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

**Date:** **December 14, 2015**

**Facility:** **Provo City Water Reclamation Facility**
**UPDES No. UT0021717**

**Receiving water:** **Mill Race (2B, 3B, 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: Mill Race → Provo Bay in Utah Lake

The maximum daily design discharge is 28.0 MGD and the maximum monthly design discharge is 21.0 MGD for the facility.

Receiving Water
The receiving water for Outfall 001 is Mill Race, which is tributary to Provo Bay in Utah Lake.

Per UAC R317-2-13.5.c, the designated beneficial uses for Mill Race from Interstate Highway 15 to the Provo City wastewater treatment plant discharge are 2B, 3B, 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 3B - Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.*

- *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 Mill Race, the 20th percentile of flow measurements from sampling station 4996570 Mill Race above Provo WWTP was calculated to estimate annual critical flow in the receiving water (Table 1).

**Table 1: Annual critical low flow**

| Season | Flow (cfs) |
|---|---|
| Summer | 2.0 |
| Fall | 2.0 |
| Winter | 1.8 |
| Spring | 2.0 |

TMDL

Mill Race was not listed as impaired for any parameters according to the 2010 303(d) list. Utah Lake was listed as impaired for Total Dissolved Solids, Total Phosphorus and PCBs in Fish Tissue in the 2010 303(d) list Integrated Report (DWQ, 2010).

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 discharge is considered instantaneously fully mixed since the effluent discharge is twice the background receiving water flow; therefore, no mixing zone is allowed per UAC R317-2-5.

Parameters of Concern

The potential parameters of concern identified for the discharge/receiving water were total suspended solids (TSS), dissolved oxygen (DO), $BOD_5$, total phosphorus (TP), total nitrogen (TN), total ammonia (TAN), total residual chlorine (TRC), and pH 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 by DWQ staff in October and November of 2014 using standard operating procedures (DWQ 2012). The model of Mill Race extends 4.2 kilometers downstream from the treatment facility outfall to the open waters of Provo Bay.

Ambient receiving water quality data were obtained from monitoring site 4996570 Mill Race above Provo WWTP. 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 4996560 Provo WWTP.

The QUAL2Kw model was used for determining the WQBELs for parameters related to eutrophication and in-stream DO criteria, as well as ammonia toxicity. Effluent concentrations were adjusted so that water quality standards were not exceeded in the receiving water. Where WQBELs exceeded secondary standards or technology based effluent limits (TBEL), the concentration in the model was set at the secondary standard or TBEL.

The QUAL2Kw model was also used to determine the limits for ammonia. 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. QUAL2Kw rates, input and output for DO and eutrophication related constituents are summarized in Appendix A.

A mass balance mixing analysis was conducted for conservative constituents such as dissolved metals. The WQBELs for conservative constituents 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 pipe of 5 minutes prior to discharge to Mill Race. The analysis for TRC is summarized in Appendix C.

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

Whole Effluent Toxicity (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 $LC_{50}$ (lethal concentration, 50%) percent effluent for acute toxicity and the $IC_{25}$ (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 $LC_{50}$ is typically 100% effluent and does not need to be determined by the WLA.

**Table 2: WET Limits for $IC_{25}$**

| Season | Percent Effluent |
|---|---|
| Summer | 94% |
| Fall | 94% |
| Winter | 95% |
| Spring | 94% |

Effluent Limits

The effect of the effluent on the DO in the receiving water was evaluated using the QUAL2Kw model. Based on secondary standards for $BOD_5$ and minimum DO limits, the DO sag downstream of the plant discharge in Mill Race was predicted to remain above the minimum instream criteria (Table 3). New ammonia limits were determined for chronic and acute conditions.

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

| Effluent Constituent | Acute | | | Chronic | | |
|---|---|---|---|---|---|---|
| | Standard | Limit | Averaging Period | Standard | Limit | Averaging Period |
| Flow (MGD) | N/A | 28.0 | 1 day | N/A | 21.0 | 30 days |
| Ammonia (mg/L) | | | | | | |
| Summer (Jul-Sep) | | 8.0* | | | 3.0* | |
| Fall (Oct-Dec) | Varies | 12.0* | 1 hour | Varies | 4.0* | 30 days |
| Winter (Jan-Mar) | | 20.0* | | | 5.0* | |
| Spring (Apr-Jun) | | 12.0* | | | 3.5* | |
| Total Residual Chlorine (mg/L) | 0.019 | 0.022 | 1 hour | 0.011 | 0.013 | 4 days |
| Min. Dissolved Oxygen (mg/L) | | | | | | |
| Summer (Jul-Sep) | | 5.0 | | | | |
| Fall (Oct-Dec) | 5.0 | 5.0 | Instantaneous | | | |
| Winter (Jan-Mar) | | 5.0 | | | | |
| Spring (Apr-Jun) | | 5.0 | | | | |
| Min. Dissolved Oxygen (mg/L) | | | | | | |
| Summer (Jul-Sep) | | 6.0 | | | 5.5 | |
| Fall (Oct-Dec) | 6.0 | 6.0 | 7 days | 5.5 | 5.5 | 30 days |
| Winter (Jan-Mar) | | 6.0 | | | 5.5 | |
| Spring (Apr-Jun) | | 6.0 | | | 5.5 | |
| $BOD_5$ (mg/L) | | | | | | |
| Summer (Jul-Sep) | | 35.0* | | | 25.0* | |
| Fall (Oct-Dec) | N/A | 35.0* | 7 days | N/A | 25.0* | 30 days |
| Winter (Jan-Mar) | | 35.0* | | | 25.0* | |
| Spring (Apr-Jun) | | 35.0* | | | 25.0* | |

*Higher limit as compared to current permit limit.

## 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 if any of the pollutant concentration or load limits are raised from the current permit.

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**Standards and Technical Services Section**

## Documents

WLA Document: *provo_potw_wla_2015_final_2015-12-14.docx*
QUAL2Kw Calibration Model: *provo_potw_q2kw_cal_2015.xlsm*
QUAL2Kw Wasteload Model: *provo_potw_q2kw_wla_2015_v3.xlsm*

## References

*Utah 2010 Integrated Report.* 2010. Utah Division of Water Quality.

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

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

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

**WASTELOAD ANALYSIS [WLA]** Date: 12/13/2015
**Appendix A: QUAL2Kw Analysis for Eutrophication**

Discharging Facility: Provo WWTP
UPDES No: UT-0021717
Permit Flow [MGD]: 21.00 Maximum Monthly Flow
28.00 Maximum Daily Flow

Receiving Water: Mill Race
Stream Classification: 2B, 3B, 4
Stream Flows [cfs]: 2.0 Summer (July-Sept) Critical Low Flow
2.0 Fall (Oct-Dec)
1.8 Winter (Jan-Mar)
2.0 Spring (Apr-June)

Acute River Width: 100.0%
Chronic River Width: 100.0%

**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) | 2.0 | 2.0 | 1.8 | 2.0 |
| Temperature (deg C) | 25.0 | 14.3 | 9.9 | 13.9 |
| Specific Conductance (µmhos) | 850 | 882 | 998 | 824 |
| Inorganic Suspended Solids (mg/L) | 2.9 | 6.5 | 10.2 | 6.1 |
| Dissolved Oxygen (mg/L) | 10.6 | 9.9 | 12.1 | 11.2 |
| $CBOD_5$ (mg/L) | 2.5 | 2.7 | 2.7 | 1.9 |
| Organic Nitrogen (mg/L) | 0.376 | 0.488 | 0.251 | 0.263 |
| NH4-Nitrogen (mg/L) | 0.030 | 0.044 | 0.052 | 0.051 |
| NO3-Nitrogen (mg/L) | 2.366 | 2.643 | 2.675 | 2.011 |
| Organic Phosphorus (mg/L) | 0.000 | 0.000 | 0.000 | 0.000 |
| Inorganic Ortho-Phosphorus (mg/L) | 0.090 | 0.082 | 0.215 | 0.075 |
| Phytoplankton (µg/L) | 0.0 | 0.0 | 0.0 | 0.0 |
| Detritus [POM] (mg/L) | 0.3 | 0.7 | 1.1 | 0.7 |
| Alkalinity (mg/L) | 294 | 300 | 300 | 261 |
| pH | 8.2 | 8.3 | 8.5 | 8.6 |

**Discharge Information**

| Chronic | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Flow (cfs) | 21.0 | 21.0 | 21.0 | 21.0 |
| Temperature (deg C) | 22.1 | 18.3 | 13.1 | 16.2 |
| Inorganic Suspended Solids (mg/L) | 0.0 | 0.0 | 0.0 | 0.0 |
| Organic Nitrogen (mg/L) | 2.020 | 4.154 | 2.778 | 3.413 |
| NO3-Nitrogen (mg/L) | 18.072 | 22.396 | 23.500 | 20.367 |
| Organic Phosphorus (mg/L) | 0.000 | 0.000 | 0.224 | 0.242 |
| Inorganic Phosphorus (mg/L) | 2.737 | 2.907 | 2.846 | 2.191 |
| Alkalinity (mg/L) | 158 | 141 | 134 | 161 |
| pH | 7.3 | 7.2 | 7.1 | 7.4 |

| Acute | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Flow (cfs) | 28.0 | 28.0 | 28.0 | 28.0 |
| Temperature (deg C) | 22.1 | 18.3 | 13.1 | 16.2 |
| Inorganic Suspended Solids (mg/L) | 0.0 | 0.0 | 0.0 | 0.0 |
| Organic Nitrogen (mg/L) | 2.020 | 4.154 | 2.778 | 3.413 |
| NO3-Nitrogen (mg/L) | 18.072 | 22.396 | 23.500 | 20.367 |
| Organic Phosphorus (mg/L) | 0.000 | 0.000 | 0.224 | 0.242 |
| Inorganic Phosphorus (mg/L) | 2.737 | 2.907 | 2.846 | 2.191 |
| Alkalinity (mg/L) | 158 | 141 | 134 | 161 |
| pH | 7.7 | 7.4 | 7.4 | 8.2 |

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 Toxicity**

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

| Chronic | Time Period | Standard | Summer | Fall | Winter | Spring |
|---|---|---|---|---|---|---|
| Flow (MGD) | Monthly | N/A | 21.0 | 21.0 | 21.0 | 21.0 |
| NH4-Nitrogen (mg/L) | 30 day | Varies | 3.0 | 4.0 | 5.0 | 3.5 |
| $CBOD_5$ (mg/L) | 7 day | N/A | 35.0 | 35.0 | 35.0 | 35.0 |
| $CBOD_5$ (mg/L) | 30 day | N/A | 25.0 | 25.0 | 25.0 | 25.0 |
| Dissolved Oxygen [Minimum] (mg/L) | 7 day | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Dissolved Oxygen [Minimum] (mg/L) | 30 day | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |

| Acute | Time Period | Standard | Summer | Fall | Winter | Spring |
|---|---|---|---|---|---|---|
| Flow (MGD) | Daily | N/A | 28.0 | 28.0 | 28.0 | 28.0 |
| NH4-Nitrogen (mg/L) | 1 hour | Varies | 8.0 | 12.0 | 20.0 | 12.0 |
| Dissolved Oxygen [Minimum] (mg/L) | Instantaneous | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |

**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 down-stream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

**Coefficients and Other Model Information**

| *Parameter* | *Value* | *Units* |
|---|---|---|
| *Stoichiometry:* | | |
| Carbon | 40 | gC |
| Nitrogen | 7.2 | gN |
| Phosphorus | 1 | gP |
| Dry weight | 100 | gD |
| Chlorophyll | 1 | gA |
| *Inorganic suspended solids:* | | |
| Settling velocity | 0.001 | m/d |
| *Oxygen:* | | |
| 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 |
| *Slow CBOD:* | | |
| Hydrolysis rate | 0 | /d |
| Temp correction | 1.047 | |
| Oxidation rate | 0.103 | /d |
| Temp correction | 1.047 | |
| *Fast CBOD:* | | |
| Oxidation rate | 10 | /d |
| Temp correction | 1.047 | |
| *Organic N:* | | |
| Hydrolysis | 0.88487524 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.001617 | m/d |
| *Ammonium:* | | |
| Nitrification | 0.9748342 | /d |
| Temp correction | 1.07 | |
| *Nitrate:* | | |
| Denitrification | 0.90803306 | /d |
| Temp correction | 1.07 | |
| Sed denitrification transfer coeff | 0.072025 | m/d |
| Temp correction | 1.07 | |
| *Organic P:* | | |
| Hydrolysis | 0.79654366 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.068508 | m/d |
| *Inorganic P:* | | |
| Settling velocity | 0.04166 | m/d |
| Sed P oxygen attenuation half sat constant | 0.59075 | mgO2/L |

| | | |
|---|---|---|
| *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 | 6.069185 | gD/m2/d or /d |
| Temp correction | 1.07 | |
| First-order model carrying capacity | 100 | gD/m2 |
| Basal respiration rate | 0.037745 | /d |
| Photo-respiration rate parameter | 0.01 | unitless |
| Temp correction | 1.07 | |
| Excretion rate | 0.195178 | /d |
| Temp correction | 1.07 | |
| Death rate | 0.370024 | /d |
| Temp correction | 1.07 | |
| External nitrogen half sat constant | 723.2564 | ugN/L |
| External phosphorus half sat constant | 127.5683 | ugP/L |
| Inorganic carbon half sat constant | 7.48E-06 | moles/L |
| Bottom algae use HCO3- as substrate | Yes | |
| Light model | Smith | |
| Light constant | 64.836 | mgO^2/L |
| Ammonia preference | 28.13175 | ugN/L |
| Subsistence quota for nitrogen | 17.6252 | mgN/gD |
| Subsistence quota for phosphorus | 3.101765 | mgP/gD |
| Maximum uptake rate for nitrogen | 109.4795 | mgN/gD/d |
| Maximum uptake rate for phosphorus | 128.6696 | mgP/gD/d |
| Internal nitrogen half sat ratio | 2.358872 | |
| Internal phosphorus half sat ratio | 3.7871525 | |
| Nitrogen uptake water column fraction | 1 | |
| Phosphorus uptake water column fraction | 1 | |
| *Detritus (POM):* | | |
| Dissolution rate | 0.658467 | /d |
| Temp correction | 1.07 | |
| Settling velocity | 0.61912 | m/d |
| *pH:* | | |
| Partial pressure of carbon dioxide | 370 | ppm |

| Atmospheric Inputs: | Summer | Fall | Winter | Spring |
|---|---|---|---|---|
| Min. Air Temperature, F | 89.5 | 49.4 | 42.5 | 74.1 |
| Max. Air Temperature, F | 61.6 | 31.4 | 24.5 | 48.4 |
| Dew Point, Temp., F | 58.6 | 35.0 | 30.3 | 48.5 |
| Wind, ft./sec. @ 21 ft. | 6.6 | 5.2 | 6.0 | 7.4 |
| Cloud Cover, % | 10% | 10% | 10% | 10% |

| Other Inputs: | |
|---|---|
| Bottom Algae Coverage | 100% |
| Bottom SOD Coverage | 100% |
| Prescribed SOD, $gO_2/m^2/day$ | 0 |

**WASTELOAD ANALYSIS [WLA]** Date: 12/13/2015

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

| | | | |
|---|---|---|---|
| Discharging Facility: | Provo WWTP | | |
| UPDES No: | UT-0021717 | | |
| Permit Flow [MGD]: | 21.00 | Maximum Monthly Flow | |
| | 28.00 | Maximum Daily Flow | |
| Receiving Water: | Mill Race | | |
| Stream Classification: | 2B, 3B, 4 | | |
| Stream Flows [cfs]: | 2.0 | Summer (July-Sept) | Critical Low Flow |
| | 2.0 | Fall (Oct-Dec) | |
| | 1.8 | Winter (Jan-Mar) | |
| | 2.0 | Spring (Apr-June) | |
| Acute River Width: | 100.0% | | |
| Chronic River Width: | 100.0% | | |

**Modeling Information**

A simple mixing analysis 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**

| | 7Q10 Flow cfs |
|---|---|
| Summer | 2.0 |
| Fall | 2.0 |
| Winter | 1.8 |
| Spring | 2.0 |

**Discharge Information**

| | Flow MGD |
|---|---|
| Maximum Daily | 28.0 |
| Maximum Monthly | 21.0 |

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

| Parameter | Maximum Concentration |
|---|---|
| **Physical** | |
| 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 3B Waters)**

| Parameter | Maximum Concentration | | | |
|---|---|---|---|---|
| **Physical** | | | | |
| **Inorganics** | **Chronic Standard (4 Day Average)** | | **Acute Standard (1 Hour Average)** | |
| | **Standard** | **Limit** | **Standard** | **Limit** |
| Phenol | | | 0.010 | 0.010 mg/L |
| Hydrogen Sulfide (Undissociated) | | | 0.002 | 0.002 mg/L |

**Total Recoverable Metals**

| | Chronic Standard (4 Day Average) | | | Acute Standard (1 Hour Average) | | |
|---|---|---|---|---|---|---|
| **Parameter (µg/L)** | **Standard[1]** | **Background[2]** | **Limit** | **Standard[1]** | **Background[2]** | **Limit** |
| Aluminum | N/A[3] | 20.6 | N/A | 750 | 20.6 | 802 |
| Arsenic | 150 | 2.8 | 164 | 340 | 2.8 | 364 |
| Cadmium | 0.5 | 0.2 | 0.6 | 5.6 | 0.2 | 6.0 |
| Chromium VI | 11.0 | 2.9 | 11.8 | 16.0 | 2.9 | 16.9 |
| Chromium III | 188 | 2.9 | 206 | 3,931 | 2.9 | 4,212 |
| Copper | 21.0 | 3.4 | 22.7 | 34.3 | 3.4 | 36.5 |
| Cyanide | 5.2 | 3.5 | 5.4 | 22.0 | 3.5 | 23.3 |
| Iron | | | | 1,000 | 19.3 | 1,070 |
| Lead | 10.7 | 0.6 | 11.6 | 274.2 | 0.6 | 294 |
| Mercury | 0.012 | 0.008 | 0.012 | 2.4 | 0.008 | 2.6 |
| Nickel | 117 | 3.7 | 127 | 1,050 | 3.7 | 1,124 |
| Selenium | 4.6 | 2.0 | 4.8 | 18.4 | 2.0 | 19.6 |
| Silver | | | | 19.4 | 9.7 | 20.1 |
| Tributylin | 0.072 | 0.048 | 0.074 | 0.46 | 0.048 | 0.49 |
| Zinc | 268 | 13.0 | 293 | 268 | 13.0 | 287 |

1: Based upon a Hardness of 259 mg/l as CaCO3

2: Background concentration assumed 67% of chronic standard

3: Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as CaCO 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).

**Organics [Pesticides]**

| | Chronic Standard (4 Day Average) | | | Acute Standard (1 Hour Average) | | |
|---|---|---|---|---|---|---|
| **Parameter (µg/L)** | **Standard** | **Background** | **Limit** | **Standard** | **Background** | **Limit** |
| Aldrin | | | | 1.500 | 1.000 | 1.536 |
| Chlordane | 0.0043 | 0.0029 | 0.0044 | 1.200 | 0.003 | 1.286 |
| DDT, DDE | 0.001 | 0.0007 | 0.0010 | 0.550 | 0.001 | 0.589 |
| Diazinon | 0.17 | 0.1133 | 0.175 | 0.17 | 0.113 | 0.174 |
| Dieldrin | 0.0056 | 0.0037 | 0.0058 | 0.240 | 0.004 | 0.257 |
| Endosulfan, a & b | 0.056 | 0.0373 | 0.058 | 0.110 | 0.037 | 0.115 |
| Endrin | 0.036 | 0.0240 | 0.037 | 0.086 | 0.024 | 0.090 |
| Heptachlor & H. epoxide | 0.0038 | 0.0025 | 0.0039 | 0.260 | 0.003 | 0.278 |
| Lindane | 0.08 | 0.0533 | 0.08 | 1.000 | 0.053 | 1.068 |
| Methoxychlor | | | | 0.030 | 0.020 | 0.031 |
| Mirex | | | | 0.001 | 0.001 | 0.001 |
| Nonylphenol | 6.6 | 4.4 | 6.8 | 28.0 | 4.4 | 29.7 |
| Parathion | 0.0130 | 0.0087 | 0.0134 | 0.066 | 0.009 | 0.070 |
| PCB's | 0.014 | 0.0093 | 0.014 | | | |
| Pentachlorophenol | 15.00 | 10 | 15.5 | 19.000 | 10.0 | 19.643 |
| Toxephene | 0.0002 | 0.0001 | 0.00020635 | 0.730 | 0.0001 | 0.782 |

**Radiological**

| **Parameter** | **Maximum Concentration** |
|---|---|
| Gross Alpha | 15 pCi/L |

**Effluent Limitation for Protection of Agriculture (Class 4 Waters)**

| | Maximum Concentration | | |
|---|---|---|---|
| **Parameter** | **Standard** | **Background** | **Limit** |
| Total Dissolved Solids (mg/L) | 1,200 | 521 | 1,249 |
| Boron (µg/L) | 750 | 110 | 796 |
| Arsenic (µg/L) | 100 | 2.8 | 107 |
| Cadmium (µg/L) | 10 | 0.2 | 10.7 |
| Chromium (µg/L) | 100 | 2.9 | 107 |
| Copper (µg/L) | 200 | 3.4 | 214 |
| Lead (µg/L) | 100 | 0.6 | 107 |
| Selenium (µg/L) | 50 | 2.0 | 53.4 |
| Gross Alpha (pCi/L) | 15 | 10 | 15.4 |

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

Date: 12/13/2015

Discharging Facility: Provo WWTP
UPDES No: UT-0021717

**CHRONIC**

| | Season | Receiving Water | Standard | Total Effluent | Mixing Zone Boundary | Effluent Limit Without Decay | Temperature (°C) | Decay Rate (/day) @ 20 deg C | Decay Rate (/day) @ T deg C | Travel Time (min) | Decay Coefficient | Effluent Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discharge (cfs) | Summer | 2.0 | | 32.5 | 34.5 | | | | | | | |
| | Fall | 2.0 | | 32.5 | 34.5 | | | | | | | |
| | Winter | 1.8 | | 32.5 | 34.3 | | | | | | | |
| | Spring | 2.0 | | 32.5 | 34.4 | | | | | | | |
| TRC (mg/L) | Summer | 0.000 | 0.011 | | | 0.012 | 22.1 | 29.86 | 32.8 | 5 | 0.8923 | 0.013 |
| | Fall | 0.000 | 0.011 | | | 0.012 | 18.3 | 29.86 | 27.6 | 5 | 0.9087 | 0.013 |
| | Winter | 0.000 | 0.011 | | | 0.012 | 13.1 | 29.86 | 21.8 | 5 | 0.9272 | 0.013 |
| | Spring | 0.000 | 0.011 | | | 0.012 | 16.2 | 29.86 | 25.0 | 5 | 0.9168 | 0.013 |

**ACUTE**

| | Season | Receiving Water | Standard | Total Effluent | Mixing Zone Boundary | Effluent Limit Without Decay | Temperature (°C) | Decay Rate (/day) @ 20 °C | Decay Rate (/day) @ T °C | Travel Time (min) | Decay Coefficient | Effluent Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discharge (cfs) | Summer | 2.0 | | 43.3 | 45.3 | | | | | | | |
| | Fall | 2.0 | | 43.3 | 45.3 | | | | | | | |
| | Winter | 1.8 | | 43.3 | 45.1 | | | | | | | |
| | Spring | 2.0 | | 43.3 | 45.3 | | | | | | | |
| TRC (mg/L) | Summer | 0.000 | 0.019 | | | 0.020 | 22.1 | 29.86 | 32.8 | 5 | 0.8923 | 0.022 |
| | Fall | 0.000 | 0.019 | | | 0.020 | 18.3 | 29.86 | 27.6 | 5 | 0.9087 | 0.022 |
| | Winter | 0.000 | 0.019 | | | 0.020 | 13.1 | 29.86 | 21.8 | 5 | 0.9272 | 0.021 |
| | Spring | 0.000 | 0.019 | | | 0.020 | 16.2 | 29.86 | 25.0 | 5 | 0.9168 | 0.022 |