Alaska Department of Environmental Conservation
Attainment Determination

Eagle River, Municipality of Anchorage, Alaska
Copper, Silver, Lead, Ammonia, and Chlorine Attainment

Contents

Recommendation

Eagle River is recommended for inclusion in Category 2 on the 2018 Integrated Report 305(b) list for attainment of the copper, silver, lead, ammonia, and chlorine standards for all designated uses.

Executive Summary

The purpose of this document is to provide the rationale for the decision to remove a section of Eagle River, near Eagle River, Alaska, from Category 4a to Category 2 on the Integrated Report 305(b) list.

The Environmental Protection Agency (EPA) completed a draft Total Maximum Daily Load (TMDL) implementation plan in 1995[1] for copper, silver, lead, ammonia and chlorine in Eagle River, near Eagle River, Alaska. The length of the impaired section of Eagle River is 0.3 miles. The impaired section of Eagle River is located near the bridge where the Glenn Highway crosses Eagle River. Eagle River was placed in Category 4a in the 2002/2003 Integrated Water Quality Monitoring and Assessment Report (2002 Integrated Report) and has remained in that category until the present. The information presented in this document supports DEC's decision to change the status of Eagle River to Category 2 in the 2018 Integrated Report and further demonstrate that Eagle River is attaining water quality standards for all designated uses for copper, silver, lead, ammonia, and chlorine.

Basic Waterbody Information

Table 1. Basic Waterbody Information

Assessment Unit ID	AK-20402-002_00
Assessment Unit Name	Eagle River
Location description	North of Anchorage; HUC: 19020402
Water Type	River/Stream
Water Size (units)	0.3 Miles
Area attaining	Entire river is approximately 33 miles
Time attaining	Year-round

Pollutant Status

Table 2.Copper for fresh water uses[2]:

Use	Criteria	Status
(A) Water Supply (iii) irrigation water	200 ug/l	Supporting
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (acute)	1-hr average $\exp\{m_A[\ln(\text{hardness})] + b_A\}(CF)$ $m_A = 0.9422$ $b_A = -3.924$ $CF = 0.960$	Supporting

[1] https://dec.alaska.gov/media/15875/eagle.pdf

[2] Alaska Department of Environmental Conservation. 2018. 18 AAC 70.010 Water Quality Standards. Amended as of April 6, 2018 - http://dec.alaska.gov/media/11546/alaska-water-quality-criteria-manual-for-toxic-and-other-deleterious-organic-and-inorganic-substances.pdf

(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (chronic)	4-day average $\exp\{m_C[\ln(\text{hardness})] + b_C\}(CF)$ $m_C = 0.8545$ $b_C = -1.702$ $CF = 0.960$	Supporting

Table 3. Silver for fresh water uses:

Use	Criteria	Status
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (acute)	1-hr average $\exp\{m_A[\ln(\text{hardness})] + b_A\}(CF)$ $m_A = 1.72$ $b_A = -6.59$ $CF = 0.85$	Supporting
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (chronic)	4-day average	Not applicable[3]

Table 4. Lead for fresh water uses:

Use	Criteria	Status
(A) Water Supply (ii) stock water	50 ug/l	Supporting
(A) Water Supply (iii) irrigation water	5,000 ug/l	Supporting
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (acute)	1-hr average $\exp\{m_A[\ln(\text{hardness})] + b_A\}(CF)$ $m_A = 1.273$ $b_A = -1.460$ $CF = 1.46203-[(\ln \text{hardness})(0.145712)]$	Supporting
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (chronic)	4-day average $\exp\{m_C[\ln(\text{hardness})] + b_C\}(CF)$ $m_C = 1.273$ $b_C = -4.705$ $CF = 1.46203-[(\ln \text{hardness})(0.145712)]$	Supporting

Table 5. Total ammonia nitrogen for fresh water uses[4]:

Use	Criteria	Status

[3] Alaska does not have established chronic criteria for growth and propagation of fish, shellfish, other aquatic life, and wildlife for fresh water.

[4] Alaska Department of Environmental Conservation. 2018. 18 AAC 70.010 Water Quality Standards. Amended as of April 6, 2018 – Appendix C and D: http://dec.alaska.gov/media/11546/alaska-water-quality-criteria-manual-for-toxic-and-other-deleterious-organic-and-inorganic-substances.pdf

(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (Acute Criteria with Salmonids Present)	1-hr average $((0.275/1 + 10^{7.204-pH}) + (39.0/1 + 10^{pH-7.204}))$	Supporting
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (Chronic when Early Life Stages of Fish are Present[5,6,7,8])	4-day average $((0.0577/1 + 10^{7.688-pH}) + (2.487/1 + 10^{pH-7.688})) \cdot MIN (2.85, 1.45 \cdot 10^{0.028(25-T)})$	Supporting

Attainment Evaluation

Data Sources

Historic

The data used for the 1995 TMDL determination is the historic water quality data for Eagle River. EPA conducted an analysis of the Eagle River Wastewater Treatment facility (ERWTF) and concluded that the facility's technological controls could not ensure that water quality standards for copper, lead, chlorine, and ammonia were met at the point of discharge and prepared a draft TMDL for the section of Eagle River adjacent to the ERWTF. Under Section 303(d)(1) of the Clean Water Act and 40 CFR 130.7, where technology–based limits or other pollution control requirements (e. g., best management practices) are not sufficient to achieve compliance with water quality standards, a TMDL must be established. Calculating a TMDL for any given body of water involves using a formula:

[5] The highest four-day average within the 30-day period should not exceed 2.5 times the chronic criterion.

[6] 1999 Update of Ambient Water Quality Criteria for Ammonia, EPA 822-R-99-014

[7] Because sensitive saltwater animals appear to have a narrow range of acute susceptibilities to ammonia, this criterion will probably be as protective as intended only when the magnitudes and/or durations of excursions are appropriately small. These values were calculated by Hampson's (1977) program and Whitfield's (1974) model for hydrolysis of ammonium ions in sea water cited in EPA, 1989, Ambient Water Quality Criteria for Ammonia (Saltwater)-1989, EPA 440-5-88-004. See below for actual references:

Hampson, B.L., 1977, Relationship Between Total Ammonia and Free Ammonia in Terrestrial and Ocean Waters, J Cons. Int. Expl. Mer 37(2): 117-122.

Whitfield, M., 1974, The Hydrolysis of Ammonium Ions in Sea Water – A Theoretical Study, J. Mar. Biol. Assoc. U.K. 54:565-580.

[8] At 15 C and above, the criterion for when the early life stages of fish are absent is the same as the criterion for when the early life stages of fish are present.

$$TMDL = WLA + LA + MOS$$

WLA is the waste load allocation for point sources, LA is the load allocation for nonpoint sources, and MOS is the margin of safety. Once a TMDL is finalized, permit limitations are developed for point sources that are consistent with the WLAs.

EPA's 1995 draft TMDL for Eagle River (Eagle River TMDL) for silver was never finalized, because EPA recognized that the ERWTF does not have a reasonable potential to cause or contribute to an exceedance of the water quality criterion for silver. No data indicated that Eagle River exceeded the criterion for silver. In 1995, there were insufficient data to establish load allocations (LA) for nonpoint sources or background concentrations for copper, lead, ammonia, and chlorine. The Eagle River TMDL specified that monitoring data required as a National Pollutant Discharge Elimination System permit condition would be used to develop the data needed to determine background concentrations for the specified parameters. Later, the Alaska Pollutant Discharge Elimination System (APDES) permit continued the ambient water quality monitoring condition requirement.

Table 6 provides a summary of the final water quality criteria used in calculating the loading capacity of each of the TMDL parameters of concern. The criteria displayed in Table 6 are for the chronic aquatic life designated use, except for silver, for which there was and currently remains, only an acute criterion.

Table 6. Final Eagle River TMDL water quality data

Parameter/ Pollutant	Criteria Summer (ug/l)	Criteria Winter* (ug/l)
Copper	11	12
Lead	2.7	3.1
Silver	3.3	3.9
Ammonia	1800	2000
Chlorine	2.0	2.0

*Due to significant differences in ambient conditions (e. g., water hardness, pH and temperature), seasonal criteria were calculated for Eagle River.

Recent

The ERWTF complied with the monitoring requirements of the APDES permit, acquiring three years (2013-2015) of ambient water quality monitoring data. A team from the Anchorage Water and Wastewater Utility (AWWU) collected ambient water samples at a monitoring location upstream of the ERWTF (Figure 1) to evaluate natural background pollutant concentrations for copper, lead, ammonia, and silver in Eagle River. A summary of that data and subsequent analysis is presented in this attainment determination and is sufficient to establish that the water quality criteria for the aquatic life acute and chronic designated uses for Eagle River are being met.

Laboratory analyses were conducted to report metals (e.g., copper, lead, and silver) in total recoverable concentrations, as well as concentrations of the dissolved metals. Alaska water quality standards are for dissolved metal concentrations.

Even though the TMDL for silver was never finalized in the 1995 EPA TMDL for Eagle River, ambient concentrations for silver were analyzed and are included in the assessment for this determination.

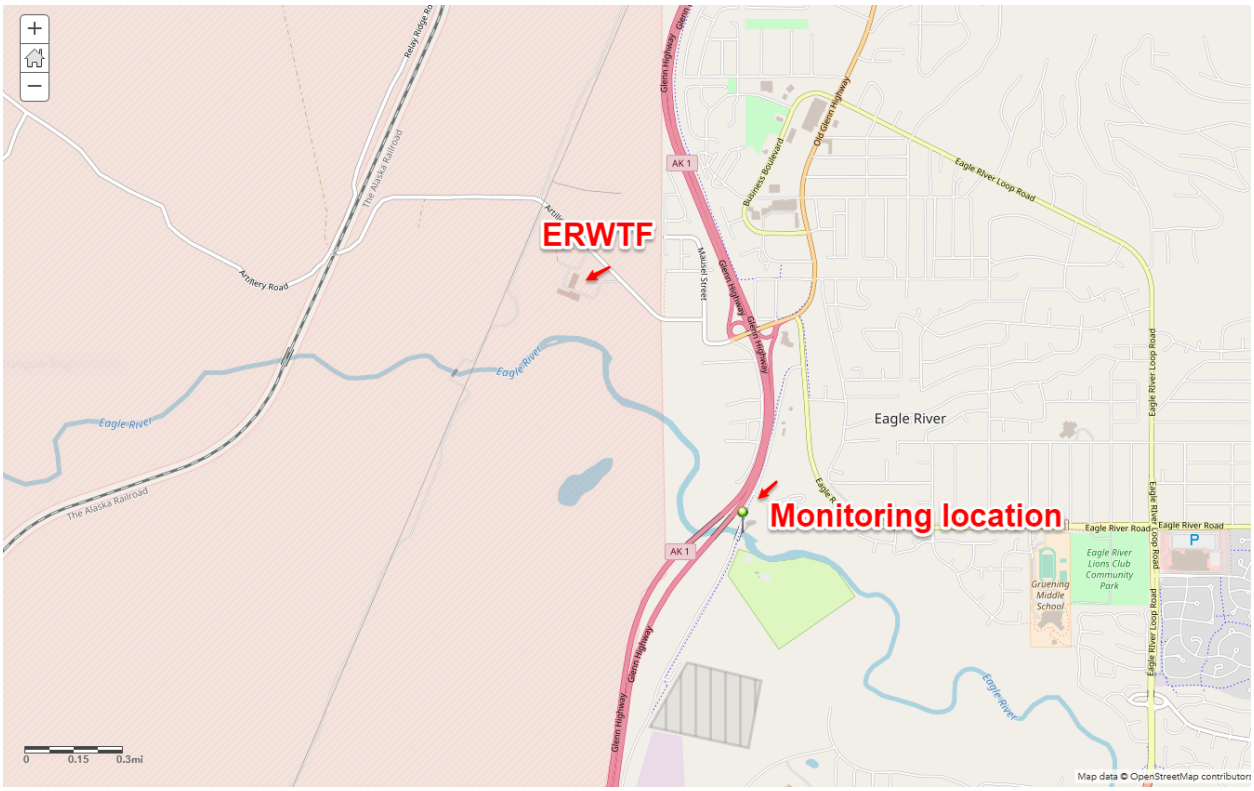
The monitoring data collected between 2013– 2015 by AWWU personnel met the Alaska Consolidated Assessment and Listing Methodology for 2018 Integrated Report on Water Quality (2018 AK CALM[9]) requirements:

Table 7. AK CALM sampling requirements for assessment purposes:

Sampling Requirement for Assessment Purpose	Recent ERWTF data sampling
Two (2) years coverage of fixed sites	Met requirement; 2013 – 2015 summer and winter sampling
Representative site(s) within an assessment unit	Met requirement; ambient water tested upstream of the ERWTF and downstream of the community of Eagle River
Sampling conducted during key periods: summer and winter	Met requirement
Minimum of 20 representative data points total	Met requirement; 23 samples for each parameter of concern and water hardness. 11 samples for ammonia; however, all samples analyzed showed ammonia to be very low or absent.
Data five (5) years old or less	Met requirement
Approved Quality Assurance Plan (QAPP)	Met requirement
QA/QC protocols followed, QA/QC results adequate	Met requirement
Approved SOPs used for field and lab; samplers well trained	Met requirement
Adequate metadata	Met requirement

[9] http://dec.alaska.gov/media/10892/2018-06-18-alaska-consolidated-assessment-and-listing-methodology-final.pdf

Figure 1. Monitoring locations near the ERWTP



Data Evaluation

Methods

Table 8. Data Analysis Considerations

Data Analysis Considerations (for all Criteria evaluated)	
Collection Method	Grab sample
Laboratory Analytical Method	Pb – USEPA 200.8
	Cu – USEPA 200.8
	Ag – USEPA 200.8
	NH_3 – APHA 4500-NH_3(D)
Hardness-laboratory method	Ca and Mg samples collected Hardness laboratory method – APHA 2340B (Hardness by calculation)

Preparation of the Data for Analysis

- Sampling data, including an approved QAPP, monitoring location coordinates and other metadata was provided to DEC by John Plaskett, Environmental Compliance Advisor, AWWU

- Sampling data was checked against the AK CALM to ensure that it was suitable for assessment purposes
- Sampling data was entered into a DEC developed spreadsheet tool, DEC 2018 Integrated Report Analysis Template (2018 IR Analysis Template) for each parameter of concern to determine attainment or impairment for all designated uses

Chronic Aquatic Life Criteria

The assessment for Eagle River considered all designated uses. However, only data for the most restrictive use, 18 AAC 70.020(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife for fresh water (chronic), is presented in the tables below. Chronic criteria were also used in developing the loading parameters for the 1998 EPA TMDL. Silver is the exception; no chronic criteria have been developed for silver, so the acute criterion is the most restrictive and is presented in this document.

Hypothesis Test

Table 18. Hypothesis Test for Impairment or Attainment

Null Hypothesis	*Waterbody is not impaired*		*If < 2 exceedances in 3 years and 4-day or daily average exceedance ≤ 5% in 3 years*
Alternative Hypothesis	*Waterbody is impaired*		*If ≥ 2 exceedances in 3 years and 4-day or daily average exceedances > 5% in 3 years*

Results

A summary of Eagle River raw sampling results, for each season and for the parameters of concern are provided in Tables 9 -16 for chronic aquatic life criteria designated uses. Results are separated into summer and winter seasons, to maintain consistency with the presentation of data used for the 1998 EPA TMDL. Graphs illustrating the raw results compared to the criterion are displayed below the tables of raw sampling results (Figures 2 – 9).

Results of analysis from 2018 Integrated Report Analysis Template and Binomial null and alternate hypothesis tests showed that Eagle River is attaining water quality standards for all designated uses for all parameters of concern; Silver (Ag), Copper (Cu), Lead (Pb) and Ammonia (NH_3)

Silver*

Table 9. Acute Aquatic Life Criteria raw data summary for summer

M/D/Y	Data (ug/l)	Hardness (mg/l)	Acute Hardness-Dependent Criteria (ug/l)	Total number of data points

5/28/2013	0.011[10]	120	4.05	11
6/25/2013	0.0091	70	1.84	
7/16/2013	0.0035	53	1.23	
8/7/2013	0.014	53	1.23	
9/5/2013	0.0045	98	3.01	
5/22/2014	0.041	98	3.01	
6/30/2014	0.019	69	1.80	
7/25/2014	0.011	57	1.36	
5/28/2014	0.05	87	2.53	
6/25/2014	0.01	67	1.73	
7/30/2014	0.01	52	1.19	

Figure 2. Raw results for silver (blue) and the silver acute criterion (orange) for summer Eagle River monitoring, 2013 – 2015.

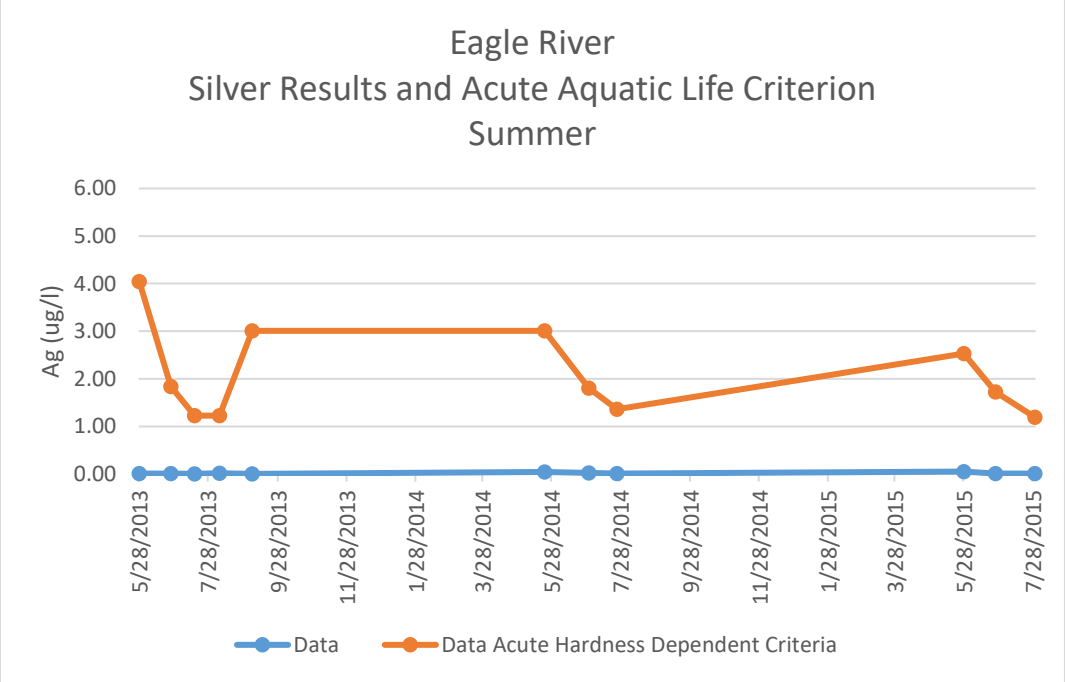


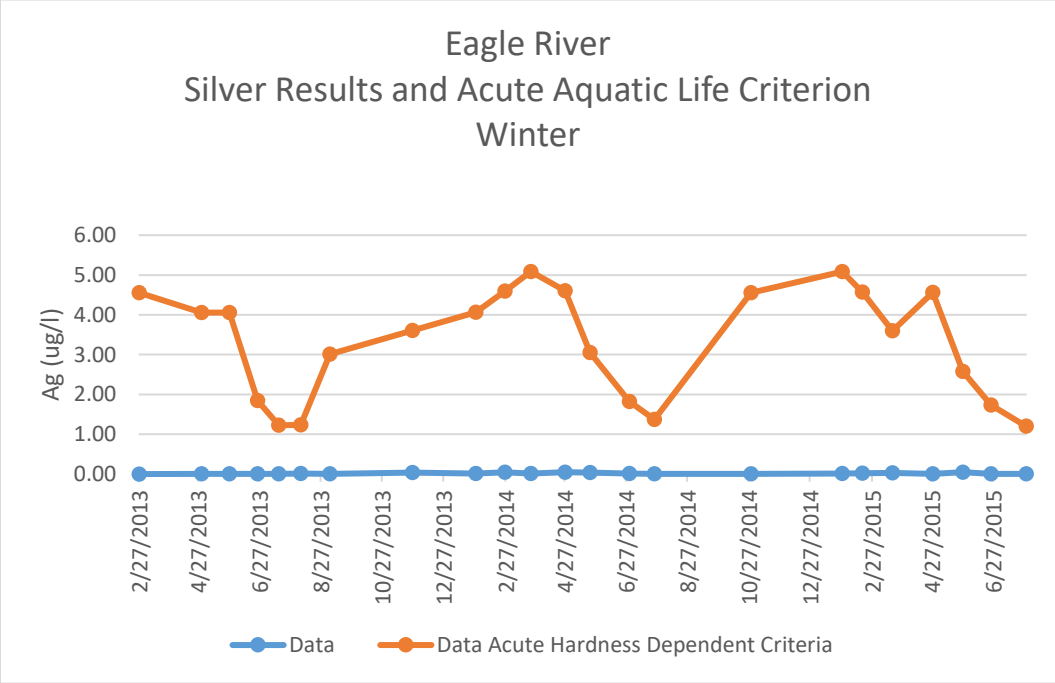
Table 10. Acute Aquatic Life Criteria raw data summary for winter

M/D/Y	Data (ug/l)	Hardness (mg/l)	Acute Hardness-Dependent Criteria (ug/l)	Total number of data points
2/27/2013	0.0027	130	4.55	
4/30/2013	0.011	120	4.05	

[10] Per 2018 Alaska CALM business rules, 0.5 x detection limit (MDL or method detection limit) will be used if the analyte is found to be in an amount below the method detection limit

11/26/2013	0.041	110	3.56	12
1/28/2014	0.017	120	4.05	
2/26/2014	0.047	130	4.55	
3/24/2014	0.018	140	5.07	
4/27/2014	0.05	130	4.55	
10/29/2014	0.0065	130	4.55	
1/28/2015	0.014	140	5.07	
2/17/2015	0.025	130	4.55	
3/19/2015	0.032	110	3.56	
4/28/2015	0.01	130	1.19	

Figure 3. Raw results for silver (blue) and the silver acute criterion (orange) for winter Eagle River monitoring, 2013 – 2015.



*DEC's *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances* does not have chronic aquatic life criteria for silver

Copper

Table 11. Chronic Aquatic Life Criteria raw data summary for summer

M/D/Y	Data (ug/l)	Hardness (mg/l)	Acute Hardness-Dependent Criteria (ug/l)	Total number of data points
5/28/2013	1.90	120	9.91	
6/25/2013	0.47	70	6.37	
7/16/2013	0.54	53	5.07	
8/7/2013	0.60	53	5.07	

9/5/2013	0.58	98	8.39	11
5/22/2014	1.10	98	8.39	
6/30/2014	0.44	69	6.29	
7/25/2014	0.26	57	5.38	
5/28/2014	1.30	87	7.61	
6/25/2014	0.51	67	6.14	
7/30/2014	0.1	52	4.99	

Figure 4. Raw results for copper (blue) and the copper chronic criterion (orange) for summer Eagle River monitoring, 2013 – 2015.

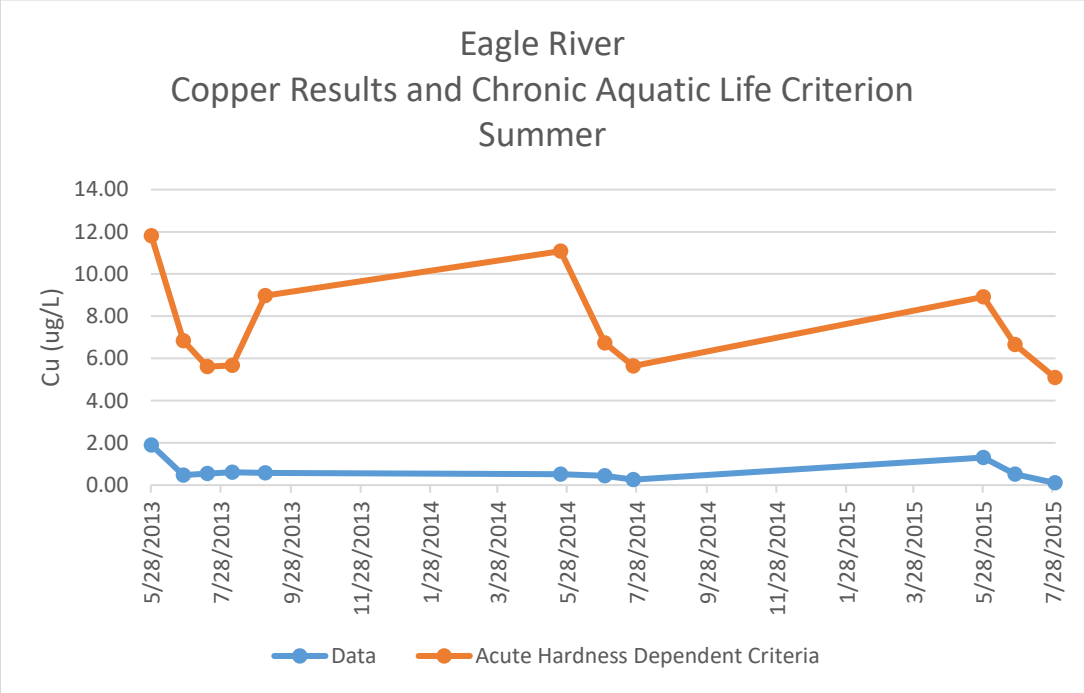
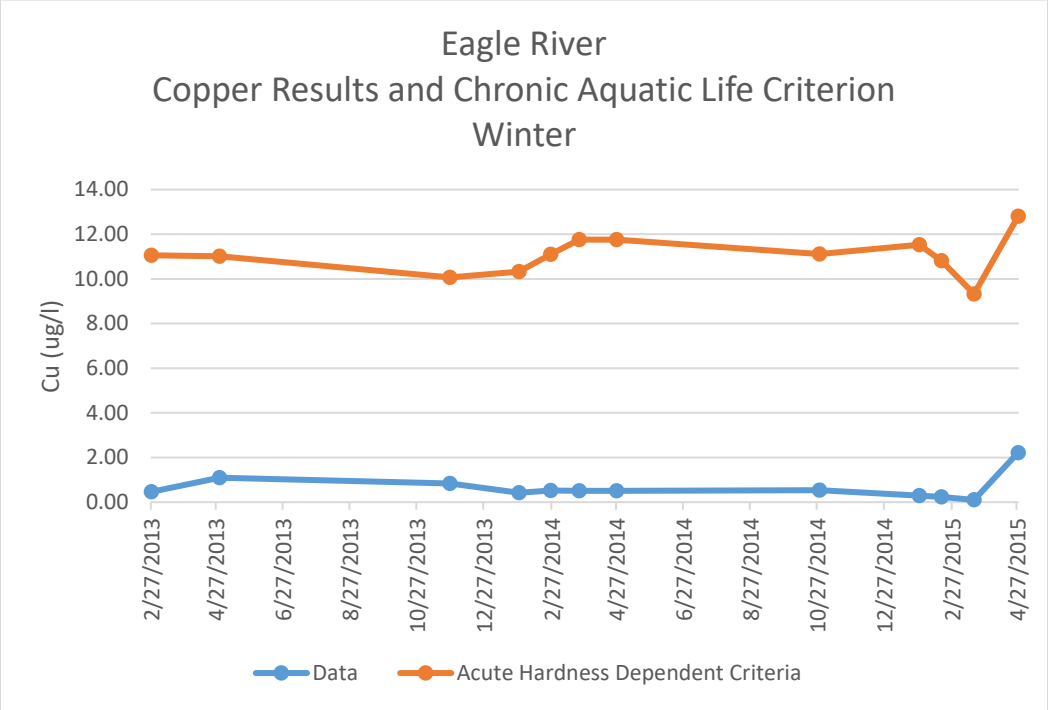


Table 12. Chronic Aquatic Life Criteria raw data summary for winter

M/D/Y	Data (ug/l)	Hardness (mg/l)	Acute Hardness-Dependent Criteria (ug/l)	Total number of data points
2/27/2013	0.47	130	10.58	12
4/30/2013	1.10	120	9.91	
11/26/2013	0.84	110	9.23	
1/28/2014	0.42	120	9.91	
2/26/2014	0.52	130	10.58	
3/24/2014	0.51	140	11.24	
4/27/2014	0.51	130	11.24	
10/29/2014	0.53	130	10.58	

1/28/2015	0.29	140	11.24	
2/17/2015	0.23	130	10.58	
3/19/2015	0.1	110	9.23	
4/28/2015	2.22	130	10.58	

Figure 5. Raw results for copper (blue) and the copper chronic criterion (orange) for winter Eagle River monitoring, 2013 – 2015.



Lead

Table 13. Chronic Aquatic Life Criteria raw data summary for summer

M/D/Y	Data (ug/l)	Hardness (mg/l)	Acute Hardness-Dependent Criteria (ug/l)	Total number of data points
5/28/2013	0.029	120	2.89	11
6/25/2013	0.021	70	1.81	
7/16/2013	0.026	53	1.36	
8/7/2013	0.020	53	1.36	
9/5/2013	0.032	98	2.46	
5/22/2014	0.050	98	2.70	
6/30/2014	0.024	69	2.89	
7/25/2014	0.017	57	0.386	

5/28/2014	0.050	87	2.21	
6/25/2014	0.14	67	1.73	
7/30/2014	0.050	52	1.33	

Figure 6. Raw results for lead (blue) and the lead chronic criterion (orange) for summer Eagle River monitoring, 2013 – 2015.

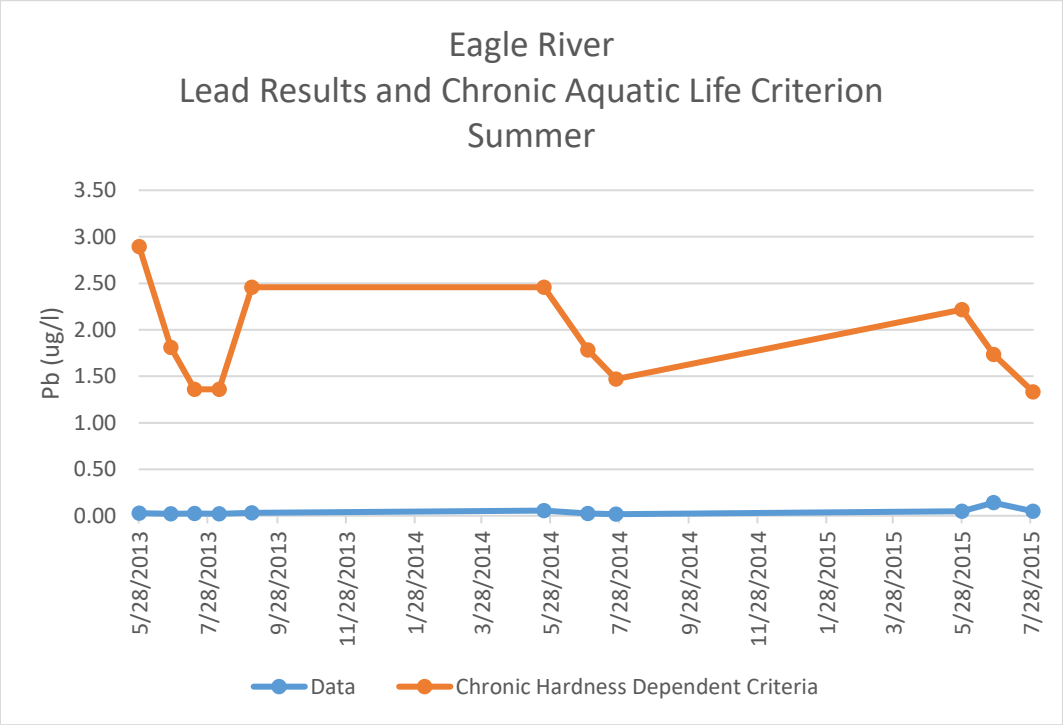
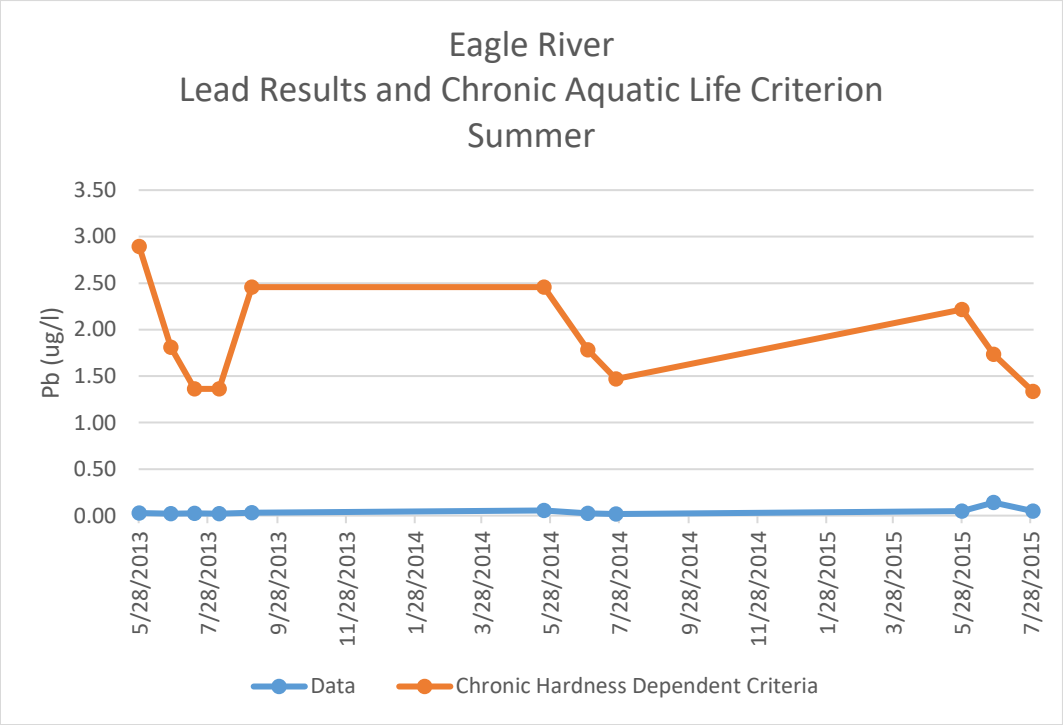


Table 14. Chronic Aquatic Life Criteria raw data summary for winter

M/D/Y	Data (ug/l)	Hardness (mg/l)	Acute Hardness-Dependent Criteria (ug/l)	Total number of data points
2/27/2013	0.062	130	3.07	12
4/30/2013	0.042	120	2.89	
11/26/2013	0.061	110	2.70	
1/28/2014	0.037	120	2.89	
2/26/2014	0.070	130	3.07	
3/24/2014	0.027	140	3.24	
4/27/2014	0.010	130	3.07	
10/29/2014	0.078	130	3.07	
1/28/2015	0.29	140	3.24	
2/17/2015	0.23	130	3.07	
3/19/2015	0.1	110	2.70	
4/28/2015	2.22	130	3.07	

Figure 7. Raw results for lead (blue) and the lead chronic criterion (orange) for winter Eagle River monitoring, 2013 – 2015.



Ammonia

Table 15. Chronic Aquatic Life Criteria based on pH and Temperature When Early Life Stages of Fish are Present - raw data summary for summer

M/D/Y	Data (ug/l)	pH	Temp (deg C)	Acute Hardness-Dependent Criteria (mg-N/L)	Total number of data points
5/22/2014	0.039	7.6	6	3.98	6
6/30/2014	0.014	7.6	8	3.98	
7/25/2014	0.017	7.0	8	5.91	
5/28/2015	0.08	7.5	10	4.36	
6/25/2015	0.011	7.9	13	2.80	
7/30/2015	0.011	7.4	6	4.73	

Figure 8. Raw results for ammonia (blue) and the ammonia chronic criterion When Early Life Stages of Fish are Present (orange) for summer Eagle River monitoring, 2014 – 2015.

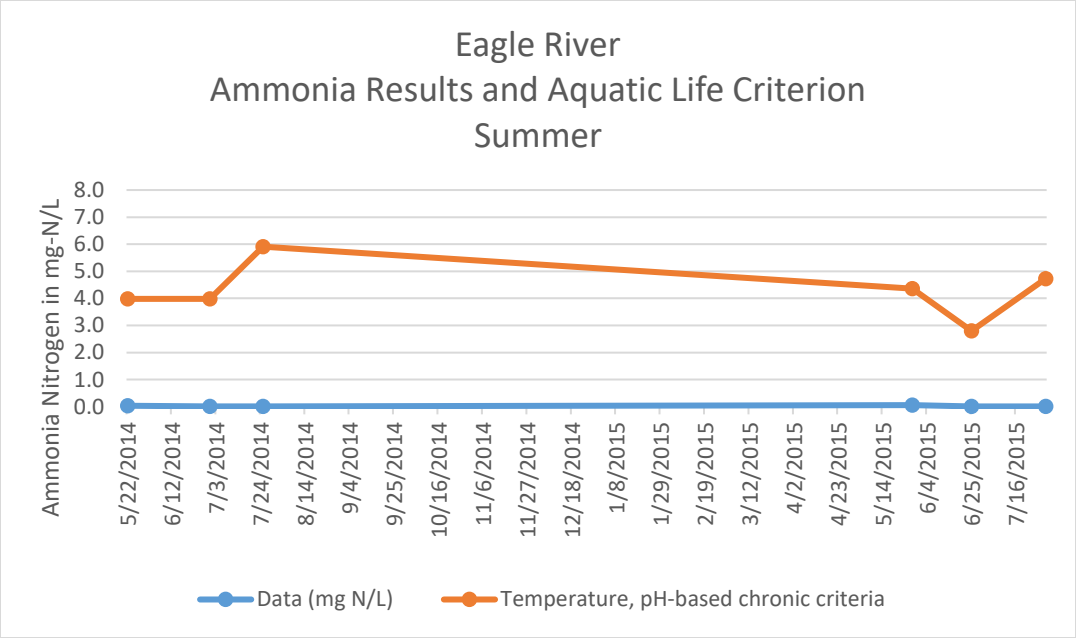
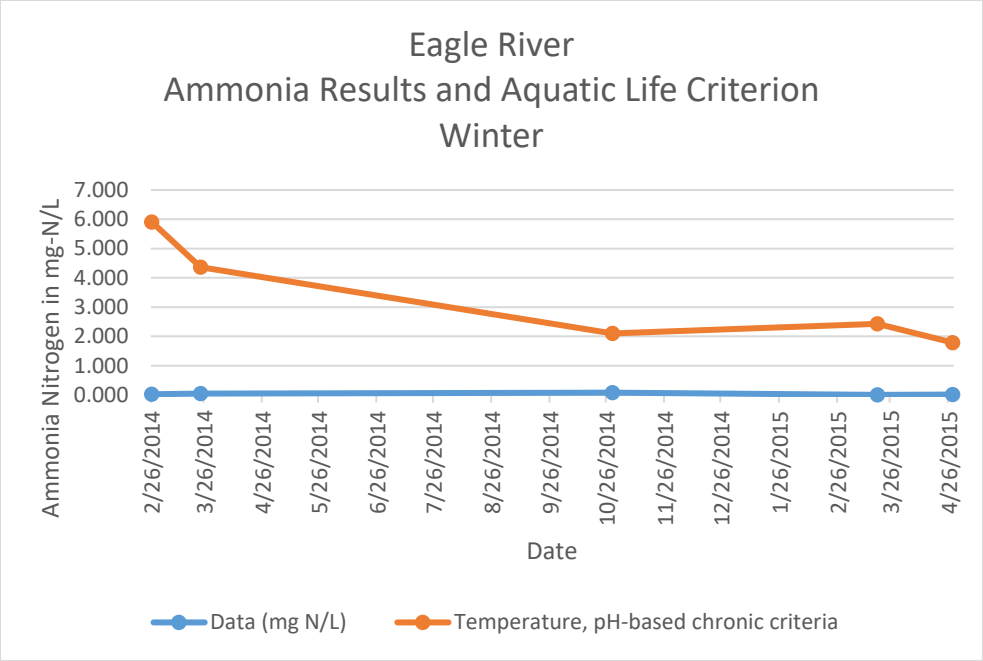


Table 16. Chronic Aquatic Life Criteria based on pH and Temperature When Early Life Stages of Fish are Present - raw data summary for winter

M/D/Y	Data (ug/l)	pH	Temperature (deg C)	Acute Hardness-Dependent Criteria (mg-N/L)	Total number of data points
2/26/2014	0.023	7.0	0	3.98	5
3/24/2014	0.047	7.5	0	3.98	
10/29/2014	0.08	8.1	0	5.91	
2/17/2015	0.1	7.6	No Temp	-----	
3/19/2015	0.005	8.0	2	2.80	
4/28/2015	0.0155	8.2	6	4.73	

Figure 9. Raw results for ammonia (blue) and the ammonia chronic criterion When Early Life Stages of Fish are Present (orange) for winter Eagle River monitoring, 2014 – 2015.



Chlorine

ERWTF uses a tertiary wastewater treatment method, but the final treatment before discharge is performed using ultraviolet light, not chlorine. No chlorine is currently used by ERWTF, so there is no possibility for the facility to exceed Alaska freshwater water quality standards for chlorine.

Ambient water quality monitoring analyses conducted by ERWTF, 2013 – 2015, did not include chlorine analyses.

Table 17. Exceedance frequencies for most restrictive designated uses

Years Sampled		Silver Acute aquatic life	Copper Chronic aquatic life	Ammonia Chronic aquatic life based on pH and Temperature When Early Life Stages of Fish are Present	Lead Chronic aquatic life
2013-2015 Summer	Total exceedances	0	0	0	0
	Total Samples	11	11	6	11
	Raw exceedance frequency	**0%**	**0%**	**0%**	**0%**
2013-	Total exceedances	0	0	0	0

2015 Winter	Total samples	12	12	5	12
	Raw exceedance frequency	**0%**	**0%**	**0%**	**0%**

Conclusion

The results of the assessment analysis found that the silver, copper, lead, and ammonia results do not exceed the most restrictive criteria for acute or chronic aquatic life designated uses. Chlorine was not analyzed, but chlorine is not used at ERWTF, so chlorine criteria for acute or chronic life designated uses cannot be exceeded.

The section of Eagle River located near the bridge where the Glenn Highway crosses Eagle River, 0.3 miles long, is attaining water quality standards for silver, copper, lead, ammonia, and chlorine for all designated uses.