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

Date: **February 20, 2020**

Facility: **Timpanogos Special Service District**
UPDES No. UT-0023639

Receiving water: **Utah Lake**

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: Utah Lake

Water is discharged in two ways to Utah Lake. The first method is for the effluent to be routed through a series of basins originally constructed for the purpose of dechlorination. These basins outlet via an open channel surface discharge to Utah Lake. The second method is direct discharge to the lake via a circular pipe.

The maximum daily design flow for the facility is 30 MGD, as provided by the permittee on the permit application.

Receiving Water
The receiving water for Outfall 001 is Utah Lake. Per UAC R317-2-13.12.x, the beneficial uses for Utah Lake are 2A, 3B, 3D and 4.

- *Class 2A: Protected for frequent primary contact recreation where there is a high likelihood of ingestion of water or a high degree of bodily contact with the water. Examples include, but are not limited to, swimming, rafting, kayaking, diving, and water skiing.*
- *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 3D: Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.*
- *Class 4: Protected for agricultural uses including irrigation of crops and stock watering.*

The critical water surface elevation for the wasteload analysis was considered the lowest elevation for seven consecutive days with a ten year return frequency (7Q10). Based on aerial photography and site reconnaissance, the 7Q10 water surface elevation was assumed to be below the discharge pipe during low lake levels, resulting in a surface discharge to Utah Lake.

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. The effluent limits derived to support the uses in Utah Lake are considered protective of downstream uses.

Parameters of Concern

The potential parameters of concern identified for the discharge were total suspended solids (TSS), dissolved oxygen (DO), BOD_5, total phosphorus (TP), total nitrogen (TN), total ammonia (TAN), dissolved metals, and pH, as determined in consultation with the UPDES Permit Writer.

Impaired Waters and TMDL

Per the 303(d) list of impaired waters in *Utah's 2016 Intergrated Report* (UDWQ 2017), Utah Lake other than Provo Bay was listed as impaired for harmful algal blooms (HAB), PCBs in fish tissue, total dissolved solids, and total phosphorus. No TMDLs have been approved for Utah Lake.

Water Quality Modeling

The Visual Plumes program (Version 20), originally developed by EPA and currently maintained and distributed by the California State Water Resources Control Board, was utilized to determine the dilution at the mixing zone boundary (Frick et al. 2003). The Prych, Davis, Shirazi (PDS) sub-model, which simulates surface discharges to waterbodies from open channels, was applied (Davis 1998). The inputs and results of the mixing zone model are attached in Appendix C.

The dilution factors determined by the mixing zone model were applied to determine the WQBELs. Water quality constituents were assumed not to decay within the mixing zone. Ambient receiving water quality data was characterized using data from monitoring site 4917310 Utah Lake 0.5 Miles West of Geneva Discharge #15-A. The mean value was calculated for each constituent with available data in the receiving water. Effluent parameters were characterized using data from monitoring site 4995038, 4995040, and 4995041 for Timpanogos WWTP. The results of the mass balance mixing analysis are summarized in Appendix A.

The water quality criterion for chronic ammonia toxicity is dependent on temperature and pH, and the water quality criterion for acute ammonia toxicity is dependent on pH. The water quality criteria for ammonia are summarized in Appendix B.

Mixing Zone

Per UAC R317-2-5, the maximum allowable mixing zone in lakes and reservoirs shall not exceed 200 feet for chronic conditions and shall not exceed 35 feet for acute conditions. Water quality standards must be met at the end of the mixing zone.

The dilution at the mixing zone boundary for acute conditions (35 feet) was 2.5:1 and for chronic conditions (200 feet) was 10:1.

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 1: WET Limits for IC_{25}

Season	Percent Effluent
Annual	9.1%

Effluent Limits

The complete list of WQBELs are attached in Appendix A. Selected WQBELs are summarized in Table 2. For parameters without a WQBEL, permit limits should be set according to rules found in R317-1-3 and categorical UPDES discharge requirements.

Table 2: Water Quality Based Effluent Limits

Effluent Constituent	Acute			Chronic		
	Standard	Limit	Averaging Period	Standard	Limit	Averaging Period
Flow (MGD)					30.0	30 days
Min. Dissolved Oxygen (mg/L)	5.0	5.0	Instant	5.5	5.5	30 days
BOD_5 (mg/L)	None	35	7 days	None	25	30 days
Ammonia (mg/l)	1.45	4.9	1 hour	0.70	7.1	30 days

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/or load is not increasing under this permit renewal.

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Documents

WLA Document: *TimpanogosWLA_2020-02-20.docx*
Analysis: *TimpanogosWLA_2020.xlsx*

References:

Davis, L.R. 1998. Fundamentals of Environmental Discharge Modeling. CRC Press.

Frick, W.E., P.J.W. Roberts, L.R. Davis, J. Keyes, D.J. Baumgartner , and K.P. George. 2003. Dilution Models for Effluent Discharges 4th Edition (Visual Plumes). United States Environmental Protection Agency, National Exposure Research Laboratory. EPA/600/R-03/025.

Utah Division of Water Quality. 2012. *Utah Wasteload Analysis Procedures Version 1.0*. State of Utah, Department of Environmental Quality.

Utah Division of Water Quality. 2016. *Utah's 2016 Integrated Report*. State of Utah, Department of Environmental Quality.

WASTELOAD ANALYSIS [WLA] Date: 2/20/2020

Appendix A: Mass Balance Mixing Analysis

Discharging Facility:	Timpanogos SSD
UPDES No:	UT-0023639
Permit Flow [MGD]:	30.00 Max. Daily
Downstream Receiving Water:	Utah Lake
Beneficial Uses:	2B, 3B, 3D, 4

Modeling Information

A mass balance 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.

Model Inputs

Mixing Information

Acute Dilution Ratio	2.5 to 1
Chronic Dilution Ratio	10.0 to 1

Summer Critical Season	Mean Temp. Deg. C	Max Temp. Deg. C	Mean pH	Max pH
Lake Background	23.9	27.9	7.50	8.10
Discharge	22.9	25.8	8.44	9.07
Mixed	23.8	27.3	8.40	8.94

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

Bacteriological

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

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

Physical Parameter	Concentration Minimum	Concentration Maximum
pH	6.5	9.0

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

Inorganics

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

Ammonia-Total (mg/L)	Chronic (30-day ave)				Acute (1-hour ave)			
Season	Standard	Background	Conc. Limit (mg/L)	Load Limit (lbs/day)	Standard	Background	Conc. Limit (mg/L)	Load Limit (lbs/day)
All	0.70	0.07	7.1	1,767	1.45	0.07	4.9	1,229

Metals-Total Recoverable	Chronic (4-day ave)				Acute (1-hour ave)			
Parameter	Standard[1]	Background	Conc. Limit (µg/L)	Load Limit (lbs/day)	Standard[1]	Background	Conc. Limit (µg/L)	Load Limit (lbs/day)
Aluminum	N/A[2]		N/A[2]	N/A[2]	750	353	1,743	436
Arsenic	150	13.6	1,514	379	340	13.6	1,156	289
Cadmium	0.7	0.1	6.5	1.6	7.6	0.1	26	6.6
Chromium VI	11.0	1.3	108	27	16.0	1.3	53	13
Chromium III	240	1.3	2,627	658	5,022	1.3	17,573	4,400
Copper	27.2	1.5	283	71	45.5	1.5	155	39
Cyanide	5.2	2.6	31.2	7.8	22.0	2.6	71	18
Iron					1,000	395	2,513	629
Lead	15.6	0.39	168	42	401	0.4	1403	351
Mercury[2]	0.012	0.006	0.072	0.018	2.4	0.006	8.4	2.1
Nickel	150	2.9	1,624	407	1,352	2.9	4,724	1,183
Selenium	4.6	1.1	39.9	10.0	18.4	1.1	62	15
Silver					32.5	0.5	113	28
Tributylin[2]	0.072	0.036	0.432	0.108	0.46	0.0	1.5	0.4
Zinc	346	8.0	3,723	932	346	8.0	1,190	298

1: Based upon a Hardness of 349.3 mg/l as CaCO3

2: Where the pH is equal to or greater than 7.0 and the hardness is equal to or greater than 50 ppm as $CaC0_3$ 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 (4-day ave)				Acute (1-hour ave)			
Parameter	Standard	Background	Conc. Limit (µg/L)	Load Limit (lbs/day)	Standard	Background	Conc. Limit (µg/L)	Load Limit (lbs/day)
Aldrin					1.5	0.75	3.4	0.8
Chlordane	0.0043	0.00215	0.0258	0.0065	1.2	0.00215	4.2	1.1
DDT, DDE	0.001	0.0005	0.006	0.002	0.55	0.0005	1.92	0.48
Diazinon	0.17	0.085	1.02	0.26	0.17	0.085	0.38	0.10
Dieldrin	0.0056	0.0028	0.0336	0.0084	0.24	0.0028	0.83	0.21
Endosulfan, a & b	0.056	0.028	0.336	0.084	0.11	0.028	0.32	0.08
Endrin	0.036	0.018	0.216	0.054	0.086	0.018	0.256	0.064
Heptachlor & H. epoxide	0.0038	0.0019	0.0228	0.0057	0.26	0.0019	0.91	0.23
Lindane	0.08	0.04	0.48	0.12	1.0	0.04	3.4	0.9
Methoxychlor					0.03	0.015	0.07	0.02
Mirex					0.001	0.0005	0.002	0.001
Nonylphenol	6.6	3.3	39.6	9.9	28.0	3.3	89.8	22.5
Parathion	0.0130	0.0065	0.0780	0.0195	0.066	0.0065	0.215	0.054
PCB's	0.014	0.007	0.084	0.021				
Pentachlorophenol	15.0	7.5	90.0	22.5	19.0	7.5	47.8	12.0
Toxephene	0.0002	0.0001	0.0012	0.0003	0.73	0.0001	2.55	0.64

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

Numeric Criteria for the Protection of Human Health from Consumption of Water and Fish

	Class 1C (Water and Organism)				Class 3 (Organism Only)			
Toxic Organics	**Standard**	**Background**	**Conc. Limit (µg/L)**	**Load Limit (lbs/day)**	**Standard**	**Background**	**Conc. Limit (µg/L)**	**Load Limit (lbs/day)**
Antimony	5.6	2.8	N/A	N/A	640	2.8	7012	1756
Copper	1300	650	N/A	N/A				
Nickel	610	305	N/A	N/A	4600	305	47550	11905
Selenium	170	85	N/A	N/A	4200	85	45350	11354
Thallium	0.24	0.12	N/A	N/A	0.47	0.12	3.97	0.99
Zinc	7400	3700	N/A	N/A	26000	3700	249000	62340
Cyanide	4	2	N/A	N/A	400	2	4380	1097
Asbestos (million fibers/L)	7	3.5	N/A	N/A				
2,3,7,8-TCDD Dioxin	5.00E-09	2.50E-09	N/A	N/A	5.1E-09	2.5E-09	3.11E-08	7.7863E-09
Acrolein	3	1.5	N/A	N/A	400	1.5	4385	1098
Acrylonitrile	0.061	0.0305	N/A	N/A	7	0.0305	76.7	19
Benzene	2.1	1.05	N/A	N/A	51	1.05	551	138
Bromoform	7	3.5	N/A	N/A	120	3.5	1285	322
Carbon Tetrachloride	0.4	0.2	N/A	N/A	5	0.2	53.0	13
Chlorobenzene	100	50	N/A	N/A	800	50	8300	2078
Chlorodibromomethane	0.8	0.4	N/A	N/A	21	0.4	227	57
Chloroform	60	30	N/A	N/A	2000	30	21700	5433
Dalapon	200	100	N/A	N/A				
Dichlorobromomethane	0.95	0.475	N/A	N/A	27	0.475	292	73
1,2-Dichloroethane	9.9	4.95	N/A	N/A	2000	4.95	21951	5496
1,1-Dichloroethylene	300	150	N/A	N/A	20000	150	218500	54704
1,2-Dichloropropane	0.9	0.45	N/A	N/A	31	0.45	337	84
1,3-Dichloropropene	0.27	0.135	N/A	N/A	12	0.135	131	33
Ethylbenzene	68	34	N/A	N/A	130	34	1090	273
Ethylene Dibromide	0.05	0.025	N/A	N/A				
Methyl Bromide	100	50	N/A	N/A	10000	50	109500	27415
Methylene Chloride	20	10	N/A	N/A	1000	10	10900	2729
1,1,2,2-Tetrachloroethane	0.2	0.1	N/A	N/A	3	0.1	32.0	8.0
Tetrachloroethylene	10	5	N/A	N/A	29	5	269	67
Toluene	57	28.5	N/A	N/A	520	28.5	5435	1361
1,2 -Trans-Dichloroethyle	100	50	N/A	N/A	4000	50	43500	10891
1,1,1-Trichloroethane	10000	5000	N/A	N/A	200000	5000	2150000	538279
1,1,2-Trichloroethane	0.55	0.275	N/A	N/A	8.9	0.275	95.2	24
Trichloroethylene	0.6	0.3	N/A	N/A	7	0.3	74.0	19
Vinyl Chloride	0.022	0.011	N/A	N/A	1.6	0.011	17.5	4.4
2-Chlorophenol	30	15	N/A	N/A	800	15	8650	2166
2,4-Dichlorophenol	10	5	N/A	N/A	60	5	610	153
2,4-Dimethylphenol	100	50	N/A	N/A	3000	50	32500	8137
2-Methyl-4,6-Dinitrophenol	2	1	N/A	N/A	30	1	320	80
2,4-Dinitrophenol	10	5	N/A	N/A	300	5	3250	814
3-Methyl-4-Chlorophenol	500	250	N/A	N/A	2000	250	19500	4882
Penetachlorophenol	0.03	0.015	N/A	N/A	0.04	0.015	0.29	0.073
Phenol	4000	2000	N/A	N/A	300000	2000	3280000	821188
2,4,5-Trichlorophenol	300	150	N/A	N/A	600	150	5100	1277
2,4,6-Trichlorophenol	1.5	0.75	N/A	N/A	2.8	0.75	23.3	6
Acenaphthene	70	35	N/A	N/A	90	35	640	160
Anthracene	300	150	N/A	N/A	400	150	2900	726
Benzidine	0.00014	0.00007	N/A	N/A	0.011	0.00007	0.1203	0.0301
BenzoaAnthracene	0.0012	0.0006	N/A	N/A	0.0013	0.0006	0.0083	0.0021
BenzoaPyrene	0.00012	0.00006	N/A	N/A	0.00013	0.00006	0.00083	0.00021
BenzobFluoranthene	0.0012	0.0006	N/A	N/A	0.0013	0.0006	0.0083	0.0021
BenzokFluoranthene	0.012	0.006	N/A	N/A	0.013	0.006	0.083	0.0208

	Class 1C (Water and Organism)				Class 3 (Organism Only)			
Toxic Organics	Standard	Background	Conc. Limit (µg/L)	Load Limit (lbs/day)	Standard	Background	Conc. Limit (µg/L)	Load Limit (lbs/day)
Bis2-Chloro1methylether	0.00015	0.000075	N/A	N/A	0.017	0.000075	0.18625	0.0466
Bis2-Chloro1methylethylether	200	100	N/A	N/A	4000	100	43000	10766
Bis2-ChloroethylEther	0.03	0.015	N/A	N/A	2.2	0.015	24.1	6.0
Bis2-Chloroisopropy1Ether	1400	700	N/A	N/A	65000	700	708000	177256
Bis2-EthylhexylPhthalate	0.32	0.16	N/A	N/A	0.37	0.16	2.47	0.62
Butylbenzyl Phthalate	0.1	0.05	N/A	N/A	0.1	0.05	0.6	0.15
2-Chloronaphthalene	800	400	N/A	N/A	1000	400	7000	1753
Chrysene	0.12	0.06	N/A	N/A	0.13	0.06	0.83	0.21
Dibenzoa, (h)Anthracene	0.00012	0.00006	N/A	N/A	0.00013	0.00006	0.00083	0.00021
1,2-Dichlorobenzene	1000	500	N/A	N/A	3000	500	28000	7010
1,3-Dichlorobenzene	7	3.5	N/A	N/A	10	3.5	75.0	19
1,4-Dichlorobenzene	300	150	N/A	N/A	900	150	8400	2103
3,3-Dichlorobenzidine	0.049	0.0245	N/A	N/A	0.15	0.0245	1.405	0.35
Diethyl Phthalate	600	300	N/A	N/A	600	300	3600	901
Dimethyl Phthalate	2000	1000	N/A	N/A	2000	1000	12000	3004
Di-n-Butyl Phthalate	20	10	N/A	N/A	30	10	230	58
2,4-Dinitrotoluene	0.049	0.0245	N/A	N/A	1.7	0.0245	18.455	4.6
Dinitrophenols	10	5	N/A	N/A	1000	5	10950	2741
1,2-Diphenylhydrazine	0.03	0.015	N/A	N/A	0.2	0.015	2.05	0.51
Fluoranthene	20	10	N/A	N/A	20	10	120	30
Fluorene	50	25	N/A	N/A	70	25	520	130
Hexachlorobenzene	0.000079	0.0000395	N/A	N/A	0.000079	0.0000395	0.000474	0.000119
Hexachlorobutedine	0.01	0.005	N/A	N/A	0.01	0.005	0.06	0.015
Hexachloroethane	0.1	0.05	N/A	N/A	0.1	0.05	0.6	0.15
Hexachlorocyclopentadiene	4	2	N/A	N/A	4	2	24.0	6.0
Ideno 1,2,3-cdPyrene	0.0012	0.0006	N/A	N/A	0.0013	0.0006	0.0083	0.0021
Isophorone	34	17	N/A	N/A	1800	17	19630	4915
Nitrobenzene	10	5	N/A	N/A	600	5	6550	1640
N-Nitrosodiethylamine	0.0008	0.0004	N/A	N/A	1.24	0.0004	13.6	3.4
N-Nitrosodimethylamine	0.00069	0.000345	N/A	N/A	3	0.000345	32.99655	8.3
N-Nitrosodi-n-Propylamine	0.005	0.0025	N/A	N/A	0.51	0.0025	5.6	1.4
N-Nitrosodiphenylamine	3.3	1.65	N/A	N/A	6	1.65	49.5	12
N-Nitrosopyrrolidine	0.016	0.008	N/A	N/A	34	0.008	373.92	94
Pentachlorobenzene	0.1	0.05	N/A	N/A	0.1	0.05	0.6	0.15
Pyrene	20	10	N/A	N/A	30	10	230	58
1,2,4-Trichlorobenzene	0.071	0.0355	N/A	N/A	0.076	0.0355	0.481	0.12
Aldrin	0.00000077	0.000000385	N/A	N/A	0.00000077	0.000000385	0.00000462	0.00000116
alpha-BHC	0.00036	0.00018	N/A	N/A	0.00039	0.00018	0.00249	0.00062
beta-BHC	0.008	0.004	N/A	N/A	0.014	0.004	0.114	0.029
gamma-BHC (Lindane)	4.2	2.1	N/A	N/A	4.4	2.1	27.4	6.9
Hexachlorocyclohexane (HCH)	0.0066	0.0033	N/A	N/A	0.01	0.0033	0.077	0.019
Chlordane	0.00031	0.000155	N/A	N/A	0.00032	0.000155	0.00197	0.00049
4,4-DDT	0.00003	0.000015	N/A	N/A	0.00003	0.000015	0.00018	0.000045
4,4-DDE	0.000018	0.000009	N/A	N/A	0.000018	0.000009	0.000108	0.000027
4,4-DDD	0.00012	0.00006	N/A	N/A	0.00012	0.00006	0.00072	0.00018
Dieldrin	0.0000012	0.0000006	N/A	N/A	0.0000012	0.0000006	0.0000072	0.0000018
alpha-Endosulfan	20	10	N/A	N/A	30	10	230	58
beta-Endosulfan	20	10	N/A	N/A	40	10	340	85
Endosulfan Sulfate	20	10	N/A	N/A	40	10	340	85
Endrin	0.03	0.015	N/A	N/A	0.03	0.015	0.18	0.05
Endrin Aldehyde	1	0.5	N/A	N/A	1	0.5	6.0	2
Heptachlor	0.0000059	0.00000295	N/A	N/A	0.0000059	0.00000295	0.0000354	0.0000089
Heptachlor Epoxide	0.000032	0.000016	N/A	N/A	0.000032	0.000016	0.000192	0.000048
Methoxychlor	0.02	0.01	N/A	N/A	0.02	0.01	0.12	0.03
Polychlorinated Biphenyls (PCB)	0.000064	0.000032	N/A	N/A	0.000064	0.000032	0.000384	0.000096
Toxaphene	0.0007	0.00035	N/A	N/A	0.00071	0.00035	0.00431	0.00108

Effluent Limitation for Protection of Agriculture (Class 4 Waters)

Parameter	Standard	Maximum Concentration Background	Conc. Limit	Load Limit (lbs/day)	
Total Dissolved Solids (mg/L)	1,200		1,200	300,435	Impaired
Boron (µg/L)	750	348	1,755	439	
Arsenic, Dissolved (µg/L)	100	13.6	316	79	
Cadmium, Dissolved (µg/L)	10	0.1	35	9	
Chromium, Dissolved (µg/L)	100	1.3	347	87	
Copper, Dissolved (µg/L)	200	1.5	696	174	
Lead, Dissolved (µg/L)	100	0.4	349	87	
Selenium, Dissolved (µg/L)	50	1.1	172	43	
Gross Alpha (pCi/L)	15		15		

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

INPUT				
	Summer	Fall	Winter	Spring
pH:	8.98	8.00	8.00	8.00
Beneficial use classification:	3B	3B	3B	3B

OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Acute:	1.36	8.41	8.41	8.41

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

INPUT	Summer	Fall	Winter	Spring
Temperature (deg C):	23.8	16.9	15.9	17.5
pH:	8.40	8.00	8.00	8.00
Are fish early life stages present?	Yes	Yes	Yes	Yes

OUTPUT				
Total ammonia nitrogen criteria (mg N/L):				
Chronic - Fish Early Life Stages Present:	0.70	2.08	2.22	2.01
Chronic - Fish Early Life Stages Absent:	0.70	2.08	2.22	2.01

Project "C:\Plumes20\TimpSurfaceWLA" memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Low
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 1
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 100
Maximum dilution reported 100000
Text output format : Standard
Max vertical reversals : to max rise or fall

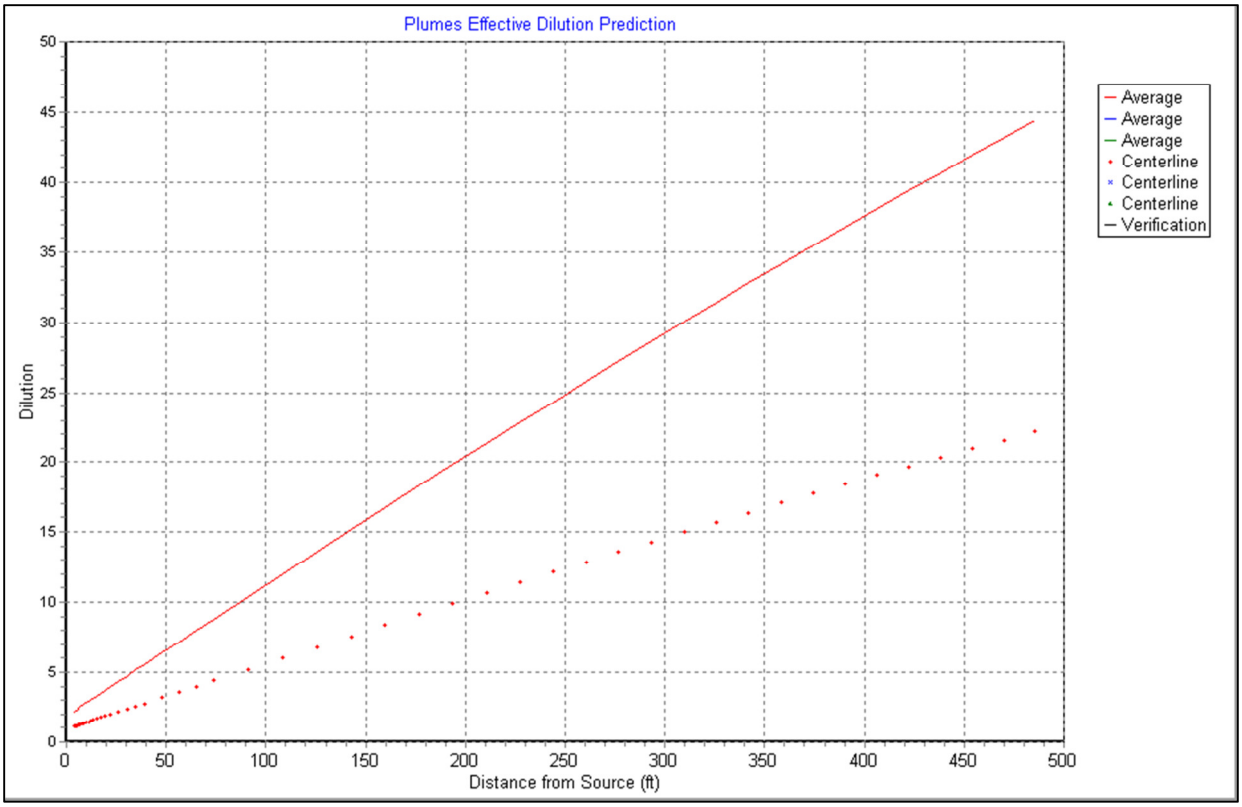
/ PDS surface discharge model

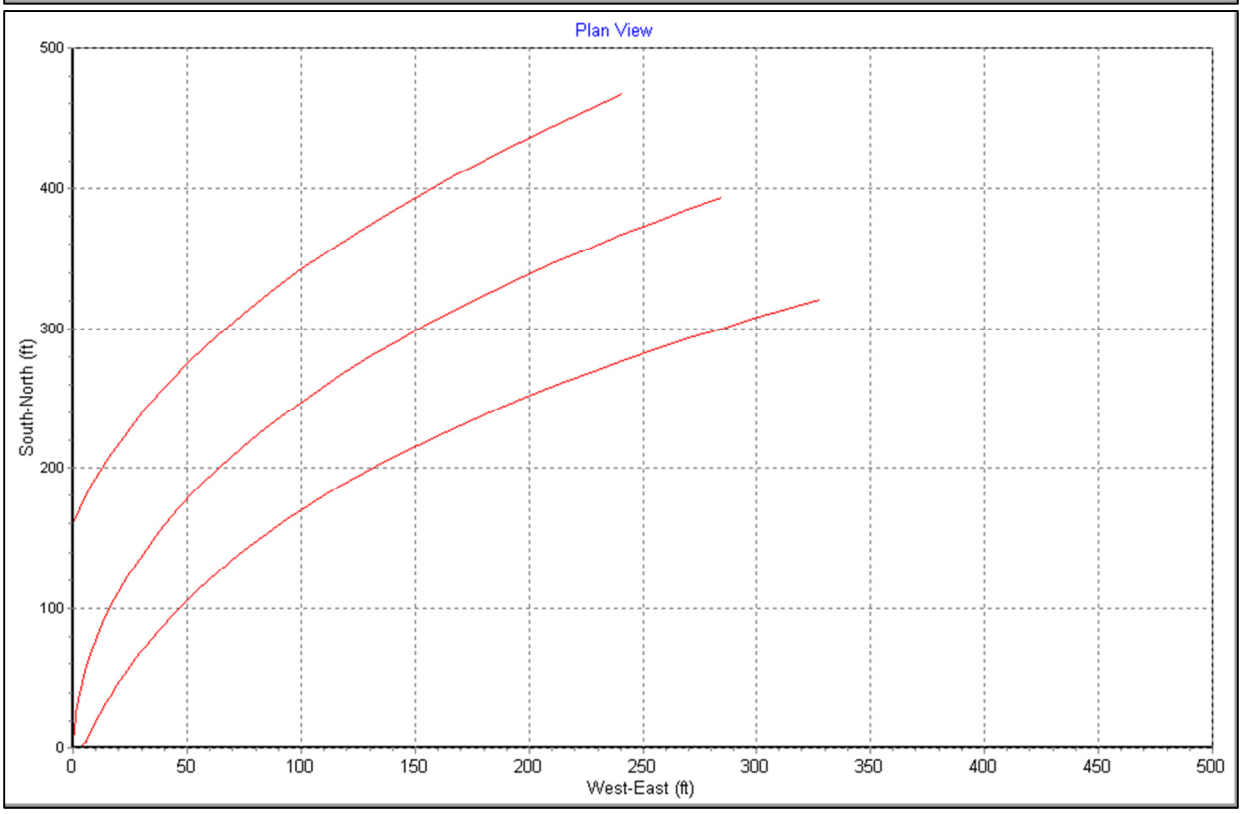
3	3.379	0.0984	10.43	4.651E-5	2.150	0.0656	3.821	0.0;	MZ dis, merging;
4	3.478	0.0984	10.70	4.545E-5	2.200	0.0656	4.180	0.0;	
5	3.543	0.0984	10.93	4.425E-5	2.260	0.0984	4.583	3.3300;	
6	3.642	0.0984	11.19	4.329E-5	2.310	0.0984	5.011	3.4100;	
7	3.806	0.0984	11.68	4.149E-5	2.410	0.131	5.887	3.5600;	
8	3.937	0.0984	12.17	3.984E-5	2.510	0.197	6.861	3.7100;	
9	4.101	0.0984	12.66	3.831E-5	2.610	0.230	7.850	3.8600;	
10	4.265	0.0984	13.16	3.690E-5	2.710	0.262	8.878	4.0100;	
11	4.429	0.0984	13.65	3.546E-5	2.820	0.328	9.920	4.1600;	
12	4.593	0.0984	14.14	3.425E-5	2.920	0.394	10.97	4.3100;	
13	4.757	0.0984	14.63	3.311E-5	3.020	0.427	12.03	4.4600;	
14	4.921	0.0984	15.12	3.205E-5	3.120	0.492	13.07	4.6100;	
15	5.249	0.0984	16.11	3.003E-5	3.330	0.623	15.16	4.9100;	
16	5.545	0.0984	17.09	2.833E-5	3.530	0.755	17.32	5.2100;	
17	5.873	0.0984	18.08	2.681E-5	3.730	0.919	19.47	5.5100;	
18	6.201	0.0984	19.06	2.538E-5	3.940	1.083	21.64	5.8100;	
19	6.824	0.0984	21.00	2.304E-5	4.340	1.444	25.88	6.4000;	
20	7.480	0.0984	22.97	2.105E-5	4.750	1.870	30.24	7.0000;	
21	8.104	0.0984	24.90	1.938E-5	5.160	2.329	34.58	7.5900;	
22	8.760	0.0984	26.87	1.795E-5	5.570	2.854	38.91	8.1900;	
23	10.01	0.0984	30.74	1.567E-5	6.380	4.068	47.44	9.3700;	
24	11.25	0.0984	34.58	1.390E-5	7.190	5.446	56.08	10.540;	
25	12.53	0.0984	38.39	1.250E-5	8.000	7.054	64.67	11.700;	
26	13.75	0.0984	42.16	1.135E-5	8.810	8.858	73.23	12.850;	
27	16.21	0.0984	49.61	9.597E-6	10.42	13.09	90.00	15.120;	
28	18.60	0.0984	56.86	8.319E-6	12.02	18.14	106.7	17.330;	
29	20.93	0.0984	63.91	7.348E-6	13.61	23.98	123.2	19.480;	
30	23.20	0.0984	70.77	6.583E-6	15.19	30.58	139.4	21.570;	
31	25.39	0.0984	77.39	5.970E-6	16.75	37.93	155.3	23.590;	
32	27.53	0.0984	83.79	5.464E-6	18.30	46.00	170.7	25.540;	
33	29.56	0.0984	89.96	5.043E-6	19.83	54.72	185.8	27.420;	
34	31.53	0.0984	95.90	4.686E-6	21.34	64.11	200.5	29.230;	
35	33.43	0.0984	101.6	4.378E-6	22.84	74.05	214.9	30.970;	

```
 36    35.27  0.0984   107.1 4.114E-6   24.31   84.55   228.8   32.640;
 37    37.01  0.0984   112.4 3.880E-6   25.77   95.54   242.3   34.250;
 38    38.68  0.0984   117.5 3.675E-6   27.21   107.0   255.4   35.800;
 39    40.29  0.0984   122.4 3.493E-6   28.63   118.9   268.1   37.300;
 40    41.86  0.0984   127.1 3.330E-6   30.03   131.2   280.4   38.730;
 41    43.34  0.0984   131.6 3.183E-6   31.42   143.8   292.3   40.120;
 42    44.78  0.0984   136.0 3.050E-6   32.79   156.8   303.9   41.460;
 43    46.16  0.0984   140.3 2.929E-6   34.14   170.1   315.1   42.750;
 44    47.51  0.0984   144.4 2.819E-6   35.47   183.7   326.0   44.000;
 45    48.79  0.0984   148.4 2.718E-6   36.79   197.5   336.5   45.220; stream limit reached;
 46    50.03  0.0984   152.2 2.625E-6   38.10   211.5   346.7   46.390;
 47    51.21  0.0984   155.9 2.539E-6   39.39   225.8   356.7   47.530;
 48    52.39  0.0984   159.6 2.459E-6   40.67   240.2   366.3   48.640;
 49    53.51  0.0984   163.1 2.384E-6   41.94   254.8   375.6   49.720;
 50    54.59  0.0984   166.6 2.315E-6   43.19   269.6   384.7   50.770;
 51    55.68  0.0984   169.9 2.251E-6   44.43   284.5   393.6   51.790;
 51    55.68  0.0984   169.9 2.251E-6   44.43   284.5   393.6   51.790;
   196000.0 m^3 (      48.433ac) within isopleth
Case 1; ambient file C:\Plumes20\TimpSurfaceWLA.001.db; Diffuser table record 1: ----------------------------------

Ambient Table:
    Depth   Amb-cur   Amb-dir   Amb-sal   Amb-tem   Amb-pol     Decay   Far-spd   Far-dir   Disprsn   Density
      m       m/s       deg       psu        C     kg/kg       s-1       m/s       deg  m0.67/s2   sigma-T
     0.0    0.0305       0.0     0.001     20.00       0.0       0.0       0.0       0.0    0.0003 -1.732077
    15.00   0.0305       0.0     0.001     20.00       0.0       0.0       0.0       0.0    0.0003 -1.732077

Diffuser table:
Cnduit wCnduit d H-Angle SourceX SourceYRegIntst Isoplth Ttl-flo Eff-sal    Temp
   (ft)    (ft)   (deg)     (m)     (m)    (ft)(concent)   (MGD)   (psu)     (C)
  6.0000  2.0000  90.000     0.0     0.0  500.00     0.0  30.000 1.00E-3  15.000
Simulation:
Low
       Depth  Amb-cur Cnduit w  Polutnt   Dilutn   x-posn   y-posn   Iso dia
Step     (ft)   (ft/s)     (ft)    (ppm)       ()     (ft)     (ft)       (m)
  0       0.0    0.100    6.000   0.0001    1.000      0.0      0.0       0.0; merging;
Simulation:
Low
       Depth  Amb-cur Cnduit w  Polutnt   Dilutn   x-posn   y-posn   Iso dia
Step     (ft)   (ft/s)     (ft)    (ppm)       ()     (ft)     (ft)       (m)
  0       0.0    0.100    6.000   0.0001    44.43      0.0      0.0    1.8288; stream limit reached, merging;
 ;
```


Plumes Effective Dilution Prediction
Dilution
Distance from Source (ft)
0
5
10
15
20
25
30
35
40
45
50
0
50
100
150
200
250
300
350
400
450
500
Average
Average
Average
Centerline
Centerline
Centerline
Verification


Plan View
South-North (ft)
West-East (ft)
0
100
200
300
400
500
0
50
100
150
200
250
300
350
400
450
500