

**Utah Division of Water Quality  
Statement of Basis  
ADDENDUM  
Wasteload Analysis and Antidegradation Level I Review**

**Date:** April 30, 2019

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Watershed Protection Section

**Facility:** Ferron Wastewater Treatment Facility  
Castle Valley Special Service District  
UPDES No. UT0020052

**Receiving water:** Ferron Creek (2B, 3C, 4)

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

Discharge

Outfall 001: Ferron Creek

The maximum daily design discharge is 0.5 MGD and the maximum monthly design discharge is 0.5 MGD for the facility.

Receiving Water

The receiving water for Outfall 001 is Ferron Creek, which is tributary to the San Rafael River, which drains to the Colorado River.

Per UAC R317-2-13.1(b), the designated beneficial uses for Ferron Creek and tributaries, from confluence with San Rafael River to Millsite Reservoir are 2B, 3C and 4.

- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*
- *Class 3C - Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.*
- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

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Typically, the critical flow for the wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Due to a lack of flow records for Ferron Creek, the 20th percentile of flow measurements at *4930820 Ferron Creek above Ferron Lagoons 001 at U10 Crossing* was calculated to estimate annual critical low flow in the receiving water (Table 1).

**Table 1: Annual critical low flow for Ferron Creek above lagoon outfall**

Season	Count	Flow (cfs)
Annual	47	0.8

Receiving water quality data were obtained from monitoring sites *4930820 Ferron Creek above Ferron Lagoons 001 at U10 Crossing* and *4930798 Ferron Creek above New Ferron Lagoons 001*. The average seasonal value was calculated for each constituent with available data in the receiving water. Effluent parameters were characterized using data from monitoring site *4930796 Ferron Lagoons New 001*.

Mixing Zone

The maximum allowable mixing zone is 15 minutes of travel time for acute conditions, not to exceed 50% of stream width, and 2,500 feet for chronic conditions, per UAC R317-2-5. Water quality standards must be met at the end of the mixing zone.

The actual length of the mixing zone was not determined; however, it was presumed to remain within the maximum allowable mixing zone dimensions. Acute limits were calculated using 50% of the seasonal critical low flow.

Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were total suspended solids (TSS), dissolved oxygen (DO), BOD<sub>5</sub>, total phosphorus (TP), total nitrogen (TN), total ammonia (TAN), E. coli, pH, and total residual chlorine (TRC) as determined in consultation with the UPDES Permit Writer.

TMDL

Due to insufficient data, Ferron Creek from the confluence with San Rafael River to Millsite Reservoir was not assessed for any parameters according to *Utah's 2016 Integrated Report*. The San Rafael River downstream of the confluence with Ferron Creek is listed as impaired on 2016 303(d) list for benthic macroinvertebrates.

Per UAC R317-2-14, Ferron Creek has a site specific criterion for TDS concentration of 3,500 mg/L that is based upon the EPA approved Total Maximum Daily Load (TMDL) *Price River, San Rafael River, and Muddy Creek TMDLs for Total Dissolved Solids, West Colorado Watershed Management Unit, Utah* (MFG Inc. 2004).

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WET Limits

The percent of effluent in the receiving water in a fully mixed condition, and acute and chronic dilution in a not fully mixed condition are calculated in the WLA in order to generate WET limits. The LC<sub>50</sub> (lethal concentration, 50%) percent effluent for acute toxicity and the IC<sub>25</sub> (inhibition concentration, 25%) percent effluent for chronic toxicity, as determined by the WET test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC<sub>50</sub> is typically 100% effluent and does not need to be determined by the WLA.

**Table 2: WET Limits for IC<sub>25</sub>**

Season	Percent Effluent
Annual	49%

Effluent Limits

Effluent limits were determined using a mass balance mixing analysis (UDWQ 2012). The mass balance analysis is summarized in Appendix A.

The water quality standard for chronic ammonia toxicity is dependent on temperature and pH, and the water quality standard for acute ammonia toxicity is dependent on pH. The seasonal average temperature and pH of Ferron Creek was used to determine the chronic criteria, and the seasonal 80<sup>th</sup> percentile pH was used to determine the acute criteria. The water quality standards for ammonia are summarized in Appendix B.

The limits for total residual chlorine were determined assuming a decay rate of 20 /day (at 20 °C) and a travel time in the outlet ditch of 10 minutes (1,000 linear feet at 0.02 ft/ft slope) prior to discharge to Ferron Creek. The analysis for TRC is summarized in Appendix C.

Due to the lack of discharge since 2005, the effects of TP, TN, DO and BOD<sub>5</sub> in the effluent on the DO in the downstream receiving waters was not assessed. It is presumed that previous permit limits for these constituents, if applicable, would be sufficiently protective of the receiving water.

**Table 3: Water Quality Based Effluent Limits Summary**

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Flow (MGD)		0.5	1 day		0.5	30 days
Ammonia (mg/L)			1 hour			30 days
Summer (Jul-Sep)	9.6	14.5		2.3	4.6	
Fall (Oct-Dec)	9.2	14.0		4.4	8.9	
Winter (Jan-Mar)	9.4	14.2		5.6	11.3	
Spring (Apr-Jun)	4.0	6.1		2.0	3.9	
Total Residual Chlorine (mg/L)	0.019	0.033	1 hour	0.011	0.026	4 days
Dissolved Oxygen (mg/L)	3.0	3.0	Minimum	5.0	5.0	30 days
Total Dissolved Solids (mg/L)	3,500	3,500	Maximum			

Model and supporting documentation are available for review upon request.

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Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remains below the WQBELs presented in this wasteload.

A Level II Antidegradation Review (ADR) is not required for this discharge since the pollutant concentration and load is not increasing under this permit renewal.

Documents:

WLA Document: *ferron\_potw\_wla\_2019-04-30.docx*

Wasteload Analysis: *ferron\_potw\_wla\_2019.xlsm*

References:

Utah Division of Water Quality. 2012. *Utah Wasteload Analysis Procedures Version 1.0*.

Utah Division of Water Quality. 2016. *Utah's 2016 Integrated Report*.

MFG Inc. 2004. *Price River, San Rafael River, and Muddy Creek TMDLs for Total Dissolved Solids, West Colorado Watershed Management Unit, Utah*. Utah Division of Water Quality.

**WASTELOAD ANALYSIS [WLA]**

Date: 4/30/2019

**Appendix A: Mass Balance Mixing Analysis for Conservative Constituents**

Discharging Facility:	Ferron Lagoons		
UPDES No:	UT-0020052		
Permit Flow [MGD]:	0.50 Annual	Max. Daily	
	0.50 Annual	Max. Monthly	
Receiving Water:	Ferron Creek		
Stream Classification:	2B, 3C, 4		
Stream Flows [cfs]:	0.8 All Seasons	Critical Low Flow	
Fully Mixed:	NO		
Acute River Width:	50%		
Chronic River Width:	100%		

**Modeling Information**

A simple mixing analysis was used to determine the effluent limits.

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

**Effluent Limitations**

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort reflect the environmental conditions expected at low stream flows.

**Effluent Limitations for Protection of Recreation (Class 2B Waters)**

**Physical**

Parameter	Maximum Concentration
pH Minimum	6.5
pH Maximum	9.0
Turbidity Increase (NTU)	10.0

**Bacteriological**

E. coli (30 Day Geometric Mean)	206 (#/100 mL)
E. coli (Maximum)	668 (#/100 mL)

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Effluent Limitations for Protection of Aquatic Wildlife (Assumed Class 3C Waters)

Temperature (deg C)	Maximum
Instantaneous	27.0
Change	4.0

Dissolved Oxygen (mg/L)	Minimum Concentration
Instantaneous	3.0
30-day Average	5.0

pH	Concentration
Minimum	6.5
Maximum	9.0

Inorganics	Chronic Standard (4 Day Average) Parameter Standard	Acute Standard (1 Hour Average) Standard
Phenol (mg/L)		0.010
Hydrogen Sulfide (Undissociated) [mg/L]		0.002

Ammonia-Total (mg/L)	Season	Chronic (30-day ave)			Acute (1-hour ave)		
		Standard	Background	Limit	Standard	Background	Limit
	Summer	2.3	0.1	4.6	9.6	0.1	14.5
	Fall	4.4	0.1	8.9	9.2	0.1	14.0
	Winter	5.6	0.1	11.3	9.4	0.1	14.2
	Spring	2.0	0.1	3.9	4.0	0.1	6.1

Metals-Total Recoverable	Parameter	Chronic (4-day ave)			Acute (1-hour ave)		
		Standard <sup>1</sup>	Background	Limit	Standard <sup>1</sup>	Background	Limit
	Aluminum (µg/L)	87.0	21.0	155.3	750.0	21.0	1127.0
	Arsenic (µg/L)	150.0	2.7	302.3	340.0	2.7	514.4
	Cadmium (µg/L)	0.6	0.48	0.8	7.7	0.48	11.5
	Chromium VI (µg/L)	11.0	5.4	16.8	16.0	5.4	21.5
	Chromium III (µg/L)	230.7	5.4	463.7	1773.3	5.4	2687.5
	Copper (µg/L)	29.3	6.2	53.1	49.6	6.2	72.1
	Cyanide (µg/L) <sup>2</sup>	5.2	3.5	7.0	22.0	3.5	31.6
	Iron (µg/L)				1000.0	23.0	1505.2
	Lead (µg/L)	10.9	1.3	20.9	280.8	1.3	425.4
	Mercury (µg/L) <sup>2</sup>	0.012	0.008	0.016	2.4	0.008	3.6
	Nickel (µg/L)	168.0	5.8	335.8	1512.9	5.8	2292.3
	Selenium (µg/L)	4.6	2.1	7.2	18.4	2.1	26.8
	Silver (µg/L)				34.9	1.1	52.4
	Tributyltin (µg/L) <sup>2</sup>	0.072	0.048	0.097	0.46	0.048	0.67
	Zinc (µg/L)	382.4	24.0	753.1	379.3	24.0	563.0

1: Based upon a Hardness of 400 mg/l as CaCO<sub>3</sub>

2: Background concentration assumed 67% of chronic standard

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Organics [Pesticides]

Parameter	Chronic (4-day ave)		Acute (1-hour ave)	
	Standard	Limit	Standard	Limit
Aldrin (µg/L)			1.5	1.5
Chlordane (µg/L)	0.0043	0.0043	1.2	1.2
DDT, DDE (µg/L)	0.001	0.001	0.55	0.55
Diazinon (µg/L)	0.17	0.17	0.17	0.17
Dieldrin (µg/L)	0.0056	0.0056	0.24	0.24
Endosulfan, a & b (µg/L)	0.056	0.056	0.11	0.11
Endrin (µg/L)	0.036	0.036	0.086	0.086
Heptachlor & H. epoxide (µg/L)	0.0038	0.0038	0.26	0.26
Lindane (µg/L)	0.08	0.08	1.0	1.0
Methoxychlor (µg/L)			0.03	0.03
Mirex (µg/L)			0.001	0.001
Nonylphenol (µg/L)	6.6	6.6	28.0	28.0
Parathion (µg/L)	0.0130	0.0130	0.066	0.066
PCB's (µg/L)	0.014	0.014		
Pentachlorophenol (µg/L)	15.0	15.0	19.0	19.0
Toxephene (µg/L)	0.0002	0.0002	0.73	0.73

Radiological

Parameter	Maximum Concentration
	Standard
Gross Alpha (pCi/L)	15

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

Parameter	Maximum Concentration		
	Standard	Background	Limit
Total Dissolved Solids (mg/L)	3500		3500
Boron (mg/L)	0.75		0.8
Arsenic, Dissolved (µg/L)	100		100
Cadmium, Dissolved (µg/L)	10		10.0
Chromium, Dissolved (µg/L)	100		100
Copper, Dissolved (µg/L)	200		200
Lead, Dissolved (µg/L)	100		100
Selenium, Dissolved (µg/L)	50		50
Gross Alpha (pCi/L)	15		15.0

Freshwater total ammonia criteria based on Title R317-2-14 Utah Administrative Code  
 Acute

<b>INPUT</b>				
	Summer	Fall	Winter	Spring
pH:	7.93	7.95	7.94	8.38
Beneficial use classification:	3C	3C	3C	3C
<b>OUTPUT</b>				
Total ammonia nitrogen criteria (mg N/L): Acute:	9.58	9.23	9.41	4.04

Freshwater total ammonia criteria based on Title R317-2-14 Utah Administrative Code  
Chronic

<b>INPUT</b>				
	Summer	Fall	Winter	Spring
Temperature (deg C):	17.9	9.9	6.6	14.5
pH:	7.9	7.8	7.7	8.1
Are fish early life stages present?	No	No	No	No
<b>OUTPUT</b>				
Total ammonia nitrogen criteria (mg N/L):				
Chronic - Fish Early Life Stages Present:	2.30	3.26	3.43	1.95
Chronic - Fish Early Life Stages Absent:	2.30	4.40	5.58	1.95

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**WASTELOAD ANALYSIS [WLA]**  
**Appendix C: Total Residual Chlorine**

Date: 4/30/2019

Discharging Facility: Ferron Lagoons  
 UPDES No: UT-0020052

**CHRONIC**

											Decay Rate (/day)			
	Season	Receiving Water	Standard	Total Effluent	Mixing Zone Boundary	Effluent Limit Without Decay	Temperature (°C)	@ 20 deg C	@ T deg C	Travel Time (min)	Decay Coefficient	Effluent Limit		
Discharge (cfs)	Annual	0.8		0.8	1.6									
TRC (mg/L)	Annual	0.000	0.011			0.022	20.0	20	20.0	10	0.87	0.026		

**ACUTE**

											Decay Rate (/day)			
	Season	Receiving Water	Standard	Total Effluent	Mixing Zone Boundary	Effluent Limit Without Decay	Temperature (°C)	@ 20 °C	@ T °C	Travel Time (min)	Decay Coefficient	Effluent Limit		
Discharge (cfs)	Annual	0.4		0.8	1.2									
TRC (mg/L)	Annual	0.000	0.019			0.029	20.0	20	20.0	10	0.87	0.033		