

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

Date: December 1, 2023

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Standards and Technical Services

Facility: Springdale Wastewater Lagoons
UPDES Permit No. UT-0025224

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: direct discharge to Virgin River at 0.29 MGD design flow.

Receiving Water

The effluent discharges directly into the Virgin River between Rockland, UT and Virgin, UT.

Per UAC R317-2-13.4, the designated beneficial uses *Virgin River and tributaries, from the Quail Creek diversion to headwaters, except as listed below* are: 1C,2B,3C,4.

- *Class 1C – Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.*
- *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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Flow

Typically, the critical flow for the receiving water in a wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten-year return frequency (7Q10). Daily in-stream flow records were analyzed from USGS 09406000: VIRGIN RIVER AT VIRGIN, UT monitoring location. The annual 7Q10 critical flow value for the Virgin River at this location is 71.86 ft³/s. Receiving water quality was characterized using data from DWQ Monitoring Station DWQ 4950850: VIRGIN R 1 MI E OF VIRGIN for the period 2000-2023.

Both of the above monitoring stations are below the Springdale Wastewater Lagoons discharge location. However, review of available stations and associated data led to the conclusion that they are the most appropriate sites to characterize the receiving water. Upstream stations on the Virgin River are upstream of the confluence with major tributaries (East Fork of the Virgin River). Upstream water quality and discharge data were infrequently collected and have not been monitored for many years. Discharge data from Springdale Wastewater Lagoons indicate that they discharge on a very intermittent basis (on the order of 4 times per year). Additionally, the lagoon discharge rate (0.45 ft³/s) is very small compared to the receiving water flow (even at annual critical low flow of 71.86 ft³/s). Given these factors, it is unlikely that downstream data is significantly influenced by the lagoon discharge.

Total Maximum Daily Load (TMDL)

According to the Utah's [Final 2022 Integrated Report on Water Quality](#) dated December 9, 2022, the receiving water for the discharge, "Virgin River and tributaries from North Creek confluence to North Fork Virgin River (Assessment Unit UT15010008-012_00)" was listed as "No Evidence of Impairment". Furthermore, downstream Assessment Unit (UT15010008-011_00) "Virgin River and tributaries from Quail Creek Diversion to North Creek confluence" was listed as "Fully Supporting"

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.

Individual mixing zones may be disallowed in consideration of site-specific factors. For the site location, biologically important areas such as fish spawning/nursery areas or segments with occurrences of federally listed threatened or endangered species may be present (R317-2-5.1.b.). According to US Fish and Wildlife Service (US FWS), endangered species downstream and possibly within this area include, Virgin River Chub (*Gila seminuda*) and Woundfin (*Plagopterus argentissimus*). Because the critical habitat of these species is potentially affected, authorized additional study may be required from agencies including but not limited to US EPA, US FWS, Utah Division of Wildlife Resources. In addition, early life species (ELS) are present at least January through August in this reach of Virgin River. Therefore, no mixing zone is granted for this effluent discharge point source. Water quality standards must be met at the end of pipe (EOP).

Further special studies commissioned by the permittee would be required to support inclusion of a dilution credit through the addition of a mixing zone.

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Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were determined in consultation with the UPDES Permit Writer, the Utah Water Quality Assessment Reports, and the industry SIC codes from <https://www.osha.gov/data/sic-search>. The potential parameters of concern for this facility include: Temperature, TDS, TSS, pH, dissolved oxygen, total ammonia, BOD, phosphorous, nitrogen, TRC, toxic organics, metals, and major ions.

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 LC₅₀ (lethal concentration, 50%) percent effluent for acute toxicity and the IC₂₅ (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 LC₅₀ is typically 100% effluent and does not need to be determined by the WLA.

WET limits for Outfall 001 for IC₂₅ should be based on 0.9% effluent.

Wasteload Allocation Methods

Effluent limits were determined for conservative constituents using a simple mass balance mixing analysis (UDWQ 2021). The mass balance analysis is summarized in the Wasteload Addendum.

The Utah Rivers Model was used to evaluate the DO sag and implications on nutrients and BOD. The analysis is summarized in the Wasteload Addendum.

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. To evaluate effluent discharge water quality, the Springdale Lagoons discharge monitoring report (DMR) was used. Background temperature and pH values from the Virgin River were used in the analysis.

Models and supporting documentation are available for review upon request.

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 facility. The proposed permit is a renewal with no additional flow or concentration of pollutants over those authorized for the Virgin River.

Documents:

WLA Document: *231201-Springdale_Lagoon_WLA_2023.docx*
Wasteload Analysis and Addendums: *231201-Springdale_Lagoon_WLA_2023.xlsm*

References:

Utah Division of Water Quality

Wasteload Analysis

Springdale Wastewater Lagoons, UPDES Permit No. UT-0025224

Utah Division of Water Quality. 2022. Final 2022 Integrated Report on Water Quality.

<https://documents.deq.utah.gov/water-quality/monitoring-reporting/integrated-report/DWQ-2022-002386.pdf>

Utah Division of Water Quality. 2021. Utah Wasteload Analysis Procedures Version 2.0.

<https://documents.deq.utah.gov/water-quality/standards-technical-services/DWQ-2021-000684.pdf>

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WASTELOAD ANALYSIS [WLA] [REDACTED] = not included in the WLA
Addendum: Statement of Basis

1-Dec-23
4:00 PM

Facilities: Springdale Lagoons
Discharging to: Virgin River

UPDES No: UT-UT0025224

I. Introduction

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 [R317-2-8, UAC]. Projected concentrations are compared to numeric water quality standards to determine acceptability. The anti-degradation policy and procedures are also considered. The primary in-stream parameters of concern may include metals (as a function of hardness), total dissolved solids (TDS), total residual chlorine (TRC), un-ionized ammonia (as a function of pH and temperature, measured and evaluated in terms of total ammonia), and dissolved oxygen.

Mathematical water quality modeling is employed to determine stream quality response to point source discharges. Models aid in the effort of anticipating stream quality at future effluent flows at critical environmental conditions (e.g., low stream flow, high temperature, high pH, etc).

The numeric criteria in this wasteload analysis may always be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

II. Receiving Water and Stream Classification

Virgin River: 1C,2B,3C,4
Antidegradation Review: Level I review completed. Level II review is not required.

III. Numeric Stream Standards for Protection of Aquatic Wildlife

Total Ammonia (TNH3)	Varies as a function of Temperature and pH Rebound. See Water Quality Standards
Chronic Total Residual Chlorine (TRC)	0.011 mg/l (4 Day Average) 0.019 mg/l (1 Hour Average)
Chronic Dissolved Oxygen (DO)	N/A 5.0 mg/l (30 Day Average) mg/l (7Day Average) 3.0 mg/l (1 Day Average)
Maximum Total Dissolved Solids	1200.0 mg/l

There are additional standards that apply to this receiving water, but were not considered in this modeling/waste load allocation analysis.

VII. Mathematical Modeling of Stream Quality

Model configuration was accomplished utilizing standard modeling procedures. Data points were plotted and coefficients adjusted as required to match observed data as closely as possible.

The modeling approach used in this analysis included one or a combination of the following models.

(1) The Utah River Model, Utah Division of Water Quality, 1992. Based upon STREAMDO IV (Region VIII) and Supplemental Ammonia Toxicity Models; EPA Region VIII, Sept. 1990 and QUAL2E (EPA, Athens, GA).

(2) Utah Ammonia/Chlorine Model, Utah Division of Water Quality, 1992.

(3) AMMTOX Model, University of Colorado, Center of Limnology, and EPA Region 8

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(4) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al.
Harper Collins Publisher, Inc. 1987, pp. 644.

Coefficients used in the model were based, in part, upon the following references:

(1) Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens Georgia. EPA/600/3-85/040 June 1985.

(2) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al.
Harper Collins Publisher, Inc. 1987, pp. 644.

VIII. Modeling Information

The required information for the model may include the following information for both the upstream conditions at low flow and the effluent conditions:

Flow, Q, (cfs or MGD)	D.O. mg/l
Temperature, Deg. C.	Total Residual Chlorine (TRC), mg/l
pH	Total NH3-N, mg/l
BOD5, mg/l	Total Dissolved Solids (TDS), mg/l
Metals, ug/l	Toxic Organics of Concern, ug/l

Other Conditions

In addition to the upstream and effluent conditions, the models require a variety of physical and biological coefficients and other technical information. In the process of actually establishing the permit limits for an effluent, values are used based upon the available data, model calibration, literature values, site visits and best professional judgement.

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis. Dry washes are considered to have an upstream flow equal to the flow of the discharge.

Current Upstream Information

	Stream							
	Critical Low							
	Flow	Temp.	pH	T-NH3	BOD5	DO	TRC	TDS
	cfs	Deg. C		mg/l as N	mg/l	mg/l	mg/l	mg/l
Summer (Irrig. Season)	51.4	22.5	8.2	0.04	2.50	6.79	0.00	509.1
Fall	70.9	10.3	8.2	0.03	2.50	---	0.00	504.5
Winter	103.7	7.8	8.2	0.03	2.50	---	0.00	504.5
Spring	64.0	16.5	8.3	0.04	2.50	---	0.00	504.5

Projected Discharge Information

Season	Flow, MGD	Temp.	TDS mg/l	TDS tons/day
Summer	0.29000	23.8	1541.00	1.86316
Fall	0.29000	11.2		
Winter	0.29000	18.6		
Spring	0.29000	12.0		

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

IX. 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).

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

Effluent Limitation for Flow based upon Water Quality Standards

In-stream criteria of downstream segments will be met with an effluent flow maximum value as follows:

Season	Daily Average	
Summer	0.290 MGD	0.449 cfs
Fall	0.290 MGD	0.449 cfs
Winter	0.290 MGD	0.449 cfs
Spring	0.290 MGD	0.449 cfs

Flow Requirement or Loading Requirement

The calculations in this wasteload analysis utilize the maximum effluent discharge flow of 0.29 MGD. If the discharger is allowed to have a flow greater than 0.29 MGD during 7Q10 conditions, and effluent limit concentrations as indicated, then water quality standards will be violated. In order to prevent this from occurring, the permit writers must include the discharge flow limitation as indicated above; or, include loading effluent limits in the permit.

Effluent Limitation for Whole Effluent Toxicity (WET) based upon WET Policy

Effluent Toxicity will not occur in downstream segments if the values below are met.

WET Requirements	LC50 > IC25 >	2.9% Effluent 0.9% Effluent	[Acute] [Chronic]	Receiving Water Flow (cfs)	Effluent Flow (MGD)	Effluent Flow (cfs)	Combined Flow (cfs)	Totally Mixed	Chronic	Acute
									IC25 % Effluent	LC50 % Effluent
Season										
Summer				51.41	0.3	0.4	51.9	NO	0.9%	0.1%
Fall				70.86	0.3	0.4	71.3	NO	0.6%	0.0%
Winter				103.71	0.3	0.4	104.2	NO	0.4%	0.0%
Spring				64.00	0.3	0.4	64.4	NO	0.7%	0.0%

Effluent Limitation for Biological Oxygen Demand (BOD) based upon Water Quality Standards or Regulations

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD limitation as follows:

Season	Concentration	
Summer	35.0 mg/l as BOD5	84.6 lbs/day
Fall	35.0 mg/l as BOD5	84.6 lbs/day
Winter	35.0 mg/l as BOD5	84.6 lbs/day
Spring	35.0 mg/l as BOD5	84.6 lbs/day

Effluent Limitation for Dissolved Oxygen (DO) based upon Water Quality Standards

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent D.O. limitation as follows:

Season	Concentration
Summer	4.00
Fall	4.00
Winter	4.00
Spring	4.00

Effluent Limitation for Total Ammonia based upon Water Quality Standards

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In-stream criteria of downstream segments for Total Ammonia will be met with an effluent limitation (expressed as Total Ammonia as N) as follows:

Season		Concentration	Load
Summer	4 Day Avg. - Chronic	104.9 mg/l as N	253.7 lbs/day
	1 Hour Avg. - Acute	222.1 mg/l as N	537.1 lbs/day
Fall	4 Day Avg. - Chronic	138.5 mg/l as N	334.9 lbs/day
	1 Hour Avg. - Acute	309.2 mg/l as N	747.7 lbs/day
Winter	4 Day Avg. - Chronic	238.9 mg/l as N	577.7 lbs/day
	1 Hour Avg. - Acute	519.9 mg/l as N	1,257.3 lbs/day
Spring	4 Day Avg. - Chronic	153.0 mg/l as N	370.0 lbs/day
	1 Hour Avg. - Acute	340.5 mg/l as N	823.4 lbs/day

Acute limit calculated with an Acute Zone of Initial Dilution (ZID) to be equal to 50.0%.

Effluent Limitation for Total Residual Chlorine based upon Water Quality Standards

In-stream criteria of downstream segments for Total Residual Chlorine will be met with an effluent limitation as follows:

Season		Concentration	Load
Summer	4 Day Avg. - Chronic	1.157 mg/l	2.80 lbs/day
	1 Hour Avg. - Acute	1.050 mg/l	2.54 lbs/day
Fall	4 Day Avg. - Chronic	1.590 mg/l	3.85 lbs/day
	1 Hour Avg. - Acute	1.440 mg/l	3.48 lbs/day
Winter	4 Day Avg. - Chronic	2.323 mg/l	5.62 lbs/day
	1 Hour Avg. - Acute	2.099 mg/l	5.08 lbs/day
Spring	4 Day Avg. - Chronic	1.437 mg/l	3.48 lbs/day
	1 Hour Avg. - Acute	1.303 mg/l	3.15 lbs/day

Effluent Limitations for Total Dissolved Solids based upon Water Quality Standards

Season		Concentration	Load
Summer	Maximum, Acute	80372.7 mg/l	97.18 tons/day
Fall	Maximum, Acute	80900.0 mg/l	97.81 tons/day
Winter	Maximum, Acute	82035.7 mg/l	99.19 tons/day
Spring	4 Day Avg. - Chronic	86478.5 mg/l	104.56 tons/day

Colorado Salinity Forum Limits Determined by Permitting Section

**Effluent Targets for Pollution Indicators
Based upon Water Quality Standards**

In-stream criteria of downstream segments for Pollution Indicators will be met with an effluent limit as follows:

	Concentration	1 Hour Average
		Loading
Gross Beta (pCi/l)	50.0 pCi/L	
BOD (mg/l)	5.0 mg/l	12.1 lbs/day
Nitrates as N	4.0 mg/l	9.7 lbs/day
Total Phosphorus as P	0.05 mg/l	0.1 lbs/day
Total Suspended Solids	90.0 mg/l	217.7 lbs/day

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

INPUT

	Summer	Fall	Winter	Spring
pH:	8.23	8.21	8.16	8.27
Beneficial use classification:	3C	3C	3C	3C

OUTPUT

	Summer	Fall	Winter	Spring
Total ammonia nitrogen criteria (mg N/L):				
Acute (Class 3A):	3.588	3.782	4.113	3.329
Acute (Class 3B, 3C, 3D):	5.372	5.663	6.158	4.984

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

INPUT				
	Summer	Fall	Winter	Spring
Temperature (deg C):	22.50	10.29	7.81	16.52
pH:	8.23	8.21	8.16	8.27
Are fish early life stages present?	Yes	Yes	Yes	Yes
OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Chronic - Fish Early Life Stages Present:	1.017	1.777	1.903	1.404
Chronic - Fish Early Life Stages Absent:	1.017	2.333	2.933	1.404