

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

Date: July 28, 2023

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Standards and Technical Services

Facility: Payson City Wastewater Treatment Facility, Payson, UT
UPDES No. UT0020427

Receiving water: Beer 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: Irrigation Ditch → Beer Creek → Benjamin Slough → Utah Lake

The maximum daily design discharge is 6.03 MGD and the maximum monthly design discharge is 5.0 MGD for the facility.

Receiving Water

The receiving water for Outfall 001 is an unnamed irrigation ditch, which is tributary to Beer Creek, which drains to Benjamin Slough and then to Utah Lake.

Per UAC R317-2-13.5.c, the designated beneficial uses for Beer Creek (Utah County) from 4850 West (in NE1/4NE1/4 sec. 36, T.8 S., R.1 E.) to headwaters 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*

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- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

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 Beer Creek, the 20th percentile of flow measurements was calculated to estimate seasonal critical flow in the receiving water (Table 1). No flow records were found for the irrigation ditch and it was assumed the ditch has no flow during critical conditions.

Payson Power (UPDES UT0025518) also discharges to the same irrigation ditch and has the potential to discharge concurrently with the Payson City Wastewater Treatment Plant discharge; however, based on information provided by the permittee, Payson Power would not discharge when the wastewater treatment plant discharge is at the maximum (AQUA Engineering 2017a).

Table 1: Annual critical low flow (cfs)

| Season | BEER CK AB PAYSON WWTP AT U115 XING (4995420) |
|--------|---|
| Summer | 2.47 |
| Fall | 6.70 |
| Winter | 11.90 |
| Spring | 6.12 |

Protection of Downstream Uses

Per UAC R317-2-8, *all actions to control waste discharges under these rules shall be modified as necessary to protect downstream designated uses.* For this discharge, 3C numeric aquatic life use criteria apply to the immediate receiving water (Beer Creek).

TMDL

Beer Creek and tributaries from confluence with Spring Creek to headwaters (UT16020202-027_00) is listed as impaired for E. coli and O/E bioassessment according to the 303(d) list in the *Utah’s Final 2021 Integrated Report (UDWQ 2021)*. Benjamin Slough from confluence with Utah Lake to Beer Creek confluence is listed as impaired for total ammonia. Utah Lake other than Provo Bay (UT-L-16020201-004_01) is listed as impaired for E. coli, Harmful Algal Blooms (HABs), Eutrophication, PCBs in Fish Tissue, Phosphorus; and Total Dissolved Solids (TDS).

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), BOD₅, 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.

Water Quality Modeling

A QUAL2Kw model of the receiving water was built and calibrated to synoptic survey data collected in October of 2013 by DWQ staff using standard operating procedures (UDWQ 2012). The model of Beer Creek extends 4 kilometers downstream from the confluence with the unnamed irrigation ditch to near the crossing with South 4850 West.

Receiving water quality data were obtained from monitoring site 4995420 Beer Creek above Payson WWTP at U-115 Crossing for the period 2002-2023. 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 4995410 Payson WWTP and 4995480 Payson Power Project Outfall for the same period.

The QUAL2Kw model was used for determining the WQBELs. Effluent concentrations were adjusted so that water quality standards were not exceeded in the receiving water. Where WQBELs exceeded secondary standards or categorical limits, the concentration in the model was set at the secondary standard or categorical limit.

The calibration and wasteload models are available for review by request.

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.

Table 2: WET Limits for IC₂₅

| Season | Percent Effluent |
|---------------|-------------------------|
| Summer | 76% |
| Fall | 54% |
| Winter | 39% |
| Spring | 56% |

Effluent Limits

The effect of the effluent on the DO in the receiving water was evaluated using the QUAL2Kw model. A DO sag downstream resulting from the plant discharge was predicted by the model in Beer Creek. However, the DO recovered and limits beyond secondary standards are not required for DO and BOD₅ (Table 3). QUAL2Kw rates, input and output for DO and eutrophication related constituents are summarized in Appendix A.

The ammonia limits for both acute and chronic toxicity were determined. The previous permit only had limits for ammonia resulting from acute toxicity (max. daily limit). In 2008, the chronic ammonia criteria were extended to 3C and 3D waters.

The limits for total residual chlorine were determined assuming an average decay rate of 42 /day (at 20 C°) and a travel time in the unnamed irrigation ditch of 107 minutes prior to discharge to Beer Creek (AQUA Engineering 2017b). The analysis for TRC is summarized in Appendix B.

A mass balance mixing analysis was conducted for conservative constituents such as dissolved metals. The WQBELs for conservative constituents are summarized in Appendix C.

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 required for this discharge since the pollutant concentration and load is an increasing flow under this permit renewal.

Utah Division of Water Quality
Wasteload Analysis
Payson City Wastewater Treatment Plant, Payson, UT
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Documents:

WLA Document : *Payson_WWTP_2023.docx*

QUAL2Kw Wasteload Model: *Payson_WLA_2023-Final.xlsm*

References:

AQUA Engineering. 2017a. *Discharge Flows to Beer Creek from Payson City and UAMPS.*

AQUA Engineering. 2017b. *Payson Chlorine Decay Rates.*

Neilson, B.T., A.J. Hobson, N. von Stackelberg, M. Shupryt, and J.D. Ostermiller. 2012. *Using QUAL2K Modeling to Support Nutrient Criteria Development and Wasteload Analyses in Utah.*

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

Utah Division of Water Quality. 2012b. *Field Data Collection for QUAL2Kw Model Build and Calibration Standard Operating Procedures Version 1.0.*

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

Utah Division of Water Quality

WASTELOAD ANALYSIS [WLA]

Date: 10/16/2023

Appendix A: QUAL2Kw Analysis for Eutrophication

Discharging Facility: Payson WWTP
 UPDES No: UT-0020427
 Permit Flow [MGD]: 5.00 Maximum Monthly Flow
 6.03 Maximum Daily Flow

Receiving Water: Beer Creek
 Stream Classification: 2B, 3C, 4
 Stream Flows [cfs]: 2.47 Summer (July-Sept) Critical Low Flow
 6.70 Fall (Oct-Dec)
 11.90 Winter (Jan-Mar)
 6.12 Spring (Apr-June)

Fully Mixed: NO
 Acute River Width: 50%
 Chronic River Width: 100%

Modeling Information

A QUAL2Kw model was used to determine these effluent limits.

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.

| Headwater/Upstream Information | Summer | Fall | Winter | Spring |
|-----------------------------------|--------|-------|--------|--------|
| Flow (cfs) | 2.5 | 6.7 | 11.9 | 6.1 |
| Temperature (deg C) | 21.2 | 8.2 | 5.7 | 15.2 |
| Specific Conductance (µmhos) | 1253 | 998 | 1123 | 1218 |
| Inorganic Suspended Solids (mg/L) | 51.0 | 49.9 | 35.1 | 40.0 |
| Dissolved Oxygen (mg/L) | 8.6 | 10.8 | 11.9 | 9.3 |
| CBOD ₅ (mg/L) | 3.2 | 3.3 | 4.9 | 5.9 |
| Organic Nitrogen (mg/L) | 1.500 | 1.500 | 1.500 | 1.500 |
| NH ₄ -Nitrogen (mg/L) | 0.060 | 0.250 | 0.590 | 0.360 |
| NO ₃ -Nitrogen (mg/L) | 1.280 | 1.840 | 1.540 | 1.220 |
| Organic Phosphorus (mg/L) | 0.080 | 1.560 | 0.080 | 0.080 |
| Inorganic Ortho-Phosphorus (mg/L) | 0.220 | 0.170 | 0.230 | 0.290 |
| Phytoplankton (µg/L) | 0.0 | 0.0 | 0.0 | 0.0 |
| Detritus [POM] (mg/L) | 5.7 | 5.5 | 3.9 | 4.4 |
| Alkalinity (mg/L) | 389 | 365 | 409 | 405 |
| pH | 7.9 | 8.2 | 8.3 | 8.3 |

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Discharge Information - Payson POTW

| Chronic | Summer | Fall | Winter | Spring |
|-----------------------------------|---------------|-------------|---------------|---------------|
| Flow (MGD) | 5.0 | 5.0 | 5.0 | 5.0 |
| Temperature (deg C) | 22.3 | 15.8 | 11.6 | 16.9 |
| Specific Conductance (µmhos) | 1561 | 1500 | 1472 | 1349 |
| Inorganic Suspended Solids (mg/L) | 3.7 | 2.8 | 4.0 | 4.2 |
| Organic Nitrogen (mg/L) | 5.000 | 5.000 | 5.000 | 5.000 |
| NO3-Nitrogen (mg/L) | 23.440 | 27.210 | 27.660 | 25.260 |
| Organic Phosphorus (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Inorganic Ortho-Phosphorus (mg/L) | 5.000 | 5.000 | 5.000 | 5.000 |
| Phytoplankton (µg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Detritus [POM] (mg/L) | 0.0 | 0.0 | 0.0 | 0.0 |
| Alkalinity (mg/L) | 215 | 200 | 193 | 203 |
| pH | 7.4 | 7.3 | 7.3 | 7.4 |

| Acute | Summer | Fall | Winter | Spring |
|-----------------------------------|---------------|-------------|---------------|---------------|
| Flow (MGD) | 6.0 | 6.0 | 6.0 | 6.0 |
| Temperature (deg C) | 22.3 | 15.8 | 11.6 | 16.9 |
| Specific Conductance (µmhos) | 1561 | 1500 | 1472 | 1349 |
| Inorganic Suspended Solids (mg/L) | 3.7 | 2.8 | 4.0 | 4.2 |
| Organic Nitrogen (mg/L) | 10.000 | 10.000 | 10.000 | 10.000 |
| NO3-Nitrogen (mg/L) | 23.440 | 27.210 | 27.660 | 25.260 |
| Organic Phosphorus (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Inorganic Ortho-Phosphorus (mg/L) | 10.000 | 10.000 | 10.000 | 10.000 |
| Phytoplankton (µg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Detritus [POM] (mg/L) | 0.0 | 0.0 | 0.0 | 0.0 |
| Alkalinity (mg/L) | 215 | 200 | 193 | 203 |
| pH | 7.8 | 7.7 | 7.7 | 8.0 |

Discharge Information - Payson Power

| Chronic | Summer | Fall | Winter | Spring |
|----------------|---------------|-------------|---------------|---------------|
| Flow (MGD) | 0.0 | 0.0 | 0.0 | 0.0 |

| Acute | Summer | Fall | Winter | Spring |
|--------------|---------------|-------------|---------------|---------------|
| Flow (MGD) | 0.0 | 0.0 | 0.0 | 0.0 |

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 based upon Water Quality Standards for DO, and Ammonia and Total Residual Chlorine Toxicity

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

| | Chronic | Standard | Summer | Fall | Winter | Spring |
|--------------------------------------|----------------|-----------------|---------------|-------------|---------------|---------------|
| Flow (MGD) | | N/A | 5.00 | 5.00 | 5.00 | 5.00 |
| NH4-Nitrogen (mg/L) | | Varies | 3.0 | 6.0 | 6.0 | 4.5 |
| CBOD ₅ (mg/L) | | N/A | 25.0 | 25.0 | 25.0 | 25.0 |
| Dissolved Oxygen [30-day Ave] (mg/L) | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Total Residual Chlorine (mg/L) | | 0.0110 | 0.5 | 0.3 | 0.2 | 0.3 |
| | Acute | Standard | Summer | Fall | Winter | Spring |
| Flow (MGD) | | N/A | 6.0 | 6.0 | 6.0 | 6.0 |
| NH4-Nitrogen (mg/L) | | Varies | 4.5 | 7.0 | 8.5 | 4.0 |
| CBOD ₅ (mg/L) | | N/A | 35.0 | 35.0 | 35.0 | 35.0 |
| Dissolved Oxygen [Minimum] (mg/L) | | 3.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Total Residual Chlorine (mg/L) | | 0.0190 | 0.7 | 0.3 | 0.3 | 0.4 |

Summary Comments

The mathematical modeling and best professional judgement indicate that violations of receiving water beneficial uses with their associated water quality standards, including important downstream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

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Coefficients and Other Model Information

| <i>Parameter</i> | <i>Value</i> | <i>Units</i> |
|--|------------------|--------------|
| <i>Stoichiometry:</i> | | |
| Carbon | 40 | gC |
| Nitrogen | 7.2 | gN |
| Phosphorus | 1 | gP |
| Dry weight | 100 | gD |
| Chlorophyll | 1 | gA |
| <i>Inorganic suspended solids:</i> | | |
| Settling velocity | 0.001 | m/d |
| <i>Oxygen:</i> | | |
| Reaeration model | Thackston-Dawson | |
| Temp correction | 1.024 | |
| Reaeration wind effect | None | |
| O2 for carbon oxidation | 2.69 | gO2/gC |
| O2 for NH4 nitrification | 4.57 | gO2/gN |
| Oxygen inhib model CBOD oxidation | Exponential | |
| Oxygen inhib parameter CBOD oxidation | 0.60 | L/mgO2 |
| Oxygen inhib model nitrification | Exponential | |
| Oxygen inhib parameter nitrification | 0.60 | L/mgO2 |
| Oxygen enhance model denitrification | Exponential | |
| Oxygen enhance parameter denitrification | 0.60 | L/mgO2 |
| Oxygen inhib model phyto resp | Exponential | |
| Oxygen inhib parameter phyto resp | 0.60 | L/mgO2 |
| Oxygen enhance model bot alg resp | Exponential | |
| Oxygen enhance parameter bot alg resp | 0.60 | L/mgO2 |
| <i>Slow CBOD:</i> | | |
| Hydrolysis rate | 0 | /d |
| Temp correction | 1.047 | |
| Oxidation rate | 0.103 | /d |
| Temp correction | 1.047 | |
| <i>Fast CBOD:</i> | | |
| Oxidation rate | 10 | /d |
| Temp correction | 1.047 | |
| <i>Organic N:</i> | | |
| Hydrolysis | 0.88120891 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.099218 | m/d |
| <i>Ammonium:</i> | | |
| Nitrification | 0.2064034 | /d |
| Temp correction | 1.07 | |
| <i>Nitrate:</i> | | |
| Denitrification | 0.28353818 | /d |
| Temp correction | 1.07 | |
| Sed denitrification transfer coeff | 0.053355 | m/d |
| Temp correction | 1.07 | |
| <i>Organic P:</i> | | |
| Hydrolysis | 0.79805215 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.096605 | m/d |
| <i>Inorganic P:</i> | | |
| Settling velocity | 0.04793 | m/d |
| Sed P oxygen attenuation half sat constant | 0.53889 | mgO2/L |

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| | | |
|---|------------|---------------------|
| Phytoplankton: | | |
| Max Growth rate | 2.8944 | /d |
| Temp correction | 1.07 | |
| Respiration rate | 0.480803 | /d |
| Temp correction | 1.07 | |
| Death rate | 0.86518 | /d |
| Temp correction | 1 | |
| Nitrogen half sat constant | 15 | ugN/L |
| Phosphorus half sat constant | 2 | ugP/L |
| Inorganic carbon half sat constant | 1.30E-05 | moles/L |
| Phytoplankton use HCO3- as substrate | Yes | |
| Light model | Smith | |
| Light constant | 57.6 | langleys/d |
| Ammonia preference | 25.4151 | ugN/L |
| Settling velocity | 0.468545 | m/d |
| Bottom Plants: | | |
| Growth model | Zero-order | |
| Max Growth rate | 10.8314 | gD/m2/d or /d |
| Temp correction | 1.07 | |
| First-order model carrying capacity | 100 | gD/m2 |
| Basal respiration rate | 0.2458802 | /d |
| Photo-respiration rate parameter | 0.01 | unitless |
| Temp correction | 1.07 | |
| Excretion rate | 0.046004 | /d |
| Temp correction | 1.07 | |
| Death rate | 0.036896 | /d |
| Temp correction | 1.07 | |
| External nitrogen half sat constant | 711.113 | ugN/L |
| External phosphorus half sat constant | 123.473 | ugP/L |
| Inorganic carbon half sat constant | 7.44E-05 | moles/L |
| Bottom algae use HCO3- as substrate | Yes | |
| Light model | Smith | |
| Light constant | 41.6646 | mgO ² /L |
| Ammonia preference | 28.99375 | ugN/L |
| Subsistence quota for nitrogen | 31.0379 | mgN/gD |
| Subsistence quota for phosphorus | 2.26157 | mgP/gD |
| Maximum uptake rate for nitrogen | 770.252 | mgN/gD/d |
| Maximum uptake rate for phosphorus | 36.4362 | mgP/gD/d |
| Internal nitrogen half sat ratio | 1.468463 | |
| Internal phosphorus half sat ratio | 3.2861345 | |
| Nitrogen uptake water column fraction | 1 | |
| Phosphorus uptake water column fraction | 1 | |
| Detritus (POM): | | |
| Dissolution rate | 2.318491 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.08897 | m/d |
| pH: | | |
| Partial pressure of carbon dioxide | 370 | ppm |
| TRC: | | |
| Decay rate | 0.8 | /d |

| Atmospheric Inputs: | Summer | Fall | Winter | Spring |
|-------------------------|--------|------|--------|--------|
| Min. Air Temperature, F | 57.7 | 29.5 | 24.0 | 45.0 |
| Max. Air Temperature, F | 90.5 | 51.0 | 44.9 | 74.2 |
| Dew Point, Temp., F | 58.6 | 35.0 | 30.3 | 48.5 |
| Wind, ft./sec. @ 21 ft. | 9.8 | 7.5 | 7.6 | 9.2 |
| Cloud Cover, % | 10% | 10% | 10% | 10% |

| Other Inputs: | |
|--|------|
| Bottom Algae Coverage | 100% |
| Bottom SOD Coverage | 100% |
| Prescribed SOD, gO ₂ /m ² /day | 0 |

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WASTELOAD ANALYSIS [WLA]
Appendix B: Total Residual Chlorine

Date: 10/16/2023

Discharging Facility: Payson WWTP
 UPDES No: UT-0020427

CHRONIC

| | Season | Receiving Water | Standard | Payson WWTP Effluent | Payson Power Effluent | Total Effluent | Mixing Zone Boundary | Dilution Factor | Effluent Limit Without Decay | Temperature (°C) | Decay Rate @ 20 °C (/day) | Decay Rate @ T °C (/day) | Travel Time (min) | Decay Coefficient | Effluent Limit |
|------------------|--------|-----------------|----------|----------------------|-----------------------|----------------|----------------------|-----------------|------------------------------|------------------|---------------------------|--------------------------|-------------------|-------------------|----------------|
| Discharge (cfs) | Summer | 2.5 | | 7.7 | 0.0 | 7.7 | 10.2 | 0.3 | | | | | | | |
| | Fall | 6.7 | | 7.7 | 0.0 | 7.7 | 14.4 | 0.9 | | | | | | | |
| | Winter | 11.9 | | 7.7 | 0.0 | 7.7 | 19.6 | 1.5 | | | | | | | |
| | Spring | 6.1 | | 7.7 | 0.0 | 7.7 | 13.9 | 0.8 | | | | | | | |
| Temperature (°C) | Summer | | | 22.3 | 29.9 | 22.3 | | | | | | | | | |
| | Fall | | | 15.8 | 22.3 | 15.8 | | | | | | | | | |
| | Winter | | | 11.6 | 27.0 | 11.6 | | | | | | | | | |
| | Spring | | | 16.9 | 25.7 | 16.9 | | | | | | | | | |
| TRC (mg/L) | Summer | 0.000 | 0.011 | | | | | | 0.015 | 22.3 | 42 | 46.7 | 107.568 | 0.03 | 0.474 |
| | Fall | 0.000 | 0.011 | | | | | | 0.021 | 15.8 | 42 | 34.6 | 107.568 | 0.08 | 0.271 |
| | Winter | 0.000 | 0.011 | | | | | | 0.028 | 11.6 | 42 | 28.6 | 107.568 | 0.12 | 0.236 |
| | Spring | 0.000 | 0.011 | | | | | | 0.020 | 16.9 | 42 | 36.5 | 107.568 | 0.07 | 0.301 |

ACUTE

| | Season | Receiving Water | Standard | Payson WWTP Effluent | Payson Power Effluent | Total Effluent | Mixing Zone Boundary | Dilution Factor | Effluent Limit Without Decay | Temperature (°C) | Decay Rate @ 20 °C (/day) | Decay Rate @ T °C (/day) | Travel Time (min) | Decay Coefficient | Effluent Limit |
|------------------|--------|-----------------|----------|----------------------|-----------------------|----------------|----------------------|-----------------|------------------------------|------------------|---------------------------|--------------------------|-------------------|-------------------|----------------|
| Discharge (cfs) | Summer | 1.2 | | 9.3 | 0.0 | 9.3 | 10.6 | 0.1 | | | | | | | |
| | Fall | 3.4 | | 9.3 | 0.0 | 9.3 | 12.7 | 0.4 | | | | | | | |
| | Winter | 6.0 | | 9.3 | 0.0 | 9.3 | 15.3 | 0.6 | | | | | | | |
| | Spring | 3.1 | | 9.3 | 0.0 | 9.3 | 12.4 | 0.3 | | | | | | | |
| Temperature (°C) | Summer | | | 22.3 | 29.9 | 22.3 | | | | | | | | | |
| | Fall | | | 15.8 | 22.3 | 15.8 | | | | | | | | | |
| | Winter | | | 11.6 | 27.0 | 11.6 | | | | | | | | | |
| | Spring | | | 16.9 | 25.7 | 16.9 | | | | | | | | | |
| TRC (mg/L) | Summer | 0.000 | 0.019 | | | | | | 0.022 | 22.3 | 42 | 46.7 | 107.568 | 0.03 | 0.702 |
| | Fall | 0.000 | 0.019 | | | | | | 0.026 | 15.8 | 42 | 34.6 | 107.568 | 0.08 | 0.341 |
| | Winter | 0.000 | 0.019 | | | | | | 0.031 | 11.6 | 42 | 28.6 | 107.568 | 0.12 | 0.263 |
| | Spring | 0.000 | 0.019 | | | | | | 0.025 | 16.9 | 42 | 36.5 | 107.568 | 0.07 | 0.385 |

124.66667

WASTELOAD ANALYSIS [WLA]

Date: 10/16/2023

Appendix C: Mass Balance Mixing Analysis for Conservative Constituents

| | |
|------------------------|--|
| Discharging Facility: | Payson WWTP |
| UPDES No: | UT-0020427 |
| Permit Flow [MGD]: | 5.00 Maximum Monthly Discharge 6.03 Maximum Daily Discharge |
| Payson Power: | 0.00 Discharge |
| Receiving Water: | Beer Creek |
| Stream Classification: | 2B, 3C, 4 |
| Stream Flows [cfs]: | 2.47 Summer (July-Sept) Critical Low Flow |
| Fully Mixed: | NO |
| Acute River Width: | 50% |
| Chronic River Width: | 100% |
| Mixed Flow [cfs]: | 10.2 Chronic 5.9 Acute |

Modeling Information

A mass balance mixing analysis was used to determine these 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.

Utah Division of Water Quality

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

| Physical Parameter | | Maximum Concentration |
|---------------------------|---------------------------------|------------------------------|
| | pH Minimum | 6.5 |
| | pH Maximum | 9.0 |
| | | |
| Bacteriological | | |
| | E. coli (30 Day Geometric Mean) | 206 (#/100 mL) |
| | E. coli (Maximum) | 668 (#/100 mL) |

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

| Physical Parameter | | Maximum Concentration |
|---------------------------|----------------------------|------------------------------|
| | Temperature (deg C) | 27 |
| | Temperature Change (deg C) | 4 |

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

| Total Recoverable Metals | Chronic Standard (4 Day Average)¹ | | | Acute Standard (1 Hour Average)¹ | | | |
|---------------------------------|---|------------------|-------------------------------|--|-----------------|-------------------------------|--------------|
| | Parameter | Standard | Background² | Limit | Standard | Background² | Limit |
| | Aluminum (µg/L) | N/A ³ | 5.4 | NONE | 750 | 5.4 | 503 |
| | Arsenic (µg/L) | 150 | 7.7 | 195 | 340 | 7.7 | 227 |
| | Cadmium (µg/L) | 0.7 | 0.5 | 0.8 | 8.5 | 0.5 | 5.6 |
| | Chromium VI (µg/L) | 11.0 | 2.5 | 13.7 | 16.0 | 2.5 | 10.4 |
| | Chromium III (µg/L) | 263 | 2.5 | 346 | 5,497 | 2.5 | 3,690 |
| | Copper (µg/L) | 29.8 | 5.3 | 37.7 | 50.5 | 5.3 | 33.1 |
| | Cyanide (µg/L) | 5.2 | 3.5 | 5.7 | 22.0 | 3.5 | 14.3 |
| | Iron (µg/L) | | | | 1,000 | 6.7 | 671 |
| | Lead (µg/L) | 18.0 | 0.3 | 23.6 | 462 | 0.3 | 310 |
| | Mercury (µg/L) | 0.012 | 0.008 | 0.013 | 2.4 | 0.0 | 1.6 |
| | Nickel (µg/L) | 165 | 0.5 | 217 | 1,484 | 0.5 | 996 |
| | Selenium (µg/L) | 4.6 | 1.9 | 5.5 | 18.4 | 1.9 | 12.1 |
| | Silver (µg/L) | | | | 39.3 | 0.1 | 26.4 |
| | Tributyltin (µg/L) | 0.072 | 0.048 | 0.080 | 0.46 | 0.05 | 0.30 |
| | Zinc (µg/L) | 380 | 10.0 | 498 | 380 | 10.0 | 253 |

1: Based upon a Hardness of 390 mg/l as CaCO₃

2: Background concentration average of monitoring data

3: Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaCO₃ in the receiving water after mixing, the 87 ug/L chronic criterion (expressed as total recoverable) will not apply, and aluminum will be regulated based on compliance with the 750 ug/L acute aluminum criterion (expressed as total recoverable).

Utah Division of Water Quality

| Organics [Pesticides] | Parameter | Chronic Standard (4 Day Average) | | | Acute Standard (1 Hour Average) | | |
|-----------------------|--------------------------------|----------------------------------|-------------------------|--------|---------------------------------|-------------------------|-------|
| | | Standard | Background ¹ | Limit | Standard | Background ¹ | Limit |
| | Aldrin (µg/L) | | | | 1.5 | 1.0 | 0.9 |
| | Chlordane (µg/L) | 0.0043 | 0.0029 | 0.0048 | 1.2 | 0.0 | 0.8 |
| | DDT, DDE (µg/L) | 0.001 | 0.001 | 0.001 | 0.55 | 0.00 | 0.37 |
| | Diazinon (µg/L) | 0.17 | 0.11 | 0.19 | 0.17 | 0.11 | 0.10 |
| | Dieldrin (µg/L) | 0.0056 | 0.0038 | 0.0062 | 0.24 | 0.00 | 0.16 |
| | Endosulfan, a & b (µg/L) | 0.056 | 0.038 | 0.062 | 0.11 | 0.04 | 0.07 |
| | Endrin (µg/L) | 0.036 | 0.024 | 0.040 | 0.086 | 0.024 | 0.054 |
| | Heptachlor & H. epoxide (µg/L) | 0.0038 | 0.0025 | 0.0042 | 0.26 | 0.00 | 0.17 |
| | Lindane (µg/L) | 0.08 | 0.05 | 0.09 | 1.0 | 0.1 | 0.7 |
| | Methoxychlor (µg/L) | | | | 0.03 | 0.02 | 0.02 |
| | Mirex (µg/L) | | | | 0.001 | 0.001 | 0.001 |
| | Nonylphenol (µg/L) | 6.6 | 4.4 | 7.3 | 28.0 | 4.4 | 18.2 |
| | Parathion (µg/L) | 0.0130 | 0.0087 | 0.0144 | 0.066 | 0.009 | 0.043 |
| | PCB's (µg/L) | 0.014 | 0.009 | 0.015 | | | |
| | Pentachlorophenol (µg/L) | 15.0 | 10.1 | 16.6 | 19.0 | 10.1 | 11.3 |
| | Toxephene (µg/L) | 0.0002 | 0.0001 | 0.0002 | 0.73 | 0.00 | 0.49 |

1: Background concentration assumed 67% of chronic standard

| Radiological | Parameter | Maximum Concentration | | |
|--------------|---------------------|-----------------------|-------------------------|-------|
| | | Standard | Background ¹ | Limit |
| | Gross Alpha (pCi/L) | 15 | 10.1 | 8.7 |

1: Background concentration assumed 67% of chronic standard; TDS is based on observed ambient data

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

| Parameter | Maximum Concentration | | |
|-------------------------------|-----------------------|-------------------------|-------|
| | Standard | Background ¹ | Limit |
| Total Dissolved Solids (mg/L) | 1,200 | 754 | 1,343 |
| Boron (mg/L) | 0.75 | 0.2 | 0.9 |
| Arsenic, Dissolved (µg/L) | 100 | 7.7 | 129 |
| Cadmium, Dissolved (µg/L) | 10 | 0.5 | 13.0 |
| Chromium, Dissolved (µg/L) | 100 | 2.5 | 131 |
| Copper, Dissolved (µg/L) | 200 | 5.3 | 262 |
| Lead, Dissolved (µg/L) | 100 | 0.3 | 132 |
| Selenium, Dissolved (µg/L) | 50 | 1.9 | 65.4 |
| Gross Alpha (pCi/L) | 15 | 10.1 | 16.6 |

1: Background concentration assumed 67% of chronic standard; TDS is based on observed ambient data