 2019, permit amendment conditions. Therefore, compliance could not be determined for this Inspection Period for the TSS composite sample limits. Monitoring for ammonia and phosphorus is required once every three years during the low flow period (August to early September). QCC reported via email on January 16, 2024, that this monitoring was conducted August 2nd, September 6th, and October 4th of 2022, and provided the monitoring results. Review of this data determined that Ammonia and Phosphorus limits stipulated in this section of the Permit were not exceeded.

Compliance:

Not Determined

Requirement Description:

1. AUTHORISED DISCHARGES, 1.1, 1.1.3

1.1.3: This subsection applies to the discharge of effluent from the NORTH COAL MINING OPERATION AND COAL PREPARATION PLANT as shown on attached Site Plan A. The site reference number for this discharge is E207409. 1.1.3 The authorised works are surface runoff collection and diversion ditches, plant-site runoff collection box, flocculation facilities, settling pond #4, 2 North pit sump, tailings storage facility, 2 North portal sump, surface and underground pumping facilities and related appurtenances approximately located as shown on attached Site Plan A.

Details/Findings:

As observed by Officer McKinnon during the onsite inspection, the Authorised Works were approximately located as shown on Site Plan A of the Permit.

Compliance:

In

Requirement Description:

1. AUTHORISED DISCHARGES, 1.1, 1.1.4

1.1.4: This subsection applies to the discharge of effluent from the NORTH COAL MINING OPERATION AND COAL PREPARATION PLANT as shown on attached Site Plan A. The site reference number for this discharge is E207409. 1.1.4 The authorised works must be complete and in operation on and from the date of this amended permit.

Details/Findings:

As confirmed by QCC staff during the onsite inspection, the Authorised Works were complete and in operation during the Inspection Period.

Compliance:

In

Requirement Description:

1. AUTHORISED DISCHARGES, 1.2, 1.2.1

1.2.1: This subsection applies to the discharge of effluent from the SOUTH COAL MINING OPERATION as shown on attached Site Plan B. The site reference number for this discharge is E218582. 1.2.1 The maximum and average authorised rates of discharge are 0.46 m3/s and 0.10 m3/s respectively. The authorised discharge period is 365 d/a.

Details/Findings:

Review of Table 26 in Appendix I of the 2022-2023 Annual Report determined that the reported daily maximum authorized rate of discharge was not exceeded during the Inspection Period. Section 6.2.1 of the 2022-2023 Annual Report states that the annual average rate of discharge for the 2022-2023 reporting year (April 1, 2022 to March 31, 2023) for E218582 was 0.024 m3/s. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

1. AUTHORISED DISCHARGES, 1.2, 1.2.2

1.2.2: This subsection applies to the discharge of effluent from the SOUTH COAL MINING OPERATION as shown on attached Site Plan B. The site reference number for this discharge is E218582. 1.2.2 The characteristics of the discharge shall not exceed: Parameters: Total Suspended Solids (daily composite), Limit: 25, Unit: mg/L; Total Suspended Solids (hourly composite), Limit: 35, Unit: mg/L ; pH, Limit: 6.0 - 8.5, Unit: - ; Ammonia (as N) , Limit: 1.0, Unit: mg/L; Phosphorus (as P) (asterisk - see NOTE 1), Limit: 0.03, Unit: mg/L; NOTE 1: Dissolved; Oil and Grease (total), Limit: less than DL (3 asterisk - See NOTE 3), Unit: mg/L; NOTE 3: less than Detection Limit; Aluminum (asterisk - see NOTE 1), Limit: 0.5, Unit: mg/L; NOTE 1: Dissolved; Copper (asterisk - see NOTE 1), Limit: 0.02, Unit: mg/L; NOTE 1: Dissolved; Iron (asterisk - see NOTE 1), Limit: 0.5, Unit: mg/L; NOTE 1: Dissolved; Lead (asterisk - see NOTE 1), Limit: 0.05, Unit: mg/L; NOTE 1: Dissolved; Zinc (asterisk - see NOTE 1), Limit: 0.2, Unit: mg/L; NOTE 1: Dissolved; Rainbow Trout Bioassay (Oncorhynchus mykiss), Limit: (double asterisk - see NOTE 2), Unit: - ; NOTE 2: No mortalities at 100 percent effluent concentration after 96 hours.

Details/Findings:

Review of Table 10 in Appendix I of the 2022-2023 Annual Report determined that all reported data was within the Permit limits stipulated in this section of the Permit. Review of Appendix III of the 2022-2023 Annual Report determined that all reported rainbow trout bioassays had no mortalities at 100 percent effluent concentration after 96 hours. However, as reported in Table 2 in Appendix I of the 2022-2023 Annual Report, Total Suspended Solids (TSS) monitoring was conducted via grab samples from October 1 to November 16, 2022. QCC reported via email on January 16, 2024, that this monitoring was missed due to a misinterpretation by QCC of the November 1st, 2019, permit amendment conditions. Therefore, compliance could not be determined for this Inspection Period for the TSS composite sample limits. As outlined in Inspection Report (IR) 194661, monitoring for Ammonia and Phosphorus is required once every three years during the low flow period (August to early September). QCC reported via email on September 20th, 2022, that this monitoring was conducted August 3 and September 6 of 2022, and provided monitoring results. Review of this data determined that Ammonia and Phosphorus limits were not exceeded.

Compliance:

Not Determined

Requirement Description:

1. AUTHORISED DISCHARGES, 1.2, 1.2.3

1.2.3: This subsection applies to the discharge of effluent from the SOUTH COAL MINING OPERATION as shown on attached Site Plan B. The site reference number for this discharge is E218582. 1.2.3 The authorised works are surface runoff collection and diversion ditches, flocculation facilities, settling pond, 3 pit sumps (1S, 2S and 3S Pits), an adit sump (4S Adit), pumping facilities , and related appurtenances approximately located as shown on attached Site Plan B.

Details/Findings:

As outlined in IR 194661, the 1S Pit sump and 4S Adit sump were reclaimed in 2015-2016. As these authorised works no longer exist, compliance with this requirement is not determined for the Inspection Period. As observed by Officer McKinnon during the onsite inspection, the remaining authorised works were approximately located as shown on Site Plan B of the Permit.

Compliance:

Not Determined

Requirement Description:

1. AUTHORISED DISCHARGES, 1.2, 1.2.4

1.2.4: This subsection applies to the discharge of effluent from the SOUTH COAL MINING OPERATION as shown on attached Site Plan B. The site reference number for this discharge is E218582. 1.2.4 The authorised works must be complete and in operation on and from the date of this amended permit.

Details/Findings:

As outlined in IR 194661, the 1S Pit sump and 4S Adit sump were reclaimed in 2015-2016. As these authorised works are no longer complete and in operation, QCC is out of compliance with this requirement. As confirmed by QCC staff during the onsite inspection, the remaining authorised works were complete and in operation during the Inspection period.

Compliance:

Out

Requirement Description:

1. AUTHORISED DISCHARGES, 1.3, 1.3.1

1.3.1: This subsection applies to the discharge of effluent from the BLOCK 242 COAL MINING OPERATION as shown on attached Site Plan C. The site reference number for this discharge is E225796. 1.3.1 Subject to Subsection 4.4.3 the maximum authorised rate of discharge is 0.0082 m3/s. The authorised discharge period is 365 d/a.

Details/Findings:

QCC staff confirmed during the onsite inspection that there was no discharge from the Block 242 Coal Mining Operation during the Inspection Period. Page 6 of the 2022-2023 Annual Report states that the area is reclaimed. As outlined in IR 194661, "On November 1, 2019, the Ministry amended the Permit to remove monitoring requirements for E225796 from the Permit monitoring program." Due to the snowy conditions on site, this location was not visited during the onsite inspection. As there is no discharge from this location, compliance with this requirement is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

1. AUTHORISED DISCHARGES, 1.4, 1.4.1

1.4.1: This subsection applies to the discharge of effluent from the 7 SOUTH MINING OPERATION as shown on attached Site Plan D and E. The site reference number for this discharge is E292069. 1.4.1 The maximum authorized rate of discharge is 0.005 m3/s. The authorized discharge period is 365 d/a.

Details/Findings:

Review of Table 27 in Appendix 1 of the 2022-2023 Annual Report determined that there was no reported flow from the 7-South Surface Decant Settling Pond (E292069) during the Inspection Period. QCC staff confirmed during the onsite inspection that effluent captured at E292069 is pumped back to the 7-South Adit Sump (E292110) and from there the effluent is pumped into the 5-South Mine pool. As no discharge occurred from E292069 during the Inspection Period, compliance with this requirement is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

1. AUTHORISED DISCHARGES, 1.4, 1.4.2

1.4.2: This subsection applies to the discharge of effluent from the 7 SOUTH MINING OPERATION as shown on attached Site Plan D and E. The site reference number for this discharge is E292069. 1.4.2 The characteristics of the discharge shall not exceed: Parameter: Total Suspended Solids (daily composite), Limit: 25, Unit: mg/L; Total Suspended Solids (hourly composite), Limit: 35, Unit: mg/L; pH, Limit: 6.0 - 8.0, Unit: - ; Sulphate (asterisk - see NOTE 1) , Limit: 500, Unit: mg/L; NOTE 1: Dissolved; Aluminum (asterisk - see NOTE 1), Limit: 0.1, Unit: mg/L; NOTE 1: Dissolved; Cadmium (asterisk - see NOTE 1), Limit: 0.000045, Unit: mg/L; NOTE 1: Dissolved; Copper (asterisk - see NOTE 1), Limit: 0.014, Unit: mg/L; NOTE 1: Dissolved; Iron (asterisk - see NOTE 1), Limit: 0.35, Unit: mg/L; NOTE 1: Dissolved; Selenium (asterisk - see NOTE 1), Limit: 0.016, Unit: mg/L; NOTE 1: Dissolved; Rainbow Trout Bioassay (Oncorhynchus mykiss), Limit: (double asterisk - see NOTE 2), Unit: - ; NOTE 2: No mortalities at 100 percent effluent concentration after 96 hours.

Details/Findings:

A review of Table 22 in Appendix I, and section 8.4, of the 2022-2023 Annual Report determined that QCC was in compliance with the Permit limits for effluent quality from the 7 south mining operation (E292069). These samples are collected in the E292069 pond before it is pumped back to E292110. However, as no discharge from E292069 occurred during the Inspection Period, compliance with this requirement is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

1. AUTHORISED DISCHARGES, 1.4, 1.4.3

1.4.3: This subsection applies to the discharge of effluent from the 7 SOUTH MINING OPERATION as shown on attached Site Plan D and E. The site reference number for this discharge is E292069. 1.4.3 The authorized works are surface runoff collection and diversion ditches, flocculation facilities, one surface settling pond, an adit sump (7S Adit), pumping facilities and related appurtenances approximately located as shown on attached Site Plan D.

Details/Findings:

As observed by Officer McKinnon during the onsite inspection, the Authorized Works were approximately located as shown on Site Plan D of the Permit.

Compliance:

In

Requirement Description:

1. AUTHORISED DISCHARGES, 1.4, 1.4.4

1.4.4: This subsection applies to the discharge of effluent from the 7 SOUTH MINING OPERATION as shown on attached Site Plan D and E. The site reference number for this discharge is E292069. 1.4.4 The authorized works must be complete and in operation when the discharge commences.

Details/Findings:

QCC confirmed during the onsite inspection that there was no discharge from E292069 during the Inspection Period, as effluent at this location is pumped back to E292110, then into the 5-South Mine pool. As the discharge has not commenced, compliance with this section of the Permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.1 Rate of Discharge

2.1.1: The maximum flow of 0.32 m3/s is the peak routed outflow from the settling pond resulting from the following inputs: a) The assumed response of the gravity fed catchment area defined in Subsection 2.1.3 up to a 1 in 10 year return period rainfall of 24 hour duration; and b) The maximum combined pumping rate from the 2-North portal sump, 2-North underground workings, and the tailings facility, as specified in Subsection 2.1.2. The Director may from time to time redefine the maximum outflow based upon actual on-site measurements.

Details/Findings:

Review of Table 25 in Appendix I of the 2022-2023 Annual Report determined that the reported maximum authorized rate of discharge did not exceed 0.32 m3/s during the Inspection Period. Review of Ministry files determined that the Director has not redefined the maximum outflow rate based upon onsite measurements during the Inspection Period.

Compliance:

In

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.2 Pumping Rate

2.1.2: The combined rate at which effluent may be pumped from the 2-North portal sump, 2-North underground workings and the tailings facility to the settling pond shall not exceed 0.32 m3/s unless authorisation has been obtained from the Director. Pumping rates shall be decreased as necessary to accommodate flows as defined in Subsection 2.1.1(a).

Details/Findings:

Review of Table 25 in Appendix I of the 2022-2023 Annual Report determined that the reported maximum authorized rate of discharge did not exceed 0.32 m3/s during the Inspection Period. Therefore, compliance with the requirement to obtain authorization from the Director to exceed the maximum authorized rate of discharge is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.3 Catchment Area

2.1.3: The gravity drained settling pond catchment area shall not exceed 4 hectares unless authorisation has been obtained from the Director.

Details/Findings:

QCC staff confirmed during the onsite inspection that there were no changes made at this location during the Inspection Period that would result in a increase to the catchment area for the settling pond. However, there is no requirement in the Permit to track or report changes to the catchment area, and this clause has been present in the Permit since at least 2010. Therefore, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.4 Wash Plant Effluent

2.1.4: Wash plant effluent shall not be conveyed to the 2-North pit sump via the wash plant ditch. The Permittee shall keep records of the date, duration and estimated volume of any overflow of the wash plant effluent sump. Subject to review of this data, the Director may request changes to the works.

Details/Findings:

During the onsite inspection QCC confirmed that they have been in care and maintenance throughout the Inspection Period and that final coal processing ceased in October of 2019. Therefore, as there has been no flow through the wash plant effluent sump during the Inspection Period, compliance with this requirement is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.5 Settling Pond Solids and Storage Volume

Settled solids that have accumulated in the settling pond shall be removed as required to maintain a minimum water depth below the pond decant of 1.0 m and a minimum water storage volume of 2 300 m3. The removed solids shall be disposed of in a manner approved by the Director.

Details/Findings:

During the onsite inspection of the decant for Settling Pond 4, accumulation of vegetative growth and organic matter (leaves) around the decant location meant it was not possible during the onsite inspection to determine the depth to the settled solids below the pond decant. QCC confirmed during the onsite inspection that no solids had been removed from the settling pond during the Inspection Period. The Permit does not contain a requirement to conduct surveys or other measurements to determine the quantity of settled solids or the water storage volume, therefore, compliance with this section is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.6 Discharge Routing

2.1.6: The discharge from the settling pond shall be conveyed to Middle Quinsam Lake in a manner acceptable to the Director.

Details/Findings:

Review of Ministry files determined that the Director has not assessed the conveyance of effluent from settling pond 4 to Middle Quinsam Lake, therefore, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.1 North Coal Mining and Coal Preparation Plant Operation (Settling Pond #4), 2.1.7 Effluent Characteristics (for Total Suspended Solids)

2.1.7: The characteristics of the effluent with respect to total suspended solids shall be equivalent to or less than the levels specified in Subsection 1.1.2 for discharge rates up to 0.32 m3/s (or as may be redefined by the Director according to Subsection 2.1.1). Variances may be allowed by the Director for higher discharge rates. The Director may as well, in the future, establish a maximum level for total suspended solids during extreme storm events.

Details/Findings:

A review of Table 5 in Appendix I of the 2022-2023 Annual Report determined that all reported total suspended solids concentrations were within the Permit limits stipulated in this section of the Permit during the Inspection Period, and review of Table 25 in Appendix I of the 2022-2023 Annual Report determined that the maximum authorized rate of discharge was not exceeded. Review of Ministry files determined that the Director did not stipulate any variances for higher discharge rates or establish a maximum level for total suspended solids during extreme storm events for the Inspection Period. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period .

Compliance:

In

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.2 South Coal Mining Operation (Settling Pond #1), 2.2.1 Rate of Discharge

2.2.1: The maximum flow of 0.46 m3/s is the peak routed outflow from the settling pond resulting from an assumed response of the maximum equivalent catchment area as defined in Subsection 2.2.2 to a design 1 in 10 year return period rainfall of 24 hour duration. The Director may from time to time redefine the maximum routed outflow based upon actual on-site measurements.

Details/Findings:

Review of Table 26 in Appendix I of the 2022-2023 Annual Report determined that the daily maximum rate of discharge for E218582 was not exceeded during the Inspection Period. Review of Ministry files determined that the Director did not redefine the maximum routed outflow based upon actual onsite measurements during the Inspection Period. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period .

Compliance:

In

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.2 South Coal Mining Operation (Settling Pond #1), 2.2.2 Catchment Area

2.2.2: The maximum equivalent settling pond catchment area shall not exceed 68.4 hectares as defined in South Pit Water Management, Settling Pond 1, Quinsam Coal Project, Ker, Priestman and Associates Limited, March 1990 unless authorisation has been obtained from the Director.

Details/Findings:

Review of Ministry files determined that the 1990 report referenced in this section of the Permit was not retained by the Ministry, and QCC could not provide the report upon request. QCC staff confirmed during the onsite inspection that there were no changes made at this location during the Inspection Period that would result in a increase to the catchment area for the settling pond. However, there is no requirement in the Permit to track or report changes to the catchment area, and this clause has been present in the Permit since at least 2010. Therefore, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.2 South Coal Mining Operation (Settling Pond #1), 2.2.3 Settling Pond Solids and Storage Volume

2.2.3: Settled solids which have accumulated in the settling pond shall be removed as required to maintain a minimum water depth below the pond decant of 1.0 m and a minimum water storage volume of 1400 m3. The removed solids shall be disposed of in a manner approved by the Director.

Details/Findings:

Accumulation of ice on the pond meant it was not possible during the onsite inspection to determine the depth to the settled solids below the pond decant. QCC confirmed during the onsite inspection that no solids had been removed from the settling pond during the Inspection Period. The Permit does not contain a requirement to conduct surveys or other measurements to determine the quantity of settled solids or the water storage volume, therefore, compliance with this section is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.2 South Coal Mining Operation (Settling Pond #1), 2.2.4 Discharge Routing

2.2.4: The discharge from the settling pond shall be conveyed to Long Lake through the adjacent wetlands as specified in Figure 1, South Pit Water Management, Settling Pond 1, Quinsam Coal Project, Ker, Priestman and Associates Limited, March 1990.

Details/Findings:

Review of Ministry files determined that the 1990 report referenced in this section was not retained by the Ministry, and QCC could not provide the report upon request. QCC staff confirmed during the onsite inspection that there were no changes made at this location during the Inspection Period that would result in a increase to the catchment area for the settling pond. However, there is no requirement in the Permit to track or report changes to the catchment area, and this clause has been present in the Permit since at least 2010. Therefore, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.2 South Coal Mining Operation (Settling Pond #1), 2.2.5 Effluent Characteristics (for Total Suspended Solids)

2.2.5: The characteristics of the effluent with respect to total suspended solids shall be equivalent to or less than the levels specified in Subsection 1.2.2 for discharge rates up to 0.46 m3/s (or as may be redefined by the Director according to Section 2.2.1). Variances may be allowed by the Director for higher discharge rates. The Director may as well, in the future, establish a maximum level for total suspended solids during extreme storm events.

Details/Findings:

Review of Table 10 in Appendix I of the 2022-2023 Annual Report determined that all reported total suspended solids concentrations were within the Permit limits during the Inspection Period and review of Table 26 in Appendix I of the 2022-2023 Annual Report determined that the daily maximum rate of discharge was not exceeded during the Inspection Period. Review of Ministry files determined that the Director did not stipulate any variances for higher discharge rates or establish a maximum level for total suspended solids during extreme storm events for the Inspection Period. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period .

Compliance:

In

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.3 Block 242 Coal Mining Operation, 2.3.1 Pumping Rate

2.3.1: Subject to Subsection 4.4.3 the rate at which effluent may be pumped from the underground sump(s) to the primary settling pond and from the primary settling pond to the secondary settling pond shall not exceed 0.043 m3/s (up to a maximum of 400 m3/d) and 0.0082 m3/s respectively.

Details/Findings:

During the onsite inspection, QCC staff confirmed that there continues to be no mine activity in Block 242 Coal Mining Operation and no subsequent discharge is occurring from this location. As there is no discharge, compliance with this Section of the Permit, and the remainder of Section 2.3, is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.4 7 South Mining Operation Settling Pond, 2.4.1 Rate of Discharge

2.4.1: The maximum flow of 0.005 m3/s is the peak routed outflow from the settling pond resulting from an assumed response of the maximum equivalent catchment area as defined in subsection 2.4.3 to a design 1 in 10 year return period of 24 hour duration. Additional flow from the 7S adit sump pump must not cause the settling pond to overflow or exceed the maximum flow. The Director may from time to time redefine the maximum routed outflow based upon actual on-site measurements.

Details/Findings:

A review of Table 27 in Appendix I of the 2022-2023 Annual Report determined that there was no reported flow from E292069 during the Inspection Period. QCC confirmed during the onsite inspection that there was no discharge from the 7S Adit sump to E292069 during the Inspection Period. Therefore, compliance with this requirement as well as Permit sections 2.4.2, 2.4.5, 2.4.6, 2.4.7, 2.4.8 and 2.4.9, is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.4 7 South Mining Operation Settling Pond, 2.4.3 Catchment Area

2.4.3: The maximum settling pond catchment area shall not exceed 3.14 hectares as defined in the Surface Water Management Plan - 7 South Development Quinsam Mine, Golder Associates, April 12, 2012 (Appendix B) unless authorisation has been obtained from the Director.

Details/Findings:

Review of Ministry files determined that the 2012 report referenced in this section was not retained by the Ministry. QCC staff confirmed during the onsite inspection that there were no changes made at this location during the Inspection Period that would result in a increase to the catchment area for the settling pond. However, there is no requirement in the Permit to track or report changes to the catchment area, and this clause has been present in the Permit since at least 2013. Therefore, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

2. SPECIFIC REQUIREMENTS, 2.4 7 South Mining Operation Settling Pond, 2.4.4 Settling Pond Solids and Storage Volume

2.4.4: Settled solids which have accumulated in the settling pond shall be removed as required to maintain a minimum water depth below the pond decant of 1.0 m and a minimum water storage volume of 340 m3. The removed solids shall be disposed of in a manner approved by the Director.

Details/Findings:

During the onsite inspection, QCC staff confirmed that no sediment removal was conducted during the Inspection Period. However, no surveys or other measurements had been undertaken to determine the storage volume of the pond during the inspection period and there is no requirement in the permit to do so. Therefore, compliance with this section is not determined for the Inspection Period

Compliance:

Not Determined

Requirement Description:

3. GENERAL REQUIREMENTS, 3.1 Flocculation

3.1: In order to meet the levels specified for total suspended solids in Subsections 1.1, 1.2, 1.3 and 1.4, it may be necessary to use chemical flocculating agents. The Permittee is required to carry out laboratory testing of the flocculants proposed for toxicity and effectiveness for removing suspended matter. The methodology and details of the testing program are subject to the approval of the Director. Based on the results of laboratory testing the Director may approve a flocculant for use under actual operating conditions. At least one alternate flocculant shall be tested and, if approved by the Director, an adequate supply shall be located within 6 hours travel time from the mine site.

Details/Findings:

During the onsite inspection, QCC staff confirmed that chemical flocculating agents had not been used during the Inspection Period. Therefore, compliance with this requirement is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

3. GENERAL REQUIREMENTS, 3.2 Environmental Procedures Manual

3.2: An Environmental Procedures Manual shall be maintained by the Permittee as a working document for use by supervisory personnel and a guide to field staff during various stages of the project. The manual should cover all aspects of onsite environmental management applicable to mine construction and operation including but not limited to, the following items: 1) Land clearing, topsoil stripping and road construction; 2) Construction of water diversion and water collection ditches; 3) Flocculation; 4) Macrophyte growth and harvesting in the ponds, drainage ditches and discharge channels; 5) Acid-base accounting and materials handling; 6) Reclamation activities; 7) Construction of waste dumps; 8) Contingency planning for effluent liming, lake aeration and forest fertilization. 9) Settling pond operation under various flow/discharge conditions for the Block 242 coal mining operation as detailed in the Block 242 Mine Water Management Quinsam Coal Mine, AGRA Earth and Environmental Limited, February 1997; 10) Underground pump operation during extreme rainfall events; 11) Settling pond operation for the 7-South mining operation, including details on the contingency measures. The Permittee shall review the Environmental Procedures Manual at least on an annual basis to determine if any changes are required and submit any revisions to the Director for approval. Annual reviews and submission of revisions are due on March 31 of each year.

Details/Findings:

A revised version of the Environmental Procedures Manual (EMP) was submitted to the Ministry via email on March 30, 2022. QCC staff confirmed during the onsite inspection that no updates were required to the EMP during the annual review. Review of Ministry files determined that the Director has not yet approved the most recent version of the EMP, therefore compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

3. GENERAL REQUIREMENTS, 3.3 Acid Generation Control

3.3: In order to prevent generation of acid rock drainage and associated environmental problems it is necessary that potentially acid generating materials be identified and be subject to special handling techniques. The frequency of sampling and analysis shall be according to procedures outlined in Mines Act Permit C-172 and the Environmental Procedures Manual. If in the opinion of the Director acid rock generation is developing, the Permittee shall undertake corrective action as outlined in the appropriate section of the Environmental Procedures Manual or take any additional steps which are considered necessary to resolve the problem.

Details/Findings:

During the onsite inspection QCC staff reported that they have been in care and maintenance throughout the Inspection Period and that final coal processing ceased in October of 2019. As such, no new potentially acid generating materials were identified during the Inspection Period and compliance with this section of the permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

3. GENERAL REQUIREMENTS, 3.4 Water Quality Objectives

3.4: Specific Water Quality Objectives have been developed by the Ministry of Environment for the Middle Quinsam Lake area and are contained in the report Campbell River Area, Middle Quinsam Lake Sub-Basin Water Quality Assessment and Objectives, November 1989. The 1989 objectives, or updated versions, may be used by the Director to assess the need for further works or controls. Presently there is no site-specific objective for sulphate in the Quinsam River watershed therefore the provincial sulphate water quality guideline for receiving waters applies. An objective for sulphate in the Middle Quinsam Lake Sub-Basin may be established in the future. The permittee shall recommend updates to the objectives, as and when requested by the Director.

Details/Findings:

Section 9.1.1.4 of the 2022-2023 Annual Report indicates that the provincial sulphate water quality guideline for Dissolved sulphate is 128 mg/L. Review of the Tables in Appendix I of the 2022-2023 Annual Report determined that the locations listed in section 4.2.3 of the Permit (Receiving Water [Streams and Lakes] Monitoring Sites) all have reported average (averaged from a minimum of 5 evenly-spaced samples collected in 30 days) concentrations of dissolved sulphate under 128 mg/L. However, Review of the Approved BC water Quality Guidelines indicates that the 128 mg/L guideline for protection of freshwater aquatic life applies to total sulphate, not dissolved. As there is no requirement to sample or report total sulphate in the Permit, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

3. GENERAL REQUIREMENTS, 3.5 Nutrient Control

3.5: The mine and coal preparation plant shall be operated such that the discharge of nutrients will not result in excessive algal growth or biomass accumulation which, in turn, could have a negative impact on water quality, fish production, and aesthetic values of Quinsam and Iron River systems. If in the opinion of the Director there is evidence of deterioration in the water quality, which can be attributed to the significant discharge of nutrients from the mine operation, the Permittee may be required to implement any of the mitigative measures outlined in the Environmental Procedures Manual (lake aeration/forest fertilization) or other methods as approved by the Director.

Details/Findings:

Review of Ministry files determined that the Director has not required the Permittee to implement any of the mitigative measures outlined in the Environmental Procedures Manual (lake aeration/forest fertilization) or other methods due to evidence of deterioration in the water quality, which can be attributed to the significant discharge of nutrients from the mine operation. During the onsite inspection, accumulation of snow and ice prevented any potential observations of algal growth or biomass accumulation on the ponds or portions of the lakes and rivers. Therefore, compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

3. GENERAL REQUIREMENTS, 3.6 Chemical Storage Contaminant Works

3.6: Approved containment works shall be placed around the chemical storage areas to prevent spills to the environment. This includes, but is not necessarily limited to, storage areas for petroleum products and flocculating agents.

Details/Findings:

Chemical storage areas were not viewed during the onsite inspection, therefore, compliance with the requirements of this section of the Permit are not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

3. GENERAL REQUIREMENTS, 3.7 Spill Reporting

3.7: All spills to the environment (as defined in the Spill Reporting Regulation) shall be reported immediately in accordance with the Spill Reporting Regulation. Notification shall be via the Provincial Emergency Program at 1-800-663-3456.

Details/Findings:

During the onsite inspection, QCC staff confirmed that no spills to the environment occurred during the Inspection Period. A review of Ministry files and databases, and section 4.0 of the 2022-2023 Annual Report, confirmed that no spills were reported during the Inspection Period. Therefore, compliance with this Section is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

3. GENERAL REQUIREMENTS, 3.8 Additional Works

3.8: Based on the results of the monitoring program and/or other information obtained in connection with these discharges, the Permittee may be required to install additional treatment works or take other measures considered necessary. This may include, but is not necessarily limited to, facilities for the removal of nutrients and metals from the effluent or the provision of additional settling pond capacity.

Details/Findings:

Review of Ministry files determined that the Director did not require the installation of any additional treatment works or require the Permittee to take any other measures considered necessary by the Director. Therefore, compliance with the requirements of this section of the Permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

3. GENERAL REQUIREMENTS, 3.9 Maintenance of Works, Non-Compliances and Emergency Procedures

3.9.1: The Permittee shall inspect the authorized works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the Permittee which prevents continuing effective operation of the authorized works, the Permittee shall take appropriate remedial action and immediately notify the Regional Waste Manager or a designated Officer.

Details/Findings:

During the onsite inspection, QCC staff reported that mine staff drive the site and inspect all roadside ditches, settling ponds and pumps daily. Inspections involve checking for unobstructed flow, clearing debris, ensuring water levels are meeting Permit limits for water cover and that settling ponds are at safe levels for discharge. These inspections involve checking mine influence water that remains within the authorized works, checking pumps and floats, checking water levels against staff gauges, ensuring flow metres are operating properly and checking the integrity of the dam structures and making observations on water quality if necessary. QCC staff also confirmed that no emergency events or conditions beyond the control of the Permittee which would prevent continuing effective operation of the authorized works occurred during the Inspection Period. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

3. GENERAL REQUIREMENTS, 3.9 Maintenance of Works, Non-Compliances and Emergency Procedures, 3.9.2

3.9.2: In the event of commissioning of the works, operational system modifications, equipment failure, operator error, spill, permit non-compliances or any other condition which may affect the quantity or quality of the discharge such that permit limits may be exceeded, the Permittee shall: take appropriate action to prevent or mitigate pollution, immediately notify the Provincial Emergency Program (PEP) 1-800-663-3456, as soon as possible, conduct sampling and analysis of discharges which may cause non-compliance with the characteristics of the discharge as specified in Section 1 of this permit and provide the results to the Regional Waste Manager or a designated Officer, as soon as practicable (but not later than 30-days after the Permittee became aware of the event), investigate the event and provide a report including results of sampling and analysis, permit non-compliance, corrections to the operational system, root cause of the event and decisions for corrective and preventive action.

Details/Findings:

Review of Ministry files, databases and Table 2 of Appendix I of the 2022-2023 Annual Report Determined that no events, as described in this section of the Permit, occurred during the Inspection Period which may affect the quantity or quality of the discharge such that permit limits may be exceeded. QCC staff confirmed during the onsite inspection that no events as described in this section of the Permit occurred during the Inspection Period. Therefore, compliance with the requirements of this section of the Permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

3. GENERAL REQUIREMENTS, 3.10 Bypasses

3.10: The Permittee shall ensure that no effluent is discharged without being processed through the authorised works unless prior written approval is received from the Director.

Details/Findings:

“Effluent” is defined in Section 1 of EMA and means “a substance that is introduced into water or onto land and that (a) injures or is capable of injuring the health or safety of a person, (b) injures or is capable of injuring property or any life form, …(f) damages or is capable of damaging the environment;”

“Authorised works” are described in the following sections of the Permit:

Section 1.1.3 describes the authorised works as surface runoff collection and diversion ditches, plant-site runoff collection box, flocculation facilities, settling pond #4, 2-North pit sump, tailings storage facility, 2-North portal sump, surface and underground pumping facilities and related appurtenances approximately located as shown on attached Site Plan A.

Section 1.2.3 describes the authorised works as surface runoff collection and diversion ditches, flocculation facilities, settling pond, 3 pit sumps (1S, 2S and 3S Pits), an adit sump (4S Adit), pumping facilities , and related appurtenances approximately located as shown on attached Site Plan B.

Section 1.3.3 describes the authorised works as surface runoff collection and diversion ditches, flocculation facilities, two surface settling ponds (primary and secondary), pumping facilities and related appurtenances approximately located as shown on attached Site Plan C.

Section 1.4.3 of the Permit and include surface runoff collection and diversion ditches, flocculation facilities, one surface settling pond, an adit sump (7S Adit), pumping facilities and related appurtenances approximately located as shown on attached Site Plan D.

Review of the 2022-2023 Annual Report, previous Inspection Records (IR), and Ministry files determined that QCC has identified the following potential seepage locations on the Site:

Long Lake Seeps (LLS and LLSM)

As documented in previous IRs, two bedrock groundwater seeps convey mine impacted water from the 2-3 South mine pool at the Site and discharge into Long Lake. These two seeps are called Long Lake Seep (LLS) and Long Lake Seep Middle (LLSM).

Review of Table 20 in Appendix I of the 2022-2023 Annual Report determined that Seep **LLS** was flowing during the sampling events which occurred on the dates outlined in Table 1 below. In other words, regarding Seep LLS, QCC failed to comply with Section 3.10 of the Permit on April 5th, May 3rd, June 1st, July 5th, August 4th, and September 6th of 2022, and on January 12th, February 6th, and March 6th of 2023.

Review of Table 20 also determined that the sample results in Table 1 below demonstrate that BC Water Quality Guidelines (BCWQG) were exceeded, confirming that this mine impacted seepage water is considered effluent, as defined in EMA.

The short-term acute BCWQG for the protection of freshwater aquatic life (AW) for total iron is 1.0 mg/L, and 0.35 mg/L for dissolved iron. As outlined in ENV's BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Report (2023), "[s]hort-term acute (i.e., maximum) WQGs are set to protect against severe effects such as lethality (e.g. LC50) or other equivalent measures (e.g., EC50) to the most sensitive species and life stage over a defined short-term exposure period (e.g., 96 hours)."

Table 1

Seep LLS (EMS # E292131)			
Date of sample collection	**Parameter / Result (mg/L)**	**BCWQG AW standard (mg/L)**	**BCWQG DW standard (mg/L)**
April 5, 2022	total iron / 3.05	total iron: 1.0	---
	dissolved iron / 2.43	dissolved iron: 0.35	---
	total manganese / 0.483	---	total manganese: 0.12
May 3, 2022	total iron / 2.31	total iron: 1.0	---
	dissolved iron / 0.883	dissolved iron: 0.35	---
	total manganese / 0.315	---	total manganese: 0.12
June 1, 2022	total iron / 2.04	total iron: 1.0	---
	dissolved iron / 1.69	dissolved iron: 0.35	---
	total manganese / 0.333	---	total manganese: 0.12
July 5, 2022	total iron / 1.31	total iron: 1.0	---
	dissolved iron / 1.29	dissolved iron: 0.35	---
	total manganese / 0.301	---	total manganese: 0.12
August 4, 2022	dissolved iron / 0.889	dissolved iron: 0.35	---
	total manganese / 0.252	---	total manganese: 0.12
September 6, 2022	dissolved iron / 0.596	dissolved iron: 0.35	---
	total manganese / 0.184	---	total manganese: 0.12
January 12, 2023	total iron / 1.12	total iron: 1.0	---
	dissolved iron / 0.804	dissolved iron: 0.35	---
	total manganese / 0.272	---	total manganese: 0.12
	total cobalt / 0.00184	---	total cobalt: 0.001
February 6, 2023	total manganese / 0.146	---	total manganese: 0.12
March 6, 2023	dissolved iron / 0.408	dissolved iron: 0.35	---
	total manganese / 0.196	---	total manganese: 0.12

Review of Table 21 in Appendix I of the 2022-2023 Annual Report determined that Seep **LLSM** was flowing during the sampling event which occurred on December 28th, 2022. In other words, regarding Seep LLSM, QCC failed to comply with Section 3.10 of the Permit on December 28th, 2022.

Review of Table 21 also determined that the sample results in Table 2 below demonstrate that BCWQGs were exceeded, confirming that this mine impacted seepage water is considered effluent, as defined in EMA.

The BCWQG Maximum Acceptable Concentration (MAC) standard for the protection of Source Drinking Water (DW) for total manganese is 0.12 mg/L. As outlined in ENV's BC Source Drinking Water Quality Guidelines: Guideline Summary (2020), the MAC is " A level that has been established for certain substances that are known or suspected to cause adverse health effects."

Table 2

Seep LLSM			
Date of sample collection	**Parameter / Result (mg/L)**	**BCWQG AW standard (mg/L)**	**BCWQG DW standard (mg/L)**
December 28, 2022	total iron / 1.06	total iron: 1.0	---
	total manganese / 0.161	---	total manganese: 0.12

S Seeps (S, S2A and S2B)

As documented in previous IRs, QCC discovered three additional seeps near the Quinsam River. Seep S is located near monitoring well QU11-09 M and flows from the Site into the Quinsam River. The S2 Seeps (S2A and S2B) are located near sampling location QRD-02 and monitoring well QU11-05 and also flow from the Site into the Quinsam River downstream of Seep S.

Review of Table 34 in Appendix I of the 2022-2023 Annual Report determined that Seep **S** was flowing during the sampling events which occurred on the dates outlined in Table 3 below. In other words, regarding Seep S, QCC failed to comply with Section 3.10 of the Permit on April 5th, 11th, 19th and 25th, May 2nd, 9th and 26th, June 2nd, 9th, 16th, 20th, 23rd and 28th, July 5th, 11th, 21st and 26th, August 4th, 11th, 18th and 25th, of 2022, and on January 12th, 18th, and 26th, February 2nd, 7th and 14th, and March 16th, of 2023.

Review of Table 34 also determined that the sample results in Table 3 below demonstrate that BCWQGs were exceeded, confirming that this mine impacted seepage water is considered effluent, as defined in EMA.

The long-term chronic BCWQG for AW for total arsenic is 0.005 mg/L. As outlined in ENV's BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Report (2023), "[l]ong-term chronic (i.e., average) WQGs are intended to protect the most sensitive species and life stage against sub-lethal and lethal effects for indefinite exposures. An averaging period approach is used for these WQGs. This approach allows concentrations of a substance to fluctuate above and below the guideline provided that the short-term acute is never exceeded and the long-term chronic is met over the specified averaging period (e.g., 5 samples in 30 days). "

Table 3

Seep S			
Date of sample collection	**Parameter / Result (mg/L)**	**BCWQG AW standard (mg/L)**	**BCWQG DW standard (mg/L)**
April 5, 2022	total arsenic / 0.0600	total arsenic: 0.005	total arsenic: 0.01
April 11, 2022	total arsenic / 0.0831	total arsenic: 0.005	total arsenic: 0.01
April 19, 2022	total arsenic / 0.0636	total arsenic: 0.005	total arsenic: 0.01
April 25, 2022	total arsenic / 0.0647	total arsenic: 0.005	total arsenic: 0.01
May 2, 2022	total arsenic / 0.0621	total arsenic: 0.005	total arsenic: 0.01
May 9, 2022	total arsenic / 0.0666	total arsenic: 0.005	total arsenic: 0.01
May 26, 2022	total arsenic / 0.0678	total arsenic: 0.005	total arsenic: 0.01
	total manganese / 0.170	---	total manganese: 0.12
June 2, 2022	total arsenic / 0.0737	total arsenic: 0.005	total arsenic: 0.01
	total manganese / 0.136	---	total manganese: 0.12
June 9, 2022	total arsenic / 0.0723	total arsenic: 0.005	total arsenic: 0.01
	total manganese / 0.142	---	total manganese: 0.12
June 16, 2022	total arsenic / 0.0681	total arsenic: 0.005	total arsenic: 0.01
June 20, 2022	total arsenic / 0.0721	total arsenic: 0.005	total arsenic: 0.01
June 23, 2022	total arsenic / 0.0698	total arsenic: 0.005	total arsenic: 0.01
June 28, 2022	total arsenic / 0.0700	total arsenic: 0.005	total arsenic: 0.01
July 5, 2022	total arsenic / 0.0702	total arsenic: 0.005	total arsenic: 0.01
July 11, 2022	total arsenic / 0.0730	total arsenic: 0.005	total arsenic: 0.01
July 21, 2022	total arsenic / 0.0716	total arsenic: 0.005	total arsenic: 0.01
July 26, 2022	total arsenic / 0.0730	total arsenic: 0.005	total arsenic: 0.01
August 4, 2022	total arsenic / 0.0670	total arsenic: 0.005	total arsenic: 0.01
August 11, 2022	total arsenic / 0.0558	total arsenic: 0.005	total arsenic: 0.01
August 18, 2022	total arsenic / 0.0740	total arsenic: 0.005	total arsenic: 0.01
	total manganese / 0.222	---	total manganese: 0.12
August 25, 2022	total arsenic / 0.0648	total arsenic: 0.005	total arsenic: 0.01
January 12, 2023	total arsenic / 0.0205	total arsenic: 0.005	total arsenic: 0.01
January 18, 2023	total arsenic / 0.0323	total arsenic: 0.005	total arsenic: 0.01
January 26, 2023	total arsenic / 0.0559	total arsenic: 0.005	total arsenic: 0.01
February 2, 2023	total arsenic / 0.0712	total arsenic: 0.005	total arsenic: 0.01
February 7, 2023	total arsenic / 0.0661	total arsenic: 0.005	total arsenic: 0.01
February 14, 2023	total arsenic / 0.0646	total arsenic: 0.005	total arsenic: 0.01
March 16, 2023	total arsenic / 0.0690	total arsenic: 0.005	total arsenic: 0.01

Review of Table 35 in Appendix I of the 2022-2023 Annual Report determined that Seep **S2A** was flowing during the sampling events which occurred on the dates outlined in Table 4 below. In other words, regarding Seep S2A, QCC failed to comply with Section 3.10 of the Permit on May 9th, July 5th, August 31st, and October 26th, of 2022, and on February 8th of 2023.

Review of Table 35 also determined that the sample results in Table 4 below demonstrate that BCWQGs were exceeded, confirming that this mine impacted seepage water is considered effluent, as defined in EMA.

Table 4

Seep S2A			
Date of sample collection	**Parameter / Result (mg/L)**	**BCWQG AW standard (mg/L)**	**BCWQG DW standard (mg/L)**
May 9, 2022	total arsenic / 0.0325	total arsenic: 0.005	total arsenic: 0.01
	dissolved iron / 0.354	dissolved iron: 0.35	---
July 5, 2022	total arsenic / 0.0443	total arsenic: 0.005	total arsenic: 0.01
	dissolved iron / 0.421	dissolved iron: 0.35	---
	total manganese / 0.666	---	total manganese: 0.12
August 31, 2022	total arsenic / 0.119	total arsenic: 0.005	total arsenic: 0.01
	total iron / 1.34	total iron: 1.0	---
	dissolved iron / 1.16	dissolved iron: 0.35	---
	total manganese / 0.557	---	total manganese: 0.12
October 26, 2022	total arsenic / 0.738	total arsenic: 0.005	total arsenic: 0.01
	dissolved iron / 0.595	dissolved iron: 0.35	---
	total manganese / 0.236	---	total manganese: 0.12
February 8, 2023	total arsenic / 0.0185	total arsenic: 0.005	total arsenic: 0.01

Review of Table 36 in Appendix I of the 2022-2023 Annual Report determined that Seep **S2B** was flowing during the sampling events which occurred on the dates outlined in Table 5 below. In other words, regarding Seep S2B, QCC failed to comply with Section 3.10 of the Permit on April 5th and June 6th of 2022, and on February 8th of 2023.

Review of Table 36 also determined that the sample results in Table 5 below demonstrate that BCWQGs were exceeded, confirming that this mine impacted seepage water is considered effluent, as defined in EMA.

Table 5

Seep S2B			
Date of sample collection	**Parameter / Result (mg/L)**	**BCWQG AW standard (mg/L)**	**BCWQG DW standard (mg/L)**
April 5, 2022	total arsenic / 0.0408	total arsenic: 0.005	total arsenic: 0.01
	total iron / 1.01	total iron: 1.0	---
	dissolved iron / 0.884	dissolved iron: 0.35	---
	total manganese / 0.201	---	total manganese: 0.12
June 6, 2022	total arsenic / 0.0418	total arsenic: 0.005	total arsenic: 0.01
	dissolved iron / 0.420	dissolved iron: 0.35	
	total manganese / 0.191	---	total manganese: 0.12
February 8, 2023	total arsenic / 0.0221	total arsenic: 0.005	total arsenic: 0.01

As these five mine impacted seeps discharged effluent from the Site into the Quinsam River and Long Lake, without this effluent being processed through the authorised works, and these discharges occurred during the periods described above, without prior written approval from the Director, these are considered to be unauthorized bypasses. Therefore, for the specific sources of effluent and specific dates described above, QCC failed to ensure that no effluent was discharged without being processed through the authorised works unless prior written approval is received from the Director. This non-compliance is being referred for administrative penalty.

Compliance:

Out

Actions to be taken:

Cease the discharge of effluent from the Site to the environment from these five mine impacted seeps. In the future, if QCC wishes to discharge effluent to the environment from these five mine impacted seeps, it must obtain prior written approval from the Director, or obtain authorization for these discharges under the Permit. Authorization information can be found at the following Ministry website:

https://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization

Requirement Description:

3. GENERAL REQUIREMENTS, 3.11 Environmental Review Procedures

3.11: An Environmental Technical Review Committee of six members has been formed. This Committee is composed of technical representatives from the Department of Fisheries and Oceans; Environment Canada; the Ministry of Environment; the Ministry of Energy, Mines and Natural Gas; the City of Campbell River; and the Permittee for the purpose of coordinating and reviewing the construction and operational monitoring results. Based on the recommendations of the Committee, the Director may revise the monitoring requirements in Section 4.

Details/Findings:

Review of Ministry files determined that the Director has not revised the monitoring requirements in Section 4 during the Inspection Period. Therefore, compliance with the requirements of this section of the Permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

3. GENERAL REQUIREMENTS, 3.12 Future Monitoring

3.12: Based on the results of the Effluent and In Mine Releases monitoring program specified in Subsection 4.1 and / or data obtained from the Receiving Environment monitoring program specified in Subsection 4.2, the Director may revise the monitoring requirements in Section 4.

Details/Findings:

Review of Ministry files determined that the Director has not revised the monitoring requirements in Section 4 during the Inspection Period. Therefore, compliance with the requirements of this section of the Permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.1 North Coal Mining and Coal Preparation Plant Operation (i) Decant - WD (EMS# E207409)

4.1.1 (i): See Attached Document for Section 4.1.1 (i) Table.

Details/Findings:

The November 1, 2019, letter amendment reduced the monitoring frequency for TSS at this location (E207409 settling pond 4 discharge) from daily to weekly 24 hour composite samples for decant flow conditions exceeding 0.054 m3/s, and the amendment letter states that dissolved metals analysis must be undertaken monthly. A review of Table 2 in Appendix I of the 2022-2023 Annual Report determined that all the required monitoring was conducted, with the exception of the following monitoring that was missed:

- From October 1st to November 16th, 2022, no 24-hour composite TSS samples were collected, and grab samples were collected instead.

Monitoring for Ammonia and Phosphorus is required once every three years during the low flow period (August to early September). QCC reported via email on January 16, 2024, that this monitoring was conducted August 2nd, September 6th,

and October 4th of 2022, and provided the monitoring results. Review of this data determined that Ammonia and Phosphorus limits were not exceeded.

Therefore, QCC is not in compliance with the requirements of this section of the Permit for failing to collect 24-hour composite TSS samples from October 1st to November 16th, 2022, due to a misinterpretation by QCC of the November 1st, 2019, permit amendment conditions.

Compliance:

Out

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.1 North Coal Mining and Coal Preparation Plant Operation (ii) Culvert at Middle Quinsam Lake Road - WC (EMS# 207411).

4.1.1 (ii): See Attached Document for Section 4.1.1 (ii) Table

Details/Findings:

The November 1, 2019, letter amendment reduced the frequency of pH and conductivity from weekly to monthly for monitoring site Middle Quinsam Lake Road WC (EMS # E207411), and removed the bi-weekly TSS monitoring requirement when SPD (E218582) Decant Flow is less than 0.046 m3/s. A review of Table 9 in Appendix I of the 2022-2023 Annual Report determined that all required monitoring was conducted in compliance with the Table in section 4.1.1 (ii) during the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.1 North Coal Mining and Coal Preparation Plant Operation (iii) 2-North Portal Sump Effluent - SN-P-Sump (EMS# E283433).

4.1.1 (iii) See Attached Document for Section 4.1.1 (iii) Table

Details/Findings:

The November 1, 2019, letter amendment reduced the frequency of pH and conductivity monitoring from weekly to monthly for monitoring site E283433. Review of Table 7 in Appendix I of the 2022-2023 Annual Report determined that all monitoring was conducted in compliance with the Table in section 4.1.1 (iii) during the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.1 North Coal Mining and Coal Preparation Plant Operation (iv) Additional Sites Monitoring Schedule

4.1.1 (iv): See Attached Document for Section 4.1.1 (iv) Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, removed monitoring site E292126 (south dyke sump) from the Permit monitoring program, and reduced the frequency of pH and conductivity monitoring from weekly to monthly for monitoring site E207412. Review of Table 6 in Appendix I of the 2022-2023 Annual Report determined that monitoring at site E207412 was conducted in compliance with the Table in section 4.1.1 (iv) during the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.2 South Coal Mining Operation (i) Decant – SPD (EMS# E218582)

4.1.2 (iv): See Attached Document for Section 4.1.2 (i) Table

Details/Findings:

The November 1, 2019, letter amendment reduced the monitoring frequency for TSS at this location (E218582 settling pond 1 discharge) from daily to weekly for decant flow conditions at SPC (E217014) exceeding 0.046 m3/s, and required that dissolved metals analysis be undertaken monthly. Review of Table 2 in Appendix I of the 2022-2023 Annual Report determined that the following monitoring was missed:

- From October 1st to November 16th, 2022, no 24-hour composite TSS samples were collected, and grab samples were collected instead.

Therefore, QCC is not in compliance with the requirements of this section of the Permit for failing to collect 24-hour composite TSS samples from October 1st to November 16th, 2022, due to a misinterpretation by QCC of the November 1st, 2019, permit amendment conditions

Compliance:

Out

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.2 South Coal Mining Operation (ii) Culvert Downstream End at Access Road - SPC (EMS #E217014)

4.1.2 (ii): See Attached Document for Section 4.1.2 (ii) Table

Details/Findings:

The November 1, 2019, letter amendment reduced the frequency of pH and conductivity monitoring from weekly to monthly for monitoring site E217014 (Culvert, Downstream End at Access Road SPC), and removed the bi-weekly TSS monitoring requirement when SPD (E218582) Decant Flow is less than 0.046 m3/s. Review of Table 18 and Table 26 in Appendix I of the 2022-2023 Annual Report determined that the following monitoring was not reported:

-No monitoring results were reported for the month of October of 2022.

QCC staff confirmed via email on January 16, 2024, that "The monitoring location E217014 was dry during this period. It is usually dry from June until November."

In the month of August, September and October 2022, the average flow rate for E218582 was less than 0.046 m3/s. Therefore no TSS sample was required those months. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.2 South Coal Mining Operation (iii) South Pit Main Sump Water - 3S (EMS #E217015)

4.1.2 (iii): See Attached Document for Section 4.1.2 (iii) Table

Details/Findings:

The November 1, 2019, letter amendment reduced the frequency of pH and conductivity monitoring from weekly to monthly for monitoring site E217015. A review of Table 17 in Appendix I of the 2022-2023 Annual Report, and Table 17 in Appendix I of the Quarterly Reports, determined that monitoring was conducted in compliance with the Table in section 4.1.2 (iii) during the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.2 South Coal Mining Operation (iv) Additional Monitoring Sites Schedule (2S, 3S77, 4S-Lo)

4.1.2 (iv): See Attached Document for Section 4.1.2 (iv) Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, removed monitoring sites E292128 (1977 bulk sample pit) and E292129 (culvert downstream of 4 south access road) from the monitoring program, and reduced the frequency of pH and conductivity monitoring from weekly to monthly for monitoring site E292127. A review of Table 15 and Table 28 in Appendix I of the 2022-2023 Annual Report determined that monitoring at site E292127 was conducted in compliance with Table in section 4.1.2 (iv) during the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.3 Block 242 Coal Mining Operation (i) Decant (EMS # E225796)

4.1.3 (i): See Attached Document for Section 4.1.3 (i) Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, removed monitoring site E225796 Block 242 decant from the monitoring program; therefore, compliance with this Section is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.3 Block 242 Coal Mining Operation (ii) Underground Settling Pond Effluent (EMS # E225797)

4.1.3 (ii): See Attached Document for Section 4.1.3 (ii) Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, removed monitoring site E225797 Block 242 underground settling pond effluent from the monitoring program; therefore, compliance with this Section is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.4 7 South Mining Operation (i) Decant - 7SSD (EMS # E292069)

4.1.4 (i): See Attached Document for Section 4.1.4 (i) Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, reduced the monitoring frequency for all parameters at this location (E292069) from monthly to quarterly when no discharge is occurring. A review of Table 22 and Table 27 in Appendix I of the 2022-2023 Annual Report and Table 22 and Table 27 in Appendix I of the Q1 Report determined that no discharge occurred during the Inspection Period, and quarterly monitoring of ponded water was conducted in compliance with the Table in section 4.1.4 (i).

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.1 Effluent and In-Mine Releases, 4.1.4 7 South Mining Operation (ii) 7 South Adit Sump - 7S-Sump (EMS # E292110)

4.1.4 (ii): See Attached Document for Section 4.1.4 (ii) Table

Details/Findings:

The Table in section 4.1.4 (ii) requires daily monitoring of TSS and weekly monitoring of all other parameters when pumping from 7 South Adit sump to 7S settling pond. QCC staff confirmed during the onsite inspection that no effluent was pumped from the 7-South Adit Sump to 7S settling pond during the Inspection Period; therefore, compliance with this requirement was not applicable during the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.2 Receiving Environment Monitoring Sites and Monitoring Requirements, 4.2.1 Initial Dilution Zone Monitoring Sites (i) Long Lake Entrance - LLE

4.2.1 (i): See Attached Document for Section 4.2.1 (i) Table

Details/Findings:

A review of Table 19 in Appendix I of the 2022-2023 Annual Report determined that E292130 was monitored as per the Table in section 4.2.1 (i).

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.2 Receiving Environment Monitoring Sites and Monitoring Requirements, 4.2.1 Initial Dilution Zone Monitoring Sites (ii) Road Crossing-etc.

4.2.1 (ii): See Attached Document for Section 4.2.1 (ii) Table

Details/Findings:

A review of Table 2, Table 24 and Table 29 in Appendix I of the 2022-2023 Annual Report determined that the following monitoring was missed: No monitoring at Road Crossing bridge on Stream 1 above the Lower Wetland 7S (EMS # E292109) was conducted during the month of November due to "Deep snow throughout November restricted access to the site." This missed sampling event resulted in missed weekly TSS samples, hardness, total and dissolved metals samples, and missed monthly alkalinity and acidity, dissolved sulphate and dissolved organic carbon samples. Therefore, QCC is not in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

Out

Actions to be taken:

As stated in section 5 of Part e of the BC field sampling manual, "[t]he sampling site must conform to Workers Compensation Board Regulations and other applicable safety requirements, and be readily accessible under all expected weather conditions." Therefore, it is the permittees responsibility to ensure they have the means to conduct the sampling program required in their permit. The permittee is responsible for ensuring monitoring locations can be accessed year round, and that samplers have the necessary equipment available to them to conduct the required monitoring in a safe manner.

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.2 Receiving Environment Monitoring Sites and Monitoring Requirements, 4.2.2 Seep Monitoring Sites (i) Long Lake Seeps (LLS)

4.2.2 (i): See Attached Document for Section 4.2.2 (i) Table

Details/Findings:

A review of Table 20 and Table 29 in Appendix I of the 2022-2023 Annual Report determined that that monitoring of long lake seep LLS (E292131) was conducted in compliance with the Table in section 4.2.2 (i).

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.2 Receiving Environment Monitoring Sites and Monitoring Requirements, 4.2.4 Sediment and Benthic Monitoring Sites

4.2.4: See Attached Document for Section 4.2.4 Table

Details/Findings:

Part (i) of section 4.2.4 requires that the permittee shall submit proposed sediment monitoring locations in the 7-South Area 5 receiving environment to the Director by October 1, 2014, for approval. The September 4, 2020, approval letter from the Ministry states that on August 19, 2020, QCC submitted an application to address permit clause 4.2.4 (i) and the Ministry subsequently approved two additional monitoring sites to be added to the sediment and benthic invertebrate sampling requirements of the Permit. These sites are:

- E297231 - IR6 Upstream of 7-South Area 5 potential impact(s), downstream of 4-South potential impact(s)

- E297232 - IR8 - New Lower Iron River site, downstream of IRT6 and the expected inflow of mine impacted water.

As outlined under section 4.2.7 (iii), sediment and benthic monitoring cycles are required every 3 to 5 years. Review of section 1.0 of the 2022-2023 Annual Report determined that the previous sediment and benthic monitoring cycle occurred in 2020 and 2021, and as stated in section 2.3.2, the next Sediment and Benthic Invertebrate monitoring program is projected to occur in 2024 or 2025. Compliance with the requirements of this section of the Permit were previously assessed in Inspection Report (IR) 194661. As the first sediment and benthic monitoring cycle was completed in 2016, the ability to conduct the subsequent cycle within 5 years as required would end in 2021. Therefore, compliance with the requirements of this section of the Permit, and section 4.2.7 (Sediment and Benthic Monitoring Requirements), is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.2 Receiving Environment Monitoring Sites and Monitoring Requirements, 4.2.5 Stream Monitoring Requirement

4.2.5: See Attached Document for Section 4.2.5 Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, removed the following monitoring sites from the monitoring program: - E286930 (Quinsam River downstream Site 1, upstream 7S operation); - E292112 (lower wetland outlet, at confluence of Quinsam River); and, - E297230 (Iron River upstream of mining operations). The November 1, 2019, letter amendment also altered the monitoring frequencies of the following monitoring sites:
- E219412 (Long Lake outlet) monitoring requirements are reduced at this site from weekly to 5-in-30 three times per year (spring, summer and fall)
- E297231 (Iron River upstream of 7SA5) and E297232 (Iron River downstream of 7SA5 and 242 inputs): The monitoring frequency at these two sites are reduced from monthly and 5-in-30 three times per year to 5-in-30 two times per year (summer and fall).
Review of Table 46 in Appendix 1 of the 2022-2023 Annual Report determined that the requirement to collect samples for total ammonia, nitrate/nitrite and phosphorus every three years was completed between July and November of 2022, for all the locations listed as streams in the Table in section 4.2.5, with the exception of locations E225798 and E225808 as outlined below. Review of Appendix 1 of the 2022-2023 Annual Report determined that monitoring of all locations was conducted as required by this section of the Permit during the Inspection Period, except the following: - No results for Summer 5 in 30 flow monitoring at E297232 due to a Level Logger failure; - No monitoring results for locations E225798 and E225808. In response to a request by the Ministry to explain why monitoring at E225798 and E225808 was not conducted, QCC staff reported via email on January 16, 2024, that "We have not monitored those locations since 2011. They were replaced with E297231 and E297232 as these sites are the same locations. It was never removed from the permit." As outlined in IR194661, although It is acknowledged that Block 242 Mining Operations has been reclaimed, the monitoring requirements for locations E225798 and E225808 have been retained in the Permit. Permit section 4.3.9 stipulates that monitoring at locations E225798 and E225808 shall commence once a discharge from the Block 242 secondary settling occurs. As mine influenced discharge has occurred from this location in the past, the requirement to monitor these locations is in effect. Therefore, QCC is not in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

Out

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.2 Receiving Environment Monitoring Sites and Monitoring Requirements, 4.2.6 Lake Monitoring Requirements

4.2.6: See Attached Document for Section 4.2.6 Table

Details/Findings:

The letter amendment issued by the Ministry on November 1, 2019, altered the monitoring frequencies of the following monitoring sites: - E217018 (No Name Lake, centre) monitoring requirements are reduced to five samples collected within a 30-day time frame (5-in-30 sampling) in the spring only. - E292118 (Lower Quinsam Lake, centre) monitoring requirements are reduced to 5-in-30 sampling in the spring only. A review of the 2022-2023 Annual Report determined that QCC conducted all lake monitoring as required by this section of the Permit during the Inspection Period, except the following: - No results for pH except at 1, 4, 9 and 1 metre from bottom at monitoring locations E206619 and E206618 due a pH probe failure. The requirement is to collect pH at 1 metre intervals from surface to bottom. Therefore, QCC is not in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

Out

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.1 Composite Sampling

4.3.1: The Permittee shall install suitable sampling facilities and obtain 24 hour composite samples of effluent for total suspended solids. Each daily composite sample shall consist of 8 samples taken at three hour intervals. Sampling shall be performed at frequencies specified in Subsections 4.1.1, 4.1.2., 4.1.3 and 4.1.4. The Permittee may also be required to collect hourly composite samples in order to verify compliance with the total suspended solids criteria of 35 mg/l specified in Subsections 1.1.2, 1.2.2, 1.3.2 and 1.4.2. Each hourly composite sample shall consist of 4 samples taken at 15 minute intervals. Proper care should be taken in sampling, storing, and transporting the samples to adequately control temperature and avoid contamination or breakage. The Permittee shall collect a grab sample instead of a composite sample when weather conditions result in freezing conditions, rendering collection of composite samples not feasible.

Details/Findings:

Composite samplers were observed during the onsite inspection, and QCC staff reported that the samplers are routinely inspected. Review of Ministry files confirmed that the Director has not required collection of hourly composite samples during the Inspection Period. Therefore, the requirement to collect hourly composite samples is not applicable for the Inspection Period. QCC staff confirmed during the onsite inspection that daily composite samples consist of 8 samples taken at three hour intervals. QCC staff confirmed via email on January 16, 2024, that 24 hour composite samples of effluent for total suspended solids for monitoring locations for E207409 and E218582 was not conducted from October 1 to November 16, 2022, due to a misinterpretation by QCC of the November 1, 2019, Permit amendment conditions. Therefore, QCC is not in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

Out

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.2 Continuous Flow Recording

4.3.2: The Permittee shall provide and maintain suitable flow measuring devices and maintain a continuous record of the rate at which the effluent is discharged from the settling ponds authorised in Subsections 1.1.3, 1.2.3, 1.4.3 and from the secondary settling pond authorised in Subsection 1.3.3.

Details/Findings:

The secondary settling pond authorized in Subsection 1.3.3 (E225796) has been reclaimed and monitoring requirements for this location were removed during the November 1, 2019, Permit amendment. Therefore, monitoring is no longer required at this location. Review of Tables 25 in Appendix I in the 2022-2023 Annual Report determined that QCC maintained a continuous record of the rate at which the effluent is discharged from the settling ponds authorized in subsections 1.1.3 (monitoring location E207409) and 1.2.3 (monitoring location E218582). Review of Table 27 in Appendix I of the 2022-2023 Annual Report determined that no flow was reported to be discharged from the settling pond authorized in Subsection 1.4.3 (monitoring location E292069) during the Inspection Period. Therefore the requirements of this section of the Permit are not applicable for monitoring location E292069 for the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.3 Iron River Flow Monitoring

4.3.3: The Permittee shall conduct a study to establish a flow calibration curve on the Iron River at a point selected by Environment Canada. The flow calibration curve shall be completed prior to the re-commencement of mining. Based on the results of this study and/or other information obtained in connection with this discharge the Director may increase the flow monitoring frequency in Iron River specified in Subsection 4.3.2 and/or limit the rate of discharge from the Block 242 mining operation during periods of low flow in Iron River.

Details/Findings:

As outlined in IR070993, dated November 15, 2017, "Ms. Russell confirmed with Officer Stewart that the study and flow calibration curve referenced in this section of the permit was completed in 2012 and conducted by consultant Lorax Environmental Services." Review of the letter amendment issued by the Ministry on November 1, 2019, determined that the Director lowered the flow monitoring frequency in the Iron River at locations specified in Subsection 4.3.2, specifically locations E297231 and E297232 had the flow monitoring requirement changed from 5 in 30 sampling three times per year to 5 in 30 sampling in the Summer and Fall. Compliance with the monitoring requirements at locations E297231 and E297232 has been assessed under section 4.2.5 of this IR. Review of the letter amendment issued by the Ministry on November 1, 2019, and Ministry files, determined that the Director has not specified requirements to limit the rate of discharge from the Block 242 mining operation during periods of low flow in Iron River. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.4 pH and Conductivity Monitoring

4.3.4: All pH and conductivity probes used for field measurements shall be maintained according to manufacturers requirements. Maintenance and calibration logs and instrument manuals shall be kept up to date and made available upon inspection. Any instance where pH results are deemed unreliable due to low conductance will be noted along with the corresponding conductance, and these results shall be included in quarterly and annual reports described in section 4.5.

Details/Findings:

QCC staff provided examples of maintenance and calibration logs, and instruction manuals, for the pH and conductivity probes used at E207409 and E218582 to Officer McKinnon during the onsite inspection. pH and conductivity readings are reported in the 2022-2023 Annual Report and no instances where pH results were deemed unreliable due to low conductance were noted. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.5 Monitoring of Seeps

4.3.5: The Permittee is required to sample in-pit, out-of-pit, underground mine, coal, and waste rock seeps. The location and frequency of sampling will be determined by the Director. Analyses will be obtained for pH, sulphate (d), and metals (t+d). Sediment sampling may also be required at seeps, as and when requested by the Director.

Details/Findings:

As discussed in the Findings for section 3.10, five seeps have been documented at QCC. Section 4.2.2 of the Permit provides a sampling frequency for the Long Lake Seep (LLS) with EMS ID E292131. The 2022-2023 Annual Report uses this EMS ID to report both LLS and LLSM monitoring data in Appendix I, tables 20 and 21, respectively. Review of Table 20 and 29 (flow monitoring) determined that monitoring of Seep LLS was conducted as required by the Table in section 4.2.2 of the Permit. The director has not specified any further Seep monitoring locations or frequencies, or additional requirements for sediment sampling at seeps.

Review of Appendix I, Tables 21, 29, 34, 35, and 36 of the 2022-2023 Annual Report determined that the following seep monitoring was conducted by QCC during the Inspection Period:

Weekly monitoring of flow and monthly monitoring of Seep LLSM for pH, conductivity, dissolved sulphate, TSS, alkalinity and acidity, and total and dissolved metals. The Seep was reported to be dry in October and November of 2022.

Weekly monitoring of flow and weekly monitoring (with the exception of October and November when the Seep was dry) of Seep S for pH, conductivity, turbidity, dissolved sulphate, alkalinity and acidity, dissolved organic carbon, chloride and fluoride, and total and dissolved metals. TSS was sampled occasionally. The Seep was reported to be dry from September of 2022 to January of 2023.

Monthly monitoring of flow and monthly monitoring of Seep S2A for pH, conductivity, turbidity, dissolved sulphate, alkalinity and acidity, dissolved organic carbon, chloride and fluoride, and total and dissolved metals. The Seep was reported to be dry in April, June, September, November and December of 2022, and January and March of 2023.

Monthly monitoring of flow and monthly monitoring of Seep S2 for pH, conductivity, turbidity, dissolved sulphate, alkalinity and acidity, dissolved organic carbon, chloride and fluoride, and total and dissolved metals. The Seep was reported to be dry in April, June, September, November and December of 2022, and January and March of 2023.

As these four additional seeps that QCC has identified do not have monitoring requirements specified in the Permit, QCC is in compliance for sampling the seeps for pH, dissolved sulphate, and total and dissolved metals during the Inspection

Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.6 Groundwater Observation Wells

4.3.6: The Permittee may be required to install groundwater observation wells in the vicinity of pits 2N, 1S, 2S, 3S, 4S, 5S, Block 242 and 7S. The number, location and structural details of these wells will be subject to the approval of the Director. As an alternative to the 2N, 1S, 2S, 3S, 4S, 5S and 7S wells, the Permittee may establish monitoring sites at the underground sumps subject to the approval of the Director.

Details/Findings:

Review of Ministry files determined that the Director has not required the installation of groundwater (GW) observation wells in the areas listed in this section of the Permit, nor has the Director decided to exercise the right to approve the number, location and structural details of the GW wells or sumps.

Review of Table 31 in Appendix I of the 2022-2023 Annual Report determined that a list of all GW wells and underground sumps, with a description of each, was provided. As outlined in Appendix VI (2022-2023 Annual GW Monitoring Report) of the 2022-2023 Annual Report, wells and sumps are located in areas 2N, 1S, 2S, 3S, 4S, Block 242, and 7S, and QCC monitored 37 sites within the vicinity of the mine footprint for water quality parameters of interest (developed by Lorax Environmental and Enterprise Geoscience Services Ltd. in 2011) during the Inspection Period. An overview of the GW monitoring regime, methods and procedures for GW monitoring, and the results and interpretation of the 2022-2023 monitoring program were included in the 2022-2023 Annual GW Monitoring Report. As the Director has not decided to exercise the rights stipulated under this section of the Permit, compliance with the requirements of this section of the Permit are not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.7 Monitoring of Drainage Ditches and Water Channels

4.3.7: Visual inspection of drainage ditches and water channels within the mining operational areas shall be carried out by Environmental Protection staff as part of the regular inspections for the entire mine operation. Based on these monitoring results the Permittee may be required to take measures to minimize soil erosion.

Details/Findings:

During the on site inspection, snow and ice accumulation limited the ability of the inspecting Ministry Officers to observe any potential soil erosion issues with the drainage ditches and water channels. No additional measures to minimize soil erosion were required during the Inspection Period. Therefore, compliance with this section of the Permit is not applicable for the Inspection Period.

Compliance:

Not Applicable

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.3 Additional Monitoring Requirements, 4.3.8 Precipitation Monitoring

4.3.8: The Permittee shall maintain a suitable rain gauge at a location approved by the Director and measure and record the daily accumulated precipitation.

Details/Findings:

Officer McKinnon observed the location of the rain gauge during the onsite inspection. The meteorological monitoring station location appeared to conform with the standards described in Chapter 3, Siting and Exposure, of the USEPA Meteorological Monitoring Guidance for Regulatory Modeling Applications (USEPA, 2000), specifically in that it was observed to be approximately 10 metres (m) in height and was approximately located a distance of at least ten times the height of any nearby obstruction (i.e. 100 m). Appendix I, Table 30 of the 2022-2023 Annual Report and Appendix I, Table 30 of the Q1 Report included daily accumulated precipitation records for the Inspection Period. The requirement to have the rain gauge at a location approved by the Director has been a requirement of the Permit since at least 2010, which is the earliest permit in the Ministry's electronic files, even though the Permit was first issued in 1987. Review of Ministry files could not determine if the current location of the rain gauge has been approved by the Director, therefore compliance with the requirements of this section of the Permit is not determined for the Inspection Period.

Compliance:

Not Determined

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.4 Monitoring Procedures, 4.4.1 Sampling and Analytical Procedures

4.4.1: Sampling shall be carried out in accordance with the procedures described in the latest version of "British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples (Permittee)", or by suitable alternative procedures as authorised by the Director. Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials", or by suitable alternative procedures as authorised by the Director. Copies of the above manuals may be purchased from Queens Printer Publications Centre, P.O. Box 9452, Stn. Prov. Govt. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or 250 387-6409 or via the internet at www.crownpub.bc.ca. The manuals are also available for review at all Environmental Protection offices.

Details/Findings:

As observed during the Split Sample Audit conducted during the onsite inspection, sampling was carried out in accordance with the procedures described in the British Columbia Field Sampling Manual (BCFSM).
A review of the 2022-2023 Annual Report, and Tables 48 to 50 of Appendix I, determined that field replicate samples are collected during every sampling event, accounting for approximately 10% of analyses requested from the laboratory, and that field blanks and trip blanks are also collected, as required by the BCFSM. Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.5 Reporting

4.5.1 (ii): The Permittee shall submit the results of the monitoring program to the Director on a quarterly basis within thirty days following the previous quarter of monitoring. Based on these results, the monitoring program may be increased or decreased at the discretion of the Director. The format and content of the quarterly report is subject to the approval the Director. An annual review and interpretative report shall be prepared and submitted by the Permittee by June 30 of each year. The report will include, but is not necessarily limited to, the following items: 1) A summary of monitoring results for the previous twelve months. 2) Spills or other unusual events. 3) Changes in the environment resulting from mining activity. 4) Summary of completed, in progress activities or studies relevant to the permitted discharges, associated authorized works and the receiving environment relevant to the reporting period. 5) Projected activities for the coming year which may have an impact on the environment. The format and content of the annual report is subject to the approval of the Environmental Technical Review Committee and the Director. 4.5.1 Through the duration of mining in 7-South Area 5, quarterly and annual reports shall include a summary of: ii. Comparison of actual water quality and quantity pumped from 7-South Area 5 development to values predicted in Lorax Environmentals June 5, 2013 report titled, 7 South Area 5 Water Quality Effects Assessment.

Details/Findings:

Review of Ministry files determined that the quarterly reports and annual report required to be submitted during the Inspection Period met the reporting frequencies outlined in this section of the Permit as follows: The Q1 report (covering April-June 2022) was submitted on July 30, 2022; The Q2 report (covering July to September 2022) was submitted on October 31, 2022; The Q3 report (covering October to December 2022) was submitted on January 30, 2023; The Q4 report (covering January - March 2023) was submitted on April 27, 2023; and, The 2022-2023 Annual Report was submitted June 29, 2023. A review of this report determined that it included items 1) though 5). Therefore, QCC is in compliance with the requirements of this section of the Permit for the Inspection Period.

Compliance:

In

Requirement Description:

4. MONITORING AND REPORTING REQUIREMENTS, 4.5 Reporting

4.5.1 (iii): The Permittee shall submit the results of the monitoring program to the Director on a quarterly basis within thirty days following the previous quarter of monitoring. Based on these results, the monitoring program may be increased or decreased at the discretion of the Director. The format and content of the quarterly report is subject to the approval the Director. An annual review and interpretative report shall be prepared and submitted by the Permittee by June 30 of each year. The report will include, but is not necessarily limited to, the following items: 1) A summary of monitoring results for the previous twelve months. 2) Spills or other unusual events. 3) Changes in the environment resulting from mining activity. 4) Summary of completed, in progress activities or studies relevant to the permitted discharges, associated authorized works and the receiving environment relevant to the reporting period. 5) Projected activities for the coming year which may have an impact on the environment. The format and content of the annual report is subject to the approval of the Environmental Technical Review Committee and the Director. 4.5.1 Through the duration of mining in 7-South Area 5, quarterly and annual reports shall include a summary of: iii. Comparison of water quality pumped from the 7-South Area 5 development to water quality at Settling Pond 4 and Middle Quinsam Lake, including a comparison of data trends, Settling Pond 4 permit limits and Middle Quinsam Lake water quality guidelines and/or objectives.

Details/Findings:

Quinsam is in care and maintenance and no mining occurred at 7-South Area 5 during the Inspection Period; therefore, compliance with requirements i. through iv. is not applicable for the Inspection Period.

Compliance:

Not Applicable

Compliance History:
2022-11-22 IR 194661 AMP: AUTHORISED DISCHARGES 1.1.1; 1.1.4; 1.2.2; 1.2.3; 1.2.4, Bypasses 3.10, Composite Sampling 4.3.1, Continuous Flow Recording 4.3.2, Maintenance of Works, Non-Compliances and Emergency Procedures 3.9.1; 3.9.2, North Coal Mining and Coal Preparation Plant Operation (i) Decent - WD (EMS # E207409) 4.1.1 (i), Reporting 4.5.1 (i), Sediment and Benthic Monitoring 4.2.7, South Coal Mining Operation (i) Decant - SPD (EMS # E218582) 4.1.2 (i), Stream Monitoring Requirements 4.2.5
2021-11-08 IR 174939 AMP: AUTHORISED DISCHARGES 1.1.2; 1.1.4; 1.2.3; 1.2.4, Bypasses 3.10, Effluent Characteristics (for Total Suspended Solids) 2.1.7, Initial Dilution Zone Monitoring Sites (ii) Road Crossing-etc 4.2.1 (ii), Maintenance of Works, Non-Compliances and Emergency Procedures 3.9.1; 3.9.2, Settling Pond Solids and Storage Volume 2.1.5, South Coal Mining Operation (i) Decant - SPD (EMS # E218582) 4.1.2 (i), South Coal Mining Operation (iv) Additional Monitoring Sites Schedule (2S, 3S77, 4S-Lo) 4.1.2 (iv)
2021-01-18 IR 159669 Warning 120(6): AUTHORISED DISCHARGES 1.1.1; 1.2.2, Bypasses 3.10, Composite Sampling 4.3.1, Continuous Flow Recording 4.3.2, Effluent Characteristics (for Total Suspended Solids 2.2.5, Initial Dilution Zone Monitoring Sites (i) Long Lake Entrance - LLE 4.2.1 (i), Lake Monitoring Requirements 4.2.6, Maintenance of Works, Non-Compliances and Emergency Procedures 3.9.1, Reporting 4.5.1 (i), Settling Pond Solids and Storage Volume 2.4.4, South Coal Mining Operation (i) Decant - SPD (EMS # E218582) 4.1.2 (i), South Coal Mining Operation (iv) Additional Monitoring Sites Schedule (2S, 3S77, 4S-Lo) 4.1.2 (iv), Stream Monitoring Requirements 4.2.5
2019-10-18 IR 139588 Advisory: Acid Generation Control 3.3, AUTHORISED DISCHARGES 1.1.1; 1.1.2, Bypasses 3.10, Composite Sampling 4.3.1, Environmental Procedures Manual 3.2, Initial Dilution Zone Monitoring Sites (i) Long Lake Entrance - LLE 4.2.1 (i), North Coal Mining and Coal Preparation Plant Operation (i) Decent - WD (EMS # E207409) 4.1.1 (i), Reporting 4.5.1 (i), South Coal Mining Operation (i) Decant - SPD (EMS # E218582) 4.1.2 (i), Stream Monitoring Requirements 4.2.5
2019-01-25 IR 106411 Advisory: AUTHORISED DISCHARGES 1.1.1; 1.1.4; 1.2.2; 1.2.4; 1.4.3, Bypasses 3.10, Composite Sampling 4.3.1, Initial Dilution Zone Monitoring Sites (i) Long Lake Entrance - LLE 4.2.1 (i), Initial Dilution Zone Monitoring Sites (ii) Road Crossing-etc 4.2.1 (ii), Lake Monitoring Requirements 4.2.6, North Coal Mining and Coal Preparation Plant Operation (i) Decent - WD (EMS # E207409) 4.1.1 (i), North Coal Mining and Coal Preparation Plant Operation (ii) Culvert, at Middle Quinsam Lake Road - WC (EMS # E207411) 4.1.1 (ii), Reporting 4.5.1 (i), South Coal Mining Operation (i) Decant - SPD (EMS # E218582) 4.1.2 (i), South Coal Mining Operation (iv) Additional Monitoring Sites Schedule (2S, 3S77, 4S-Lo) 4.1.2 (iv), Stream Monitoring Requirements 4.2.5
2017-11-15 IR 70993 Warning 120(6): AUTHORISED DISCHARGES 1.1.1; 1.1.2; 1.1.3; 1.1.4; 1.2.2; 1.2.3; 1.2.4; 1.4.2; 1.4.3; 1.4.4, Composite Sampling 4.3.1, Continuous Flow Recording 4.3.2

The Ministry of Environment Compliance and Enforcement Policy and Procedure (C&E Policy) prescribes common requirements and procedures for all Ministry staff to ensure consistent and risk-based assessment and response to non-compliance. Using the Non-Compliance Decision Matrix, the compliance determination for this inspection has been assessed as Level 2, Category C, AMP.

More information about Environmental Compliance, the Non-Compliance Decision Matrix, and reporting and data submission requirements can be found at the links below:
General compliance information:
www.gov.bc.ca/environmentalcompliance
Non-Compliance Decision Matrix information:
www.gov.bc.ca/environment/how-compliance-is-assessed
Reporting and data submission requirements (to be sent to EnvAuthorizationsReporting@gov.bc.ca):
https://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/comply

Please be advised that this inspection report may be published on the provincial government website within 7 days.

Below are attachments related to this inspection.

If you have any questions about this letter, please contact the undersigned.

Yours truly,

Ben McKinnon
Environmental Protection Officer

Ministry of Environment and Climate Change Strategy
Compliance and Environmental Enforcement Branch
Mailing Address:
3rd Floor
2975 Jutland Road
Victoria BC V8W 9M1
Telephone: 250 387 3205
Facsimile: 250 356 9836
Website: www.gov.bc.ca/env

cc:

Attachments:

1) 2015 06 23 Tables PE 7008 - Section 4.1.1, 4.1.2, 4.1.3, 4.1.4.pdf

2) 2015 06 23 Tables PE 7008 - Section 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6.pdf

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Ministry of Environment and Climate Change Strategy

Compliance and Environmental Enforcement Branch

Mailing Address:
3rd Floor
2975 Jutland Road
Victoria BC V8W 9M1

Telephone: 250 387 3205
Facsimile: 250 356 9836
Website: www.gov.bc.ca/env