Rico-Argentine Site
Removal Action Work Plan
Appendix B: Water Treatment Performance Criteria

September 2021

Administrative Settlement Agreement and Order on Consent

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1.0 INTRODUCTION AND BACKGROUND

1.1 Purpose

This Water Treatment Performance Criteria document for the Rico-Argentine Site (hereafter referenced as the Site) establishes Removal Action (RA) performance criteria for water treatment. These criteria will be applied to treated water that flows from the St. Louis Tunnel (SLT) and interconnected mine workings that ultimately discharge to the Dolores River. This document has been prepared as an appendix to the Administrative Settlement Agreement and Order on Consent (AOC) Removal Action Work Plan (RAWP) (EPA 2021).

1.2 Background

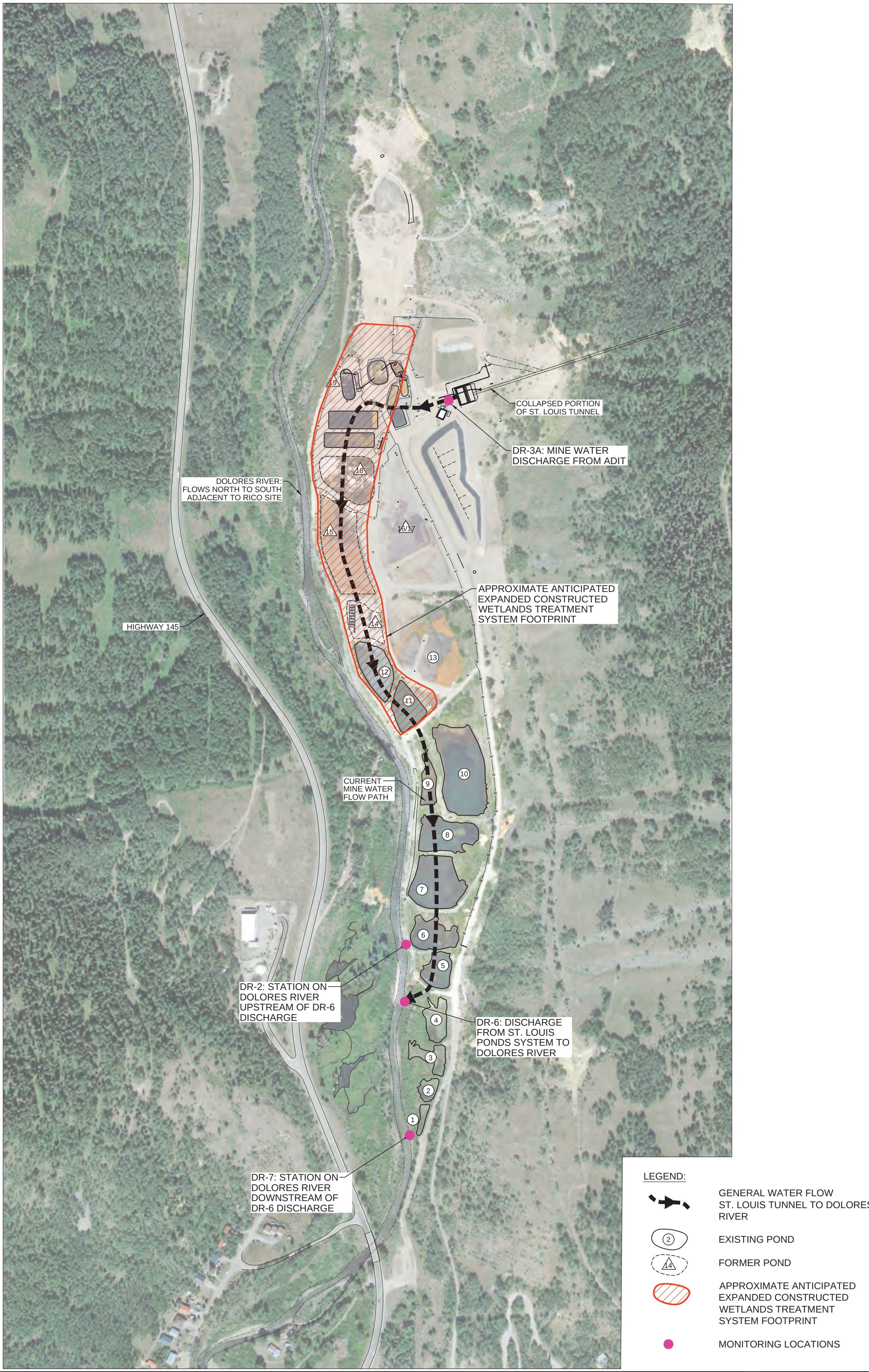
The Site is located approximately 0.75 miles north of the northern boundary of the Town of Rico in Dolores County, Colorado. The Site description and background are detailed in the AOC RAWP to which this document is appended.

As detailed in the Performance Evaluation and Technology Selection Report (Appendix A of the AOC RAWP), the selected water treatment system for water that flows from the SLT is an expansion of the current demonstration-scale constructed wetlands treatment systems (Expanded Constructed Wetlands Treatment System).

The current demonstration-scale treatment system discharges to Pond 12 in the St. Louis Ponds System. It is anticipated that the Expanded Constructed Wetlands Treatment System may discharge to Pond 9 (see Figure 1). Treated water currently flows through the St. Louis Ponds System, and subsequently to the Dolores River at sampling location DR-6 (see Figure 1). The discharge is to segment COSJDO03 of the Dolores River as identified in the Code of Colorado Regulations (Water Quality Control Commission Regulation # 34; CDPHE, 2020a). The segment is described as the "*Mainstem of the Dolores River from a point immediately above the confluence with Horse Creek to a point immediately above the confluence with Bear Creek*".

2.0 DEVELOPMENT OF PERFORMANCE CRITERIA

The performance criteria set forth in this appendix were developed to satisfy the objectives and requirements of the removal action. Under the 2011 Unilateral Administrative Order (UAO) (Docket No. CERCLA-08-2011-0005, March 17, 2011), Atlantic Richfield was required to develop a preliminary design for and construct a new treatment system for the SLT discharge. The Removal Action Work Plan appended to the UAO states that *"The objective of this task ... is to provide a water management system that provides a sustainable approach to managing the St. Louis Tunnel discharge that is protective of the Dolores River and complies with the associated Applicable or Relevant and Appropriate Requirements (ARARs)."* Under the AOC, Atlantic Richfield must include final performance criteria in the SLT Water Treatment System Final Design. Further, following construction and shakedown of the SLT water treatment system, performance criteria will be updated, as necessary, and provided in the Operations Plan (see AOC § 23). Evaluation of system performance against the performance criteria will occur during system operation per this plan.



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Atlantic Richfield Company

Project: 70817.20

Rico - Argentine Mine Site
Dolores County, Colorado

Figure 1

Rico Site Layout and Selected Monitoring Locations

2.1 Site-Specific Water Treatment Aspects

Factors considered in developing the performance criteria for the SLT Water Treatment System include:

- **Limited Available Area for Water Treatment System and Other Site Infrastructure.** The Site consists of a comparatively small flood plain between the Dolores River and the adjoining Telescope Mountain.
- **Freshet vs. Non-freshet Conditions.** Relatively short-term, yet potentially severe, freshet conditions (high flow and high metals concentrations) associated with spring runoff complicate water treatment design and operation, because there are technical and practical limitations to the design of the treatment system that govern effectiveness, including sizing, flow and hydraulic retention time requirements, along with the ability of biological treatment systems to handle rapidly changing conditions (e.g. pH, metals concentrations, solids, etc.). Freshet conditions can be highly variable year-to-year. Weak freshets in three of the last four years have made it difficult to implement necessary studies to optimize a final design for freshet conditions.
- **Maximum Design Flow.** As the source of SLT water is infiltrated rain or snowmelt, there may be infrequent extreme freshet flow years where the peak SLT flow will exceed the maximum treatment system design flow. While modeling has indicated that the statistical average recurrence interval of such years will be 25 years or more, in those extremely high flow years, there will be periods in which the portion of SLT flow above the treatment system design flow may be diverted around a portion of the treatment system and be blended with treated effluent through the St. Louis Ponds System prior to discharge. The 25-year recurrence period is a statistical correlation; actual conditions may result in such flows more, or less often than once every 25 years. It is anticipated that all SLT flow will receive treatment for suspended solids, and that the portion above the maximum design flow will be diverted around the biocell, aeration cascade, and rock drain process steps. In these instances, there may be a time lag in biocell response as it returns to normal operating conditions.
- **Winter Access and Conditions, with Associated Health and Safety Considerations.** The Site is relatively remote and encounters prolonged and harsh winter conditions along with known avalanche hazards.

2.2 Performance Criteria Considerations

The SLT waters will flow through the Expanded Constructed Wetlands Treatment System, the St. Louis Pond System, and subsequently to the Dolores River. Colorado Regulation No. 34.6(4) establishes classifications and water quality standards for streams in the San Juan and Dolores River Basins. The receiving stream segment #COSJDO03 is classified for Agriculture, Cold Water Aquatic Life 1, Class E Recreation, and Water Supply uses. These uses determine water quality standards for physical and biological, inorganic, and metal parameters, which are specified in Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34 Regulation No. 34, Classifications and Numeric Standards for San Juan River and Dolores River Basins; Appendix 34-1 contains Stream Classifications and Water Quality Standards Tables (current version, effective date 06/30/2020) as provided in Table 1.

***Table 1**. Water Quality Standards for Dolores River Segment COSJDO03*

Physical and Biological		
Temperature (°C)	DM CS-I Jun-Sept 21.7 Oct-May 13.0	MWAT CS-I Jun-Sept 17.0 Oct-May 9.0
	acute	chronic
Dissolved Oxygen (mg/l) D.O. (spawning)	--	6.0 (minimum) 7.0 (minimum)
pH	6.5-9.0	--
chlorophyll a (mg/m^2)	--	150
E.coli chronic colonies/100 ml	--	126
Inorganic (mg/l)		
	acute	chronic
Ammonia	TVS	TVS
Boron	--	0.75
Chloride	--	250
Chlorine	0.019	0.011
Cyanide	0.005	--
Nitrate	10	--
Nitrite	0.05	--
Phosphorus	--	0.11
Sulfate	--	250 (WS)
Sulfide	--	0.002
Metals (µg/l)		
	acute	chronic
Aluminum	--	TVS
Arsenic	340	--
Arsenic, total recoverable	--	0.02-3.0*
Beryllium	--	--
Cadmium	TVS	TVS
Cadmium, total recoverable	5.0	--
Chromium +3	TVS	TVS
Chromium +3, total recoverable	50	--
Chromium +6	TVS	TVS
Copper	TVS	TVS
Iron	--	300 (WS)
Iron, total recoverable	--	1000
Lead	TVS	TVS
Lead, total recoverable	50	--
Manganese	TVS	TVS/255
Mercury	--	0.01(t)
Molybdenum, total recoverable	--	150
Nickel	TVS	TVS
Nickel, total recoverable	--	100
Selenium	TVS	TVS
Silver	TVS	TVS
Uranium	--	--
Zinc	TVS	TVS

Notes:
"--": No standard specified in Reg. 34 for segment COSJDO03.

All metals are dissolved unless otherwise noted. Compliance for dissolved constituents determined by potentially dissolved analyses.
*Arsenic(chronic) = temporary hybrid standard with expiration date of 12/31/2024
CS-I = cold stream tier one
DM = daily maximum temperature
mg/l = milligrams per liter
MWAT = maximum weekly average temperature
t = total
TVS = table value standard (CDPHE 6/30/20, Section 34.6)
µg/l = micrograms per liter
WS = water supply

In developing performance criteria for the SLT Water Treatment System, it is important to consider the relevant regulatory framework. In Colorado, water quality standards are used to derive effluent limitations for industrial discharges permitted in accordance with the Colorado Discharge Permit System Regulations, Regulation 61, 5CCR 1002-61. Because the SLT Water Treatment System will be designed, constructed, and operated as part of a CERCLA removal action, it will not be subject to a Colorado Discharge Permit System (CDPS) discharge permit (*see* 42 U.S.C.§ 9621(e)). Accordingly, water quality-based effluent limits will not be established for the discharge. Even so, numeric water quality standards for segment #COSJDO03, and numeric effluent limitations based on those standards, may be considered potential ARARs for the removal action. Under CERCLA, however, attainment of ARARs is only required to the extent practicable considering the exigencies of the situation and other appropriate site-specific factors. *See* 40 C.F.R. § 300.415(j).

Based on this regulatory framework, Atlantic Richfield requested in November 2018 that staff with the Colorado Water Quality Control Division (the "Division") develop preliminary effluent limitations (PELs) for the SLT Water Treatment System discharge. The Division offers a fee-based service to identify PELs for a potential discharge to state waters, which may be used by entities to plan and design the wastewater management and treatment processes to meet these objectives. At the time Atlantic Richfield submitted its PEL application in early 2018, it had not yet been determined whether post-construction operation of the SLT Water Treatment System would require issuance of a CDPS permit or remain subject to a CERCLA AOC.

The Division delivered its PEL document to Atlantic Richfield on March 24, 2020. A copy of the PEL document is enclosed as Attachment 1. It included multiple sets of PELs for the SLT discharge based on the following discharge scenarios: direct discharge to the Dolores River at a design flow of 1.74 MGD, non-seasonal; direct discharge to the Dolores River at a design flow of 1.74 MGD, May 1 – August 31; direct discharge to the Dolores River at a design flow of 1.44 MGD, September 1 – April 30; and discharge to wetlands at a design flow of 1.74 MGD, non-seasonal. The calculated PELs for certain constituents were substantially lower than concentrations that have been determined to be achievable for the SLT Water Treatment System, at least during freshet conditions.

Independent of the Division's PEL process, Atlantic Richfield performed an evaluation of potential SLT discharge effluent limitations using the methods prescribed in Regulation 61. The comparative analysis of Atlantic Richfield's and the Division's PELs is summarized in Attachment 2. As explained in the Attachment, Atlantic Richfield's input assumptions and methodologies differed from CDPHE's in certain material respects, including:

- Table Value Standards (TVS) for metals based on in-stream hardness;
- Dolores River low-flow calculations; and
- Selected in-stream segment standards.

These differences resulted in several discrepancies in the calculated PELs.

Atlantic Richfield's evaluation also highlighted the overly strong conservative nature of the PEL calculation process for this specific situation. For example, the PEL document calculations for chronic standards were based on a Design Flow of 2.7 cubic feet per second (CFS) and a Dolores River flow of 5.4 CFS (the 30E3 chronic low flow), or a ratio of Dolores River flow to Design Flow of 2.0. Historical flow records indicate that this ratio has only been approached in two periods in the last ten years as shown in Figure 2 below, and that generally much more assimilative capacity is available. These two periods were during the extremely dry winters of 2017-2018 and 2018-2019, with associated low Dolores River flows. Over the last ten years, the ratio has been higher than 3.0 for 98.6% of the time and above 4.0 for 96.4%. All else being equal (hardness, background concentration, etc.), flow ratios of 3.0 and 4.0 result in increases of 33% and 66%, respectively, over calculated water quality-based effluent limits in the Division's PEL. The conclusion from Atlantic Richfield's evaluation was that exceeding a PEL at end-of-pipe would not necessarily translate into an exceedance of instream water quality standards.

In addition to the evaluation of potential SLT discharge effluent limitations, Atlantic Richfield thoroughly evaluated the hydrologic and chemical conditions of the SLT discharge and other site-specific considerations in connection with the preparation of the Performance Evaluation and Technology Screening Report (Appendix A of AOC RAWP).

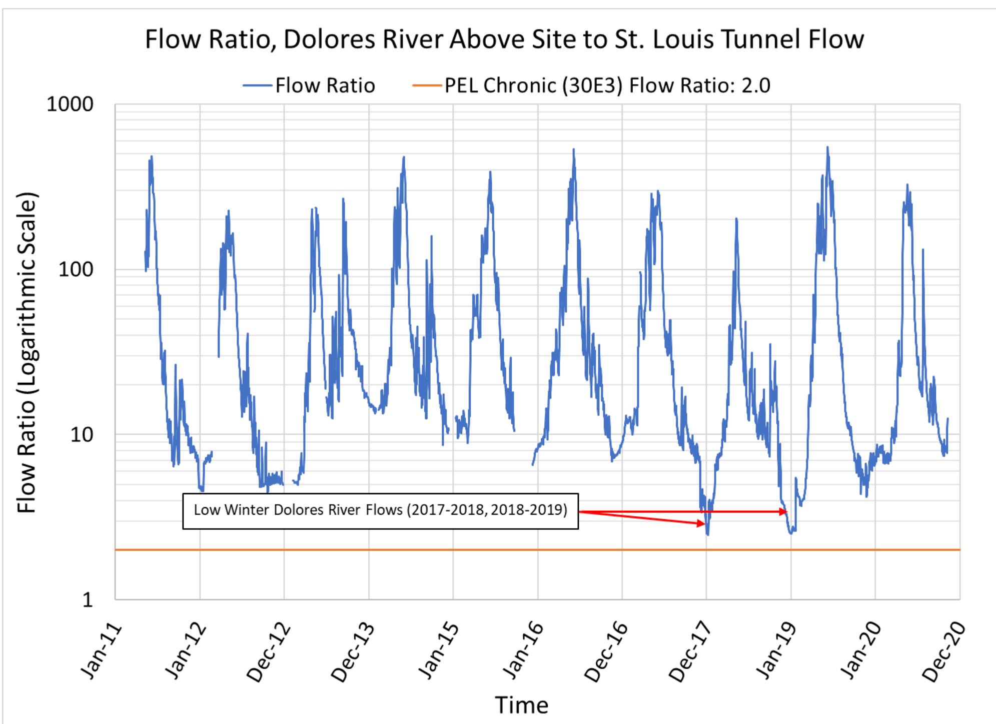

Figure 2. *Dolores River to St. Louis Tunnel Discharge Flow Ratio*

The evaluation identified several factors that affect the practicability of attaining the calculated PELs for the SLT discharge, including:

- CDPHE regulations require the use of "Design Flow" (i.e., maximum flow) in combination with biologically-based, statistically-low Dolores River flows to calculate PELs. However, this condition does not occur at the Site, since SLT flows mimic River flows; high flows from the SLT occur in years with high Dolores River flows, and low SLT flows occur in years with low Dolores River flows, as both originate largely from precipitation and melting of snowpack. Further, Figure 3 below illustrates that the maximum monthly average SLT flow occurs in mid-summer (July/August), and the minimum Dolores River flow occurs in mid-winter (January/February). Therefore, the Dolores River actual assimilative capacity is not realistically reflected in the PEL calculations, and results in unrealistically restrictive PEL values.
- Passive and semi-passive systems have distinct advantages in the Site's alpine setting and provide effective treatment; but, unlike active systems, they can require time to respond to process/operational changes, and to recover from upsets.
- Due to limited space availability and the potential for occasional very high flow years exceeding the treatment system design capacity, there will be rare occasional need to temporarily route a small portion of inthe SLT flow around the biological portions of the treatment process (biotreatment cell(s) and limestone-based rock drain(s)) directly to the St. Louis Ponds System below the Expanded Constructed Wetlands Treatment System. This will occur only in very wet freshet seasons, anticipated to occur on the order of 25-year recurrence intervals or more. Such routing of SLT flows will also occur during media changeouts and maintenance periods when treatment cells are taken out of service. Flows will still be treated with a settling aid (flocculant and/or coagulant) and solids with appurtenant metals settled in the treatment system settling basins. In these instances, there may be a time lag in biocell response as it returns to normal operating conditions.
- Inherent in the passive system design is a need to occasionally (estimated between 7 and 15 years) replace organic media and limestone media in portions of the Expanded Constructed Wetlands Treatment System. During replacement and the subsequent three-to-six-month biocell startup periods to reestablish bacterial populations, it is anticipated that metals removal effectiveness may be temporarily reduced. As the expanded treatment system will contain process cells in parallel and possibly in series, operational flexibility will exist, and best efforts will be made to minimize the conditioning period and any possible reductions in treatment capacity during media conditioning or replacements.
- Freshet conditions in particular pose a significant challenge by combining rapidly changing conditions of influent flow and metals load. This is mitigated to a degree by the presence of generally increased Dolores River flow during freshet periods for increased assimilative capacity.

Atlantic Richfield's evaluation confirmed that PELs may be attainable at certain times under certain conditions; but, attainment will not be technically practicable at all times under all conditions, particularly during freshet episodes. As a result, water quality-based effluent limitations were not selected as appropriate performance criteria for the SLT Water Treatment System.

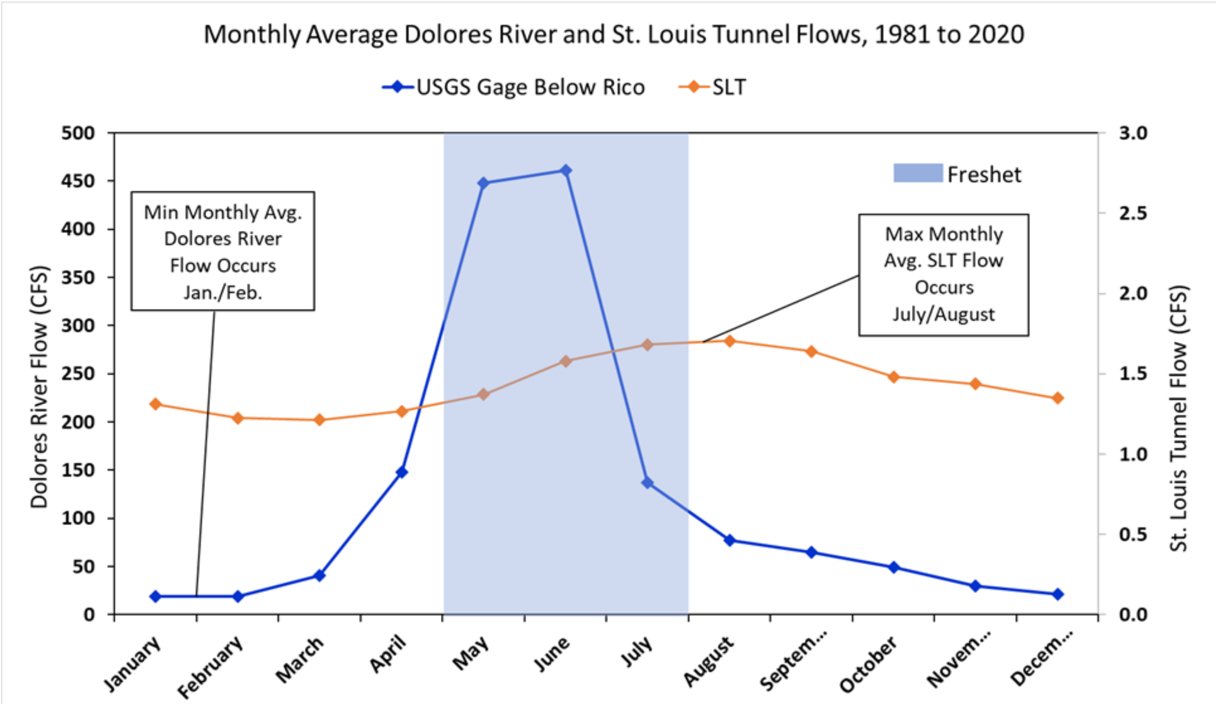

Figure 3. *Monthly Average Dolores River and St. Louis Tunnel Flows*

2.3 Performance Criteria

Instead of numeric water quality-based effluent limitations derived using the methods described in the PEL document, the performance criteria for the SLT Water Treatment System will be based on mass removal efficiencies for the following metal constituents: aluminum, cadmium, copper, iron, lead, manganese, and zinc; these metals are considered "Key" as they commonly flow from the SLT at concentrations exceeding standards. The values in the "Annual Minimum" column in Table 2, shaded in green, are the performance criteria for these Key metal constituents.

Table 2. *Performance Criteria for Key Constituents (Flow-Weighted Minimum and Average, Annual Basis)*

Analyte	Annual Minimum	Annual Average
Aluminum	98.3%	99.3%
Cadmium	94.6%	98.4%
Copper	99.6%	99.8%
Iron	98.0%	99.0%
Lead	99.3%	99.5%
Manganese	63.9%	74.2%
Zinc	80.0%	90.4%

Note: Green-shaded column presents performance criteria.

These criteria were developed based on the observed performance of the Enhanced Wetland Demonstration (EWD) system over the five-year operating period of 2016 through 2020. Details on how these criteria were developed are provided in Attachment 3.

Data collected to monitor the performance of the EWD system since startup in late 2015 show that the mass removal for most Key constituents has been greater than 90% based on monthly and annual averages. As the design for the Expanded Constructed Wetlands Treatment System has yet to be developed, using EWD performance data provides a reasonable basis for evaluating the future performance of the expanded system. The EWD has a design capacity of 550 gallons per minute (gpm). Five full years of operational data is available. The Expanded Constructed Wetlands Treatment System performance is anticipated to be at least as efficient as the EWD.

Improved performance relative to the EWD is anticipated with the expanded system due to 1) improved system design to handle freshet periods in most years; and 2) the likely inclusion of a limestone-based rock drain, which should result in improved manganese removal as well as provide some additional polishing of other metals concentrations, since the manganese dioxide collected in the rock drain is a known, effective sorbent. The benefits to performance from these enhancements cannot be verified pre-final design. Final performance criteria will be provided with the final design, and any necessary changes will be provided in the Operations Plan, post-shakedown.

The percent removals provided in Table 2 will result in substantial mass of metals removed from flows entering the Dolores River by the expanded treatment system. Table 3 presents projected minimum and average annual mass removal values, corresponding to the percent removal values shown in Table 2 and projected annual metal mass loads (based on average 2016 to 2020 SLT discharge mass loadings) that the expanded system will receive. These are the projected masses of Key metal constituents that will be captured and removed by the Expanded Constructed Wetlands Treatment System.

Table 3*. Expanded Constructed Wetlands Treatment System Projected Average Minimum and Annual Mass Removals for Key Constituents*

Analyte	Projected Minimum Mass Removal (lb.)	Projected Annual Mass Removal (lb.)
Aluminum	4,567	4,613
Cadmium	71.3	74.2
Copper	986	988
Iron	37,452	37,834
Lead	64.0	64.1
Manganese	4,759	5,526
Zinc	10,690	12,079

Metals removal from SLT water via treatment directly leads to decreased metals concentrations in the Dolores River. The relationship between percent metal removal and Dolores River metals concentrations is complex since background concentrations in the river can be variable and the Dolores River and SLT flow rates are variable. As both Dolores River and SLT flows are ultimately based on precipitation and snowmelt, their flows tend to vary similarly on a seasonal and annual basis, with the Dolores River flow peaking approximately one to two months prior to the SLT reaching its peak flow.

To provide information on the relationship of the current EWD system treatment with instream Dolores River water quality, Attachment 4 provides water quality data measured at monitoring location DR-7, downstream of the Site discharge. Plots of each Key metal constituent (along with sulfate) are presented from 2011 to October 2015 (pre-EWD period) and from November 2015 to the present (EWD operating period) to provide perspective of the effect of the EWD operation on the Dolores River water quality. As can be seen in Attachment 4, cadmium, copper, manganese, and zinc concentrations have shown a decrease at DR-7 since the EWD startup, while other constituents such as aluminum, iron, and lead have shown little change since their removal is primarily by settling, which was occurring prior to the EWD startup. Table 4 presents a summary of the comparison of measured water quality at DR-7 with instream Dolores River chronic water quality standards since the EWD startup in November 2015. Key metals concentrations have met the water quality standards during all non-freshet sampling events, with the exception of manganese; manganese met TVS standards in all sampling events; but exceeded the Water Supply standard in 6 of 17 samples. Several metal exceedances occurred during freshet sampling events, when flows exceeded the 550 gpm design capacity of the EWD. Testing performed in August and November 2020, during non-freshet conditions, demonstrated the absence of acute and chronic toxicity at monitoring location DR-7 (Atlantic Richfield, 2021.)

Table 4. *Summary of DR-7 Water Quality Data vs. Dolores River Segment Chronic Water Quality Standards Since EWD Startup in November 2015*

Key Constituent	# of Segment Standard Exceedances	Total # of Samples[2]	Comments
Aluminum	3	12	For all three exceedances (during 2017, 2019, and 2020 freshets), aluminum also exceeded TVS standards in the Dolores River upstream of the Site. Further, in the 2019 freshet the aluminum concentration was lower at DR-7 than at DR-2, indicating improved aluminum concentration below the Site discharge.
Cadmium	1	17	Exceeded TVS standard during 2017 freshet.
Copper	0	17	
Iron	0	17	
Lead	1	17	For the single exceedance (during the 2019 freshet), the lead concentration also exceeded TVS standards in the Dolores River upstream of the Site. The lead concentration was lower at DR-7 than at DR-2, indicating improved lead concentration below the Site discharge.
Manganese	0 6	17 17	No exceedances of TVS standard; Exceeded Water Supply Standard.
Sulfate	1	17	Exceeded Water Supply standard during winter 2020 with low Dolores River flow; prior years sampling occurred in the fall months.
Zinc	2	17	Exceeded TVS standard during 2017 and 2019 freshets.

Notes:

[1] Exceedances of Dolores River Segment (#COSJDO03) Chronic Standards as provided in Table 1. Total metals analyses used for all metals for conservatism (rather than potentially dissolved analyses).

[2] Number of samples collected since EWD startup in November 2015 to December 2020.

The Key metal constituents discussed above are of primary concern at the Site. Other constituents, such as sulfate, arsenic, and minor constituents including boron, chloride, and others, are of less concern at the Site and are described below.

<u>Sulfate:</u> Sulfate treatment was not a goal for any of the treatability studies conducted. A small amount of sulfate is removed in the demonstration systems, producing sulfide for subsequent metals precipitation and removal. Sulfate concentration in the SLT flow is not significantly changed by either of the current demonstration systems and will not be significantly changed by the Expanded Constructed Wetlands Treatment System. Sulfate measurements at monitoring location DR-7 presented in Attachment 4 show that sulfate concentrations have been below the segment Water Supply standard of 250 mg/L nearly 100% of the time, before and after the operation of the demonstration systems. Since no significant treatment will occur, and sulfate concentrations in the Dolores River have complied with the Water Supply standard nearly all the time regardless, no performance criterion is proposed for sulfate.

Arsenic: Arsenic is a unique case, in that it currently has a "hybrid" temporary modification of the standard in effect until at least December 31, 2024. This temporary modification consists of a chronic total recoverable arsenic standard of 0.02 to 3.0 µg/L. The first number in the temporary modification range (0.02 ug/L) is the health-based standard in the applicable river segment to protect combined exposure from drinking water and fish consumption. The second value in the range (3.0 µg/l) is the technology-based achievable effluent value to be monitored at end-of-pipe. As described in CDPHE, 2020a: *"Control requirements, such as discharge permit effluent limitations, shall be established using the first number in the range as the ambient water quality target, provided that no effluent limitation shall require an "end-of-pipe" discharge level more restrictive than the second number in the range."* Total recoverable arsenic concentrations measured at the discharge to the Dolores River (sample location DR-6) have been well below the 3.0 µg/L technology-based achievable effluent value in all sampling events since 2011 (both pre- and post-EWD startup), with a maximum measured value of 0.59 µg/L. As the discharge has been well below the arsenic standard for all sampling events since 2011, including the period prior to EWD startup in November 2015, no performance criterion is proposed for arsenic.

Minor Constituents: Minor constituents for which standards exist for Dolores River segment COSJDO03 include ammonia, boron, chloride, phosphorus, sulfide, chromium-III, chromium-VI, mercury, molybdenum, nickel, selenium, and silver. Site data collected has shown these to be well below standards, and no performance criteria are necessary.

2.4 Performance Evaluation Approach

To evaluate system performance, samples and flow measurements will be taken from the sampling locations representing the SLT flow (treatment system influent) and the St. Louis Ponds outfall to the Dolores River. These correspond to current sampling locations DR-3A and DR-6, respectively, as indicated on Figure 1. Flow rate and concentration data will be used to calculate an annual percent mass removal for each Key metal constituent, as described below.

The percent-removal performance criteria for the Key constituents in Table 2 are based on the calculated annual calendar-year values from EWD system performance from 2016 through 2020. Performance of the Expanded Constructed Wetlands Treatment System will be evaluated by calculation of annual percent removal values for each Key constituent, based on measurements made throughout the calendar year, and comparing them to the Table 2 performance criteria. Calculations will be made using the following general equations, which use zinc (Zn) as an example. Additional detail is provided below.

$$Annual\ \%\ Zn\ Mass\ Removal = \left\{1 - \frac{\sum Zn\ Mass_{DR-6}}{\sum Zn\ Mass_{DR-3A}}\right\} x\ 100\%$$

Where:

$\sum Zn\ Mass_{DR-6}$ = sum of DR-6 Zn mass increments through the calendar year

$$= (Zn\ Mass_{DR-6})_{Jan} + (Zn\ Mass_{DR-6})_{Feb} + (Zn\ Mass_{DR-6})_{Mar} + \cdots + (Zn\ Mass_{DR-6})_{Dec}$$

$\sum Zn\ Mass_{DR-3A}$ = sum of DR-3A Zn mass increments through the calendar year

$$= (Zn\ Mass_{DR-3A})_{Jan} + (Zn\ Mass_{DR-3A})_{Feb} + (Zn\ Mass_{DR-3A})_{Mar} + \cdots + (Zn\ Mass_{DR-3A})_{Dec}$$

and

$(Zn\ Mass_{DR\text{-}6})_{Jan}$ = January Zn mass at DR-6
$(Zn\ Mass_{DR\text{-}6})_{Feb}$ = February Zn mass at DR-6
$(Zn\ Mass_{DR\text{-}6})_{Mar}$ = March Zn mass at DR-6
.
.
$(Zn\ Mass_{DR\text{-}6})_{Dec}$ = December Zn mass at DR-6

and

$(Zn\ Mass_{DR\text{-}3A})_{Jan}$ = January Zn mass at DR-3A
$(Zn\ Mass_{DR\text{-}3A})_{Feb}$ = February Zn mass at DR-3A
$(Zn\ Mass_{DR\text{-}3A})_{Mar}$ = March Zn mass at DR-3A
.
.
$(Zn\ Mass_{DR\text{-}3A})_{Dec}$ = December Zn mass at DR-3A

Zn mass increments for DR-6 and DR-3A will be calculated for each time increment by the following equations:

DR-6 Zn mass increment = (DR-6 Zn concentration representing time increment) x (average DR-6 flow over time increment) x (duration of time increment)

DR-3A Zn mass increment = (DR-3A Zn concentration representing time increment) x (average DR-3A flow over time increment) x (duration of time increment)

Time increments will be monthly or biweekly (every two weeks), as discussed further below. If additional samples are obtained within a given time increment, the results of all samples will be averaged for use in the calculation. DR-6 and DR-3A flow rates will be monitored continuously and will be averaged over the length of the time increment. Using this information, percent removal over time increments can be calculated.

During base-flow periods (approximately July through April), site experience has shown that monthly time increments are adequate since metal concentrations and flow rates are relatively steady and change slowly. Site experience has also shown that the freshet period (generally May through June) can involve more rapid concentration changes, and therefore, shorter time increments may be needed to define the mass increments more accurately. The same mass increment equations will be used, but with shorter duration of time increments. While subject to refinement in the future and to real-time observations, collection of DR-3A and DR-6 samples at biweekly intervals from May through June should provide this definition. Therefore, the time increments utilized in the DR-6 and DR-3A mass increment equations above will be biweekly during May and June, and one month in the other months of the year. Depending on circumstances, additional samples may be taken within particular time increments, and if so, will be averaged to provide the metal concentration for the time increment.

As an example to illustrate the percent removal calculation for a given month, using the month of January as the time increment and calculating zinc mass removal:

$$January\ \%\ Zn\ Mass\ Removal = \left\{1 - \frac{January\ Zn\ Mass_{DR-6}}{January\ Zn\ Mass_{DR-3A}}\right\} x\ 100\%$$

Where:

January Zn $Mass_{DR-6}$ = (January DR-6 Zn concentration) x (average DR-6 flow over January) x (January duration)

January Zn $Mass_{DR-3A}$ = (January DR-3A Zn concentration) x (average DR-3A flow over January) x (January duration)

The remaining months other than May and June would be calculated similarly. May and June will differ in that they will have biweekly time and mass increments that will be summed for each of those months.

Percent mass removals will be calculated and reported monthly for each Key constituent. Performance will be evaluated by comparison of the calculated annual percent removal values to the Table 2 performance criteria at the end of the calendar year as discussed in Section 3.0. There may be months of the year where calculated monthly percent removal values are below the Table 2 performance criteria values, which are annual values. This phenomenon is expected during particularly notable freshet events.

Best efforts will be made to conduct the sampling on a monthly basis during base flow; however, there may be periods (particularly in winter) when there may be health and safety issues associated with access to the Dolores River and Site that may preclude sampling.

Unusual Conditions:

Unusual conditions may occur, such as periods in which full water treatment is not occurring due maintenance or media changeouts, or occasions when the SLT flow temporarily exceeds the Expanded Constructed Wetlands Treatment System maximum design flow. During any periods in which full water treatment is not occurring, such as for maintenance or media changeouts, no performance evaluation sampling will occur.

Rerouted or partially treated flow effects, (above the design capacity), which adversely influence the effluent data will be subtracted to properly reflect system performance. Such effects might include excess metals load due to excess flows over and above the engineered design capacity of the treatment system, for example. As shown below for zinc as an example, the percent removal calculation will be modified to subtract the mass associated with the SLT flow above the maximum design flow from both the DR-6 mass and DR-3A mass in the percent removal equations. This mass can be thought of as "excess" mass associated with the flow beyond which the treatment system was designed to treat, and by subtracting it from the DR-3A and DR-6 mass increments, it is removed from consideration. This equation will be used in the annual percent removal calculation for any time increment in which the SLT flow exceeds the maximum design flow. Note that if the DR-3A flow is equal to or less than the maximum design flow, this "excess mass" is zero, and the equation becomes identical to the previously shown equation.

$$Excess\ SLT\ Flow\ Conditions: \%\ Zn\ Mass\ Removal = \left\{1 - \frac{\sum(Zn\ Mass_{DR-6} - Zn\ Mass_{Excess})}{\sum(Zn\ Mass_{DR-3A} - Zn\ Mass_{Excess})}\right\} x\ 100\%$$

Where:

$Zn\ Mass_{Excess}$ = (DR-3A Zn concentration) x [(DR-3A flow) – (maximum design flow)] x (time duration)

∑: indicates summation of time increments for which SLT flow exceeds maximum design flow

3.0 PERFORMANCE EVALUATION AND REPORTING

Evaluation of the Expanded Constructed Wetlands Treatment System against performance criteria along with associated reporting will be conducted throughout the RA periods. Per the AOC, the RA periods consist of: 1) RA Construction, including shakedown, 2) Operations, and 3) Post-Removal Site Control. Monitoring and reporting for each period will be conducted according to the appropriate documents as specified in the AOC and the RAWP.

Monitoring will include:

- Continuous flow measurement and recording at locations DR-3A and DR-6, and
- Analytical samples for aluminum, cadmium, copper, iron, lead, manganese, and zinc obtained at DR-3A and DR-6 at a monthly frequency from January through April and July through December, and at a biweekly frequency during May and June.

Reporting will be performed monthly and will include calculated percent removals for aluminum, cadmium, copper, iron, lead, manganese, and zinc for the month. The December monthly report of each year will include calculated annual percent removals for aluminum, cadmium, copper, iron, lead, manganese, and zinc for the calendar year, and compared to the Table 2 performance criteria.

4.0 REFERENCES

Atlantic Richfield, 2021. Whole Effluent Toxicity (WET) Testing Data Summary and Analysis Report, March 2021.

CDPHE, 2020a. Water Quality Control Commission, Regulation No. 34 – Classifications and Numeric Standards for San Juan River and Dolores River Basins, 5 CCR 1002-34. Current effective date 6/30/2020.

CDPHE, 2020b. PEL 230051, Rico-Argentine Mine Site, Preliminary Effluent Limits, March 24, 2020.

CDPHE, 2020c. Water Quality Control Commission, Regulation No. 31 – The Basic Standards and Methodologies for Surface Water, 5 CCR 1002-31. Current effective date 6/30/2020.

Attachment 1

PEL 230051, Rico-Argentine Mine Site, Preliminary Effluent Limits

(Dated March 24, 2020)

Anthony Brown
Atlantic Richfield Company
4 Centerpointe Drive, 2nd Floor, Suite 200
La Palma, CA 90623-1066

TO: Anthony Brown

FROM: WQCD: Erin Scott, 303-692-3506, erin.scott@state.co.us

DATE: March 24, 2020

Re: PEL 230051, Rico-Argentine Mine Site, Preliminary Effluent Limits

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The Water Quality Control Division (Division) of the Colorado Department of Public Health and Environment has prepared, per your request, the Preliminary Effluent Limits (PELs) for the Rico-Argentine wastewater treatment facility. These effluent limits were developed as detailed in the attached document, for planning in the development of appropriate treatment.

Due to the nature of the facility, seasonal design flows were requested, as follows;

Rico-Argentine Mine- May 1-August 31	1.74 MGD	2.7 CFS
Rico-Argentine Mine- Sept 1- April 30	1.44 MGD	2.2 CFS

Further, three discharge scenarios were requested, as follows;

- A discharge scenario direct to the Dolores River, and
- A discharge scenario to the "naturalized wetlands" below Pond 14, (Prior to entering the Dolores river) and
- A discharge scenario through the "naturalized wetlands/beaver ponds" (Prior to entering the Dolores river) then out outfall 009

The PELs developed for this facility are based on the water quality standards for the receiving stream identified in the PEL application, narrative water quality standards, technology based limitations established in the *Regulations for Effluent Limitations* (Regulation No. 62), and any applicable federal Effluent Limitation Guidelines (ELGs) developed specific to this industry type. The water quality standard based limitations presented in this PEL may be incorporated into a CDPS permit contingent on analyses conducted during permit development. The technology based limitations will also be incorporated into the permit unless a more stringent limitation is applied.

As explained in the attached document, the water quality based limitations have been developed based on the current and/or next effective water quality standards for the receiving stream, the ambient water quality of the receiving stream, the calculated low flows, the stated effluent flows of the facility, and where necessary the antidegradation regulations, mixing zone policies, and any designation of a receiving stream by the US Fish and Wildlife Service as habitat for federally listed threatened and endangered (T&E) fish. A determination of which PELs ultimately apply in a permit will be dependent on decisions regarding treatment, pollutants of concern, chemical usage, receiving streams, design flows, or other information presented to the Division at the time of permit application.

The division notes that currently the series of treatment ponds are located along the Dolores River, and seep into the Dolores river alluvium. The division advises Atlantic Richfield to line the ponds, as compliance points in a final permit may be different from those proposed by Rico in the PEL application if the ponds remained unlined. For example, compliance points may be designated by the division prior to entering the ponds, or may be designated within the ponds themselves prior to seeping through the alluvium, rather than in the currently piped locations. Compliance points will be discussed, evaluated, and determined during the permitting process.

Note that, as requested, this PEL was drafted for seasonal considerations for the Dolores River. However, the dilution ratio in both seasons is 3:1, and only minimal differences in WQBELs result from a seasonal analysis with a 2:1 ratio. Therefore, the division retains the discretion to issue a permit without seasons, based on the critical (low flow) condition as directed in Regulation 31, and permit limitations may be based on a non-seasonal discharge permit. Therefore, permit limitations based on a non-seasonal evaluation with the following effluent flow was also developed.

Rico-Argentine Mine	1.74 MGD	2.7 CFS

This non-seasonal evaluation also facilitated the development of the antidegradation evaluation, which is not a seasonal concept, and seasonal ADBELs are not applicable.

The following tables contain a summaries of the limitations that have been developed in this PEL for this facility. Note that for a discharge into either wetland scenario, the WQBELs and ultimate permit limits are the same.

The Rico-Argentine mine will be expected to meet the limitations for these parameters upon commencement of permit coverage.

Table 1
Preliminary Effluent Limits for the Rico Argentine Mine
Discharge to the Dolores River
at a Design Flow of 1.74 MGD (Non-Seasonal)

Effluent Parameter	Effluent Limitations Maximum Concentrations			
	30-Day Average	7-Day Average	Daily Maximum	2-Year Average
Effluent Flow (MGD)	1.74			
Temp Daily Max (°C) June-Sept			21.7	
Temp Daily Max (°C) Oct-May			13	
Temp MWAT (°C) June-Sept		17		
Temp MWAT (°C) Oct-May		9		
pH (su)			6.5-9.0	
TSS (mg/l)	30	45		
Oil and Grease (mg/l)			10	

Al, TR (µg/l)	103		22229	37
Sb, PD (µg/l)	17			2.7
As, TR (µg/l)	0.06			
As, PD (µg/l)			793	119
Be, TR (µg/l)	12			2.3
Cd, TR (µg/l)			12	3.5
Cd, PD (µg/l)	2.3		7.7	
Cr+3, TR (µg/l)			117	19
Cr+3, PD (µg/l)	411		2459	63
Cr+6, Dis (µg/l)	33		37	5.1
Cu, PD (µg/l)	20		61	
CN, WAD (µg/l)			12	1.8
Fe, Dis (µg/l)	772			
Fe, TR (µg/l)	1410			
Pb, TR (µg/l)			117	18
Pb, PD (µg/l)	13		336	
Mn, Dis / PD (µg/l)*	539		8918	
Mo, TR (µg/l)	478			76
Hg, Tot (µg/l)	0.03			0.0054
Ni, TR (µg/l)	300			45
Ni, PD (µg/l)	80		2061	
Se, PD (µg/l)	13		42	3.4
Ag, PD (µg/l)	0.06		17	
U, TR (µg/l)	50			7.5
U, PD (µg/l)	10305		12831	1545
Zn, PD (µg/l)	707		731	
B, Tot (mg/l)	2.3			0.33
Chloride (mg/l)	745			112
Sulfate (mg/l)	642			
Sulfide as H2S (mg/l)	0.006			0.0009
SAR pass/fail **	Pass/Fail			
EC (dS/m)	4.4			
Thallium, TR (µg/l)	0.72			11
Radium 226+228(pC/l)	15			2.3
WET, chronic				
Static Renewal 7 Day Chronic *Pimephales promelas*			NOEC or IC25 $\geq$ 33	
Static Renewal 7 Day Chronic *Ceriodaphnia dubia*			NOEC or IC25 $\geq$ 33	

*Manganese- 30 day average is in 'dissolved' form, daily maximum in 'potentially dissolved' form
** SAR limit is calculated using the actual measured EC value (30-day average) of the effluent and substituting this value in to the following equation to solve for SAR. The equation for determining the SAR limit is: SAR = (7.1 * EC) – 2.48

Table 2
Preliminary Effluent Limits for the Rico Argentine Mine
Discharge to the Dolores River
at a Design Flow of 1.74 MGD (May 1- August 31)

Effluent Parameter	Effluent Limitations Maximum Concentrations			
	30-Day Average	7-Day Average	Daily Maximum	2-Year Average
Effluent Flow (MGD)	1.74			
Temp Daily Max (°C) June-Sept			21.7	
Temp Daily Max (°C) Oct-May			13	
Temp MWAT (°C) June-Sept		17		
Temp MWAT (°C) Oct-May		9		
pH (su)			6.5-9.0	
TSS (mg/l)	30	45		
Oil and Grease (mg/l)			10	
Al, TR (µg/l)	114		51763	37
Sb, PD (µg/l)	24			2.7
As, TR (µg/l)	0.087			
As, PD (µg/l)			1851	119
Be, TR (µg/l)	17			2.3
Cd, TR (µg/l)			27	3.5
Cd, PD (µg/l)	3.3		18	
Cr+3, TR (µg/l)			272	19
Cr+3, PD (µg/l)	594		5737	63
Cr+6, Dis (µg/l)	48		87	5.1
Cu, PD (µg/l)	20 (NIL)		139	
CN, WAD (µg/l)			27	1.8
Fe, Dis (µg/l)	1087			
Fe, TR (µg/l)	1410 (NIL)			
Pb, TR (µg/l)			272	18
Pb, PD (µg/l)	19		782	
Mn, Dis / PD (µg/l)*	768		20777	
Mo, TR (µg/l)	690			76
Hg, Tot (µg/l)	0.043			0.0054
Ni, TR (µg/l)	430			45
Ni, PD (µg/l)	80 (NIL)		4809	
Se, PD (µg/l)	18		98	3.4
Ag, PD (µg/l)	0.06 (NIL)		40	
U, TR (µg/l)	73			7.5
U, PD (µg/l)	14884		29938	1545
Zn, PD (µg/l)	1018		1696	
B, Tot (mg/l)	3.3			0.33
Chloride (mg/l)	1075			112
Sulfate (mg/l)	903			
Sulfide as H2S (mg/l)	0.0087			0.0009
SAR pass/fail **	Pass/Fail			
EC (dS/m)	5.5			
Thallium, TR (µg/l)	1			11
Radium 226+228(pC/l)	22			2.3
WET, chronic				
Static Renewal 7 Day Chronic *Pimephales promelas*			NOEC or IC25 $\geq$ 23***	

4300 Cherry Creek Drive S., Denver, CO 80246-1530 P 303-692-2000 www.colorado.gov/cdphe/wqcd

Static Renewal 7 Day Chronic *Ceriodaphnia dubia*			NOEC or IC25 ≥ 23***	

* Manganese- 30 day average is in ‘dissolved’ form, daily maximum in ‘potentially dissolved’ form
** SAR limit is calculated using the actual measured EC value (30-day average) of the effluent and substituting this value in to the following equation to solve for SAR. The equation for determining the SAR limit is: SAR = (7.1 * EC) – 2.48
*** The IWC for May - August is 23 %. The IWC for the season September - April is 29 %. If the frequency of WET testing is quarterly in a permit, the IWC for the quarter will be set to the most stringent month during that quarter

Table 2
Preliminary Effluent Limits for the Rico Argentine Mine Discharge to the Dolores River at a Design Flow of 1.44 MGD (Sept 1- April 30)

Effluent Parameter	Effluent Limitations Maximum Concentrations			
	30-Day Average	7-Day Average	Daily Maximum	2-Year Average
Effluent Flow (MGD)	1.44			
Temp Daily Max (°C) June-Sept			21.7	
Temp Daily Max (°C) Oct-May			13	
Temp MWAT (°C) June-Sept		17		
Temp MWAT (°C) Oct-May		9		
pH (su)			6.5-9.0	
TSS (mg/l)	30	45		
Oil and Grease (mg/l)			10	
Al, TR (µg/l)	107		25106	37
Sb, PD (µg/l)	19			2.7
As, TR (µg/l)	0.069			
As, PD (µg/l)			896	119
Be, TR (µg/l)	14			2.3
Cd, TR (µg/l)			13	3.5
Cd, PD (µg/l)	2.6		8.7	
Cr+3, TR (µg/l)			132	19
Cr+3, PD (µg/l)	473		2779	63
Cr+6, Dis (µg/l)	38		42	5.1
Cu, PD (µg/l)	20 (NIL)		68	
CN, WAD (µg/l)			13	1.8
Fe, Dis (µg/l)	879			
Fe, TR (µg/l)	1410 (NIL)			
Pb, TR (µg/l)			132	18
Pb, PD (µg/l)	15		379	
Mn, Dis / PD (µg/l)*	617		10073	
Mo, TR (µg/l)	551			76
Hg, Tot (µg/l)	0.035			0.0054
Ni, TR (µg/l)	345			45
Ni, PD (µg/l)	80 (NIL)		2329	
Se, PD (µg/l)	14		48	3.4
Ag, PD (µg/l)	0.06 (NIL)		19	
U, TR (µg/l)	58			7.5
U, PD (µg/l)	11866		14497	1545
Zn, PD (µg/l)	813		825	
B, Tot (mg/l)	2.6			0.33
Chloride (mg/l)	857			112

Sulfate (mg/l)	731			
Sulfide as H2S (mg/l)	0.0069			0.0009
SAR pass/fail **	Pass/Fail			
EC (dS/m)	4.4			
Thallium, TR (µg/l)	0.83			11
Radium 226+228(pC/l)	17			2.3
WET, chronic				
Static Renewal 7 Day Chronic *Pimephales promelas*			NOEC or IC25 ≥ 29***	
Static Renewal 7 Day Chronic *Ceriodaphnia dubia*			NOEC or IC25 ≥ 29***	

* Manganese- 30 day average is in 'dissolved' form, daily maximum in 'potentially dissolved' form
** SAR limit is calculated using the actual measured EC value (30-day average) of the effluent and substituting this value in to the following equation to solve for SAR. The equation for determining the SAR limit is: SAR = (7.1 * EC) – 2.48
*** The IWC for May - August is 23 %. The IWC for the season September - April is 29 %. If the frequency of WET testing is quarterly in a permit, the IWC for the quarter will be set to the most stringent month during that quart

Table 2
Preliminary Effluent Limits for the Rico Argentine Mine Discharge to Wetlands into the Dolores River at a Design Flow of 1.74 MGD

Effluent Parameter	Effluent Limitations Maximum Concentrations			
	30-Day Average	7-Day Average	Daily Maximum	2-Year Average
Effluent Flow (MGD)	1.74		Report	
Temp Daily Max (°C) June-Sept			21.7	
Temp Daily Max (°C) Oct-May			13	
Temp MWAT (°C) June-Sept		17		
Temp MWAT (°C) Oct-May		9		
pH (su)			6.5-9.0	
TSS (mg/l)	30	45		
Oil and Grease (mg/l)			10	
Al, TR (µg/l)	87		10071	13
Sb, PD (µg/l)	5.6			0.84
As, TR (µg/l)	0.02			0.003
As, PD (µg/l)			340	51
Be, TR (µg/l)	4			0.6
Cd, TR (µg/l)			5	
Cd, PD (µg/l)	1.2		5.7	
Cr+3, TR (µg/l)			50	7.5
Cr+3, PD (µg/l)	137		1773	21
Cr+6, Dis (µg/l)	11		16	1.7
Cu, PD (µg/l)	20		50	
CN, WAD (µg/l)			5	0.75
Fe, Dis (µg/l)***	772			
Fe, TR (µg/l)	1000			
Pb, TR (µg/l)	9.9		50	
Pb, PD (µg/l)	11		281	
Mn, Dis / PD (µg/l)	255		4738	

Mo, TR (µg/l)	160			24
Hg, Tot (µg/l)	0.01			0.0015
Ni, TR (µg/l)	100			15
Ni, PD (µg/l)	80		1513	
Se, PD (µg/l)	4.6		18	1.1
Ag, PD (µg/l)	0.81		22	0.15
U, TR (µg/l)***	50			7.5
U, PD (µg/l)	6915		11070	1037
Zn, PD (µg/l)	428		564	
B, Tot (mg/l)	0.75			0.11
Chloride (mg/l)	250			38
Sulfate (mg/l)***	642			
Sulfide as H2S (mg/l)	0.002			0.0003
SAR pass/fail ***	Pass/Fail			Report
EC (dS/m) ***	4.4			
Thallium, TR (µg/l)	0.24			0.036
Radium 226+228 (pCi/l)	5			0.75
WET, chronic				
Static Renewal 7 Day Chronic *Pimephales promelas*			NOEC or IC25 ≥ 100	
Static Renewal 7 Day Chronic *Ceriodaphnia dubia*			NOEC or IC25 ≥ 100	

* Manganese- 30 day average is in 'dissolved' form, daily maximum in 'potentially dissolved' form
** SAR limit is calculated using the actual measured EC value (30-day average) of the effluent and substituting this value in to the following equation to solve for SAR. The equation for determining the SAR limit is: $SAR = (7.1 * EC) - 2.48$
*** Based on the Delores River

Preliminary Effluent Limitations
The Dolores River or the "Naturalized" Wetlands to the Dolores River
ATLANTIC RICHFIELD CO., THE RICO-ARGENTINE MINE
Erin Scott
March 2020

Table of Contents

I. Preliminary Effluent Limitations Summary

Table A-1 includes summary information related to this PEL. This summary table includes key regulatory starting points used in development of the PEL such as: receiving stream information; threatened and endangered species; 303(d) and Monitoring and Evaluation listings; low flow and facility flow summaries; and a list of parameters evaluated.

Table A-1
PEL Summary

Facility Information

Facility Name	Design Flow (max 30-day ave, MGD)	Design Flow (max 30-day ave, CFS)
Rico-Argentine Mine- May 1-August 31	1.74	2.7
Rico-Argentine Mine- Sept 1- April 30	1.44	2.2
Rico-Argentine Mine (non-seasonal)	1.74	2.7

Receiving Stream Information

Receiving Stream Name	Segment ID	Designation	Classification(s)
S1. The Dolores River	COSJDO03	Reviewable	COLD CLASS 1 RECREATION E AGRICULTURE WATER SUPPLY
S2 The Wetlands to the Dolores River	COSJDO05A	Reviewable	COLD CLASS 1 RECREATION E AGRICULTURE WATER SUPPLY

Low Flows (cfs)

Receiving Stream Name	1E3 (1-day)	7E3 (7-day)	30E3 (30-day)	Ratio of 30E3 to the Design Flow (cfs)
S1. The Dolores River (May 1- Aug 31)	12	12	9	3:1
S1. The Dolores River (Sept 1- April 30)	3.6	4.1	5.4	3:1
S1. The Dolores River (non-seasonal)	3.6	4.1	5.5	2:1
S2. The Wetlands	0	0	0	0:1

Regulatory Information

T&E Species	303(d) (Reg 93)	Monitor and Eval (Reg 93)	Existing TMDL	Temporary Modification(s)	Control Regulation
Yes or No	None	None	No	Arsenic (chronic) = hybrid, Exp 12/31/2024	None

Pollutants Evaluated

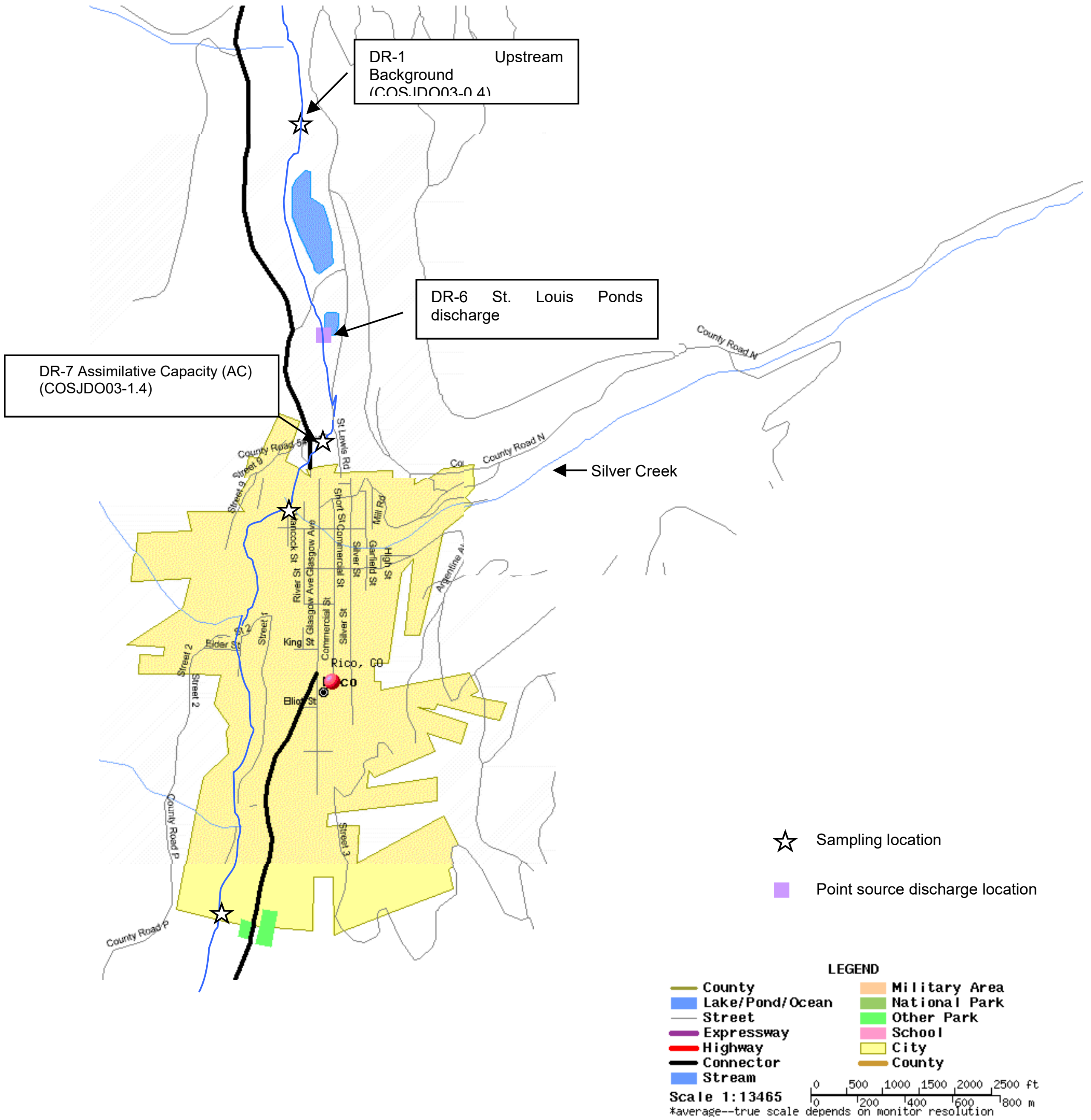
Metals, Chloride, Boron, Cyanide, Temp, Radionuclides, SAR, EC

II. Introduction

The Preliminary Effluent Limitations (PEL) of the Dolores River near the Rico-Argentine Mine site, located in Dolores County, is intended to determine the assimilative capacities available for pollutants found to be of concern. This PEL describes how the water quality based effluent limits (WQBELs) are developed. These parameters may or may not appear in the permit with limitations or monitoring requirements, subject to other determinations such as reasonable potential analysis, evaluation of federal effluent limitation guidelines, implementation of state-based technology based limits, mixing zone analyses, 303(d) listings, threatened and endangered species listing, or other requirements as discussed in the permit rationale.

Figure A-1 contains a map of the study area evaluated as part of this PEL.

Figure 1 - WQA Study Area



The Rico Tunnel discharges to the Dolores River, which is stream segment COSJDO03. This means the San Juan Basin, Dolores Sub-basin, Stream Segment 03. This segment is composed of the "Mainstem of the Dolores River from a point immediately above the confluence with Horse Creek to a point immediately above the confluence with Bear Creek". Stream segment 03 is classified for Cold Class 1, Recreation E, Water Supply and Agriculture. Note that the downstream segment is over 12 steam miles away with several major tributaries between the discharge location and the next stream segment. Further, the downstream segment is not impaired, and has less stringent TVS standards, due to the higher hardness on the segment (station 914 in Stoner).

A second option under this PEL is to discharge into "naturalized" wetlands, which are non-constructed wetlands that then flow into the Dolores river. The wetlands are in stream segment COSJDO05A. The segment is composed of the "All tributaries to the Dolores and West Dolores rivers including all wetlands, from the source to a point immediately below the confluence with the West Dolores river." Stream segment 05A is classified for Cold Class 1, Recreation E, Water Supply and Agriculture.

The Rico (also known as the St. Louis) Tunnel discharge is located north of the Town of Rico, upstream of the confluence with Silver Creek. The discharge flows from the tunnel through a series of settling ponds before discharging to the Dolores River. It should be noted that the discharge from the tunnel was previously covered under a permit held by the Rico Development Corporation. Due to the dissolution of the Rico Development Corporation and other circumstances in 1996, the operation and maintenance of the tunnel pond treatment system was abandoned and the expired permit was never renewed. Thus, the Rico Tunnel has been discharging mine drainage for the past 10 years with only passive settling of naturally precipitated metals as the flow passed through the pond system. Figure A-1 on the following page contains a map of the study area evaluated as part of this WQA.

Information evaluated as part of this assessment includes data gathered from the Atlantic Richfield Company and its consultants, the Town of Rico, WQCD, Colorado Division of Water Resources (DWR), U.S. Environmental Protection Agency (EPA), U. S. Geological Survey (USGS), and the local water commissioner. The actual data used in the assessment consist of the best information available at the time of preparation of this WQA package.

III. Water Quality Standards

Narrative Standards

Narrative Statewide Basic Standards have been developed in Section 31.11(1) of the regulations, and apply to any pollutant of concern, even where there is no numeric standard for that pollutant. Waters of the state shall be free from substances attributable to human-caused point source or nonpoint source discharges in amounts, concentrations or combinations which:

for all surface waters except wetlands;

(i) can settle to form bottom deposits detrimental to the beneficial uses. Depositions are stream bottom buildup of materials which include but are not limited to anaerobic sludge, mine slurry or tailings, silt, or mud; or (ii) form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or (iii) produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species or to the water; or (iv) are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or (v) produce a predominance of undesirable aquatic life; or (vi) cause a film on the surface or produce a deposit on shorelines; and for surface waters in wetlands;

(i) produce color, odor, changes in pH, or other conditions in such a degree as to create a nuisance or harm water quality dependent functions or impart any undesirable taste to significant edible aquatic species of the wetland; or (ii) are toxic to humans, animals, plants, or aquatic life of the wetland.

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for any parameter of concern could be put in CDPS discharge permits.

Standards for Organic Parameters and Radionuclides

Radionuclides: Statewide Basic Standards have been developed in Section 31.11(2) and (3) of The Basic Standards and Methodologies for Surface Water to protect the waters of the state from radionuclides and organic chemicals.

In no case shall radioactive materials in surface waters be increased by any cause attributable to municipal, industrial, or agricultural practices or discharges to as to exceed the following levels, unless alternative site-specific standards have been adopted. Standards for radionuclides are shown in Table A-2.

Table A-2
Radionuclide Standards

Parameter	Picocuries per Liter
Americium 241*	0.15
Cesium 134	80
Plutonium 239, and 240*	0.15
Radium 226 and 228*	5
Strontium 90*	8
Thorium 230 and 232*	60
Tritium	20,000

*Radionuclide samples for these materials should be analyzed using unfiltered (total) samples. These Human Health standards are 30-day average values.

Organics: The organic pollutant standards contained in the Basic Standards for Organic Chemicals Table are applicable to all surface waters of the state for the corresponding use classifications, unless alternative site-specific standards have been adopted. These standards have been adopted as "interim standards" and will remain in effect until alternative permanent standards are adopted by the Commission. These interim standards shall not be considered final or permanent standards subject to antibacksliding or downgrading restrictions. Although not reproduced in this PEL, the specific standards for organic chemicals can be found in Regulation 31.11(3).

In order to protect the Basic Standards in waters of the state, effluent limitations and/or monitoring requirements for radionuclides, organics, or any other parameter of concern could be put in CDPS discharge permits.

The aquatic life standards for organics apply to all stream segments that are classified for aquatic life. The water supply standards apply only to those segments that are classified for water supply. The water + fish standards apply to those segments that have a Class 1 aquatic life and a water supply classification. The fish ingestion standards apply to Class 1 aquatic life segments that do not have a water supply designation. The water + fish and the fish ingestion standards may also apply to Class 2 aquatic life segments, where the Water Quality Control Commission has made such determination.

Because the receiving water is classified for Cold Class 1, with a water supply designation, the water supply, water + fish, and aquatic life standards apply to this discharge.

Salinity and Nutrients

Nutrients
Total Phosphorus and Total Inorganic Nitrogen: Regulation 85, the Nutrients Management Control Regulation has been adopted by the Water Quality Control Commission and became effective September 30, 2012. This regulation contains requirements for phosphorus and Total Inorganic Nitrogen (TIN) concentrations for some point source dischargers. Limitations for phosphorus and TIN may be applied in accordance with this regulation.

Salinity: Regulation 61.8(2)(l) contains requirements regarding salinity for any discharges to the Colorado River Watershed. For industrial dischargers and for the discharge of intercepted groundwater, this is a no-salt discharge requirement. However, the regulation states that this requirement may be waived where the salt load reaching the mainstem of the Colorado River is less than 1 ton per day, or less than 350 tons per year. The Division may permit the discharge of salt upon a satisfactory demonstration that it is not practicable to prevent the discharge of all salt. See Regulation 61.8(2)(l)(i)(A)(1) for industrial discharges and 61.8(2)(l)(iii) for discharges of intercepted groundwater for more information regarding this demonstration.

In addition, the Division's policy, Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, may be applied to discharges where an agricultural water intake exists downstream of a discharge point. Limitations for electrical conductivity and sodium absorption ratio may be applied in accordance with this policy.

Temperature
Temperature shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life. This standard shall not be interpreted or applied in a manner inconsistent with section 25-8-104, C.R.S.

Segment Specific Numeric Standards
Numeric standards are developed on a basin-specific basis and are adopted for particular stream segments by the Water Quality Control Commission. The standards in Table A-3a have been assigned to stream segments COSJDO03/5A. Additionally, the parameters in Table A-3b are also being evaluated as they are parameters of concern for this facility type. These parameters are being included based on the numeric standards in Regulation 31.

Table A-3a

In-stream Standards for Stream Segment COSJDO03 & COSJDO05A

Physical and Biological
Dissolved Oxygen (DO) = 6 mg/l, minimum (7 mg/l, minimum during spawning)
pH 6.5- 9.0
E. coli chronic = 126 colonies/100 ml
Temperature June-Sept = 17° C MWAT and 21.7° C DM

Temperature Oct-May = 9° C MWAT and 13° C DM
Inorganic
Total Ammonia acute and chronic = TVS
Chlorine acute = 0.019 mg/l
Chlorine chronic = 0.011 mg/l
Free Cyanide acute = 0.005 mg/l
Sulfide chronic = 0.002 mg/l
Boron chronic = 0.75 mg/l
Nitrite acute = 0.05 mg/l
Nitrate acute = 10 mg/l
Chloride chronic = 250 mg/l
Sulfate chronic = For WS, the greater of ambient water quality as of January 1, 2000 or 250 mg/l
Metals
Total Recoverable Aluminum acute and chronic = TVS
Dissolved Arsenic acute = 340 µg/l
Total Recoverable Arsenic chronic = 0.02 µg/l*
Dissolved Cadmium acute and chronic = TVS
Total recoverable Cadmium acute = 5 ug/l
Total Recoverable Trivalent Chromium acute = 50 µg/l
Dissolved Trivalent Chromium acute and chronic = TVS
Dissolved Hexavalent Chromium acute and chronic = TVS
Dissolved Copper acute and chronic = TVS
Dissolved Iron chronic WS = The greater of ambient water quality as of January 1, 2000, or 300 µg/l
Total Recoverable Iron chronic = 1000 µg/l
Dissolved Lead acute and chronic = TVS
Total Recoverable Lead acute = 50 ug/l
Dissolved Manganese chronic WS = The greater of ambient water quality as of January 1, 2000 or 50 µg/l
Dissolved Manganese acute and chronic = TVS & 255 ug/l
Total Recoverable Molybdenum chronic = 160 µg/l
Total Mercury chronic = 0.01 µg/l
Dissolved Nickel acute and chronic = TVS
Total Recoverable Nickel chronic = 100 ug/l
Dissolved Selenium acute and chronic = TVS
Dissolved Silver acute and chronic = TVS
Dissolved Zinc acute and chronic = TVS
Dissolved Uranium acute and chronic = TVS
Total Uranium = 16.8-30 ug/l

*Beginning 01/01/2025- A temporary modification for chronic total recoverable arsenic, which is equal to 'current conditions', with an expiration date of 12/31/2024 is applicable. The Water Quality Control Commission's regulations state that current conditions be maintained and existing uses protected during the duration of a temporary modification.

Table A-3b Additional Standards Being Evaluated Based on Regulation 31
Total Recoverable Beryllium chronic = 4 ug/l
Dissolved Antimony chronic = 5.6 ug/l
Total Recoverable Thallium chronic = 0.24 ug/l

Water Supply- Dissolved Iron, Dissolved Manganese, and Sulfate

The standard for dissolved manganese, dissolved iron, and sulfate for water supply segments is the greater of the ambient water quality as of January 1, 2000, or 50 µg/l, 300 ug/l, and 250 mg/l, respectively. Per division practice, ambient water quality as of January 1, 2000, is the 85th percentile of data as listed in the Assessment unit database from January 1995 to December 1999 if there are at least 10 data points. If there are less than 10 data points from January 1995 to December 1999, then the date range expands from January 1995 to December 2004 to capture 10 data points.

For all parameters, there were 8 data points, and so the period of record is January 1995 to December 1999. For dissolved iron, the ambient water quality was 109 ug/l, so the standard is 300 ug/l. For dissolved manganese, the ambient water quality was 195 ug/l, so the value of 195 ug/l is the water supply standard. For sulfate, the ambient water quality was 120 mg/l, so the standard is 250 mg/l.

Table Value Standards and Hardness Calculations

Standards for metals are generally shown in the regulations as Table Value Standards (TVS), and these often must be derived from equations that depend on the receiving stream hardness or species of fish present. The Classification and Numeric Standards documents for each basin include a specification for appropriate hardness values to be used. Specifically, the regulations state that:

> The hardness values used in calculating the appropriate metal standard should be based on the lower 95% confidence limit of the mean hardness value at the periodic low flow criteria as determined from a regression analysis of site-specific data. Where insufficient site-specific data exists to define the mean hardness value at the periodic low flow criteria, representative regional data shall be used to perform the regression analysis. Where a regression analysis is not appropriate, a site-specific method should be used.

Dolores River

Hardness data for The Dolores River near the point of discharge of were insufficient to conduct a regression analysis based on the low flow. Therefore, the Division's alternative approach to calculating hardness was used, which involves computing a mean hardness.

The mean hardness was computed to be 212 mg/l based on sampling data from sampling location DR-7, Dolores river just below the settling ponds system. This hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals, with the results shown in Table A-4a.

Table A-4a

TVS-Based Metals Water Quality Standards for PEL 230051- Dolores River

Parameter	*In-Stream Water Quality Standard*			*TVS Formula: Hardness (mg/l) as CaCO3 =* **212**
Aluminum, Total Recoverable	Acute	9572	µg/l	$e^{(1.3695(\ln(hardness))+1.8308)}$
	Chronic	87	µg/l	$e^{(1.3695(\ln(hardness))-0.1158)}$
Cadmium, Dissolved	Acute	3.3	µg/l	$[1.136672-0.041838\ln(hardness)]e^{(0.9151(\ln(hardness))-3.6236)}$
	Chronic	0.75	µg/l	$[1.101672-0.041838\ln(hardness)]e^{(0.7998(\ln(hardness))-4.4451)}$
Trivalent Chromium, Dissolved	Acute	1054	µg/l	$e^{(0.819(\ln(hardness))+2.5736)}$
	Chronic	137	µg/l	$e^{(0.819(\ln(hardness))+0.5340)}$
Hexavalent Chromium, Dissolved	Acute	16	µg/l	Numeric standards provided, formula not applicable
	Chronic	11	µg/l	Numeric standards provided, formula not applicable
Copper, Dissolved	Acute	27	µg/l	$e^{(0.9422(\ln(hardness))-1.7408)}$
	Chronic	17	µg/l	$e^{(0.8545(\ln(hardness))-1.7428)}$
Lead, Dissolved	Acute	145	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-1.46)}]$
	Chronic	5.6	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-4.705)}]$
Manganese, Dissolved	Acute	3835	µg/l	$e^{(0.3331(\ln(hardness))+6.4676)}$
	Chronic	255*	µg/l	Numeric Water Supply Standard, formula not applicable
Nickel, Dissolved	Acute	884	µg/l	$e^{(0.846(\ln(hardness))+2.253)}$
	Chronic	98	µg/l	$e^{(0.846(\ln(hardness))+0.0554)}$
Selenium, Dissolved	Acute	18.4	µg/l	Numeric standards provided, formula not applicable
	Chronic	4.6	µg/l	Numeric standards provided, formula not applicable
Silver, Dissolved	Acute	7.4	µg/l	$\frac{1}{2} e^{(1.72(\ln(hardness))-6.52)}$
	Chronic	0.27	µg/l	$e^{(1.72(\ln(hardness))-10.51)}$
Uranium, Dissolved	Acute	5499	µg/l	$e^{(1.1021(\ln(hardness))+2.7088)}$
	Chronic	3435	µg/l	$e^{(1.1021(\ln(hardness))+2.2382)}$
Zinc, Dissolved	Acute	272	µg/l	$0.978e^{(0.8525(\ln(hardness))+1.0617)}$
	Chronic	589	µg/l	$e^{(2.140(\ln(hardness))-5.084)}$

*Numeric Aquatic Life Standard Per Regulation 36. Note that a Water Supply Standard also applies

The Wetlands

Hardness data for The Wetlands was provided by Atlantic Richfield, and corresponds to Rico sampling location DR-6.

The mean hardness was computed to be 797 mg/l based on robust sampling data from DR-6 with 70 data points. The *Basic Standards and Methodologies for Surface Water* indicates that hardness must be capped at 400 mg/l when determining in-stream metal water quality standards using the equations in the TVS. This maximum hardness value and the formulas contained in the TVS were used to calculate the in-stream water quality standards for metals, with the results shown in Table A-4b.

Table A-4b
TVS-Based Metals Water Quality Standards for PEL 230051- The Wetlands

Parameter	***In-Stream Water Quality Standard***			***TVS Formula: Hardness (mg/l) as CaCO3 =*** **400**
Aluminum, Total Recoverable	Acute	10071	µg/l	$e^{(1.3695(\ln(hardness))+1.8308)}$
	Chronic	87	µg/l	$e^{(1.3695(\ln(hardness))-0.1158)}$
Cadmium, Dissolved	Acute	5.7	µg/l	$[1.136672-0.041838\ln(hardness)]e^{(0.9151(\ln(hardness))-3.6236)}$
	Chronic	1.2	µg/l	$[1.101672-0.041838\ln(hardness)]e^{(0.7998(\ln(hardness))-4.4451)}$
Trivalent Chromium, Dissolved	Acute	1773	µg/l	$e^{(0.819(\ln(hardness))+2.5736)}$
	Chronic	231	µg/l	$e^{(0.819(\ln(hardness))+0.5340)}$
Hexavalent Chromium, Dissolved	Acute	16	µg/l	Numeric standards provided, formula not applicable
	Chronic	11	µg/l	Numeric standards provided, formula not applicable
Copper, Dissolved	Acute	50	µg/l	$e^{(0.9422(\ln(hardness))-1.7408)}$
	Chronic	29	µg/l	$e^{(0.8545(\ln(hardness))-1.7428)}$
Lead, Dissolved	Acute	281	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-1.46)}]$
	Chronic	11	µg/l	$[1.46203-0.145712\ln(hardness)][e^{(1.273(\ln(hardness))-4.705)}]$
Manganese, Dissolved	Acute	4738	µg/l	$e^{(0.3331(\ln(hardness))+6.4676)}$
	Chronic	255*	µg/l	$e^{(0.3331(\ln(hardness))+5.8743)}$
Nickel, Dissolved	Acute	1513	µg/l	$e^{(0.846(\ln(hardness))+2.253)}$
	Chronic	168	µg/l	$e^{(0.846(\ln(hardness))+0.0554)}$
Selenium, Dissolved	Acute	18.4	µg/l	Numeric standards provided, formula not applicable
	Chronic	4.6	µg/l	Numeric standards provided, formula not applicable
Silver, Dissolved	Acute	22	µg/l	$\frac{1}{2} e^{(1.72(\ln(hardness))-6.52)}$
	Chronic	0.81	µg/l	$e^{(1.72(\ln(hardness))-10.51)}$
Uranium, Dissolved	Acute	11070	µg/l	$e^{(1.1021(\ln(hardness))+2.7088)}$
	Chronic	6915	µg/l	$e^{(1.1021(\ln(hardness))+2.2382)}$
Zinc, Dissolved	Acute	467	µg/l	$0.978e^{(0.8525(\ln(hardness))+1.0617)}$
	Chronic	2293	µg/l	$e^{(2.140(\ln(hardness))-5.084)}$

*Numeric Aquatic Life Standard Per Regulation 36. Note that a Water Supply Standard also applies

Total Maximum Daily Loads and Regulation 93 – Colorado's Section 303(d) List of Impaired

Waters and Monitoring and Evaluation List

This stream segment is not listed on the Division's 303(d) list of water quality impacted streams and is not on the monitoring and evaluation list.

IV. Receiving Stream Information

Low Flow Analysis

The Colorado Regulations specify the use of low flow conditions when establishing water quality based effluent limitations, specifically the acute and chronic low flows. The acute low flow, referred to as 1E3, represents the one-day low flow recurring in a three-year interval, and is used in developing limitations based on an acute standard. The 7-day average low flow, 7E3, represents the seven-day average low flow recurring in a 3 year interval, and is used in developing limitations based on a Maximum Weekly Average Temperature standard (MWAT). The chronic low flow, 30E3, represents the 30-day average low flow recurring in a three-year interval, and is used in developing limitations based on a chronic standard.

To calculate low flows, a flow gage measurement immediately upstream of the site should be used. However, there were no flow gages immediately upstream of the site, and so a downstream gage station was used. To determine the upstream low flows available to the Rio-Argentine mine, daily flow at location DR-3 (St. Louis Tunnel discharge at adit entrance) was subtracted from the daily flow measured from USGS Station 09165000 (Dolores River Below Rico, CO). For any day that was missing flow data at location DR-3, the flow for that day was set to the monthly maximum flow that was recorded.

Next, a watershed ratio was calculated from the USGS gage station approximately 4-5 miles downstream of the discharge. The area above the USGS gage is 106 square miles and the area above the discharge is 72.2 square miles, resulting in a watershed ratio of 0.68.

Two seasonal periods of record were analyzed, using a period of record from May 11, 2011, to July 31, 2018, as that was the period of record for flow data provided by the facility for location DR-3. The annual 1E3, 7E3, and 30E3 low flows were calculated using U.S. Environmental Protection Agency (EPA) DFLOW software. The output from DFLOW provides calculated acute and chronic low flows for each month. Based on the low flow analysis described above, the upstream low flows available to the facility were calculated and are presented in Table A-5a.

The low flow during May 1- August 31, is 12 cfs (1E3 and 7E3), and 9 cfs (30E3). The low flow during the season, September 1- April 30 is 3.6cfs (1E3), 4.1 cfs (7E3), and 5.4 cfs (30E3).

Table A-5a

Low Flows for Dolores River at the Rico-Argentine Mine Site

Low Flow (cfs)	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1E3 Acute	3.6	3.6	5.3	5.9	17	42	13	12	13	7.3	6.6	6.7	3.7
7E3 Chronic	4.1	4.1	5.2	5.7	12	36	13	13	12	7.3	6.7	6.7	4.1

Table A-5a

Low Flows for Dolores River at the Rico-Argentine Mine Site

30E3 Chronic	5.4	5.4	5.4	5.7	7.6	23	16	16	9	7.4	6.8	6.2	5.4

May 1-August 31- The ratio of the low flow of the Dolores River to the effluent flow of 1.74 MGD is 3:1

September 1- April 30- The ratio of the low flow of the Dolores River to the effluent flow of 1.44 MGD is 3:1

Non-Seasonal- The ratio of the low flow of the Dolores River to the effluent flow of 1.74 MGD is 2:1

During the months of March, April, May, and August, the acute low flow calculated by DFLOW exceeded the chronic low flow. In accordance with Division standard procedures, the acute low flow was thus set equal to the chronic low flow for these months.

WETLANDS
For discharge to the "naturalized" wetlands (COSJDO05A), the division automatically assumes that no mixing occurs during times of low flow until, and unless, a mixing zone has been submitted to the division and approved. The low flow information is summarized in Table A-5b.

Table A-5b

Low Flows for the "Naturalized" Wetland at the Rico-Argentine Mine Site

Low Flow (cfs)	*Annual*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
1E3 Acute	0	0	0	0	0	0	0	0	0	0	0	0	0
7E3 Chronic	0	0	0	0	0	0	0	0	0	0	0	0	0
30E3 Chronic	0	0	0	0	0	0	0	0	0	0	0	0	0

The ratio of the low flow of wetlands to the Rico-Argentine design flow is 0:1.

Mixing Zones

The amount of the available assimilative capacity (dilution) that may be used by the permittee for the purposes of calculating the WQBELs may be limited in a permitting action based upon a mixing zone analysis or other factor. These other factors that may reduce the amount of assimilative capacity available in a permit are: presence of other dischargers in the vicinity; the presence of a water diversion downstream of the discharge (in the mixing zone); the need to provide a zone of passage for aquatic life; the likelihood of bioaccumulation of toxins in fish or wildlife; habitat considerations such as fish spawning or nursery areas; the presence of threatened and endangered species; potential for human exposure through drinking water or recreation; the possibility that aquatic life will be attracted to the effluent plume; the potential for adverse effects on groundwater; and the toxicity or persistence of the substance discharged.

Unless a facility has performed a mixing zone study during the course of the previous permit, and a decision has been made regarding the amount of the assimilative capacity that can be used by the facility, the Division assumes that the full assimilative capacity can be allocated. Note that the review of mixing study considerations, exemptions and perhaps performing a new mixing study (due to changes in low flow, change in facility design flow, channel geomorphology or other reason) is evaluated in every permit and permit renewal.

If a mixing zone study has been performed and a decision regarding the amount of available assimilative capacity has been made, the Division may calculate the water quality based effluent limitations (WQBELs) based on this available capacity. In addition, the amount of assimilative capacity may be reduced by T&E implications.

For this facility, 100% of the available assimilative capacity for the receiving stream (not applicable to the wetlands) may be used as the facility has not yet performed a mixing zone study, and the discharge is not to a T&E stream segment, and is not expected to have an influence on any of the other factors listed above. Note, however, this facility will be required to complete a mixing zone analysis for a discharge into the Dolores River, per the Colorado Mixing Zone guidance.

Ambient Water Quality

The Division evaluates ambient water quality based on a variety of statistical methods as prescribed in Section 31.8(2)(a)(i) and 31.8(2)(b)(i)(B) of the *Colorado Department of Public Health and Environment Water Quality Control Commission Regulation No. 31*, and as outlined in the Division's Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits (WQP-19). Ambient water quality is evaluated in this PEL analysis for use in determining assimilative capacities and in completing antidegradation reviews for pollutants of concern, where applicable.

The Dolores River- To conduct an assessment of the ambient water quality upstream of the Rico site, data were gathered from sampling location DR-1, submitted by the permittee, and located just upstream from the facility settling ponds. The period of record varied from parameter to parameter, but was generally October 1999 through May 2018. These data are summarized in Table A-6.

Table A-6

Ambient Water Quality for The Dolores River

Parameter	Number of Samples	15th Percentile	50th Percentile	85th Percentile	Mean	Maximum	Chronic Stream Standard*	Notes
Al, TR (µg/l)	50	15	79	358	190	1780	87	
Sb, Dis (µg/l)	44	0	0	0	0	0	5.6	2
As, TR (µg/l)	60	0	0	0	0.089	1.1	0.02	2
As, Dis (µg/l)	64	0	0	0	0.042	1	340	2
Be, TR (µg/l)	44	0	0	0	0	0	4	2
Cd, TR (µg/l)	65	0	0	0	0.0074	0.26	5	2
Cd, Dis (µg/l)	40	0	0	0	0.0065	0.2	0.75	2
Cr, TR (µg/l)	74	0	0	0.72	0.29	2.2	50	2
Cr, Dis (µg/l)	35	0	0.69	1.4	0.83	4.2	NA	2
Cu, Dis (µg/l)	40	0	0.68	1.7	0.83	3.5	17	2

CN, Tot (µg/l)	71	0	0	0	0.0003	0.0073	5	2
Fe, Dis (µg/l)	76	0	0	64	30	423	300	2
Fe, TR (µg/l)	74	0	87	370	242	2320	1000	2
Pb, TR (µg/l)	65	0	0.1	0.64	0.3	2.7	50	2
Pb, Dis (µg/l)	40	0	0.045	1.7	2.6	34	5.6	2
Mn, Dis (µg/l)	39	8.7	13	23	16	51	195	
Mo, TR (µg/l)	33	0.7	0.87	1	0.85	1.6	160	
Hg, Tot (µg/l)	69	0	0	0	0.0003	0.009	0.01	2
Ni, TR (µg/l)	60	0	0	0.74	0.31	2.8	100	2
Ni, Dis (µg/l)	40	0	0	0.88	0.35	3.1	98	2
Se, Dis (µg/l)	39	0	0.32	0.57	0.27	1	4.6	2
Ag, Dis (µg/l)	40	0	0	0.043	0.017	0.16	0.27	2
U, TR (µg/l)	1	0	0	0	0	0	30	2
U, Dis (µg/l)	1	0.25	0.25	0.25	0.25	0.25	3435	
Zn, Dis (µg/l)	40	0	1.8	6.7	4.3	31	240	2
B, Tot (mg/l)	0	0	0	0	0	0	0.75	2
Chloride (mg/l)	49	0	1.1	2.6	1.3	5.7	250	2
Sulfate (mg/l)	64	14	38	54	36	76	250	
Sulfide as H_2S (mg/l)	45	0	0	0	0	0	0.002	2
Thallium, TR (µg/l)	46	0	0	0	0.061	2.8	0.24	2
Hardness as $CaCO_3$ (mg/l)	70	98	221	312	212	410	NA	4
Note 2: Sample results were below detection levels, zero was used in accordance with the Division's approach for summarizing & averaging.								
Note 3: The ambient water quality exceeds the water quality standards for these parameters.								
Note 4: Hardness data collected downstream at DR-7								
*When there is no chronic standard, the acute standard is shown								

V. Facility Information and Pollutants Evaluated

Facility Information

The Rico-Argentine Mine site is located upstream of the confluence with Silver Creek and the Town of Rico in Dolores County. The discharge is made up of mine drainage emanating from the mountain, which is routed through a series of 11 settling ponds before discharging to the Dolores River. Flow rates into (and out of) the ponds are dependent upon regional precipitation patterns and natural hydrogeologic processes. The design capacity of the facility is seasonal, as follows;

Rico-Argentine Mine- May 1-August 31	1.74 MGD	2.7 CFS
Rico-Argentine Mine- Sept 1- April 30	1.44 MGD	2.2 CFS

According to the PEL application, wastewater treatment is accomplished using “aeration, coagulation addition, settling, and bio-treatment including manganese polishing.” This treatment is through a series of ponds. The technical analyses that follow include assessments of the assimilative capacity based on these effluent discharge scenarios.

The Rico-Argentine mine is the sole known point source contributor to the Dolores river in this area. No other individual permit point sources were identified as dischargers to the Dolores river in this area. Note that due to the intermittent nature of stormwater discharges, and that these types of discharges do not typically occur at low flow conditions, they are not considered in this PEL.

The Naturalized Wetlands

Due to the in-stream low flow of zero, the assimilative capacities during times of low flow are not affected by nearby contributions. Therefore, modeling nearby facilities in conjunction with this facility was not necessary.

Pollutants of Concern

Pollutants of concern may be determined by one or more of the following: facility type; effluent characteristics and chemistry; effluent water quality data; receiving water quality; presence of federal effluent limitation guidelines; or other information. Parameters evaluated in this PEL may or may not appear in a permit with limitations or monitoring requirements, subject to other determinations such as a reasonable potential analysis, mixing zone analyses, 303(d) listings, threatened and endangered species listings or other requirement as discussed in a permit rationale.

There are no site-specific in-stream water quality standards for TSS and oil and grease for this receiving stream. Thus, assimilative capacities were not determined for these parameters. The applicable limitations for these pollutants can be found in Regulation No. 62 and will be applied in the permit for the facility.

The following parameters were identified by the Division as pollutants to be evaluated for this facility:

- Temperature
- SAR and EC
- Metals and Cyanide
- Radionuclides

According to the *Classifications, Standards, and Designations of Regulation 36*, stream CODJDO03/5A are designated a water supply. Thus, the dissolved iron, dissolved manganese (water supply), sulfate standard(s) are further evaluated as part of this PEL for the Dolores river. Note that the aquatic life TVS standard for dissolved manganese also remains applicable and is evaluated below.

Note that for the wetland, no surface intakes and no wells expected to be supplied by hydrologically connected groundwater are evaluated for this receiving water. For this reason, the sulfate, dissolved iron, and dissolved manganese standard for the wetland are not evaluated as part of this analysis. However, the water supply uses on the Dolores river are still applicable for a discharge into the wetlands, and limits based on the Dolores river for water supply are applied. Also note that the aquatic life TVS standard for dissolved manganese on the wetland remains applicable and is evaluated below.

VI. Determination of Water Quality Based Effluent Limitations (WQBELs)

Technical Information

Note that the WQBELs developed in the following paragraphs, are calculations of what an effluent limitation may be in a permit. The WQBELs for any given parameter, will be compared to other potential limitations (federal Effluent Limitations Guidelines, State Effluent Limitations, or other applicable limitation) and typically the more stringent limit is incorporated into a permit. If the WQBEL is the more stringent limitation, incorporation into a permit is dependent upon a reasonable potential analysis.

In-stream background data and low flows evaluated in Sections II and III are used to determine the assimilative capacity of the Dolores River near the Rico-Argentine mine for pollutants of concern, and to calculate the WQBELs. For all parameters except ammonia, it is the Division's approach to calculate the WQBELs using the lowest of the monthly low flows (referred to as the annual low flow) as determined in the low flow analysis. For ammonia, it is the standard procedure of the Division to determine monthly WQBELs using the monthly low flows, as the regulations allow the use of seasonal flows.

The Division's standard analysis consists of steady-state, mass-balance calculations for most pollutants and modeling for pollutants such as ammonia. The mass-balance equation is used by the Division to calculate the WQBELs, and accounts for the upstream concentration of a pollutant at the existing quality, critical low flow (minimal dilution), effluent flow and the water quality standard. The mass-balance equation is expressed as:

$$M_2 = \frac{M_3 Q_3 - M_1 Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3)
Q_2 = Average daily effluent flow (design capacity)
Q_3 = Downstream flow (Q_1 + Q_2)
M_1 = In-stream background pollutant concentrations at the existing quality
M_2 = Calculated WQBEL
M_3 = Water Quality Standard, or other maximum allowable pollutant concentration

<u>The "Naturalized" Wetlands</u>

When Q_1 equals zero, Q_2 equals Q_3, and the following results: $M_2 = M_3$

Because the low flow (Q_1) for the "naturalized wetlands" is zero, the WQBELs for the pollutants of concern are equal to the in-stream water quality standards for this discharge location.

A more detailed discussion of the technical analysis is provided in the pages that follow.

<u>The Dolores River</u>

The upstream background pollutant concentrations used in the mass-balance equation will vary based on the regulatory definition of existing ambient water quality. For most pollutants, existing quality is determined to be the 85th percentile. For metals in the total or total recoverable form, existing quality is determined to be the 50th percentile.

For temperature, the highest 7-day mean (for the chronic standard) of daily average stream temperature, over a seven consecutive day period will be used in calculations of the chronic temperature assimilative capacity, where the daily average temperature should be calculated from a minimum of three measurements spaced equally through the day. The highest 2-hour mean (for the acute standard) of stream temperature will be used in calculations of the acute temperature assimilative capacity. The highest 2-hour mean should be calculated from a minimum of 12 measurements spaced equally through the day.

Calculation of WQBELs

Using the mass-balance equation provided in the beginning of Section VI, the acute and chronic low flows set out in Section IV, ambient water quality as discussed in Section IV, and the in-stream standards shown in Section III, the WQBELs for were calculated. The data used and the resulting WQBELs, M_2, are set forth in the tables below. Where a WQBEL is calculated to be a negative number and interpreted to be zero or When the ambient water quality exceeds the in-stream standard, the Division standard procedure is to allocate the water quality standard to prevent further degradation of the receiving waters.

Temperature:

The Dolores River

A WQBEL for temperature can only be calculated if there is representative data, in the proper form, to determine what the background Maximum Weekly Average Temperature and Daily Maximum ambient temperatures are. As this data is not available at this time, the temperature limitation will be set at the water quality standard and will be revisited in the future when representative temperature data becomes available.

Total Recoverable Uranium Ranges: Because total uranium assimilative capacities are calculated based on a range of standards, *The Basic Standards and Methodologies for Surface Water* requires further evaluation. Specifically, the regulations state that “Control requirements, such as discharge permit effluent limitations, shall be established using the first number in the range as the ambient water quality target, provided that no effluent limitation shall require an “end-of-pipe” discharge level more restrictive than the second number in the range.”

For the Dolores river, because the WQBEL for total recoverable uranium has been calculated to be less than the second number in the range of standards, the second standard (as shown in Table A-3a) would instead be substituted as the WQBEL pursuant to the regulations.

WQBELS- THE DOLORES RIVER

Table A-7a

Chronic WQBELs- The Dolores River
May 1- August 30
Effluent Flow: 1.74 MGD (2.7 CFS)

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1	M_3	M_2	Notes
Temp MWAT (°C) June-Sept	9	2.7	11.7	NA	17	***17***	
Temp MWAT (°C) Oct-May	9	2.7	11.7	NA	9	***9***	
Al, TR (µg/l)	9	2.7	11.7	79	87	***114***	
Sb, Dis (µg/l)	9	2.7	11.7	0	5.6	***24***	
As, TR (µg/l) – Beginning 01/01/2025	9	2.7	11.7	0	0.02	***0.087***	
Be, TR (µg/l)	9	2.7	11.7	0	4	***17***	

Cd, Dis (µg/l)	9	2.7	11.7	0	0.75	***3.3***	
Cr+3, Dis (µg/l)	9	2.7	11.7	0	137	***594***	
Cr+6, Dis (µg/l)	9	2.7	11.7	0	11	***48***	
Cu, Dis (µg/l)	9	2.7	11.7	1.7	17	***68***	
Fe, Dis (µg/l)	9	2.7	11.7	64	300	***1087***	
Fe, TR (µg/l)	9	2.7	11.7	87	1000	***4043***	
Pb, Dis (µg/l)	9	2.7	11.7	1.7	5.6	***19***	
Mn, Dis (µg/l)	9	2.7	11.7	23	195	***768***	WS
Mn, Dis (µg/l)	9	2.7	11.7	23	255	***1028***	AL
Mo, TR (µg/l)	9	2.7	11.7	0.87	160	***690***	
Hg, Tot (µg/l)	9	2.7	11.7	0	0.01	***0.043***	
Ni, TR (µg/l)	9	2.7	11.7	0.88	100	***430***	
Ni, Dis (µg/l)	9	2.7	11.7	0.88	98	***422***	
Se, Dis (µg/l)	9	2.7	11.7	0.57	4.6	***18***	
Ag, Dis (µg/l)	9	2.7	11.7	0.043	0.27	***1***	
U, TR (µg/l)	9	2.7	11.7	0	16.8	***73***	
U, Dis (µg/l)	9	2.7	11.7	0.25	3435	***14884***	
Zn, Dis (µg/l)	9	2.7	11.7	6.7	240	***1018***	
B, Tot (mg/l)	9	2.7	11.7	0	0.75	***3.3***	
Chloride (mg/l)	9	2.7	11.7	2.6	250	***1075***	
Sulfate (mg/l)	9	2.7	11.7	54	250	***903***	
Sulfide as H2S (mg/l)	9	2.7	11.7	0	0.002	***0.0087***	
Radium 226+228 (pCi/l)	9	2.7	11.7	0	5	***22***	
Thallium, TR (µg/l)	9	2.7	11.7	0	0.24	***1***	

WS= Water Supply/AL= Aquatic Life

Table A-7b
Chronic WQBELs – The Dolores River
September 1- April 30
Effluent Flow 1.44 MGD (2.2 CFS)

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***	***Notes***
Temp MWAT (°C) June-Sept	5.4	2.2	7.6	NA	17	***17***	
Temp MWAT (°C) Oct-May	5.4	2.2	7.6	NA	9	***9***	
Al, TR (µg/l)	5.4	2.2	7.6	79	87	***107***	
Sb, Dis (µg/l)	5.4	2.2	7.6	0	5.6	***19***	
As, TR (µg/l) – Beginning 01/01/2025	5.4	2.2	7.6	0	0.02	***0.069***	
Be, TR (µg/l)	5.4	2.2	7.6	0	4	***14***	
Cd, Dis (µg/l)	5.4	2.2	7.6	0	0.75	***2.6***	
Cr+3, Dis (µg/l)	5.4	2.2	7.6	0	137	***473***	
Cr+6, Dis (µg/l)	5.4	2.2	7.6	0	11	***38***	
Cu, Dis (µg/l)	5.4	2.2	7.6	1.7	17	***55***	
Fe, Dis (µg/l)	5.4	2.2	7.6	64	300	***879***	
Fe, TR (µg/l)	5.4	2.2	7.6	87	1000	***3241***	
Pb, Dis (µg/l)	5.4	2.2	7.6	1.7	5.6	***15***	

Mn, Dis (µg/l)	5.4	2.2	7.6	23	195	***617***	WS
Mn, Dis (µg/l)	5.4	2.2	7.6	23	255	***824***	AL
Mo, TR (µg/l)	5.4	2.2	7.6	0.87	160	***551***	
Hg, Tot (µg/l)	5.4	2.2	7.6	0	0.01	***0.035***	
Ni, TR (µg/l)	5.4	2.2	7.6	0	100	***345***	
Ni, Dis (µg/l)	5.4	2.2	7.6	0.88	98	***336***	
Se, Dis (µg/l)	5.4	2.2	7.6	0.57	4.6	***14***	
Ag, Dis (µg/l)	5.4	2.2	7.6	0.043	0.27	***0.83***	
U, TR (µg/l)	5.4	2.2	7.6	0	16.8	***58***	
U, Dis (µg/l)	5.4	2.2	7.6	0.25	3435	***11866***	
Zn, Dis (µg/l)	5.4	2.2	7.6	6.7	240	***813***	
B, Tot (mg/l)	5.4	2.2	7.6	0	0.75	***2.6***	
Chloride (mg/l)	5.4	2.2	7.6	2.6	250	***857***	
Sulfate (mg/l)	5.4	2.2	7.6	54	250	***731***	
Sulfide as H2S (mg/l)	5.4	2.2	7.6	0	0.002	***0.0069***	
Radium 226+228 (pCi/l)	5.4	2.2	7.6	0	5	***17***	
Thallium, TR (ug/l	5.4	2.2	7.6	0	0.24	***0.83***	

WS= Water Supply/AL= Aquatic Life

Table A-7c
Acute WQBELs - The Dolores River
May 1- August 31
Effluent Flow 1.74 MGD (2.7 CFS)

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***
Temp Daily Max (°C) June-Sept	12	2.7	14.7	NA	21.7	***21.7***
Temp Daily Max (°C) Oct-May	12	2.7	14.7	NA	13.0	***13***
Al, TR (µg/l)	12	2.7	14.7	79	9572	***51763***
As, Dis (µg/l)	12	2.7	14.7	0	340	***1851***
Cd, TR (µg/l)	12	2.7	14.7	0	5	***27***
Cd, Dis (µg/l)	12	2.7	14.7	0	3.3	***18***
Cr, TR (µg/l)	12	2.7	14.7	0	50	***272***
Cr+3, TR (µg/l)	12	2.7	14.7	0	50	***272***
Cr+3, Dis (µg/l)	12	2.7	14.7	0	1054	***5738***
Cr+6, Dis (µg/l)	12	2.7	14.7	0	16	***87***
Cu, Dis (µg/l)	12	2.7	14.7	1.7	27	***139***
CN, Free (µg/l)	12	2.7	14.7	0	5	***27***
Pb, TR (µg/l)	12	2.7	14.7	0.1	50	***272***
Pb, Dis (µg/l)	12	2.7	14.7	1.7	145	***782***
Mn, Dis (µg/l)	12	2.7	14.7	23	3835	***20777***
Ni, Dis (µg/l)	12	2.7	14.7	0.88	884	***4809***
Se, Dis (µg/l)	12	2.7	14.7	0.57	18.4	***98***

Ag, Dis (µg/l)	12	2.7	14.7	0.043	7.4	***40***
U, Dis (µg/l)	12	2.7	14.7	0.25	5499	***29938***
Zn, Dis (µg/l)	12	2.7	14.7	6.7	317	***1696***

Table A-7d
Acute WQBELS- The Dolores River
September 1 - April 30
Effluent Flow 1.44 MGD (2.2 CFS)

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***
Temp Daily Max (°C) June-Sept	3.6	2.2	5.8	NA	21.7	***21.7***
Temp Daily Max (°C) Oct-May	3.6	2.2	5.8	NA	13.0	***13***
Al, TR (µg/l)	3.6	2.2	5.8	79	9572	***25106***
As, Dis (µg/l)	3.6	2.2	5.8	0	340	***896***
Cd, TR (µg/l)	3.6	2.2	5.8	0	5	***13***
Cd, Dis (µg/l)	3.6	2.2	5.8	0	3.3	***8.7***
Cr, TR (µg/l)	3.6	2.2	5.8	0	50	***132***
Cr+3, TR (µg/l)	3.6	2.2	5.8	0	50	***132***
Cr+3, Dis (µg/l)	3.6	2.2	5.8	0	1054	***2779***
Cr+6, Dis (µg/l)	3.6	2.2	5.8	0	16	***42***
Cu, Dis (µg/l)	3.6	2.2	5.8	1.7	27	***68***
CN, Free (µg/l)	3.6	2.2	5.8	0	5	***13***
Pb, TR (µg/l)	3.6	2.2	5.8	0.1	50	***132***
Pb, Dis (µg/l)	3.6	2.2	5.8	1.7	145	***379***
Mn, Dis (µg/l)	3.6	2.2	5.8	23	3835	***10073***
Ni, Dis (µg/l)	3.6	2.2	5.8	0.88	884	***2329***
Se, Dis (µg/l)	3.6	2.2	5.8	0.57	18.4	***48***
Ag, Dis (µg/l)	3.6	2.2	5.8	0.043	7.4	***19***
U, Dis (µg/l)	3.6	2.2	5.8	0.25	5499	***14497***
Zn, Dis (µg/l)	3.6	2.2	5.8	6.7	317	***825***

WQBELS- THE DOLORES RIVER- NON SEASONAL

Table A-7e

Chronic WQBELs- The Dolores River Non-Seasonal
Effluent Flow: 1.74 MGD (2.7 CFS)

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***	***Notes***
Temp MWAT (°C) June-Sept	5.4	2.7	8.1	NA	17	***17***	
Temp MWAT (°C) Oct-May	5.4	2.7	8.1	NA	9	***9***	
Al, TR (µg/l)	5.4	2.7	8.1	79	87	***103***	
Sb, Dis (µg/l)	5.4	2.7	8.1	0	5.6	***17***	
As, TR (µg/l) –Beginning 01/01/2025	5.4	2.7	8.1	0	0.02	***0.06***	
Be, TR (µg/l)	5.4	2.7	8.1	0	4	***12***	
Cd, Dis (µg/l)	5.4	2.7	8.1	0	0.75	***2.3***	
Cr+3, Dis (µg/l)	5.4	2.7	8.1	0	137	***411***	
Cr+6, Dis (µg/l)	5.4	2.7	8.1	0	11	***33***	
Cu, Dis (µg/l)	5.4	2.7	8.1	1.7	17	***48***	
Fe, Dis (µg/l)	5.4	2.7	8.1	64	300	***772***	

Fe, TR (µg/l)	5.4	2.7	8.1	87	1000	***2826***	
Pb, Dis (µg/l)	5.4	2.7	8.1	1.7	5.6	***13***	
Mn, Dis (µg/l)	5.4	2.7	8.1	23	255	***719***	AL
Mn, Dis (µg/l)	5.4	2.7	8.1	23	195	***539***	WS
Mo, TR (µg/l)	5.4	2.7	8.1	0.87	160	***478***	
Hg, Tot (µg/l)	5.4	2.7	8.1	0	0.01	***0.03***	
Ni, TR (µg/l)	5.4	2.7	8.1	0	100	***300***	
Ni, Dis (µg/l)	5.4	2.7	8.1	0.88	98	***292***	
Se, Dis (µg/l)	5.4	2.7	8.1	0.57	4.6	***13***	
Ag, Dis (µg/l)	5.4	2.7	8.1	0.043	0.27	***0.72***	
U, TR (µg/l)	5.4	2.7	8.1	0	16.8	***50***	
U, Dis (µg/l)	5.4	2.7	8.1	0.25	3435	***10305***	
Zn, Dis (µg/l)	5.4	2.7	8.1	6.7	240	***707***	
B, Tot (mg/l)	5.4	2.7	8.1	0	0.75	***2.3***	
Chloride (mg/l)	5.4	2.7	8.1	2.6	250	***745***	
Sulfate (mg/l)	5.4	2.7	8.1	54	250	***642***	
Sulfide as H2S (mg/l)	5.4	2.7	8.1	0	0.002	***0.006***	
Radium 226+228 pCi/l	5.4	2.7	8.1	0	5	***15***	
Thallium, TR (ug/l	5.4	2.7	8.1	0	0.24	***0.72***	

AL=Aquatic Life/WS=Water Supply

Table A-7f
Acute WQBELs – The Dolores River Non-Seasonal
Effluent Flow 1.74 MGD (2.7 CFS)

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***	***Notes***
Temp Daily Max (°C) June-Sept	3.6	2.7	6.3	NA	21.7	***21.7***	
Temp Daily Max (°C) Oct-May	3.6	2.7	6.3	NA	13.0	***13***	
Al, TR (µg/l)	3.6	2.7	6.3	79	9572	***22229***	
As, Dis (µg/l)	3.6	2.7	6.3	0	340	***793***	
Cd, TR (µg/l)	3.6	2.7	6.3	0	5	***12***	
Cd, Dis (µg/l)	3.6	2.7	6.3	0	3.3	***7.7***	
Cr, TR (µg/l)	3.6	2.7	6.3	0	50	***117***	
Cr+3, TR (µg/l)	3.6	2.7	6.3	0	50	***117***	
Cr+3, Dis (µg/l)	3.6	2.7	6.3	0	1054	***2459***	
Cr+6, Dis (µg/l)	3.6	2.7	6.3	0	16	***37***	
Cu, Dis (µg/l)	3.6	2.7	6.3	1.7	27	***61***	
CN, Free (µg/l)	3.6	2.7	6.3	0	5	***12***	
Pb, TR (µg/l)	3.6	2.7	6.3	0.1	50	***117***	
Pb, Dis (µg/l)	3.6	2.7	6.3	1.7	145	***336***	
Mn, Dis (µg/l)	3.6	2.7	6.3	23	3835	***8918***	
Ni, Dis (µg/l)	3.6	2.7	6.3	0.88	884	***2061***	
Se, Dis (µg/l)	3.6	2.7	6.3	0.57	18.4	***42***	
Ag, Dis (µg/l)	3.6	2.7	6.3	0.043	7.4	***17***	
U, Dis (µg/l)	3.6	2.7	6.3	0.25	5499	***12831***	
Zn, Dis (µg/l)	3.6	2.7	6.3	6.7	317	***731***	

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THE WETLANDS

Table A-7g
Chronic WQBELs – The Wetlands, Segment COSJDO05A

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1	M_3	M_2
Temp MWAT (°C) June-Sept	0	2.7	2.7	NA	17	***17***
Temp MWAT (°C) Oct-May	0	2.7	2.7	NA	9	***9***
Al, TR (µg/l)	0	2.7	2.7	0	87	***87***
Sb, Dis (µg/l)	0	2.7	2.7	0	5.6	***5.6***
As, TR (µg/l)	0	2.7	2.7	0	0.02	***0.02***
Be, TR (µg/l)	0	2.7	2.7	0	4	***4***
Cd, Dis (µg/l)	0	2.7	2.7	0	1.2	***1.2***
Cr+3, Dis (µg/l)	0	2.7	2.7	0	137	***137***
Cr+6, Dis (µg/l)	0	2.7	2.7	0	11	***11***
Cu, Dis (µg/l)	0	2.7	2.7	0	29	***29***
Fe, TR (µg/l)	0	2.7	2.7	0	1000	***1000***
Pb, Dis (µg/l)	0	2.7	2.7	0	11	***11***
Mn, Dis (µg/l)	0	2.7	2.7	0	255	***255***
Mo, TR (µg/l)	0	2.7	2.7	0	160	***160***
Hg, Tot (µg/l)	0	2.7	2.7	0	0.01	***0.01***
Ni, TR (µg/l)	0	2.7	2.7	0	100	***100***
Ni, Dis (µg/l)	0	2.7	2.7	0	168	***168***
Se, Dis (µg/l)	0	2.7	2.7	0	4.6	***4.6***
Ag, Dis (µg/l)	0	2.7	2.7	0	0.81	***0.81***
U, TR (µg/l)	0	2.7	2.7	0	16.8	***30***
U, Dis (µg/l)	0	2.7	2.7	0	6915	***6915***
Zn, Dis (µg/l)	0	2.7	2.7	0	428	***428***
B, Tot (mg/l)	0	2.7	2.7	0	0.75	***0.75***
Chloride (mg/l)	0	2.7	2.7	0	250	***250***
Sulfide as H2S (mg/l)	0	2.7	2.7	0	0.002	***0.002***
Radium 226+228 pCi/l	0	2.7	2.7	0	5	***5***
Thallium, TR (ug/l)	0	2.7	2.7	0	0.24	***0.24***

Table A-7h
Acute WQBELs – The Wetlands, Segment COSJDO05A

Parameter	Q_1 (cfs)	Q_2 (cfs)	Q_3 (cfs)	M_1	M_3	M_2
Temp Daily Max (°C) June-Sept	0	2.7	2.7	NA	21.7	***21.7***
Temp Daily Max (°C) Oct-May	0	2.7	2.7	NA	13.0	***13***
Al, TR (µg/l)	0	2.7	2.7	0	10071	***10071***
As, Dis (µg/l)	0	2.7	2.7	0	340	***340***
Cd, TR (µg/l)	0	2.7	2.7	0	5	***5***
Cd, Dis (µg/l)	0	2.7	2.7	0	5.7	***5.7***
Cr, TR (µg/l)	0	2.7	2.7	0	50	***50***
Cr+3, TR (µg/l)	0	2.7	2.7	0	50	***50***
Cr+3, Dis (µg/l)	0	2.7	2.7	0	1773	***1773***
Cr+6, Dis (µg/l)	0	2.7	2.7	0	16	***16***
Cu, Dis (µg/l)	0	2.7	2.7	0	50	***50***
CN, Free (µg/l)	0	2.7	2.7	0	5	***5***

Pb, TR (µg/l)	0	2.7	2.7	0	50	***50***
Pb, Dis (µg/l)	0	2.7	2.7	0	281	***281***
Mn, Dis (µg/l)	0	2.7	2.7	0	4738	***4738***
Ni, Dis (µg/l)	0	2.7	2.7	0	1513	***1513***
Se, Dis (µg/l)	0	2.7	2.7	0	18.4	***18***
Ag, Dis (µg/l)	0	2.7	2.7	0	22	***22***
U, Dis (µg/l)	0	2.7	2.7	0	11070	***11070***
Zn, Dis (µg/l)	0	2.7	2.7	0	564	***564***

Whole Effluent Toxicity (WET) Testing

The Water Quality Control Division has established the use of WET testing as a method for identifying and controlling toxic discharges from wastewater treatment facilities. WET testing is being utilized as a means to ensure that there are no discharges of pollutants "in amounts, concentrations or combinations which are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life" as required by Section 31.11 (1) of the Basic Standards and Methodologies for Surface Waters. The requirements for WET testing are being implemented in accordance with Division policy, Implementation of the Narrative Standard for Toxicity in Discharge Permits Using Whole Effluent Toxicity (Sept 30, 2010). Note that this policy has recently been updated and the permittee should refer to this document for additional information regarding WET.

In-Stream Waste Concentration (IWC) – Where monitoring or limitations for WET are deemed appropriate by the Division, the chronic in-stream dilution is critical in determining whether acute or chronic conditions shall apply. In accordance with Division policy, for those discharges where the chronic IWC is greater than 9.1% and the receiving stream has a Class 1 Aquatic Life use or Class 2 Aquatic Life use with all of the appropriate aquatic life numeric standards, chronic conditions will normally apply. Where the chronic IWC is less than or equal to 9.1, or the stream is not classified as described above, acute conditions will normally apply. The chronic IWC is determined using the following equation:

IWC = [Facility Flow (FF)/(Stream Chronic Low Flow (annual) + FF)] X 100%

The flows and corresponding IWC for the appropriate discharge point are:

Receiving Water/Season	Chronic Low Flow, 30E3 (cfs)	Facility Design Flow (cfs)	IWC, (%)
The Dolores River May 1- Aug 31	9	2.7	23
The Dolores River Sept 1- Ap 30	5.4	2.2	29
The Dolores River- Non Seasonal	5.4	2.7	33
The Wetlands	0	2.7	100

The Dolores River

The IWC for the season May through August is 23 %, which represents a wastewater concentration of 23% effluent to 77 % receiving stream. The IWC for the season September through April is 29 %, which represents a wastewater concentration of 29 % effluent to 71 % receiving stream. These IWCs correlate to chronic WET testing. Note that if the frequency of WET testing is quarterly in a permitting action, the IWC for the quarter will be set to the most stringent month during that quarter.

In the event a non-seasonal permit is applied, The IWC is 33%, which represents a wastewater concentration of 33% effluent to 67% receiving stream. This IWC correlates to chronic WET testing.

The Wetlands
The IWC is 100 %, which represents a wastewater concentration of 100% effluent to 0 % receiving water. This IWC correlates to chronic WET testing.

Agricultural Use Parameters (SAR and EC):

Section 31.11(1)(a)(iv) of *The Basic Standards and Methodologies for Surface Waters* (Regulation No. 31) includes the narrative standard that State surface waters shall be free of substances that are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life. The interpretation of these conditions (i.e., "no harm to plants" and "no harm to the beneficial uses") and how they were to be applied in permits were contemplated by the Division as part of an Agricultural Work Group, and culminated in the most recent policy entitled *Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops* (hereafter the Ag Policy)

Based on available information, the water in **The Dolores River,** downstream from the town of Rico is used for irrigation water. At the confluence of Bear Creek and the Dolores river, several fields are irrigated for grass hay. The evaluation of the suitability (i.e., quality) of irrigation water is complex and involves the detailed understanding of the interactions of plant tolerances, soil types, and agricultural management practices. Irrigation water has two properties – salinity and sodicity – that can have concurrent impacts on the irrigated crop beneficial use. The Division has thus determined that two parameters, specifically electrical conductivity (EC) and sodium absorption ratio (SAR), are the best parameters to regulate in discharge permits to control levels of salts to minimize both the loss of irrigated crop yield and the sodium hazard.

In order to establish "standards" and limits for EC and SAR, the Division must: (1) determine the most sensitive crop usually grown in the area downstream from the discharge and determine the corresponding EC of irrigation water (EC_w) threshold value for no reduction in yield below100%; and (2) determine the SAR based on the EC_w value, with consideration of existing water quality, to prevent the exceedance of the SAR.

Electrical Conductivity: The electrical conductivity (EC) is also known as specific conductance, conductance, conductivity, or specific conductivity. Crops have varying sensitivity to electrical conductivity. Studies have established the maximum conductivity in the water in the root zone that will result in no reduction of crop yield. This value is referred to as the EC saturation extract or EC_e. However, the EC_e is not the same as the EC of the irrigation water (EC_w). The EC_w is the maximum conductivity in the irrigation water that will result in no reduction in crop yield.

Common crop EC_w thresholds are reproduced from the Ag Policy, and are summarized in Table A-9a. Note that other EC_w are listed in tables in appendixes to the Ag Policy.

Table A-9a **Maximum EC_w That Will Not Reduce The 100% Yield of Selected Irrigated Crops**	
Common Colorado Crops	***Irrigation Water Electrical Conductivity (EC_w)***
Beans	0.7
Onion	0.8
Corn (grain)	1.1
Potato	1.1
Corn (silage)	1.2
Alfalfa	1.3
Orchard Grass	1.5
Wheat	4.0
Sugarbeet	4.7
Barley	5.3

The EC_w that is used in the development of permit limits is determined based on the most sensitive of the EC_w's for the crops grown in the area. Based on available information, for waters originating from **The Dolores River** and used for crop irrigation, orchard grass was determined to be the most sensitive crop.

For **the Dolores River**, the EC limit is calculated using the mass balance equation found at the beginning of Section IV of this analysis. The data used and the resulting calculations of the EC limit, M_2, are set forth in the table below. Note that in accordance with the Ag Policy, the EC limit will be imposed as a chronic (30-day average) limit and therefore chronic low flows were used together with 85th percentile EC concentrations when calculating the limit.

May 1- August 31

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***
EC (dS/m)	9	2.7	11.7	0.3	1.5	***5.5***

September 1- April 30

Parameter	***Q_1 (cfs)***	***Q_2 (cfs)***	***Q_3 (cfs)***	***M_1***	***M_3***	***M_2***
EC (dS/m)	5.4	2.2	7.6	0.3	1.5	***4.4***

Note that in Figure A-2 at an EC value of 0.36 or less, the SAR must be 0. In order to achieve a 0 SAR, any treatment process would have to eliminate all sodium, which is virtually impossible. Therefore, a minimum EC at 0.36 will be instigated in the permit.

SAR – SAR means Sodium Adsorption Ratio, which is a representation of the relative proportion of sodium cations to calcium and magnesium cations (also known as the "sodium hazard"). The equation for SAR follows:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

The values for sodium (Na^+), calcium (Ca^{++}) and magnesium (Mg^{++}) in this equation are expressed in units of milliequivalents per liter (meq/l). Generally, data for sodium, calcium and magnesium are reported in terms of mg/l, which must then be converted to calculate the SAR. The conversions are:

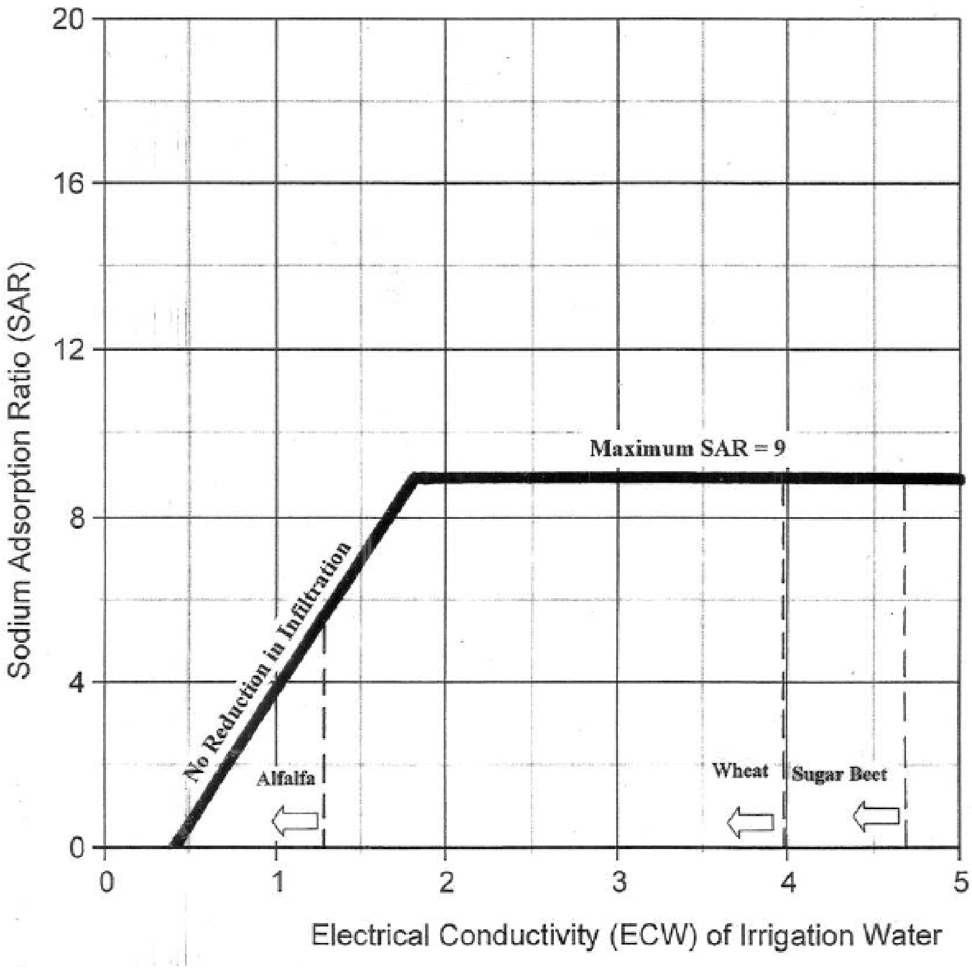
$$\text{meq/l} = \frac{Concentration\ in\ mg/l}{Equivalent\ weight\ in\ mg/meq}$$

Where the equivalent weights are determined based on the atomic weight of the element divided by the ion's charge:

Na^+ = 23.0 mg/meq (atomic weight of 23, charge of 1)
Ca^{++} = 20.0 mg/meq (atomic weight of 40.078, charge of 2)
Mg^{++} = 12.15 mg/meq (atomic weight of 24.3, charge of 2)

The SAR standard is established using the SAR/EC equation, shown graphically in Figure A-2, which is reproduced herein from the Ag Policy. Since the allowable SAR value is tied to the actual EC of the effluent, the EC/SAR equation (SAR = (7.1 * EC) – 2.48) will be the SAR limit in the permit, however the allowable SAR of the effluent will be capped at the value above or 9, whichever is less. Due to the effect of bicarbonate on the available calcium and magnesium, limitations may be expressed as adjusted SAR, which accounts for bicarbonate in the effluent. This is applicable if bicarbonate in the effluent is 150 mg/l or greater.

Figure A-2: Relative Rate of Water Infiltration as Affected by EC_w and SAR with Modification to Show Upper Limit for SAR = 9



VII. Antidegradation Evaluation

As set out in *The Basic Standards and Methodologies for Surface Water*, Section 31.8(2)(b), an antidegradation analysis is required except in cases where the receiving water is designated as "Use Protected." Note that "Use Protected" waters are waters "that the Commission has determined do not warrant the special protection provided by the outstanding waters designation or the antidegradation review process" as set out in Section 31.8(2)(b). The antidegradation section of the regulation became effective in December 2000, and therefore antidegradation considerations are applicable to this PEL analysis.

According to the *Regulation No. 34- Classifications and Numeric Standards for San Juan River and Dolores River Basins*, stream segments COSJDO03/5A are Undesignated (Reviewable). Thus, an antidegradation review is required for this segment if new or increased impacts are found to occur.

DOLORES RIVER WATER SUPPLY – Dissolved Iron, Dissolved Manganese, and Sulfate

The Water Quality Control Commission completed a final action for *The Basic Standards and Methodologies for Surface Water, Regulation 31* which became effective January 1, 2017. The final action exempts dissolved iron, dissolved manganese, and sulfate from antidegradation consideration on the basis that this level of protection extends to standards that protect "fishable/swimmable" uses, and not water supply uses. Dissolved iron, dissolved manganese and sulfate are based on secondary Safe Drinking Water Act criteria and are not surrogates for any swimmable criteria, and are therefore exempt from further antidegradation review. This WQA has been developed in conformance with the preliminary final action, as any permitting action based on this WQA would take effect just prior to the effective date of this regulation.

Introduction to the Antidegradation Process

The antidegradation process conducted as part of this Preliminary Effluent Limitations is designed to determine if an antidegradation review is necessary and if necessary, to complete the required calculations to determine the limits that can be selected as the antidegradation-based effluent limit (ADBEL), absent further analyses that must be conducted by the facility.

As outlined in the *Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance* (AD Guidance), the first consideration of an antidegradation evaluation is to determine if new or increased impacts are expected to occur. This is determined by a comparison of the newly calculated WQBELs verses the existing permit limitations in place as of September 30, 2000, and is described in more detail in the analysis. Note that the AD Guidance refers to the permit limitations as of September 30, 2000 as the existing limits.

If a new or increased impact is found to occur, then the next step of the antidegradation process is to go through the significance determination tests. These tests include: 1) bioaccumulative toxic pollutant test; 2) temporary impacts test; 3) dilution test (100:1 dilution at low flow) and; 4) a concentration test.

As the determination of new or increased impacts, and the bioaccumulative and concentration significance determination tests require more extensive calculations, the Division will begin the antidegradation evaluation with the dilution and temporary impact significance determination tests. These two significance tests may exempt a facility from further AD review without the additional calculations.

Note that the antidegradation requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. The appropriate standards are used in the following antidegradation analysis.

Significance Tests for Temporary Impacts and Dilution

The ratio of the chronic (30E3) low flow to the design flow is less than the 100:1 significance criteria. Therefore this facility is not exempt from an AD evaluation based on the dilution significance determination test, and the AD evaluation must continue.

For the determination of a new or increased impact and for the remaining significance determination tests, additional calculations are necessary. Therefore, at this point in the antidegradation evaluation, the Division will go back to the new or increased impacts test. If there is a new or increased impact, the last two significance tests will be evaluated.

New or Increased Impact and Non Impact Limitations (NILs)

To determine if there is a new or increased impact to the receiving water, a comparison of the new WQBEL concentrations and loadings verses the concentrations and loadings as of September 30, 2000, needs to occur. If either the new concentration or loading is greater than the September 2000 concentration or loading, then a new or increased impact is determined. If this is a new facility (commencement of discharge after September 30, 2000) it is automatically considered a new or increased impact.

Note that the AD Guidance document includes a step in the New or Increased Impact Test that calculates the Non-Impact Limit (NIL). The permittee may choose to retain a NIL if certain conditions are met, and therefore the AD evaluation for that parameter would be complete. As the NIL is typically greater than the ADBAC, and is therefore the chosen limit, the Division will typically conclude the AD evaluation after determining the NIL. Where the NILs are very stringent, or upon request of a permittee, the Division will calculate both the NIL and the AD limitation so that the limitations can be compared and the permittee can determine which of the two limits they would prefer, one which does not allow any increased impact (NIL), or the other which allows an insignificant impact (AD limit).

The non impact limit (NIL) is defined as the limit which results in no increased water quality impact (no increase in load or limit over the September 2000 load or limit). The NIL is calculated as the September 2000 loading, divided by the increased design flow (if applicable), and divided by a conversion factor of 8.34. If there is no change in design flow, or if there is a decrease in design flow, then the NIL is equal to the September 2000 permit limitation.

If the facility was in place, but did not have a limitation for a particular parameter in the September 2000 permit, the Division may substitute an implicit limitation. Consistent with the First Update to the AD Guidance of April 2002, an implicit limit is determined based on the approach that specifies that the implicit limit is the maximum concentration of the effluent from October 1998 to September 2000, if such data is available. If this data is unavailable, the Division may substitute more recent representative data, if appropriate, on a case by case basis. Note that if there is a change in design flow, the implicit limit/loading is subject to recalculation based on the new design flow. For parameters that are undisclosed by the permittee, and unknown to the Division to be present, an implicit limitation may not be recognized. Note that there is not a current permit for the St. Louis Tunnel discharge.

This facility was in place and discharging to the Delores River prior to September 30, 2000 (CO0029793), and therefore the new or increased impacts test must be conducted. The design flow of this facility has decreased from 2.6 MGD (4 cfs) during the AD period, to 1.74 MGD (2.7 cfs).

<u>NILs- TR Cadmium and TR Lead</u>
For total recoverable cadmium and total recoverable lead, the limitations of September 2000, 0.4 ug/l and 9.9 ug/l, respectively, were used in the evaluation of new or increased impacts. The remaining permit limits were in 'total recoverable' form, and not in the current 'dissolved' form so could not be used for NILs.

<u>Implicit NILs</u>
For total recoverable arsenic, dissolved arsenic, potentially dissolved Cadmium, chloride, Dissolved trivalent and hexavalent chromium, potentially dissolved copper, cyanide, total recoverable iron, potentially dissolved lead, potentially dissolved manganese, potentially dissolved nickel, potentially dissolved selenium, potentially dissolved silver, and potentially dissolved zinc, data prior to 2000 were either not available, or very limited (data was available for dissolved Mn only prior to 2000), as the permit limitations and monitoring at that time was in 'total' form. Therefore,

data from October 1999 through January 2006 were determined to be representative of the AD period, and were used to determine the implicit limitations. This period of record is representative because there were no water quality changes to the watershed nor were there any changes to the effluent quality since before September 30, 2000. The data summary for the implicit NILs based on this data is shown below. Note, the standard deviation is included simply to show the variability in the data, and because this was shown in the previous 2008 WQA.

Parameter	Count	Min of Monthly Avg's	Max of Monthly Avg's	Std. Dev. of Monthly Avg's
Arsenic, TR (µg/l)	2	<0.5	0	0
Arsenic, Dis (µg/l)	4	<2	0	0
Cadmium, Pd (ug/l)	18	1.8	84.8	19.16576949
Chromium, Dis (µg/l)	5	<0.1	0	0
Copper. Pd (ug/l)	18	<10	20.4	7.491424291
Cyanide, Tot (mg/l)	7	<0.005	0	0
Iron, TR (µg/l)	30	<20	1410	453.4167981
Lead, Pd (ug/l)	18	<0.1	32	7.409031849
Manganese, Pd (ug/l)	18	312	4110	868.8688763
Mercury, Tot (µg/l)	13	<0.0002	0.0004	0.000149786
Nickel, Pd (ug/l)	14	<18.6	80	21.20128547
Selenium, Pd (ug/l)	15	<8	0.9	0.28149262
Silver, Pd (ug/l)	17	<1	0.06	0.014552138
Zinc, Pd (ug/l)	17	410	14500	3399.145005
Chloride (mg/l)	5	<8	0.9	0.402492236

No Data
For total recoverable aluminum, potentially dissolved antimony, total recoverable beryllium, total recoverable trivalent chromium, total recoverable molybdenum, total recoverable nickel, total recoverable uranium, potentially dissolved uranium, boron, sulfide, radium 226+228, strontium and thallium, there are no effluent data available and therefore, the Division will calculate the ADBACs.

Calculation of Loadings for New or Increased Impact Test

The equations for the loading calculations are given below. Note that the AD requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the AD review; however, where there is only an acute standard, the acute standard should be used. Thus, the chronic low flows will be used later in this AD evaluation for all parameters with a chronic standard, and the acute low flows will be used for those parameters with only an acute standard.

$$\text{Previous permit load} = M_{permitted}\ (mg/l) \times Q_{permitted}\ (mgd) \times 8.34$$
$$\text{New WQBELs load} = M_2\ (mg/l) \times Q_2\ (mgd) \times 8.34$$

Where,

$M_{permitted}$ = September 2000 permit limit (or implicit limit) **(mg/l)**
$Q_{permitted}$ = design flow as of September 2000 **(mgd)**
Q_2 = current design flow (same as used in the WQBEL calculations)
M_2 = new WQBEL concentration **(mg/l)**
8.34 = unit conversion factor

Table A-10 shows the results of these calculations and the determination of a new or increased impact.

Table A-10a

Determination of New or Increased Impacts- The Dolores River

Pollutant	Sept 2000 Permit Limit	Sept 2000 Permit Load (lbs/day)	NIL or Implicit NIL	New WQBEL	New WQBEL Load (lbs/day)	New or Increased Impact
As, TR (µg/l)	NA	NA	0	0.06	0.00087	Yes
As, Dis (µg/l)	NA	NA	0	793	12	Yes
Cd, TR (µg/l)	0.4	0.0087	0.4	12	0.17	Yes
Cd, Dis (µg/l)	NA	NA	85	2.3	0.033	No
Cr+3, Dis (µg/l)*	NA	NA	0*	411	6	Yes
Cr+6, Dis (µg/l)*	NA	NA	0*	33	0.48	Yes
Cu, Dis (µg/l)	NA	NA	20	48	0.7	Yes
CN, Tot (µg/l)	NA	NA	0	12	0.19	Yes
Fe, TR (µg/l)	NA	NA	1410	2826	41	Yes
Pb, TR (µg/l)	9.9	0.21	9.9	150	2.2	Yes
Pb, Dis (µg/l)	NA	NA	32	13	0.19	No
Mn, Dis (µg/l)	NA	NA	4110	719	10	No
Hg, Tot (µg/l)	NA	NA	0.0004	0.03	0.00044	Yes
Ni, Dis (µg/l)	NA	NA	80	292	4.2	Yes
Se, Dis (µg/l)	NA	NA	0.9	13	0.19	Yes
Ag, Dis (µg/l)	NA	NA	0.06	0.72	0.01	Yes
Zn, Dis (µg/l)	NA	NA	14500	707	10	No
Chloride (mg/l)	NA	NA	0.9	745	10811	Yes

*Data based on the unspeciated (total) form of dissolved chromium

As shown in Table A-10a, there are no new or increased impacts to the receiving stream based on the new WQBELS for dissolved cadmium, dissolved lead, dissolved manganese and dissolved zinc, and for these parameters the AD evaluation is complete and the WQBELs are the final result of this PEL.

For the remaining parameters in the table above, there are new or increased impacts and in accordance with regulation, the permittee has the option of choosing either the NIL's or ADBAC's. Normally, the Division would assign the NILs as permit limitations, or prescribe monitoring to determine the appropriate implicit limitations as necessary, however, in this case, the NILs are very stringent for some parameters and for purposes of this PEL, the Division will calculate the ADBACs for comparison.

Table A-10b

Determination of New or Increased Impacts- The Wetlands

Pollutant	*Sept 2000 Permit Limit*	*Sept 2000 Permit Load (lbs/day)*	*NIL or Implicit NIL*	*New WQBEL*	*New WQBEL Load (lbs/day)*	*New or Increased Impact*
As, TR (µg/l)	NA	NA	0	0.02	0.00029	Yes
As, Dis (µg/l)	NA	NA	0	340	4.9	Yes
Cd, TR (µg/l)	0.4	0.0087	0.4	5	0.073	Yes
Cd, Dis (µg/l)	NA	NA	85	1.2	0.017	No
Cr+3, Dis (µg/l)	NA	NA	0*	137	2	Yes
Cr+6, Dis (µg/l)	NA	NA	0*	11	0.16	Yes
Cu, Dis (µg/l)	NA	NA	20	29	0.42	Yes
CN, Tot (µg/l)	NA	NA	0	13	0.19	Yes
Fe, TR (µg/l)	NA	NA	1410	1000	15	No
Pb, TR (µg/l)	9.9	0.21	9.9	50	0.73	Yes
Pb, Dis (µg/l)	NA	NA	32	11	0.16	No
Mn, Dis (µg/l)	NA	NA	4110	255	3.7	No
Hg, Tot (µg/l)	NA	NA	0.0004	0.01	0.00015	Yes
Ni, Dis (µg/l)	NA	NA	80	168	2.4	Yes
Se, Dis (µg/l)	NA	NA	0.9	4.6	0.067	Yes
Ag, Dis (µg/l)	NA	NA	0.06	0.81	0.012	Yes
Zn, Dis (µg/l)	NA	NA	14500	428	6.2	No
Chloride (mg/l)	NA	NA	0.9	250	3628	Yes

*Data based on the unspeciated (total) form of dissolved chromium

As shown in Table A-10b, there are no new or increased impacts to the receiving stream based on the new WQBELS for dissolved cadmium, total recoverable iron, dissolved lead, dissolved manganese and dissolved zinc, and for these parameters the AD evaluation is complete and the WQBELs are the final result of this PEL.

For the remaining parameters in the table above, there are new or increased impacts and in accordance with regulation, the permittee has the option of choosing either the NIL's or ADBAC's. Normally, the Division would assign the NILs as permit limitations, or prescribe monitoring to determine the appropriate implicit limitations as necessary, however, in this case, the NILs are very stringent for some parameters and for purposes of this PEL, the Division will calculate the ADBACs for comparison.

The final two significance determination tests (bioaccumulative and concentration) need to be applied, to determine if AD limits are applicable. For the bioaccumulative test, the determination of the baseline water quality (BWQ), the baseline water quality loading (BWQload), the threshold load (TL) and the threshold load concentration (TL conc) needs to occur. For the concentration test, the BWQ, significant concentration thresholds (SCT) and antidegradation based average concentrations (ADBACs) need to be calculated. These calculations are explained in the following sections, and each significance determination test will be performed as the necessary calculations are complete. The AD low flow may also need to be calculated when determining the BWQ for an existing discharger (as of Sept 2000) when upstream water quality data are used.

<u>Determination of Baseline Water Quality (BWQ)</u>

The BWQ is the ambient condition of the water quality as of September 30, 2000. The BWQ defines the baseline low flow pollutant concentration, and for bioaccumulative toxic pollutants, the baseline load. The BWQ is to take into account the influence of the discharger if the discharge was in place prior to September 30, 2000. In such a case, data from a downstream location should be used to determine the BWQ. If only upstream data is available, then a mass balance equation may be applied, using the facilities effluent data to determine the BWQ. If the discharge was not present prior to September 30, 2000, then the influence of that discharge would not be taken into account in determining the BWQ. If the BWQ has already been determined in a previous PEL AD evaluation, it may not need to be recalculated as the BWQ is the water quality as of September 30, 2000, and therefore should not change unless additional data is obtained or the calculations were in error.

Dolores River, BWQ-Previous WQA

The BWQ concentrations were correctly determined for the Dolores River for dissolved hexavalent chromium (based on unspeciated dissolved chromium data), total recoverable trivalent chromium (based on unspeciated total chromium data), dissolved copper, cyanide, total recoverable iron, dissolved nickel, dissolved selenium, and dissolved silver potential pollutants of concern as part of a previous WQA (2008). These are summarized in Table A-11a.

Table A-11a

Dolores River- BWQ Concentrations Based on Previous Determinations

Pollutant	*BWQ (µg/l)*
Cr+6, Dis	0.05
Cr+3, Trec	0.54
Cu, Dis	1.24
CN, Free	0
Fe, Trec	250
Ni, Dis	0
Se, Dis	0.92
Ag, Dis	0

For the remaining parameters, consistent with Division procedures, the BWQ concentrations should be established so that it can be used as part of an antidegradation review.

Dolores River, BWQ (remaining parameters)

This discharger was in place as of September 30, 2000, and therefore the BWQ will include the influence of the discharger. Data collected at DR-7 (the same as sampling location COSJDO03-1.4, 2008 WQA) located just downstream from the pond outfall, were determined to be representative of fully mixed condition downstream from the facility, without other influences, and thus the data were used to determine the BWQ concentrations. Since the data were collected downstream of the discharge, it takes into account the contribution of the facility.

Currently, it is the Division’s approach to evaluate five years of ambient water quality data, if available, for the five years prior to September 30, 2000, when determining the BWQ. However, due to very limited data (between 1-4 data points) available during the timeframe of September 30, 1995 through September 30, 2000, the period of record was expanded, from April 1998 through January 2006 for most pollutants. Although these data were not collected during the five years prior to September 2000, the Division has determined that, absent data available during the AD period, the available data are considered representative of the BWQ during the AD period. There have been no water quality changes to the watershed during this time, nor have there been any changes to the effluent quality since before September 2000. Using an expanded period of record, with a more robust data set more accurately characterizes the baseline water quality. Data for total recoverable aluminum, total recoverable beryllium and total recoverable thallium were not available during the AD timeframe, and data closest to the AD period was from April 2011 through February 2014. Data for potentially dissolved antimony was available from March 2012 through February 2014. Data for total recoverable molybdenum was available from June 2012 through February 2014. Data for sulfide was available from June 2012 through May 2018. A longer data set in the instance of sulfide was deemed acceptable as all data was non-detect. Absent data available during the AD period, the available data are considered representative of the BWQ during the AD period. For the remaining parameters, there is no ambient water quality data available from any timeframe (e.g. Radium 226+228 pCi/l).

These ambient water quality data are summarized in Table A-11b. The BWQ concentrations based on these data, represented by the 50th percentile for total recoverable metals and total metals, and the 85th percentile for dissolved metals and other pollutants, are summarized in Table A-11c. Note that in some cases samples were available in potentially dissolved and dissolved on the same day. In those instances, the potentially dissolved values were used in determining the BWQ.

Table A-11b

Ambient Water Quality Data Summary for AD Period- Dolores River

Parameter	*No. of Samples*	*15th Percentile*	*50th Percentile*	*85th Percentile*	*Mean*	*Location*
Al, TR (µg/l)	32	17	61	317	153	Downstream
Sb, Dis (µg/l)	21	0	0	0.083	0.045	Downstream
As, TR (µg/l)	4	0	0.25	0.78	0.38	Downstream
Be, TR (µg/l)	30	0	0.2	0.2	0.11	Downstream
Cd, TR (µg/l)	4	0.75	0.9	1	0.88	Downstream
Cr, TR (µg/l)	12	0	0	0.62	0.31	Downstream
Cr, Dis (µg/l)	4	0	0	0.11	0.05	Downstream
Pb, TR (µg/l)	6	0.075	0.15	0.8	0.53	Downstream
Mo, TR (µg/l)	20	0.96	1.8	2.8	1.9	Downstream
Hg, Tot (µg/l)	11	0	0.0003	0.00085	0.001	Downstream
Ni, TR (µg/l)*	16	0	0	0	0	Downstream
Chloride (mg/l)	4	0	0.55	1.2	0.6	Downstream
Sulfide as H2S (mg/l)	30	0	0	0	0	Downstream
Thallium, TR (ug/l)	32	0	0	0	0	Downstream

*dissolved data used in the absence of total data

Table A-11c

BWQ Concentrations for Potential Pollutants of Concern Based on Downstream Ambient Water Quality Concentrations- Dolores River

Pollutant	*BWQ*	*WQS*
Al, TR (µg/l)	61	87
Sb, Dis (µg/l)	0.083	5.6
As, TR (µg/l)	**0.25**	0.02
Be, TR (µg/l)	0.2	4

Cd, TR (µg/l)	0.9	5
Cr+3, Dis (µg/l)	0.11	137
Pb, TR (µg/l)	0.15	50
Mo, TR (µg/l)	1.8	160
Hg, Tot (µg/l)	0.0003	0.01
Ni, TR (µg/l)	0	100
Se, Dis (µg/l)	0.92	4.6
Chloride (mg/l)	1.2	250
Sulfide as H2S (mg/l)	0	0.002
Thallium, TR (ug/l)	0	0.24

In cases where the BWQ concentration exceeds the water quality standard, the calculated BWQ concentration must then be set equal to the water quality standard. This occurred for total recoverable arsenic.

The Wetlands, BWQ

This discharger was in place as of September 30, 2000, and therefore the BWQ will include the influence of the discharger. Data collected at DR-6 (the St. Louis settling pond outfall) located at the last treatment pond were determined to be representative of the wetlands water quality with the influence of the discharge, during the AD period. Thus the data were used to determine the BWQ concentrations for a discharge into the wetlands. Since the data were collected at the end of the treatment of the discharge, it takes into account the contribution of the facility.

Currently, it is the Division's approach to evaluate five years of ambient water quality data, if available, for the five years prior to September 30, 2000, when determining the BWQ. However, due to very limited data (between 1-4 data points) available during the timeframe of September 30, 1995 through September 30, 2000, the period of record was expanded, from October 1999 through January 2006 for most pollutants. Although these data were not collected during the five years prior to September 2000, the Division has determined that, absent data available during the AD period, the available data are considered representative of the BWQ during the AD period. There have been no water quality changes to the watershed during this time, nor have there been any changes to the discharge since before September 2000. Using an expanded period of record, with a more robust data set more accurately characterizes the baseline water quality. Data were available for arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, chloride, cyanide,nickel, selenium, silver and zinc. For the remaining parameters, there is no ambient water quality data available.

These ambient water quality data are summarized in Table A-11d. The BWQ concentrations based on these data, represented by the 50th percentile for total recoverable metals and total metals, and the 85th percentile for dissolved metals and other pollutants, are summarized in Table A-11e.

Table A-11d

Ambient Water Quality Data Summary for AD Period- The Wetlands

Parameter	*Number of Samples*	*15th Percentile*	*50th Percentile*	*85th Percentile*	*Mean*	*Location*	*Notes*
As, TR (µg/l)	7	0	0	0.14	0.2	Effluent	1
As, Dis (µg/l)	5	0	0	0.56	0.28	Effluent	

Cd, TR (µg/l)	15	8	11	17	18	Effluent	
Cr, TR (µg/l)	15	0	0.0016	0.2	0.093	Effluent	
Cr, Dis (µg/l)	5	0	0	0	0	Effluent	
Cu, Dis (µg/l)	38	0	3.1	12	5.3	Effluent	
CN, Tot (µg/l)	7	0	0	0	0	Effluent	
Pb, TR (µg/l)	15	0.5	1.1	2	1.4	Effluent	
Hg, Tot (µg/l)	13	0	0	0.0003	0.00011	Effluent	
Ni, TR (µg/l)	29	0	0	7.3	2	Effluent	2
Ni, Dis (µg/l)	29	0	0	7.3	2	Effluent	
Se, Dis (µg/l)	29	0	0	0.48	0.24	Effluent	
Ag, Dis (µg/l)	37	0	0	0.03	0.015	Effluent	
Chloride (mg/l)	5	0	0	0.36	0.18	Effluent	

Note 1: Dissolved values included due to a lack of total data
Note 2: dissolved nickel data used in the absence of total data

Table A-11e

BWQ Concentrations for Potential Pollutants of Concern Based on Downstream Ambient Water Quality Concentrations- The Wetlands

Pollutant	*BWQ*	*WQS*
As, TR (µg/l)	0	0.02
As, Dis (µg/l)	0.56	340
Cd, TR (µg/l)	11	5
Cr, TR (µg/l)	0.0016	50
Cr+3, TR (µg/l)	0.0016	50
Cr+3, Dis (µg/l)	0	137
Cu, Dis (µg/l)	12	29
CN, Tot (µg/l)	0	5
Pb, TR (µg/l)	1.1	50
Hg, Tot (µg/l)	0	0.01
Ni, TR (µg/l)	0	100
Ni, Dis (µg/l)	7.3	168
Se, Dis (µg/l)	0.48	4.6
Ag, Dis (µg/l)	0.03	0.81
Chloride (mg/l)	0.36	250

Note that the AD requirements outlined in *The Basic Standards and Methodologies for Surface Water* specify that chronic numeric standards should be used in the antidegradation review; however, where there is only an acute standard, the acute standard should be used. Chronic standards were available for all pollutants except total recoverable trivalent chromium, total recoverable cadmium, total recoverable lead, and total recoverable nickel.

Bioaccumulative Significance Test

For mercury, the bioaccumulative significance test can now be completed with some minor additional calculations for the baseline water quality load (BWQload), the threshold load (TL), the new load based on the WQBELs, and the threshold load concentration (TL conc). These terms are defined by the following equations:

BWQload = BWQ (from Table A-11a or e) * AD low flow (chronic) * 8.34
Threshold Load (TL) = 0.1 * BWQload
Threshold Load Concentration (TL Conc) = TL ÷ new design flow ÷ 8.34
WQBEL Load = new WQBEL (concentration) * new design flow * 8.34

The discharge is considered to be insignificant if the new load (WQBEL load) is less than the threshold load (TL), or if the new WQBEL (concentration) is less than the TL Conc. The results of the calculations and the comparisons are shown in Table A-12.

Table A-12

Bioaccumulative Significance Test

Parameter	Threshold Load Concentration (TL Conc)	Threshold Load (TL)	WQBEL Conc	WQBEL Load
Mercury, Total (Delores)	$2.1X10^{-6}$	0.00003	0.00003 mg/l	0.00044
Mercury, Total (Wetlands)	0	0	0.00001 mg/l	0.00015

For mercury, the threshold load is less than the WQBEL load and the TL Conc is less than the WQBEL Concentration. The antidegradation review for this parameter will continue with the calculation of the SCT and ADBACs, in the same manner as the other non-bioaccumulative toxic pollutants.

Significant Concentration Threshold

The SCT is defined as the BWQ plus 15% of the baseline available increment (BAI), and is calculated by the following equation:

SCT = (0.15 × BAI) + BWQ

The BAI is the concentration increment between the baseline water quality and the water quality standard, expressed by the term (WQS – BWQ). Substituting this into the SCT equation results in:

SCT = 0.15 × (WQS-BWQ) + BWQ

Where,
WQS = Chronic standard or, in the absence of a chronic standard, the acute standard
BWQ = Value from Table A-11a, e, or c

When the BWQ concentration is equal to zero, the following equation results: *SCT = 0.15 × WQS*

Determination of the Antidegradation Based Average Concentrations

Antidegradation based average concentrations (ADBACs) are determined for all parameters except ammonia, by using the mass-balance equation, and substituting the SCT in place of the water quality standard, as shown in the following equation:

$$ADBAC = \frac{SCT \times Q_3 - M_1 \times Q_1}{Q_2}$$

Where,

Q_1 = Upstream low flow (1E3 or 30E3 based on either the chronic or acute standard)
Q_2 = Current design capacity of the facility
Q_3 = Downstream flow (Q_1 + Q_2)
M_1 = Current ambient water quality concentration (From Section III)
SCT = Significant concentration threshold

Wetlands
When Q_1 is equal to zero, Q_2 equals Q_3, and therefore the following equation results: *ADBAC = SCT*

The ADBACs were calculated using the SCTs, and are set forth in Table A-13a.

Table A-13a

SCTs and ADBACs – The Dolores River

Pollutant	*Q_1(cfs)*	*Q_2 (cfs)*	*Q_3 (cfs)*	*M_1*	*SCT*	*ADBAC*
Al, TR (µg/l)	5.4	2.7	8.1	79	65	37
Sb, Dis (µg/l)	5.4	2.7	8.1	0	0.91	2.7
As, TR (µg/l)	5.4	2.7	8.1	0	0.02	0.06
As, Dis (µg/l)	3.6	2.7	6.3	0	51	119
Be, TR (µg/l)	5.4	2.7	8.1	0	0.77	2.3
Cr+3, TR (µg/l)	3.6	2.7	6.3	0	8	19
Cr+3, Dis (µg/l)	5.4	2.7	8.1	0	21	63
Cr+6, Dis (µg/l)	5.4	2.7	8.1	0	1.7	5.1
CN, Free (µg/l)	3.6	2.7	6.3	0	0.75	1.8
Fe, TR (µg/l)	5.4	2.7	8.1	87	363	915
Pb, TR (µg/l)	3.6	2.7	6.3	0.1	7.6	18
Mo, TR (µg/l)	5.4	2.7	8.1	0.87	26	76
Hg, Tot (µg/l)	5.4	2.7	8.1	0	0.0018	0.0054
Ni, TR (µg/l)	5.4	2.7	8.1	0	15	45
Ni, Dis (µg/l)	5.4	2.7	8.1	0.88	15	43
Se, Dis (µg/l)	5.4	2.7	8.1	0.57	1.5	3.4
Ag, Dis (µg/l)	5.4	2.7	8.1	0.043	0.041	0.037
U, TR (µg/l)	5.4	2.7	8.1	0	2.5	7.5
U, Dis (µg/l)	5.4	2.7	8.1	0.25	515	1545
B, Tot (mg/l)	5.4	2.7	8.1	0	0.11	0.33
Chloride (mg/l)	5.4	2.7	8.1	2.6	39	112
Sulfide as H2S (mg/l)	5.4	2.7	8.1	0	0.0003	0.0009
Thallium, TR (µg/l)	5.4	2.7	8.1	0	0.036	0.11
Radium 226+228(pC/l)	5.4	2.7	8.1	0	0.75	2.3

FOR SCT > ADBAC: Based on these calculations, the ambient water quality exceeds the SCT for total recoverable aluminum and dissolved silver. Where an assimilative capacity is calculated to be less than the standard, the Division standard procedure is to allocate the water quality standard, which in this case is the SCT, to prevent degradation of the receiving stream.

Table A-13b
SCTs and ADBACs - The Wetlands

Pollutant	Q_1*(cfs)*	Q_2 *(cfs)*	Q_3 *(cfs)*	M_1	*SCT*	*ADBAC*
Al, TR (µg/l)	0	2.7	2.7	0	13	13
Sb, Dis (µg/l)	0	2.7	2.7	0	0.84	0.84
As, TR (µg/l)	0	2.7	2.7	0	0.003	0.003
As, Dis (µg/l)	0	2.7	2.7	0	51	51
Be, TR (µg/l)	0	2.7	2.7	0	0.6	0.6
Cd, TR (µg/l)	0	2.7	2.7	0	5	5
Cr+3, TR (µg/l)	0	2.7	2.7	0	7.5	7.5
Cr+3, Dis (µg/l)	0	2.7	2.7	0	21	21
Cr+6, Dis (µg/l)	0	2.7	2.7	0	1.7	1.7
Cu, Dis (µg/l)	0	2.7	2.7	0	15	15
CN, Tot (µg/l)	0	2.7	2.7	0	0.75	0.75
Pb, TR (µg/l)	0	2.7	2.7	0	8.4	8.4
Mo, TR (µg/l)	0	2.7	2.7	0	24	24
Hg, Tot (µg/l)	0	2.7	2.7	0	0.0015	0.0015
Ni, TR (µg/l)	0	2.7	2.7	0	15	15
Ni, Dis (µg/l)	0	2.7	2.7	0	31	31
Se, Dis (µg/l)	0	2.7	2.7	0	1.1	1.1
Ag, Dis (µg/l)	0	2.7	2.7	0	0.15	0.15
U, Dis (µg/l)	0	2.7	2.7	0	1037	1037
B, Tot (mg/l)	0	2.7	2.7	0	0.11	0.11
Chloride (mg/l)	0	2.7	2.7	0	38	38
Sulfide as H2S (mg/l)	0	2.7	2.7	0	0.0003	0.0003
Thallium, TR (ug/l)	0	2.7	2.7	0	0.036	0.036
Radium 226+228 (pCi/l)	0	2.7	2.7	0	0.75	0.75

Concentration Significance Tests

The concentration significance determination test considers the cumulative impact of the discharges over the baseline condition. In order to be insignificant, the new or increased discharge may not increase the actual instream concentration by more than 15% of the available increment over the baseline condition. The insignificant level is the ADBAC calculated in Tables A-13a and A-13b above. If the new WQBEL concentration (or potentially the TL Conc for bioaccumulatives) is greater than the ADBAC, an AD limit would be applied. This comparison is shown in Tables A-14a for the Dolores River and A-14b for the Wetlands.

Table A-14a

Concentration Significance Test- The Dolores River

Pollutant	*New WQBEL*	*ADBAC*	*Concentration Test Result*
Al, TR (µg/l)	103	37	Significant
Sb, Dis (µg/l)	17	2.7	Significant
As, TR (µg/l)	0.06	0.06	Insignificant
As, Dis (µg/l)	793	119	Significant

Be, TR (µg/l)	12	2.3	Significant
Cr+3, TR (µg/l)	117	19	Significant
Cr+3, Dis (µg/l)	411	63	Significant
Cr+6, Dis (µg/l)	33	5.1	Significant
CN, Free (µg/l)	12	1.8	Significant
Fe, TR (µg/l)	2826	915	Significant
Pb, TR (µg/l)	150	18	Significant
Mo, TR (µg/l)	478	76	Significant
Hg, Tot (µg/l)	0.03	0.0054	Significant
Ni, TR (µg/l)	300	45	Significant
Ni, Dis (µg/l)	292	43	Significant
Se, Dis (µg/l)	13	3.4	Significant
Ag, Dis (µg/l)	0.72	0.037	Significant
U, TR (µg/l)	50	7.5	Significant
U, Dis (µg/l)	10305	1545	Significant
B, Tot (mg/l)	2.3	0.33	Significant
Chloride (mg/l)	745	112	Significant
Sulfide as H2S (mg/l)	0.006	0.0009	Significant
Thallium, TR (ug/l)	0.72	0.11	Significant
Radium 226+228 (Pci/l)	15	2.3	Significant

For total recoverable arsenic, the WQBELs are equal to the ADBAC and therefore, the concentration test results in an insignificant determination. The WQBELs are the final result of this PEL for this parameter and AD limitations are not necessary. For the remaining parameters, the WQBELs are greater than the ADBACs and therefore, the concentration test results in a significance determination, and the antidegradation based effluent limitations (ADBELs) must be determined.

Table A-14b

Concentration Significance Test – The Wetlands

Pollutant	***New WQBEL***	***ADBAC***	***Concentration Test Result***
Al, TR (µg/l)	87	13	Significant
Sb, Dis (µg/l)	5.6	0.84	Significant
As, TR (µg/l)	0.02	0.003	Significant
As, Dis (µg/l)	340	51	Significant
Be, TR (µg/l)	4	0.6	Significant
Cd, TR (µg/l)	5	5	Insignificant
Cr+3, TR (µg/l)	50	7.5	Significant
Cr+3, Dis (µg/l)	137	21	Significant
Cr+6, Dis (µg/l)	11	1.7	Significant
Cu, Dis (µg/l)	29	15	Significant
CN, Free (µg/l)	5	0.75	Significant
Pb, TR (µg/l)	50	8.4	Significant
Mo, TR (µg/l)	160	24	Significant
Hg, Tot (µg/l)	0.01	0.0015	Significant
Ni, TR (µg/l)	100	15	Significant
Ni, Dis (µg/l)	168	31	Significant
Se, Dis (µg/l)	4.6	1.1	Significant
Ag, Dis (µg/l)	0.81	0.15	Significant

U, Dis (µg/l)	6915	1037	Significant
B, Tot (mg/l)	0.75	0.11	Significant
Chloride (mg/l)	250	38	Significant
Sulfide as H2S (mg/l)	0.002	0.0003	Significant
Thallium, TR (ug/l)	0.24	0.036	Significant
Radium 226+228 (pCi/l)	5	0.75	Significant

For total recoverable cadmium, the WQBEL is equal to the ADBAC and therefore, the concentration test results in an insignificant determination. The WQBELs are the final result of this PEL for this parameter and AD limitations are not necessary.

For the remaining parameters, the WQBELs are greater than the ADBACs and therefore, the concentration test results in a significance determination, and the antidegradation based effluent limitations (ADBELs) must be determined.

Antidegradation Based Effluent Limitations (ADBELs)

The ADBEL is defined as the potential limitation resulting from the AD evaluation, and may be either the ADBAC, the NIL, or may be based on the concentration associated with the threshold load concentration (for the bioaccumulative toxic pollutants). ADBACs, NILs and TLs have already been determined in the AD evaluation, and therefore to complete the evaluation, a final comparison of limitations needs to be completed.

Note that ADBACs and NILs are not applicable when the new WQBEL concentration (and loading as evaluated in the New and Increased Impacts Test) is less than the NIL concentration (and loading), or when the new WQBEL is less than the ADBAC.

Where an ADBAC or NIL applies, the permittee has the final choice between the two limitations. A NIL is applied as a 30-day average (and the acute WQBEL would also apply where applicable) while the ADBAC would be applied as a 2 year rolling average concentration. For the purposes of this PEL, the Division has made an attempt to determine whether the NIL or ADBAC will apply. The end results of this AD evaluation are in the tables below, including any parameter that was previously exempted from further AD evaluation, with the final potential limitation identified (NIL, WQBEL or ADBAC).

Table A-15a

Final Selection of WQBELs, NILs, and ADBACs- The Dolores River

Pollutant	*NIL*	*New WQBEL*	*ADBAC*	*Chosen Limit*
Al, TR (µg/l)	NA	103	37	ADBAC
Sb, Dis (µg/l)	NA	17	2.7	ADBAC
As, TR (µg/l)	0	0.06	0.06	WQBEL
As, Dis (µg/l)	0	793	119	ADBAC
Be, TR (µg/l)	NA	12	2.3	ADBAC
Cd, TR (µg/l)	0.4	12	3.5	ADBAC
Cd, Dis (µg/l)	85	2.3	NA	WQBEL
Cr+3, TR (µg/l)	NA	117	19	ADBAC
Cr+3, Dis (µg/l)	0	411	63	ADBAC
Cr+6, Dis (µg/l)	0	33	5.1	ADBAC

Cu, Dis (µg/l)	20	48	7.4	NIL
CN, Tot (µg/l)	0	12	1.8	ADBAC
Fe, TR (µg/l)	1410	2826	915	NIL
Pb, TR (µg/l)	9.9	150	18	ADBAC
Pb, Dis (µg/l)	32	13	NA	WQBEL
Mn, Dis (µg/l)	4110	719	NA	WQBEL*
Mo, TR (µg/l)	NA	478	76	ADBAC
Hg, Tot (µg/l)	0.0004	0.03	0.0054	ADBAC
Ni, TR (µg/l)	NA	300	45	ADBAC
Ni, Dis (µg/l)	80	292	43	NIL
Se, Dis (µg/l)	0.9	13	3.4	ADBAC
Ag, Dis (µg/l)	0.06	0.72	0.037	NIL
U, TR (µg/l)	NA	50	7.5	ADBAC
U, Dis (µg/l)	NA	10305	1545	ADBAC
Zn, Dis (µg/l)	14500	707	NA	WQBEL
B, Tot (mg/l)	NA	2.3	0.33	ADBAC
Chloride (mg/l)	0.9	745	112	ADBAC
Sulfide as H2S (mg/l)	NA	0.006	0.0009	ADBAC
Thallium, TR (µg/l)	NA	0.72	0.11	ADBAC
Radium 226+228(pC/l)	NA	15	2.3	ADBAC

*Note that the AD analysis was completed on the aquatic life value, the water supply WQBEL of 539 ug/l still applies

NILs

For dissolved copper, total recoverable iron, and dissolved silver the NILs have been established for this facility. The NILs were selected as they are less stringent than the ADBACs. NILs are implemented as 30-day averages. However, the facility has the final choice between the NILs and ADBACs, and if the ADBAC is preferred, the permit writer should be contacted.

ADBACs

For total recoverable aluminum, potentially dissolved antimony, dissolved arsenic, total recoverable beryllium, total recoverable cadmium, total recoverable and dissolved trivalent chromium, dissolved hexavalent chromium, cyanide, total recoverable lead, total recoverable molybdenum, total mercury, potentially dissolved selenium, total recoverable and dissolved uranium, boron, chloride, sulfide, total recoverable thallium, and radium 226+228 the ADBACs have been established for this facility. The ADBACs were selected as they are less stringent than the the NILs, or perhaps due to the application as a two-year rolling average. However, the facility has the final choice between the NILs and ADBACs, and if the ADBAC is preferred, the permit writer should be contacted.

WQBELs

As shown in Table A-14, there are no new or increased impacts to the receiving stream based on the new WQBELS for dissolved cadmium, dissolved lead, dissolved manganese and dissolved zinc, and for these parameters the WQBELs are the final result of this PEL.

Table A-15b

Final Selection of WQBELs, NILs, and ADBACs- The Wetlands

Pollutant	***NIL/Implicit NIL***	***New WQBEL***	***ADBAC***	***Chosen Limit***
Al, TR (µg/l)	NA	87	13	ADBAC

Sb, Dis (µg/l)	NA	5.6	0.84	ADBAC
As, TR (µg/l)	0	0.02	0.003	ADBAC
As, Dis (µg/l)	0	340	51	ADBAC
Be, TR (µg/l)	NA	4	0.6	ADBAC
Cd, TR (µg/l)	0.4	5	5	WQBEL
Cd, Dis (µg/l)	85	1.2	NA	WQBEL
Cr+3, TR (µg/l)	NA	50	7.5	ADBAC
Cr+3, Dis (µg/l)	0	137	21	ADBAC
Cr+6, Dis (µg/l)	0	11	1.7	ADBAC
Cu, Dis (µg/l)	20	29	15	NIL
CN, Tot (µg/l)	0	5	0.75	ADBAC
Fe, TR (µg/l)	1410	1000	NA	WQBEL
Pb, TR (µg/l)	9.9	50	8.4	NIL
Pb, Dis (µg/l)	32	11	NA	WQBEL
Mn, Dis (µg/l)	4110	255	NA	WQBEL
Mo, TR (µg/l)	NA	160	24	ADBAC
Hg, Tot (µg/l)	0.0004	0.01	0.0015	ADBAC
Ni, TR (µg/l)	NA	100	15	ADBAC
Ni, Dis (µg/l)	80	168	31	NIL
Se, Dis (µg/l)	0.9	4.6	1.1	ADBAC
Ag, Dis (µg/l)	0.06	0.81	0.15	ADBAC
U, Dis (µg/l)	NA	6915	1037	ADBAC
Zn, Dis (µg/l)	14500	428	NA	WQBEL
B, Tot (mg/l)	NA	0.75	0.11	ADBAC
Chloride (mg/l)	0.9	250	38	ADBAC
Sulfide as H2S (mg/l)	NA	0.002	0.0003	ADBAC
Thallium, TR (ug/l)	NA	0.24	0.036	ADBAC
Radium 226+228 (pCi/l)	NA	5	0.75	ADBAC

NILs
For dissolved copper, total recoverable lead, and dissolved nickel the NILs have been established for this facility. The NILs were selected as they are less stringent than the ADBACs. NILs are implemented as 30-day averages. However, the facility has the final choice between the NILs and ADBACs, and if the ADBAC is preferred, the permit writer should be contacted.

WQBELs
For total recoverable cadmium, dissolved cadmium, total recoverable iron, dissolved lead, dissolved manganese, and dissolved zinc, there are no new or increased impacts to the receiving stream based on the new WQBELS, and for these parameters the WQBELs are the final result of this PEL.

ADBACs
For the remaining parameters, the ADBACs have been established for this facility. The ADBACs were selected as they are less stringent than the NILs, or perhaps due to the application as a two-year rolling average. However, the facility has the final choice between the NILs and ADBACs, and if the ADBAC is preferred, the permit writer should be contacted.

VIII. Technology Based Limitations

Regulations for Effluent Limitations

Regulation No. 62, the Regulations for Effluent Limitations, includes effluent limitations that apply to all discharges of wastewater to State waters, with the exception of storm water and agricultural return flows. These regulations are applicable to the discharge from the proposed discharge.

Table A-16 contains a summary of the applicable limitations for pollutants of concern at this facility.

Table A-16

Regulation 62 Based Limitations

Parameter	***30-Day Average***	***7-Day Average***	***Instantaneous Maximum***
TSS	30 mg/l	45 mg/l	NA
pH	NA	NA	6.0-9.0 s.u.
Oil and Grease	NA	NA	10 mg/l

IX. References

Regulations:

The Basic Standards and Methodologies for Surface Water, Regulation 31, Colorado Department Public Health and Environment, Water Quality Control Commission, effective January 31, 2018.

Classifications and Numeric Standards for San Juan River and Delores River Basins, Regulation No. 34, Colorado Department Public Health and Environment, Water Quality Control Commission, effective June 30, 2019

Regulations for Effluent Limitations, Regulation 62, CDPHE, WQCC, July 30, 2012.

Nutrients Management Control Regulation, Regulation 85, Colorado Department Public Health and Environment, Water Quality Control Commission, effective September 30, 2012.

Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List, Regulation 93, Colorado Department Public Health and Environment, Water Quality Control Commission, effective March 30, 2012.

Policy and Guidance Documents:

Antidegradation Significance Determination for New or Increased Water Quality Impacts, Procedural Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, December 2001.

Memorandum Re: First Update to (Antidegradation) Guidance Version 1.0, Colorado Department Public Health and Environment, Water Quality Control Division, April 23, 2002.

Colorado Mixing Zone Implementation Guidance, Colorado Department Public Health and Environment, Water Quality Control Division, effective April 2002.

Policy for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-23, effective July 3, 2008.

Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-24, effective March 10, 2008.

Policy for Characterizing Ambient Water Quality for Use in Determining Water Quality Standards Based Effluent Limits, Colorado Department Public Health and Environment, Water Quality Control Division Policy Number WQP-19, effective May 2002.

Attachment 2

Comparison of CDPHE PEL to Atlantic Richfield Evaluation

Comparison of CDPHE PEL to Atlantic Richfield Evaluation

Introduction

In November of 2018, Atlantic Richfield Company (Atlantic Richfield) submitted a Preliminary Effluent Limits (PEL) application to the Colorado Department of Public Health & Environment (CDPHE) for the Rico St. Louis Tunnel (SLT) discharge based on assumptions of design flow and discharge location for a future expanded Rico water treatment system. CDPHE submitted the PEL document to Atlantic Richfield in March 2020 (CDPHE, 2020b). Upon receiving the PEL document from the State, the data, assumptions, and provided PELs were evaluated by Atlantic Richfield. This evaluation resulted in differences between the State's PELs and Atlantic Richfield's PEL analysis. The PEL values and basis for selection of these values from the Water Quality-Based Effluent Limitations (WQBELs), Antidegradation Based Average Concentrations (ADBAC), and Non-Impact Limit (NIL) values for both the PEL and Atlantic Richfield's evaluations are provided in Table 2-1. Key differences are noted for the following items, and these are discussed in more detail below.

- Table Value Standards (TVS) for metals based on in-stream hardness;
- Dolores River low-flow calculations; and
- Selected in-stream segment standards.

Table 2-1. *Final Selection of WQBELs, NILs, and ADBACs - The Dolores River*

	CDPHE Values[1]				Atlantic Richfield Values			
Pollutant	**NIL**	**NEW WQBEL**	**ADBAC**	**Chosen Limit**	**NIL**	**NEW WQBEL**	**ADBAC**	**Chosen Limit**
Al, TR (µg/l)	NA	103	**37**	ADBAC	162	**90**	65	***WQBEL***
Sb, Dis (µg/l)	NA	17	**2.7**	ADBAC	0.3	17	**2.7**	ADBAC
As, TR (µg/l)	0	**0.06**	0.06	WQBEL	0	**0.06**	0.06	WQBEL
As, Dis (µg/l)	0	793	**119**	ADBAC	1.4	989	**150**	ADBAC
Be, TR (µg/l)	NA	12	**2.3**	ADBAC	0.32	12	**1.8**	ADBAC
Cd, TR (µg/l)	0.4	12	**3.50**	ADBAC	82.2	**15**	4.16	***WQBEL***
Cd, Dis (µg/l)	85.0	**2.3**	NA	WQBEL	R	R	R	R
Cadmium, Dissolved[2] (Updated CO Standard) (Acute, cold) (µg/l)	85.0	**8.44**	NA	WQBEL	84.8	**14.0**	4.3175	WQBEL

Table 2-1. *Final Selection of WQBELs, NILs, and ADBACs - The Dolores River*

	CDPHE Values[1]				**Atlantic Richfield Values**			
Pollutant	**NIL**	**NEW WQBEL**	**ADBAC**	**Chosen Limit**	**NIL**	**NEW WQBEL**	**ADBAC**	**Chosen Limit**
Cadmium, Dissolved[2] (Updated CO Standard) (Chronic) (µg/l)	85.0	**3.79**	NA	WQBEL	84.8	**4.75**	3.0	WQBEL
Cr^{+3}, TR (µg/l)	NA	117	**19**	ADBAC	1.6	145	**23.1**	ADBAC
Cr^{+3}, Dis (µg/l)	0	411	**63**	ADBAC	0	525	**78**	ADBAC
Cr^{+6}, Dis (µg/l)	0	33	**5.1**	ADBAC	0	32	**3.9**	ADBAC
Cu, Dis (µg/l)	**20**	48	7.4	NIL	**20**	63	10.26	NIL
CN, Tot (µg/l)	0	12	**1.8**	ADBAC	0	15	**2.18**	ADBAC
Fe, TR (µg/l)	**1410**	2826	915	NIL	**1410**	2800	907	NIL
Pb, TR (µg/l)	9.9	150	**18**	ADBAC	4.4	145	**22.1**	ADBAC
Pb, Dis (µg/l)	32	**13**	NA	WQBEL	32	**23**	4.0	WQBEL
Mn, Dis (µg/l)	4110	**719 (539)**	NA	WQBEL[3]	4210	**720**	NA	WQBEL[4]
Mo, TR (µg/l)	NA	478	**76**	ADBAC	18.2	444	**70**	ADBAC
Hg, Tot (µg/l)	0.0004	0.03	**0.0054**	ADBAC	0.0004	0.0297	**0.0056**	ADBAC
Ni, TR (µg/l)	NA	300	**45**	ADBAC	8.4	297	**45**	ADBAC
Ni, Dis (µg/l)	**80**	292	43	NIL	**80**	375	52	NIL
Se, Dis (µg/l)	0.9	13	**3.4**	ADBAC	1.39	12.7	**3.5**	ADBAC
Ag, Dis (µg/l)	**0.06**	0.72	0.037	NIL	0.27	5.94	**0.891**	***ADBAC***
U, TR (µg/l)	NA	50	**7.5**	ADBAC	NA	89	**13.4**	ADBAC
U, Dis (µg/l)	NA	10305	**1545**	ADBAC	NA	14415	**2162**	ADBAC
Zn, Dis (µg/l)	14500	**707**	NA	WQBEL	14500	**939**	NA	WQBEL

Table 2-1. *Final Selection of WQBELs, NILs, and ADBACs - The Dolores River*

	CDPHE Values[1]				Atlantic Richfield Values			
Pollutant	**NIL**	**NEW WQBEL**	**ADBAC**	**Chosen Limit**	**NIL**	**NEW WQBEL**	**ADBAC**	**Chosen Limit**
B, Tot (mg/l)	NA	2.3	**0.33**	ADBAC	NA	2.23	**0.334**	ADBAC
Chloride (mg/l)	0.9	745	**112**	ADBAC	0.9	738	**109**	ADBAC
Sulfide as H2S (mg/l)	NA	0.006	**0.0009**	ADBAC	0.077	**0.0059**	0.0009	***WQBEL***
Thallium, TR (µg/l)	NA	0.72	**0.11**	ADBAC	NA	0.713	**0.107**	ADBAC
Radium 226+228(pC/l)	NA	15	**2.3**	ADBAC	NA	14.85	**2.23**	ADBAC

Notes:
Bolded values are the chosen numeric limit values.
Bolded and Italicized indicate that the chosen limit differs between CDPHE and Atlantic Richfield.
R = Dissolved cadmium standards for acute and chronic water quality standards have been revised and listed in the following rows.
[1] Values as presented in Table A-15a of the 2020 CDHPE PEL.
[2] Cadmium standards updated in Regulation 31 on June 30, 2020.
[3] Note that the AD analysis was completed on the aquatic life value, the water supply WQBEL of 539 ug/l still applies.
[4] WQBEL were determined using the Site-specific standard of 255 ug/L.

NILs were established by determining the maximum daily averages from statistical analysis of the analytical data collected at the discharge location DR-6. Both WQBELs and ADBACs were established by using the chronic in-stream standards including the hardness based TVS with chronic low flow values in mass balance equations. However, ADBACs also took into consideration the baseline water quality of this stream segment. Chronic water quality standards were used in the calculations along with the chronic annual low flow value unless there was not a chronic water quality standard listed. When this was the case, the acute water quality standard was used with the acute annual low flow value. The recommended chosen limit values are bolded for the CDPHE as well as Atlantic Richfield. Note the differences between chosen limit values due to flow rates and hardness values used in the calculations.

If there are NIL, WQBEL and ADBAC values listed for a parameter, it is likely that the middle value is chosen for the limit. And if there are only two values, then it is likely that the lesser of the two limits is chosen. However, when the New WQBEL is greater than the NIL or the ADBAC, then the comparison is between the NIL and ADBAC. According to the PEL, "*the permittee has the final choice between the two limitations. A NIL is applied as a 30-day average (and the acute WQBEL would also apply where applicable) while the ADBAC would be applied as a 2-year rolling average concentration."*

TVS-Based Metals and Hardness

In Regulations 31 and 34, several metal standards are listed as TVS and are hardness-based standards. As provided in PEL document Table A-4A – *TVS-Based Metals Water Quality Standards for PEL 230051- Dolores River*, CDPHE calculated in-stream hardness based on a mean hardness using DR-7 data and cited a lack of data for not utilizing a linear regression analysis. A linear regression utilizing paired flow and hardness data is the preferred approach, and several other methods are mentioned in the regulations. One of these methods is using the mean of the hardness during the low flow season established in the permit. The value that CDPHE calculated was 212 mg/L $CaCO_3$. Analysis by Atlantic Richfield shows that hardness is a clear function of Dolores River flow and thus calculated an in-stream hardness based on the linear regression analysis method using DR-7 hardness data and statistically-low flow data from DR-G, which produced a value of 290 mg/L $CaCO_3$.

The relationship between hardness and flow rates at the DR-7 location is shown on the plot in Figure 2-1. A "power" trendline fits DR-7 data with high hardness values (above 300 mg/L $CaCO_3$) being measured at low flow rates (<10 cfs) and lower hardness values (200 mg/L $CaCO_3$) being measured at higher flow rates (>25 cfs).

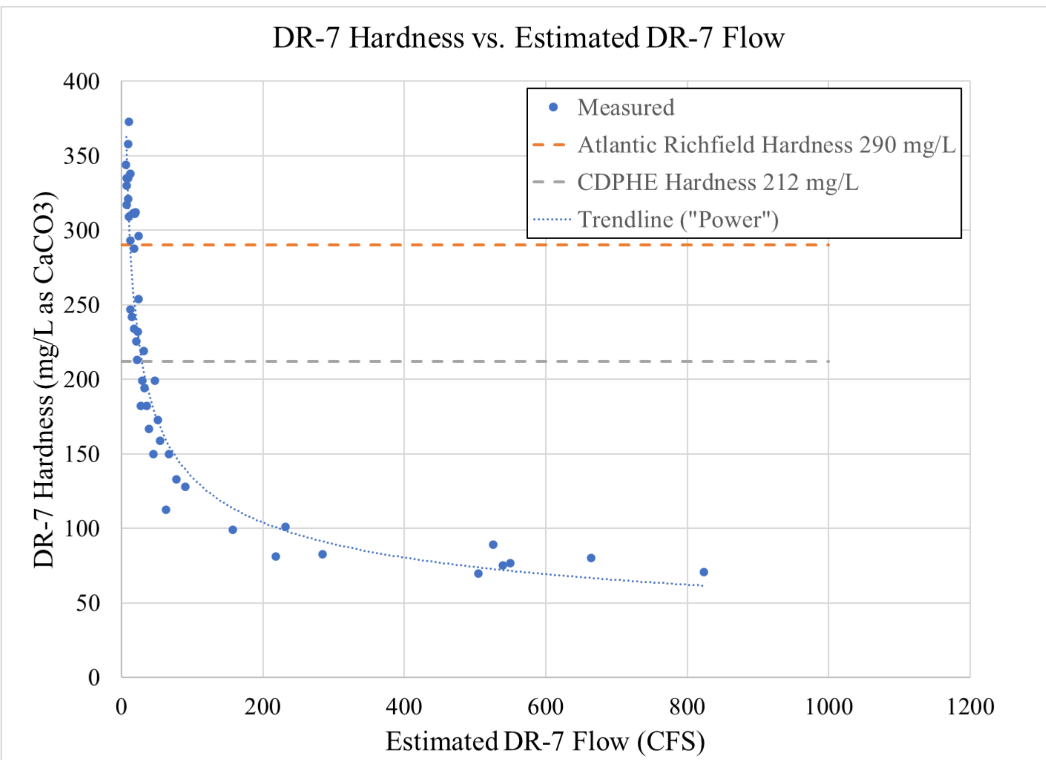


Figure 2-1. *Hardness and flow rate measurements at DR-7 demonstrate the relationship between low flows and high hardness values as well as high flows and low hardness values. The calculated TVS hardness values are also shown.*

Showing the CDPHE 1E3 (acute) and 30E3 (chronic) low flow rates (see Figure 2-2) results in expected corresponding hardness values greater than 300 mg/L $CaCO_3$ which supports the calculated hardness value of 290 mg/L $CaCO_3$ in this analysis. As the hardness value is used in the equations for the TVS, the greater the hardness value, the higher the TVS. The TVS values are used when determining the water quality-based effluent limits (WQBELs).

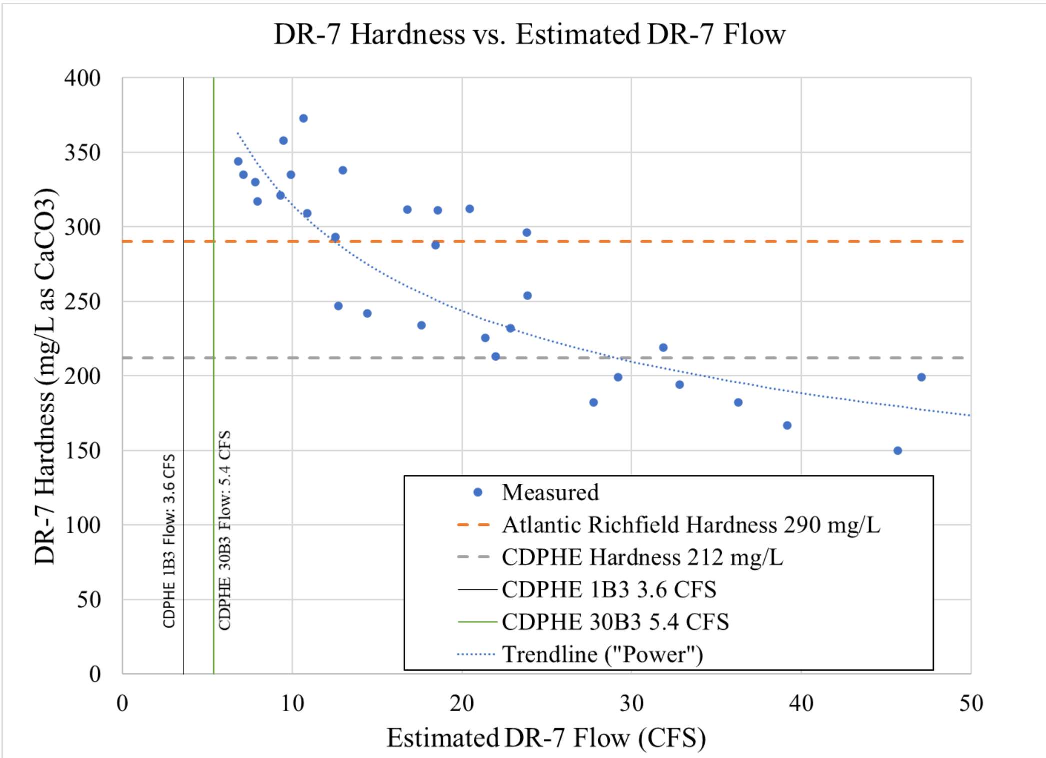


Figure 2-2. *Hardness and flow rate measurements at DR-7 with the CDPHE low flow values for 1E3 (acute) and 30E3 (chronic) as well as the calculated hardness values shown.*

<u>Dolores River Low Flow Calculations</u>

The Dolores River low flow values in the CDPHE PEL Table A-5a - *Low Flows for Dolores River at the Rico-Argentine Mine Site* were based on the following method for estimating Dolores River flow above the Site: starting with the daily DR-G flow (from USGS gage 09165000 located below the town of Rico), the daily DR-3 flow was subtracted, and the remainder was multiplied by a watershed ratio of 0.68. This ratio represents the relative area of the watershed above the Site discharge (72.2 square miles) compared to the watershed area above the USGS gage (106 square miles). The estimated Dolores River flow values above the Site were then used in the EPA DFLOW low flow program to calculate “biologically based” monthly low flows. Atlantic Richfield was unable to replicate the CDPHE values using this method.

The following tables (Tables 2-2 and 2-3) show the annual and monthly Dolores River low flow rates determined by the CDPHE and Atlantic Richfield, respectively. The annual rates use the lowest monthly flow value over the twelve-month period. The annual chronic (30E3) and acute (1E3) low flow values were used to determine the water quality-based effluent limits (WQBELs). Larger annual low flow values will produce larger WQBELs. There is less than a two percent difference between the State and Atlantic Richfield’s annual chronic (30E3) low flow values with the larger value shown in CDPHE's table. There is a difference of approximately 45% between the CDHPE and Atlantic Richfield annual acute low flow values with the higher value shown in Atlantic Richfield's table. Generally, chronic effluent limits would be more restrictive, so the difference in acute low flow values may not be significant.

Table 2-2. *CDPHE Low Flow Calculated Values for the Dolores River at the Rico-Argentine Mine Site*

Low Flow (cfs)	***Annual***	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sept***	***Oct***	***Nov***	***Dec***
1E3 Acute	3.6	**3.6**	5.3	5.9	17	42	13	12	13	7.3	6.6	6.7	3.7
7E3 Chronic	4.1	**4.1**	5.2	5.7	12	36	13	13	12	7.3	6.7	6.7	**4.1**
30E3 Chronic	5.4	**5.4**	**5.4**	5.7	7.6	23	16	16	9	7.4	6.8	6.2	**5.4**

Note: *Bolded values highlight which months had the lowest flow value(s) that were used for the annual low flow value.*

Table 2-3. *Atlantic Richfield Low Flow Calculated Values for the Dolores River at the Rico-Argentine Mine Site*

Low Flow (cfs)	***Annual***	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***
1E3 Acute	5.2	**5.2**	5.4	6.0	16	71	21	15.6	12	7.2	6.5	6.2	5.3
7E3 Chronic	5.2	**5.2**	5.6	6.3	21	91	25	17.7	12	7.2	6.7	6.6	5.4
30E3 Chronic	5.3	**5.3**	5.6	7.8	68	194	58	25.0	17	9.1	7.4	6.7	6.1

Note: *Bolded values highlight which months had the lowest flow value(s) that were used for the annual low flow value.*

All 1E3 acute values, the 7E3 chronic annual value, and the 30E3 chronic values, except the value for February, used the DFLOW program to determine the low flows. (Because February has less than 30 days, the DFLOW program cannot provide 30E3 values.) The 7E3 monthly values and the 30E3 chronic February values were unable to be determined using the DFLOW program so the USGS Integrated Design Flow (IDF) program was used to determine these low flows.

In-Stream Segment Standards

The segment standards for manganese, molybdenum and cadmium differ between the PEL and the Atlantic Richfield evaluation due to classification assumptions and changes to the State regulations. The values identified by Atlantic Richfield are believed to be correct as discussed below.

Manganese

The Site discharges to Dolores River Segment COSJDO03, which is classified for Water Supply (WS), and therefore the WS regulations apply for sulfate, iron, and manganese. Regulation 34, Section 38 presents "Statement of Basis, Specific Statutory Authority and Purpose; September 10, 2012 Rulemaking; Final Action November 5, 2012; Effective Date March 30, 2013".

In Section 34.38(G), the regulation states that "*A site-specific manganese standard of 255 ug/L was added to Dolores Segment 3. This value was calculated as the 85th percentile of available data from 1/1/1995 – 12/31/2012 and is expected to be representative of conditions on January 1, 2000, consistent with 31.11(6)*."

Section 31.11 referenced in the 34.38(G) rulemaking effort contains "Basic Standards Applicable to Surface Water of the State", and further, Section 31.11(6) contains the Water Supply standard. There are two key points.

1. Section 31.11(6) states that *"Except where the Commission adopts or has adopted a different standard on a site-specific basis…"* and goes on to describe the Water Supply standard. Section 34.38(G) clearly states that a site-specific manganese standard of 255 µg/L was adopted for Dolores Segment 3 and references the Water Supply standard in Section 31.11(6).
2. Section 34.38(G) further states that the 255 µg/L value*"… is expected to be representative of conditions on January 1, 2000, consistent with Section 31.11(6)."* This statement specifically references the Water Supply standard. Section 31.11(6) states that the less restrictive of the following two options shall apply:
   - Existing quality as of January 1, 2000; or
   - 50 µg/L (dissolved), for manganese.

The CDPHE PEL document does not reference or acknowledge this and calculates a dissolved manganese standard based on the 85th percentile of data as listed in the Assessment unit database from January 1995 to December 1999. The data is not presented and is not readily available. The value calculated is 195 µg/L.

For segment COSJDO03, the current version of Regulation 34 shows "WS" for the sulfate chronic standard and for the dissolved iron chronic standard. For manganese it does not show "WS" at all, it shows "TVS/255". The 255 ug/L site specific value for Segment COSJDO03 identified in Section 34.38(G) about the Water Supply standard (31.11(6)) is the correct value for the manganese Water Supply standard in that segment and was used in the PEL evaluation provided in Table 2-1.

Cadmium

The dissolved cadmium standard has been updated since Atlantic Richfield received the PEL. In December 2019, the Water Quality Control Commission (WQCC) approved new cadmium hardness-based water quality standards that took effect on June 30, 2020. The Atlantic Richfield evaluation used the updated dissolved cadmium standard (see Table 2-1), which results in less restrictive values than previously determined for the chronic standard at all hardness values as well as for the acute (cold) standard when hardness is greater than 45 mg/L.

Molybdenum

The segment standard for molybdenum is different between the PEL and the Atlantic Richfield analysis. PEL document Table A-3a – *In-stream Standards for Stream Segment COSJDO03 & COSJDO05A* lists the total recoverable molybdenum chronic standard as 160 ug/L; however, State Regulation 34 lists the in-stream standard as 150 ug/L. The 150 µg/L value specified in State Regulation 34 was used in the Atlantic Richfield evaluation (see Table 2-1).

Attachment 3

Supporting Information for Percent Removal Calculations

Supporting Information for Percent Removal Calculations

This attachment provides additional information supporting Table 2, which presents performance criteria based on calculated annual minimum and annual average percent removal values for constituents of interest observed during operation of the Enhanced Wetland Demonstration (EWD) at the Site, over the years of 2016 through 2020. The EWD has been operated as a treatability study.

Atlantic Richfield Company (Atlantic Richfield) measures the EWD treatment flow continuously and obtains samples of the EWD influent and effluent streams regularly (at least bimonthly, and more frequently during freshet periods). Atlantic Richfield also regularly samples intermediate points within the overall EWD process to monitor system health and to learn about its operation.

To facilitate mass-based percent removal calculations, each constituent influent and effluent mass was first compiled on a daily basis. In doing this, the continuous flow measurement was averaged over each day to produce a daily average flow rate value. Since influent and effluent samples are taken at discrete points in time, each influent and effluent sample was assumed to represent a constant influent or effluent composition from the sample date until the next influent or effluent sample was obtained, at which time the new sample dataset would represent the composition until the next subsequent sample dataset was obtained.

Percent removal calculations were developed using the total constituent mass entering the EWD and total constituent mass leaving the EWD, over the time period represented by the analytical sample. A formula illustrating the general percent removal calculation is illustrated below:

$$\%\, Mass\ Removal = \left\{1 - \frac{Mass_{Effluent}}{Mass_{Influent}}\right\} x\ 100\%$$

Where:

$Mass_{Effluent}$ = (Effluent concentration) x (average EWD flow for time period) x (time)
$Mass_{Influent}$ = (Influent concentration) x (average EWD flow for time period) x (time)

To produce a daily-basis percent removal, the daily masses were used explicitly. To produce a monthly-basis percent removal, the daily masses were summed for each calendar month. To produce a yearly-basis percent removal, the daily masses were summed for each calendar year. The values in Table 2 represent calculated EWD percent removal values for the constituents of interest for the calendar years of 2016 through 2020. The values in the “Annual Minimum” column are the minimum calendar-year percent removals observed over the 2016 through 2020 timeframe. The values in the “Annual Average” column are the average percent removals observed over the timeframe.

Figures 3-1 through 3-5 present monthly-basis average influent and effluent concentrations and percent removal for aluminum, cadmium, iron, manganese, and zinc for the calendar years of 2016 through 2020. There are several aspects in these figures that warrant discussion:

1. There are rapid increases and subsequent decreases in the constituents for some calendar years. These tend to coincide with the gray shaded areas, which represent the May 1st to July 31st timeframe each year. This is the general timeframe of the freshet period, where

there is a rise and fall in metals concentrations along with a rise and gradual drop in St. Louis Tunnel flow. The behavior generally tends to lag the Dolores River runoff hydrograph by three to six weeks.

2. The increases in concentrations during the freshet period vary from year to year. This is due to a number of factors including the water content of the snowpack, the rate of melting, the previous year's freshet, and others. As an example, it can be seen in Figure 3-5 that there were distinct increases in zinc concentration during the 2016, 2017, and 2019 freshets; there was no zinc concentration increase in 2018 as it was a very dry preceding winter; and there was only a small increase in 2020, again due to a relatively dry preceding summer/fall.
3. Some constituents show a decrease in percent removal during the freshet periods (e.g., zinc and manganese). In general, percent removals were quite high between freshet periods. The EWD design did not include provisions for effective treatment during strong freshets, as this aspect was not well-understood at the time of the EWD design.
4. Outside of the freshet periods, the influent metals concentrations (blue line) tend to be relatively low and to change relatively slowly, conditions that are very amenable to effective treatment.

The annual minimum and average percent removal values appearing in Table 2 utilized the same data set as illustrated in Figures 3-1 through 3-5 but were summed over each calendar year to develop results on a yearly basis, rather than the monthly basis in the figures below.

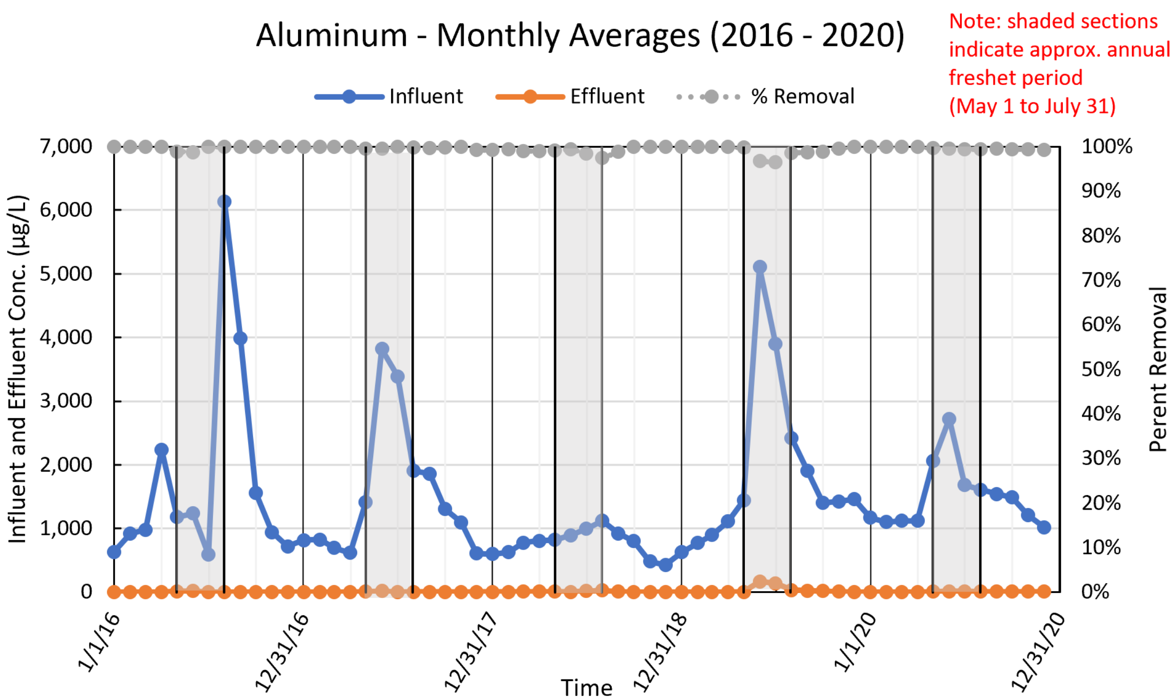


Figure 3-1. *Aluminum Monthly Average Influent, Effluent, and Percent Removal for EWD System from 2016 through 2020*

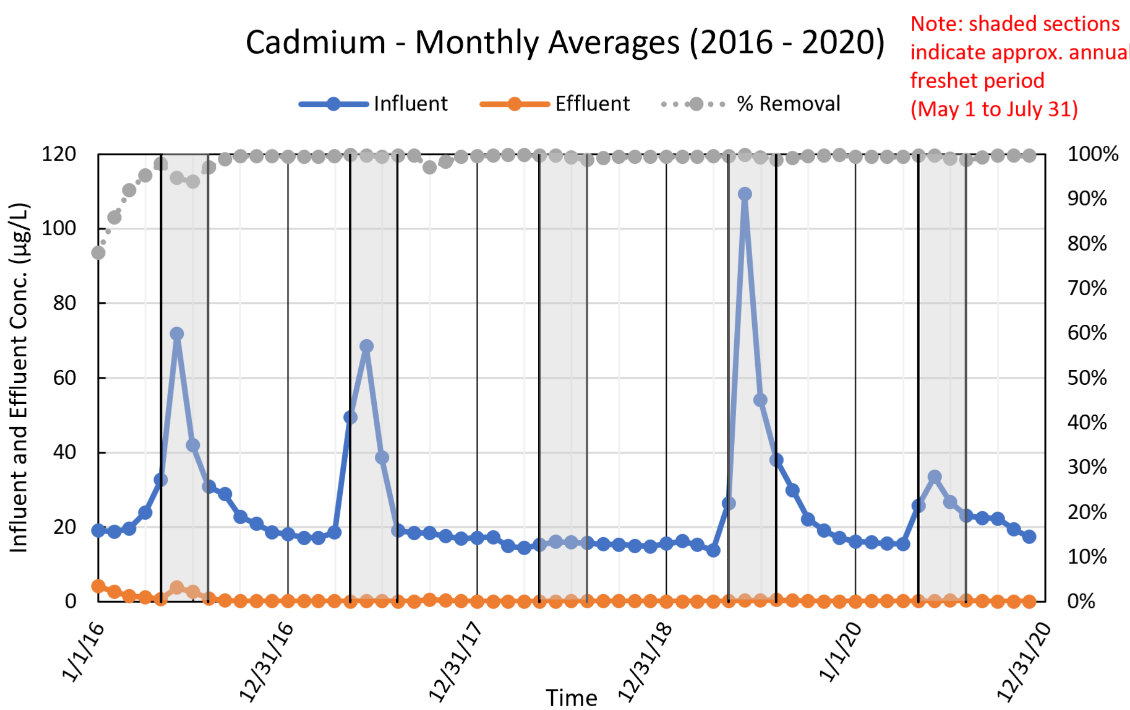


Figure 3-2*. Cadmium Monthly Average Influent, Effluent, and Percent Removal for EWD System from 2016 through 2020*

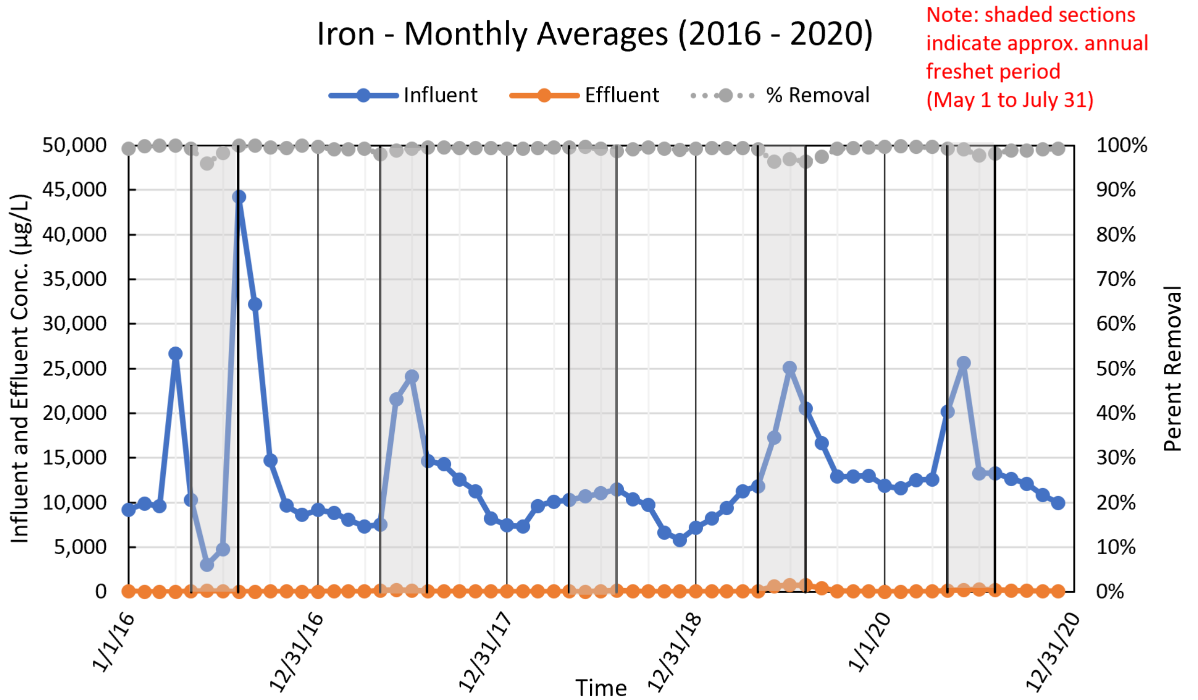


Figure 3-3. *Iron Monthly Average Influent, Effluent, and Percent Removal for EWD System from 2016 through 2020*

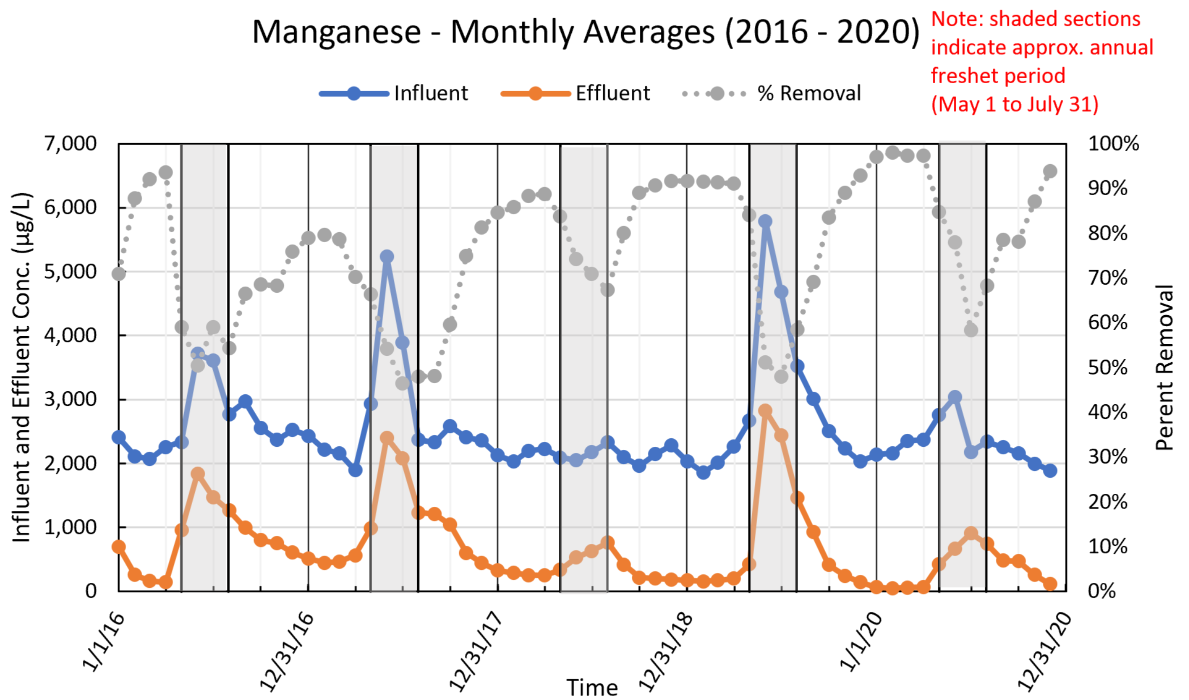


Figure 3-4. *Manganese Monthly Average Influent, Effluent, and Percent Removal for EWD System from 2016 through 2020*

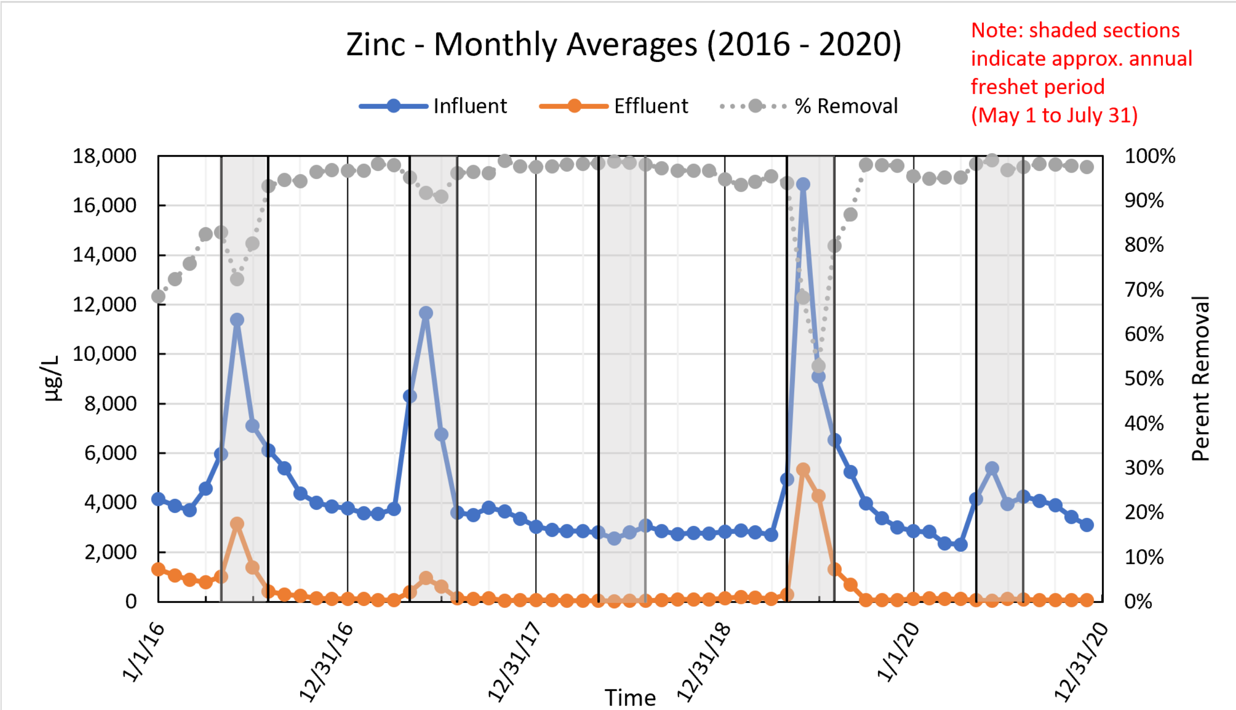


Figure 3-5. *Zinc Monthly Average Influent, Effluent, and Percent Removal for EWD System from 2016 through 2020*

Attachment 4

Comparison of Measured Dolores River Water Quality to Applicable Water Quality Standards

Comparison of Measured Dolores River Water Quality to Applicable Water Quality Standards

This attachment discusses measured water quality in the Dolores River downstream of the Site wetland treatment system discharge compared with applicable CDPHE Water Quality Control Division water quality standards.

The Enhanced Wetland Demonstration (EWD) system became operational in late 2015 and has operated continuously to the present. The system was constructed and operated as a treatability study, and the system design basis was 550 gallons per minute (gpm). During periods of St. Louis Tunnel (SLT) base flow, the EWD (along with the two smaller treatability study systems known collectively as the Constructed Wetland Demonstration [CWD]) has treated all of the SLT flow. During periods with SLT flow above approximately 600 gpm, the portion of flow above 600 gpm has been routed around the treatability study systems to the St. Louis Ponds for settling. After entering the ponds, this routed water would mix with the treated water, and the mixed waters would flow through the ponds and ultimately to the Dolores River. In addition to high-flow periods, flow was also routed around the treatment system during relatively brief maintenance periods, such as to remove settled solids from settling basins.

The following plots present data from samples obtained from sampling location DR-7, which is located in the Dolores River downstream of the St. Louis Ponds discharge location DR-6. These locations are shown on Figure 1 of the parent document. A mixing zone analysis performed in accordance with CDPHE's Colorado Mixing Zone Implementation Guidance, confirmed that the DR-6 discharge mixes fully with the receiving water at a point in the Dolores River upstream of DR-7 (Atlantic Richfield, 2008).

The following figures compare measured data from DR-7 to State of Colorado chronic standards for Dolores River segment COSJDO03 as presented in Regulation No. 34 – Classifications and Numeric Standards for San Juan River and Dolores River Basins (5 CCR 1002-34, effective date June 30, 2020). These include hardness-based chronic standards for aluminum, cadmium, copper, lead, and zinc; the chronic total iron standard; water supply standards for iron, sulfate, and manganese; and the current temporary hybrid chronic standard for total arsenic. Note that compliance with the hardness-based standards (with the exception of aluminum) are to be demonstrated using potentially dissolved analyses; these figures used total analyses. This is conservative, as total analyses should be equal to or greater than potentially dissolved analyses.

The figures present data from 2011 through 2020. Startup of the EWD is shown as November 1, 2015. The shaded areas represent the approximate freshet periods for 2016 through 2020 (May 1 through July 31) for reference. Figure 4-1 presents Dolores River flow at the United States Geological Survey (USGS) gage below Rico (09165000) along with hardness measured at DR-7, for reference, as it shows how hardness (and therefore hardness-based water quality standards) is strongly affected by Dolores River flow; hardness is diluted during high flow runoff periods and considerably higher during base flow periods.

The subsequent figures, Figures 4-2 through 4-10, show that conditions in the Dolores River downstream of the Rico discharge have consistently met the segment chronic standards since the EWD startup in late 2015, with only a few exceptions observed during freshet conditions. The following briefly summarizes the comparison of measured data with chronic water quality standards for the segment, for each Key constituent. Table 4-1 presents a summary of the comparison.

***Table 4-1**. Summary of DR-7 Water Quality Data vs. Dolores River Segment Chronic Water Quality Standards Since EWD Startup in November 2015*

Key Constituent	# of Segment Standard Exceedances[1]	Total # of Samples[2]	Comments
Aluminum	3	12	For all three exceedances (during 2017, 2019, and 2020 freshets), aluminum also exceeded TVS standards in the Dolores River upstream of the Site. Further, in the 2019 freshet the aluminum concentration was lower at DR-7 than at DR-2, indicating improved aluminum concentration below the Site discharge.
Cadmium	1	17	Exceeded TVS standard during 2017 freshet.
Copper	0	17	
Iron	0	17	
Lead	1	17	For the single exceedance (during the 2019 freshet), the lead concentration also exceeded TVS standards in the Dolores River upstream of the Site. The lead concentration was lower at DR-7 than at DR-2, indicating improved lead concentration below the Site discharge.
Manganese	0 6	17 17	No exceedances of TVS standard; Exceeded Water Supply Standard.
Sulfate	1	17	Exceeded Water Supply standard during winter 2020 with low Dolores River flow; prior years sampling occurred in the fall months.
Zinc	2	17	Exceeded TVS standard during 2017 and 2019 freshets.

Notes:
[1] Exceedances of Dolores River Segment (#COSJDO03) Chronic Standards as provided in Table 1. Total metals analyses used for all metals for conservatism (rather than potentially dissolved analyses).
[2] Number of samples collected since EWD startup in November 2015 to December 2020.

- Aluminum (Figure 4-2) has exceeded the chronic segment standard three times, during the 2017, 2018, and 2019 freshets. However, data collection at the Site has shown that the background total aluminum tends to be very high during the runoff period from upstream sources such as clays. Total aluminum data from sample location DR-2 upstream of the Site are included in Figure 4-2. These data indicate that the source of elevated aluminum concentrations at DR-7 are from upstream, and that total aluminum concentrations above the Site have exceeded standards for each freshet for which data was available. Further, in the 2019 freshet the aluminum concentration was lower at DR-7 than at DR-2, indicating improved aluminum concentration below the Site discharge.

- Cadmium (Figure 4-3) exceeded the chronic segment standard once, during the 2017 freshet.
- Copper (Figure 4-4) has had no exceedances relative to the chronic segment standard throughout the EWD operation.
- Iron (Figure 4-5, Figure 4-6) has had no exceedances relative to both the chronic and Water Supply segment standards throughout the EWD operation.
- Lead (Figure 4-7) exceeded the chronic segment standard once, during the 2019 freshet. Similar to the aluminum discussion above, data collection at the Site have shown elevated lead concentrations from upstream sources, possibly sorbed to particulate iron or aluminum. Total lead concentrations measured at location DR-2 above the Site are included in Figure 4-7. The total lead value measured above the segment chronic TVS during the 2019 freshet can be seen to be due to high concentrations in the Dolores River above the Site. The lead concentration was lower at DR-7 than at DR-2, indicating improved lead concentration below the Site discharge.
- Manganese (Figure 4-8) has exceeded the segment Water Supply standard of 255 µg/L six times. It should be noted that the EWD system does not include a limestone-based rock drain for manganese removal, as is anticipated for the future Expanded Constructed Wetlands Treatment System. There have been no exceedances of the chronic table value standard (TVS) for manganese.
- Sulfate (Figure 4-9) exceeded the segment Water Supply standard once, during low winter flows in the Dolores River in 2020. Prior sampling events have occurred in the fall months, with increased Dolores River flows.
- Zinc (Figure 4-10) exceeded the segment chronic standard twice, once each during the 2017 and 2019 freshets.

REFERENCES

Atlantic Richfield, 2008. Technical Memorandum on Mixing Zone Evaluation for the St. Louis Ponds Discharge; Rico, Colorado, July 1, 2008.

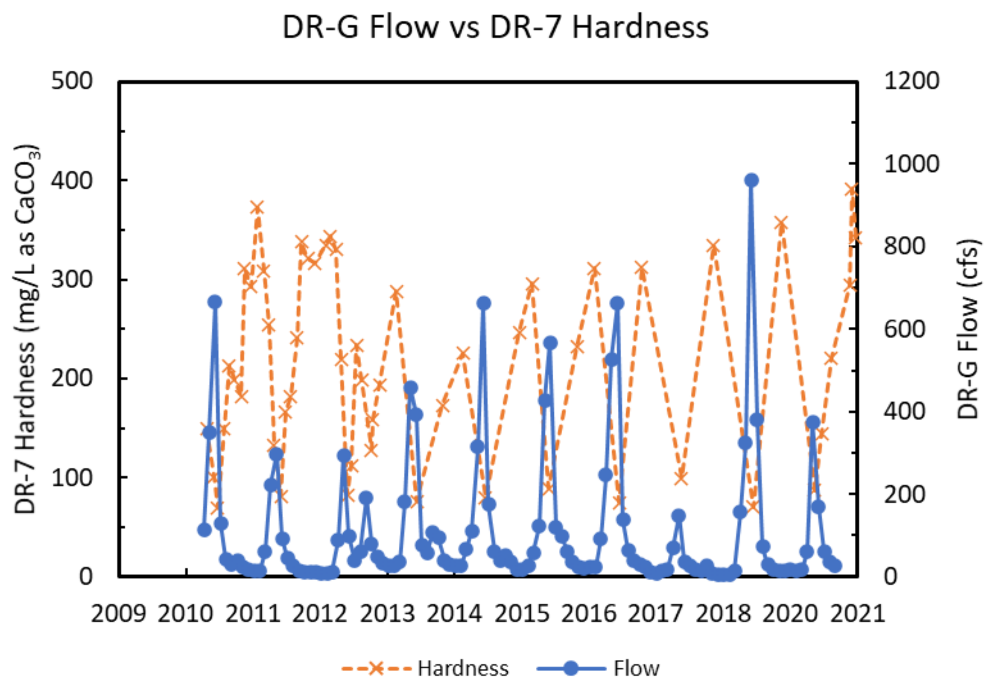


Figure 4-1. *Flow at DR-G (USGS Gage 09165000) with Hardness Measured at DR-7*

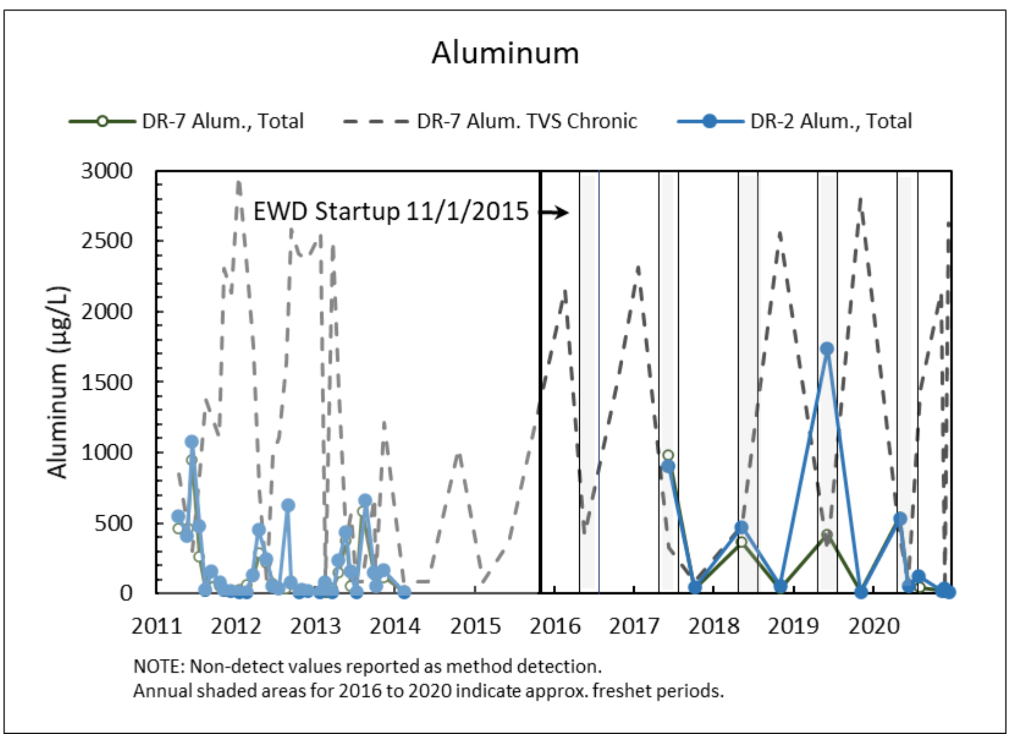


Figure 4-2. *Total Aluminum Measured at DR-7 and DR-2 Compared to Chronic TVS Standard at DR-7*

Figure 4-3. *Total Arsenic Measured at DR-6 Compared to Temporary Chronic Hybrid Standard*

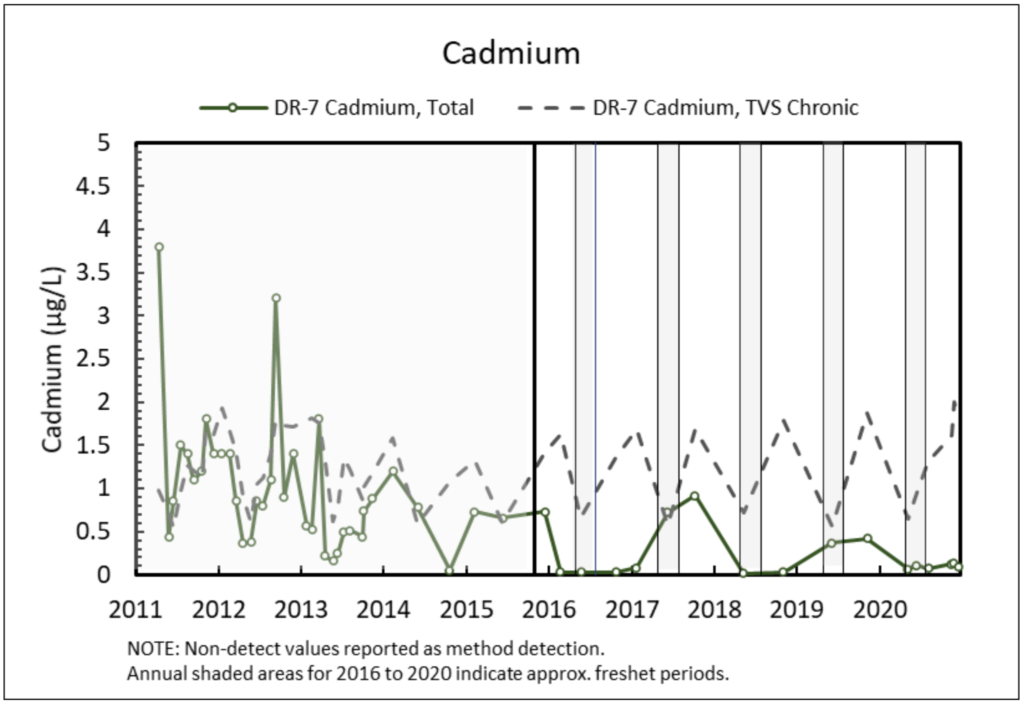


Figure 4-3. *Total Cadmium Measured at DR-7 Compared to Chronic TVS Standard*

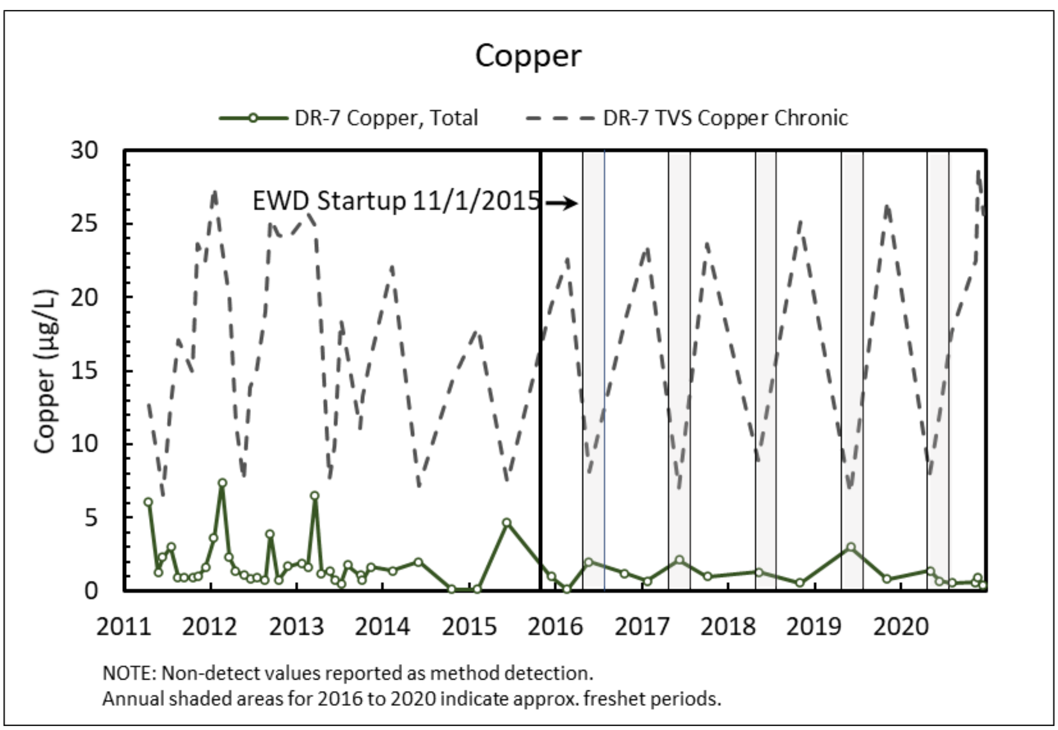


Figure 4-4. *Total Copper Measured at DR-7 Compared to Chronic TVS Standard*

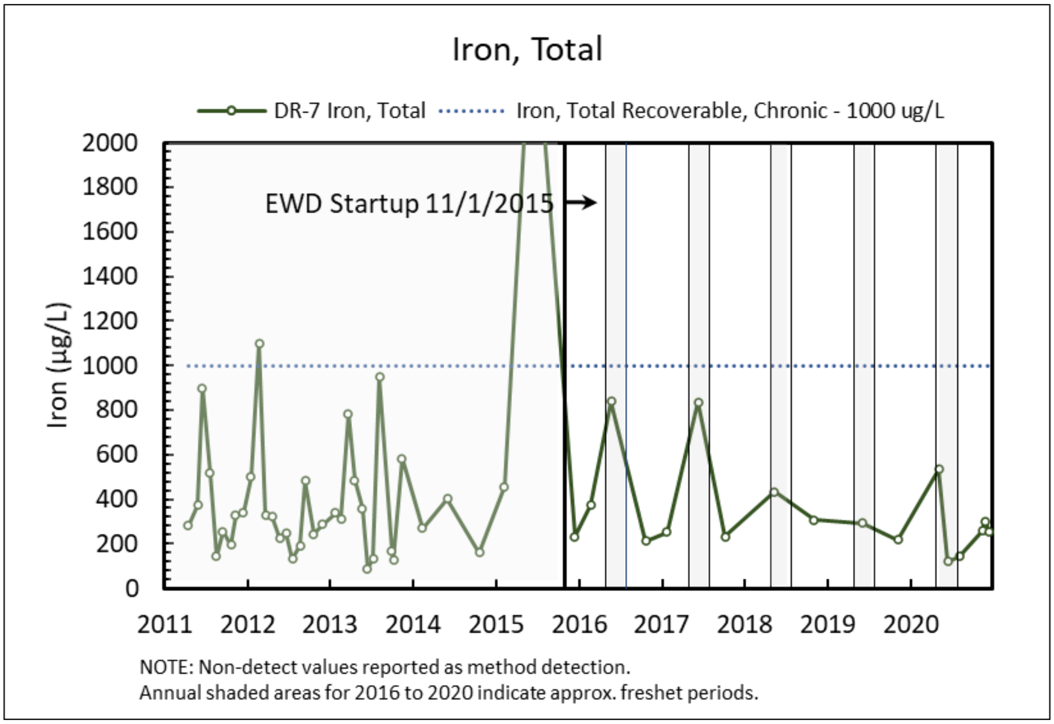


Figure 4-5. *Total Iron Measured at DR-7 Compared to Chronic Standard*

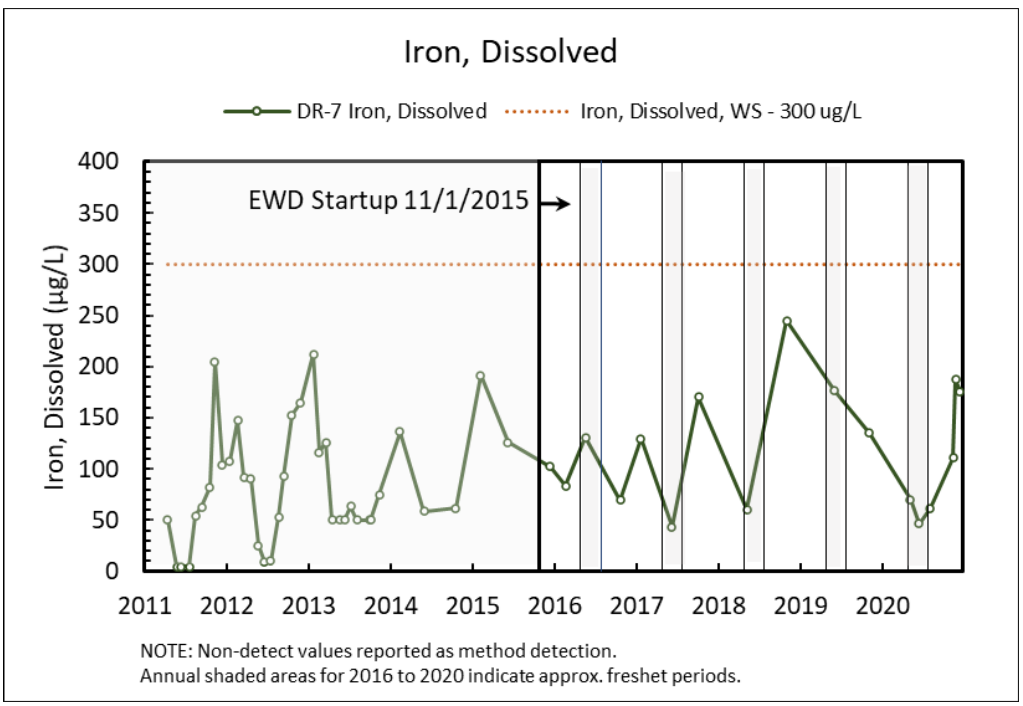


Figure 4-6. *Dissolved Iron Measured at DR-7 Compared to Water Supply Standard*

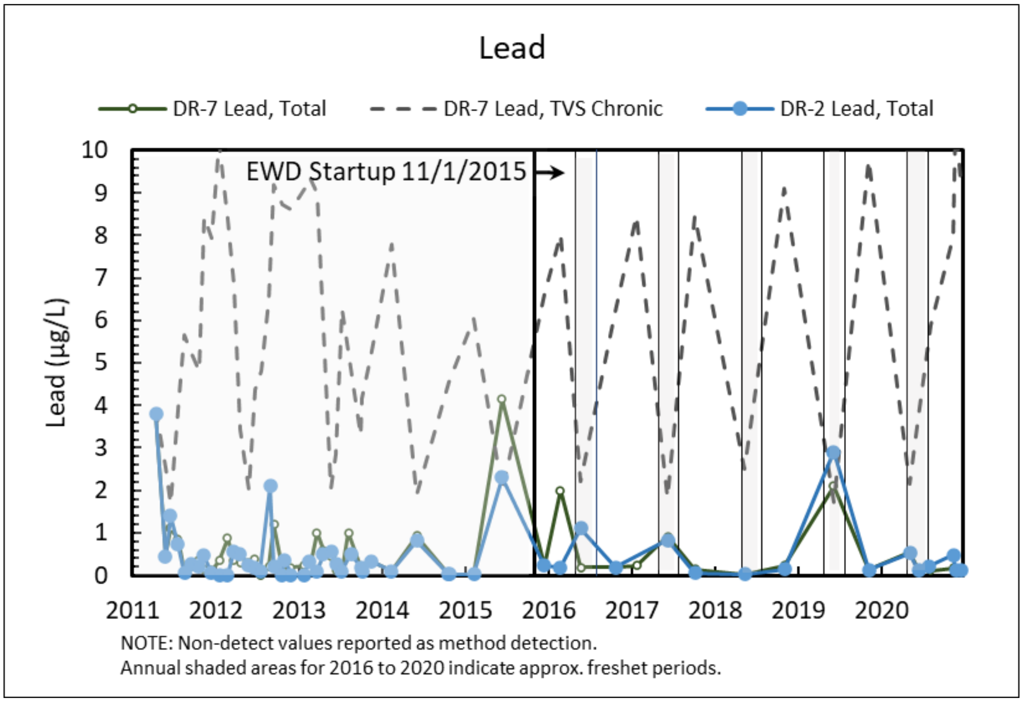


Figure 4-7. *Total Lead Measured at DR-7 and DR-2 Compared to Chronic TVS Standard*

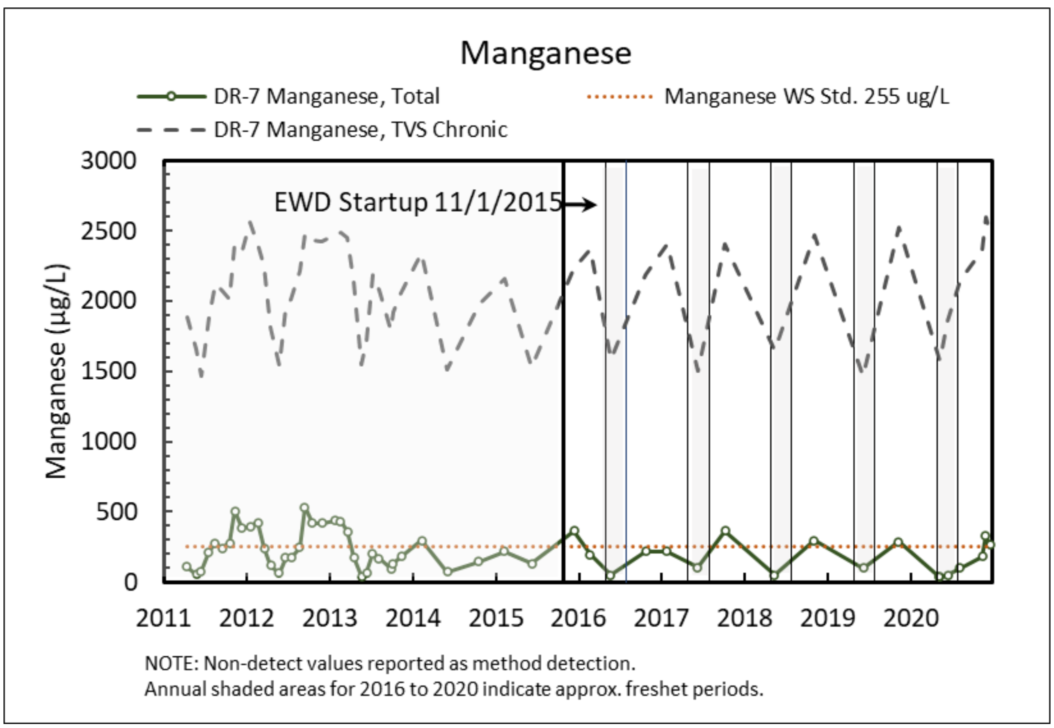


Figure 4-8. *Total Manganese Measured at DR-7 Compared to Water Supply Standard and Chronic TVS Standard*

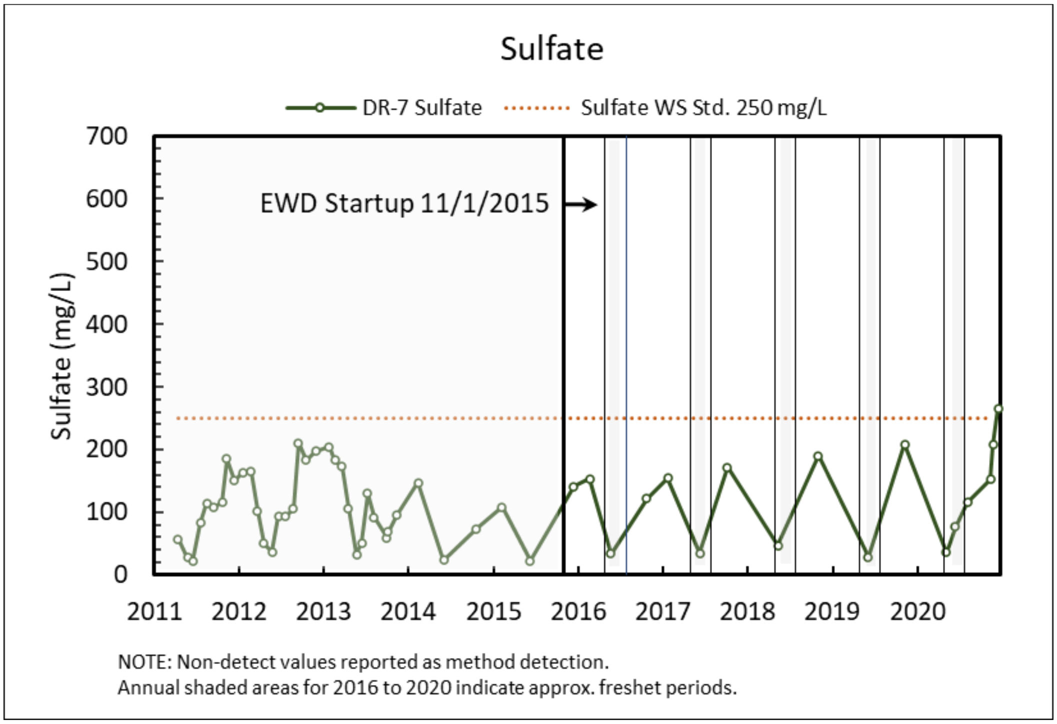


Figure 4-9. *Sulfate Measured at DR-7 Compared to Water Supply Standard*

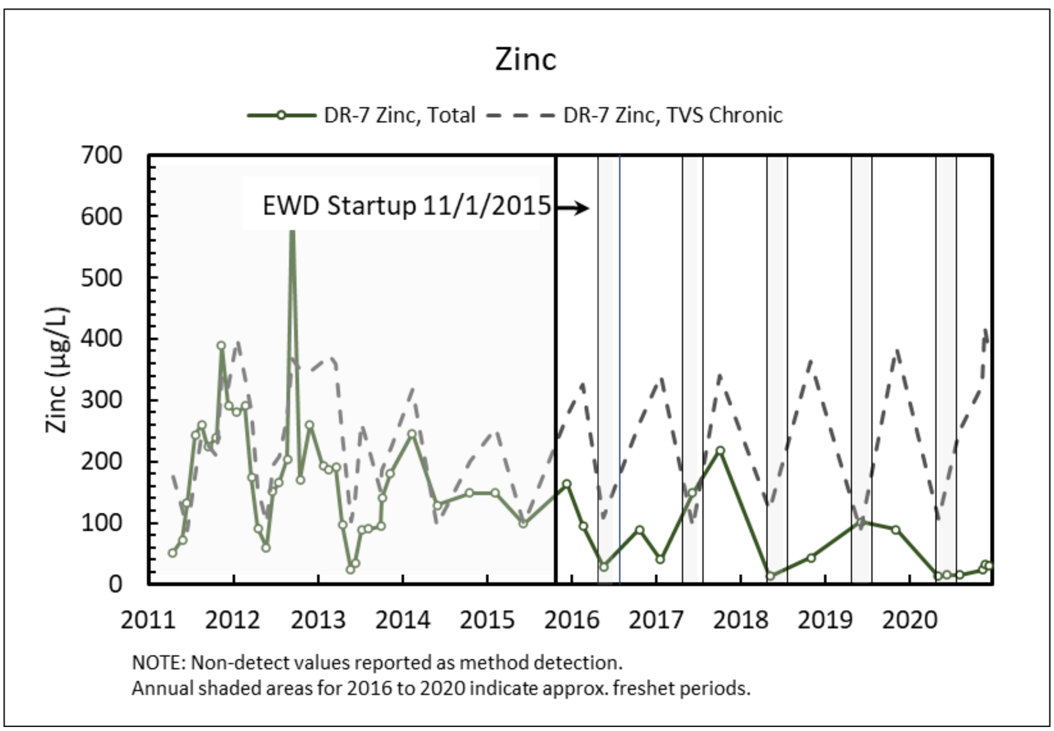


Figure 4-10. *Total Zinc Measured at DR-7 Compared to Chronic TVS Standard*