

Appendix J. Dissolved Oxygen Modeling

1.0 Sandusky River near Bucyrus**1.1 Reach Description**

Ohio EPA has collected biological, chemical and physical data in the Sandusky River upstream and downstream of Bucyrus since 1979. At that time, the lowest dissolved oxygen measurement recorded in the survey of 22 mainstem sites was located about 5 miles downstream of the Bucyrus WWTP outfall (Ohio EPA, 1991). Since 1988, the Bucyrus WWTP has been discharging a fraction of the ammonia, CBOD, and suspended solids load that it had discharged in the past. However, a considerable load of nutrients and sediments still enter the Sandusky River through Combined Sewer Overflows (CSOs) from the cities of Crestline, Bucyrus, Upper Sandusky, and Tiffin. Among these, the Sandusky River downstream of Bucyrus stands out as usually having low dissolved oxygen concentrations. In fact, this assessment unit (#04100011-020) receives a higher load of nutrients per unit area than other assessment units within the Sandusky watershed. Figure 1 compares the summer phosphorus loads from point sources discharging to the various assessment units in the Sandusky watershed. The data in the Figure 1 excludes the loads from combined sewer overflows (CSOs), because total phosphorus is not monitored during overflow events.

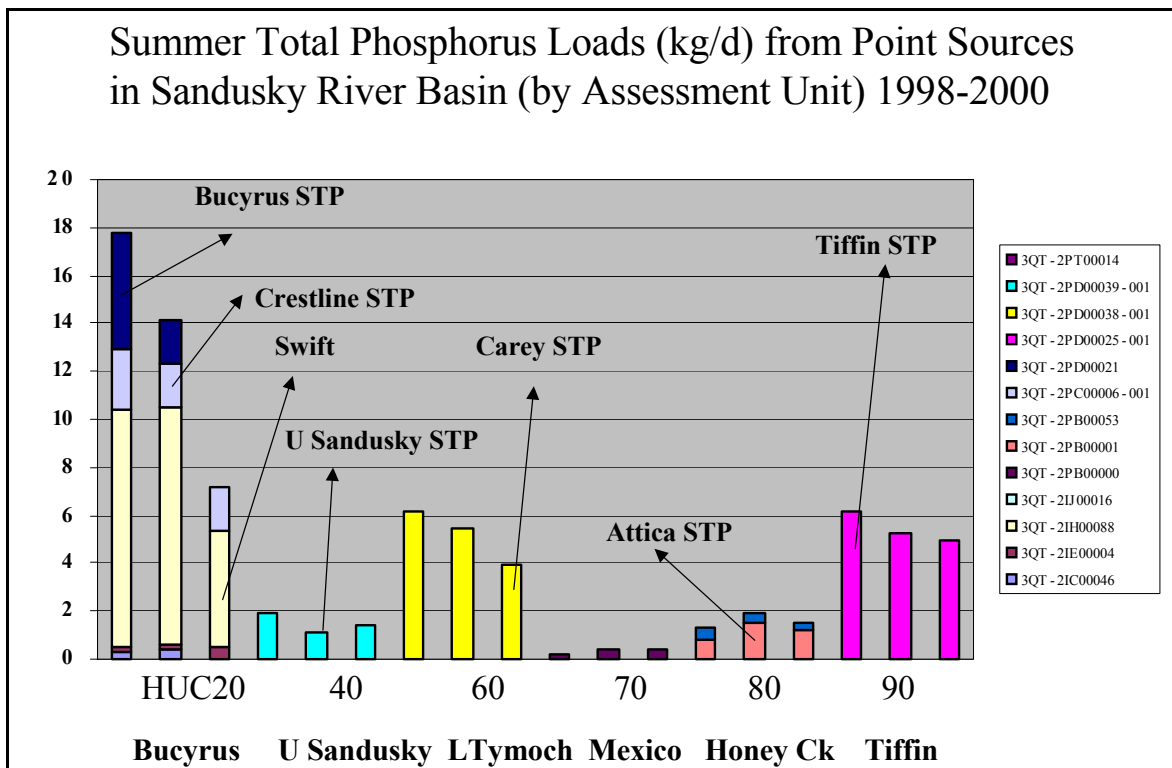


Figure 1. Average Total P summer loads from major point sources in the Upper Sandusky River study area for years 1998, 1999 and 2000 (excludes CSO discharges).

Figures 2 and 3 compare the range of loads per unit area measured for total phosphorus and CBOD₂₀ at various subwatersheds in the Sandusky river basin. The loads are based on grab samples and instantaneous streamflow measurement at the time of sample collection, so they are not technically daily loads, and are therefore labeled as flux plots instead of load plots. The data was collected at the temporary gaging stations set up by Ohio EPA (location was shown in chapter 3, figure and shown earlier in chapter .

The plots show the relative pollutant contribution from each tributary, indicating that unit area loads are highest in Paramour Creek and Little Sandusky for total phosphorus. The data shown for the Sandusky mainstem is limited to what was collected downstream from Paramour Creek and upstream of the city of Bucyrus.

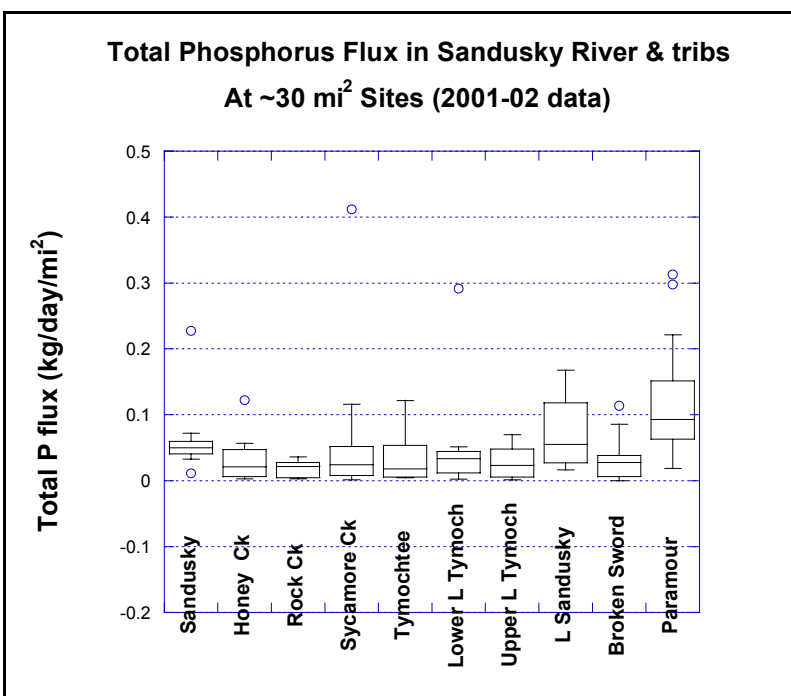


Figure 2. Total P Flux measured at various Sandusky river tributaries during 2001-2002.

The CBOD₂₀ load contributes to oxygen depletion in the water column, and figure 3 indicates that Paramour Creek has the highest load per unit area for this parameter. The Crestline WWTP was shown to be a significant source of CBOD and total phosphorus in Paramour Creek, although CSOs contribute larger loads. (Figure 1 and also in chapter 3 of the TMDL report).

The load of phosphorus and CBOD from the Crestline area enrich the stream with nutrients which promote attached and suspended algal growth. The settling of nutrient particles (including dead algae, suspended solids from CSO and effluent, other sources) in pooled areas of the stream causes high sediment oxygen demand as the nutrients are decomposed. The combination of sediment oxygen demand and algal respiration/oxygen production has a marked effect on the stream's dissolved oxygen. Figure 4 shows the diurnal variation (max, min and average) in D.O. concentration observed in the Sandusky River during low flow conditions (August 13-15, 2002). The reach between river miles 125 and 115 has deep pools where suspended algae flourish, and the lack of riffles limit the streams' ability to aerate the stream naturally (low reaeration coefficient). The average D.O. drops below the water quality standard near river mile 121, indicating that the stream's assimilative capacity for oxygen-demanding substances is being exceeded during low flow conditions. The other D.O. sag point near river mile 111 is caused by excessive nutrients from the Bucyrus CSOs and

WWTP effluent. The only other significant D.O. sag detected in the mainstem was observed near river mile 83, where the average D.O. dropped slightly below the WQS during a July 2001 survey. However, that reach of the Sandusky River is in full attainment of the aquatic life use designation, hence the occasional D.O. WQS exceedance is not impairing the stream. For that reason, D.O. modeling for the Sandusky River mainstem was deemed necessary only down to river mile 95.

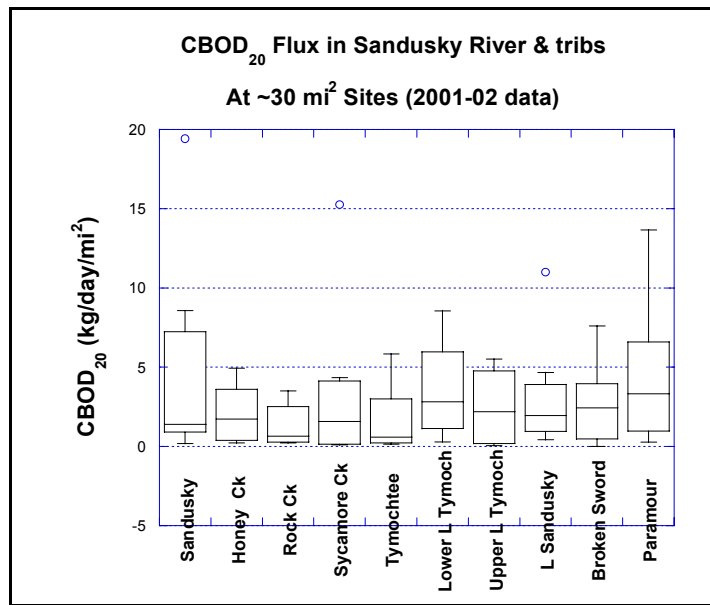


Figure 3. CBOD₂₀ measured at various Sandusky river tributaries during 2001-2002.

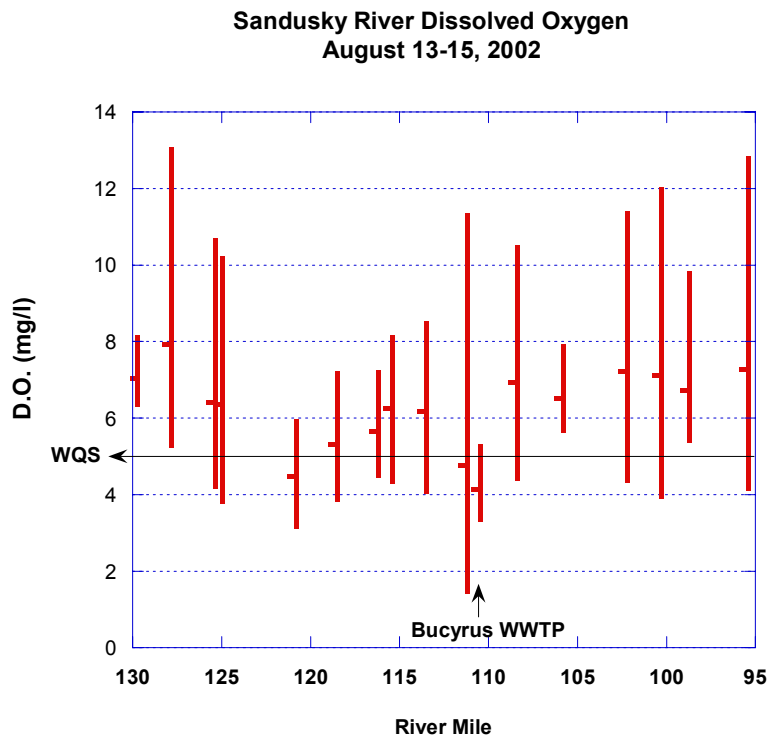


Figure 4. D.O. Concentration in the Sandusky River during Aug13-15 Ohio EPA Survey (2002)

1.2 Model Overview

The U.S. EPA's Simplified method provides a simplified technique for calculating dissolved oxygen and un-ionized ammonia concentrations resulting from discharges from small POTWs into effluent dominated streams. The Multiple Discharge version Simplified Method Program (Multi-SMP) used in the Sandusky watershed simulations is a user-friendly version of the Simplified Method modified to accommodate wasteload allocations involving multiple discharges. Multi-SMP predicts dissolved oxygen and un-ionized ammonia concentrations for a maximum of 10 dischargers (1 discharger per reach), and allows the user to allocate CBOD and ammonia without exceeding user-defined water quality standards for oxygen and ammonia. The stream can be divided into up to 10 reaches having fairly uniform hydraulic (velocity, depth, width) characteristics. The model takes into account the major factors affecting dissolved oxygen such as reaeration (the entrainment of oxygen in/out of the water column from turbulence), CBOD and ammonia decay, sediment oxygen demand (oxygen used by settled organic matter), and algal photosynthesis/respiration. More details about the model are available in the Multi-SMP User's Guide (LTI, 1992).

1.3 Model Calibration

The model was calibrated using water quality and hydraulic data collected during surveys conducted by Ohio EPA during 2002, as well as data from earlier Ohio EPA surveys of the study area. The stream slope was estimated from USGS topographic maps, and is illustrated in figure 5. The reaeration rates for the model were determined from 5 predictive equations selected on the basis of streamflow and reach slope. These equations were selected by Ohio EPA among 18 equations as the ones showing the smallest relative errors relative to field measurements of reaeration rates performed in Ohio streams (Skalsky & Fischer, 1984). The rates vary with velocity and depth (therefore are flow dependent). The equations used for the Sandusky River-Bucyrus assessment unit D.O. model were Tsivoglou-Neal, Parkhurst-Pomeroy, Krenkel-Orlob, and Negulescu-Rojanski. Which one of the equations was used depended on the reach slope and flow. More details about the application of the reaeration equations is available in the reference mentioned above.

As seen in figure 5, the Sandusky River reach being simulated has several areas with fairly flat slope (very slight decrease in elevation as you travel downstream). Those areas have low reaeration coefficient and low velocities, therefore any settleable nutrients in the water column will likely accumulate there and exert a benthic oxygen demand that contributes to a D.O. sag. This assumption is supported by the results of the dissolved oxygen survey shown in figure 4. Due to this natural limitation, the load of nutrients and suspended solids in this reach (mainly from CSOs in Crestline and Bucyrus) cannot be assimilated by the stream without incurring a dissolved oxygen deficit (particularly during low flow periods).

The decay rates for cBOD and ammonia were determined based on water quality data and time of travel measurements obtained by Ohio EPA during surveys in the area.

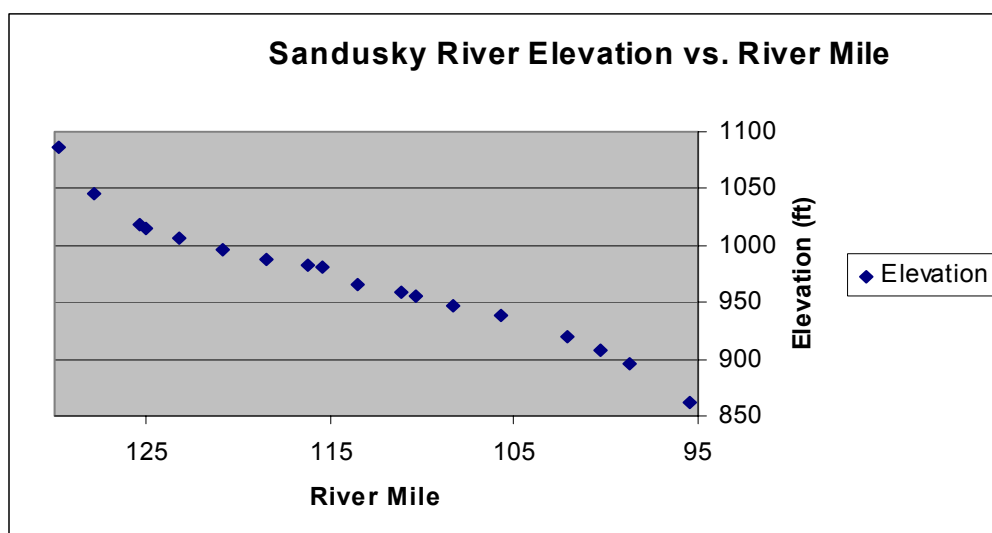


Figure 5. Sandusky River Slope in the Crestline-Bucyrus Study Area

Due to the impact of the Crestline WWTP and CSOs, Paramour Creek (headwaters of the Sandusky River) was also included as part of the reach being simulated. Ohio EPA already had collected velocity and depth data for Paramour Creek in previous years. Time of travel and cross sectional area measurements were made from river mile 129.7 to river mile 95.4 in the Sandusky River to determine the velocity and depth for each reach. The time of travel studies were done by injecting a fluorescent dye (Rhodamine WT) at various locations, and collecting stream samples at periodic intervals at downstream sites. The dye concentrations in water were measured in the field with a fluorometer to determine the time when the dye passed through each sampling station. The August 13-15, 2002 time of travel survey was conducted when the stream was at 7Q10 (critical low) flow, and the measured stream velocities were extremely low.

The major physical input parameters (reach length, depth, velocity, temperature and slope) used for the calibration of the Multi-SMP D.O. model are shown in Table 1 for each reach in the Sandusky River-Bucyrus study area.

Table 2 shows the decay rates for CBOD and ammonia, the sediment oxygen demand, and the reaeration rates used for each reach during the model calibration. The decay rates and the sediment oxygen demand rate used in the calibration were left unchanged (except for temperature compensation) when the water quality simulations under various scenarios were performed. The reaeration coefficient was recalculated when higher streamflows were simulated, because that rate varies with changes in depth and velocity.

Although no sediment oxygen demand (SOD) field measurements were performed, the SOD values used to calibrate the model were estimated based on professional judgement and on the observed D.O. data, stream velocity, and settling rate of suspended solids in various reaches.

Table 1. Physical input parameters for the calibration of the Multi-SMP D.O. model of the Sandusky River

Reach	Description	Length (mi)	Velocity (ft/sec)	Slope (ft/mi)	Depth (ft)	Temp (C)
1	Paramour Ck dst. Crestline	1.7	0.1	4.7	0.46	22.5
2	Lower Leesville Rd.	1.9	0.16	15.4	0.35	24.3
3	Remlinger Rd.	2.8	0.09	10.9	0.41	24.7
4	McCurdy Rd.	6.5	0.04	4.6	0.63	24.3
5	Beech Grove Rd.	3.1	0.02	2.1	0.675	23.7
6	Highland Avenue	1.9	0.06	8.2	0.56	23.7
7	Upstream Bucyrus WWTP	2.3	0.04	3.4	0.7	24.2
8	Downstream Bucyrus WWTP	5.4	0.04	3.4	1.0	23.8
9	County Line Rd.	5.5	0.05	5.7	0.9	25.2
10	County Rd 130	4.9	0.07	9.4	0.85	25.2

Table 2. Summary of important rates (at 20°C) used in the calibration of the Multi-SMP D.O. model of the Sandusky River

Reach	River Mile Range	CBOD removal rate	Sediment oxygen demand	Ammonia oxidation	Reaeration Coefficient
		(day ⁻¹)	(g/ft ² /day)	(day ⁻¹)	(day ⁻¹)
1	131.6 -129.7	0.012	0.2	0.07	3.18
2	129.7-127.8	0.024	0	0.059	4.44
3	12.78 - 125	0.024	0	0.059	4.7
4	125 - 118.5	0.011	1.5	0.059	1.63
5	118.5 -115.4	0.011	1.0	0.059	1.53
6	115.4 - 113.5	0.033	1.0	0.059	2.66
7	113.5 - 111.2	0.033	1.3	0.059	1.3
8	111.2 - 105.8	0.014	0.2	0.15	0.92
9	105.8 - 100.3	0.014	0.2	0.15	1.35
10	100.3 - 95.4	0.04	0.2	0.217	1.96

No additional D.O. surveys were conducted in the Sandusky River in order to validate the calibration. For that reason, a sensitivity analysis was performed to determine the model's sensitivity to variations in the value of various input values. The results indicate that the model is most sensitive to input values of sediment oxygen demand and the reaeration coefficient. The reaeration coefficients calculated for the Sandusky River simulations are considered reasonable because they are based on equations that have been compared to actual field measurements of the reaeration coefficient performed in Ohio streams by Ohio EPA and USGS in the 1980's. The estimated SOD rates were used as calibration tool, and represent very well the oxygen demand that has been observed in this reach of the Sandusky River during several previous Ohio EPA surveys. There is some uncertainty regarding what portion of the oxygen demand is due to algal respiration, and how much is due to benthic oxygen demand. In either case, the oxygen demand is due to nutrient enrichment, and the solution is the same: reduction of nutrient loads. Ohio EPA has recommended a 50% load reduction in phosphorus for dischargers in this reach, as well as a 50% reduction in ammonia effluent limits for the Crestline WWTP. In addition, recommended long term CSO abatement plans for Crestline and Bucyrus are expected to cut the load of suspended solids and CBOD by a minimum of 60%, by limiting CSO events to 4 per year.

Since the calibration was performed under critical low flows (7Q10), it can be used with minor modifications to simulate various scenarios that don't depart widely from critical low flows. The calibrated model was used to simulate water quality in the Sandusky River to assess the impact of the various dischargers on the dissolved oxygen regime.

1.4 Low Flow Simulations for the Upper Sandusky River

The calibrated Multi-SMP model for the Upper Sandusky River was used to simulate water quality under summer 7Q10 design conditions. Upstream flows and discharger water quality for these design conditions are specified in table 3.

Table 3. Upstream flow and discharger effluent quality used in summer D.O. simulations of the Sandusky River near Bucyrus

	Flow (cfs)	CBOD5 (mg/l)	NH3-N (mg/l)	D.O. (mg/l)
Upstream	0.36	3.7	0.07	5.5
Crestline WWTP	1.47	10.0	0.8	6.0
Timken	0.62	10.0	1.0	6.0
Bucyrus WWTP	5.26	10.0	2.0	6.0
Swift	0.25	10.0	2.0	6.0

In addition to changing the inputs for flow and water quality in the calibrated Multi-SMP model, it was also necessary to adjust the depth, velocity, and reaeration rate for each reach of the model to the new flow condition (model depth, velocity, and reaeration are all flow dependent). The depth adjustment was based on the following equation:

$$\text{Depth}_{\text{low}} = (\text{Flow}_{\text{low}}/\text{Flow}_{\text{base}})^{0.6} * \text{Depth}_{\text{base}}$$

where $\text{Depth}_{\text{low}}$ = calculated depth at low flow
 Flow_{low} = stream flow under low flow conditions
 $\text{Flow}_{\text{base}}$ = stream flow under field conditions
 $\text{Depth}_{\text{base}}$ = stream depth under field conditions

For this exercise, $\text{Flow}_{\text{base}}$ and $\text{Depth}_{\text{base}}$ were assumed to be the reach flow and depth from the model calibration run. The velocity adjustment was completed in the same manner as depth, except a value of 0.4 was substituted for the exponent of 0.6. The reaeration rate for each reach was then calculated using the new reach depth and velocity. The complete Multi-SMP model input/output is printed at the end of this appendix.

The predicted instream D.O. in the Upper Sandusky River under summer 7Q10 design conditions is shown in Figure 6. As can be seen from the figure, violations of the average D.O. water quality standard were predicted under summer 7Q10 design conditions.

This D.O. deficit is believed to be due to a combination of several factors: large CSO nutrient loads that settle in the pooled areas; very low summer flow due to impact of agricultural drainage tiles and water withdrawals, and low reaeration coefficient in parts of the stream due to low stream slope.

1.5 Restoration Scenarios

Elimination of CSO Loads

The most beneficial action to reduce oxygen demand in this reach of the Sandusky River is believed to be the virtual elimination of CSO releases to the stream from Crestline and Bucyrus. Both municipalities are required to submit long term plans limiting their CSO discharges to 4 events per year. Based on existing data, the CSO releases seem to occur at least 10 times per year. The effect of this load reduction cannot be reliably simulated by the Multi-SMP model, which is designed for steady state, low flow conditions. The expected result is a lower sediment oxygen demand rate, which will lead to higher concentration of D.O. in the water column.

Flow Augmentation

As an alternative (or supplement) to reducing nutrient loads to the Upper Sandusky River, flow augmentation was investigated. Two additional simulations were conducted under summer 7Q10 design conditions. One of these simulations included 0.5 cfs of augmentation flow at RM 129.7, while the other simulation assessed the impact of 1.5 cfs of augmentation flow. Reach depth, velocity, and reaeration were adjusted as discussed above. The predicted instream D.O. in the Upper Sandusky River under

summer 7Q10 under the two flow augmentation scenarios is shown in Figure 6. The simulation indicates that the stream's D.O. would increase about 0.5 mg/l as a result of the increased streamflow if an additional 1.5 cfs is added as upstream flow. The source of the extra flow could be water stored in one of the numerous quarries that dot the landscape in this watershed, and would involve coordination among county and private parties. The model shows insignificant increase in D.O. with a flow augmentation of 0.5 cfs.

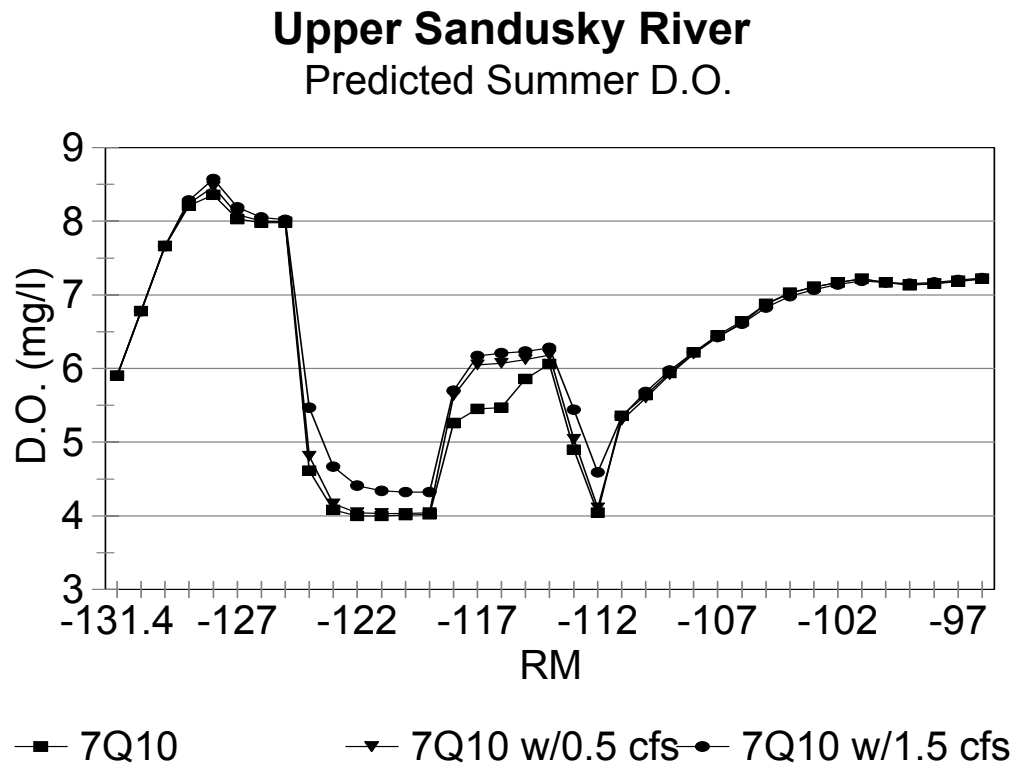


Figure 6. Summer D.O. Simulation of the Upper Sandusky River under 7Q10 and Flow Augmentation Scenarios

Water Withdrawals

The streamflow in the Sandusky River was extremely low during the summer of 2002, and particularly during the stream survey conducted by Ohio EPA on August 13, 2002. In spite of the low flows, some local citizens were observed pumping water out of the stream to fill their ponds. Education of the local population regarding the ramifications of a desiccated stream (inability to assimilate wastewater, impairment of aquatic life, possible transfer of bacteria-laden water into their ponds, etc) could be beneficial to voluntarily curtail this type of activity during drought periods.

References

Butts T.A. & R.L. Evans. 1978. Sediment Oxygen Demand Studies of Selected Northeastern Illinois Streams, Illinois State Water Survey, Urbana, Illinois, ISWS/CIR-129/78.

Skalsky D.S. & L.D. Fischer, 1984. Predicting the Reaeration Coefficient for Ohio Streams, Ohio Environmental Protection Agency.

Ohio EPA, 1991. Biological and Water Quality Study of the Sandusky River & Selected Tributaries, Ecological Assessment Section, EAS/1991-6-2.

LTI, 1992. Multi-SMP: Simplified Method Program for Multiple Dischargers, LTI, Limno-Tech, Inc, December 1992.

D.O. Model Appendix for Upper Sandusky

Multi-SMP Model Calibration Run

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*****
*                               SIMPLIFIED METHOD PROGRAM                               *
*                               COMPLETE INPUT LISTING                               *
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----*--* Run Information *--*--*--*

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Name of receiving stream ----- Sandusky
Number of discharges ----- 4
Number of reaches ----- 10
Reaeration type ----- Manually specified
Run title ----- Sandusky DO
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----*--* Upstream Parameters *--*--*--*

Parameter	Value	Comment
Flow (cfs)	0.160	
Temperature (°C)	22.500	
Dissolved Oxygen (mg/l)	5.500	
5-Day BOD (mg/l)	3.710	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.620	
Ammonia (mg/l)	0.070	
Alkalinity (mg/l)	-0.000	

----*--* Effluent Parameters *--*--*--*

Number of Discharges = 4

For Discharge Number 1 (Crestline WWTP)

Parameter	Value	Comment
Flow (MGD)	0.646	field data
Temperature (°C)	22.300	
Dissolved Oxygen (mg/l)	5.500	sondeOldfield
5-Day BOD (mg/l)	1.320	field data
Ult. CBOD / 5-Day BOD	5.400	
pH (su)	7.600	
Ammonia (mg/l)	0.800	field data
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	1.000	

For Discharge Number 2 (Timken/Linlare)

Parameter	Value	Comment
Flow (MGD)	0.190	Timken
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	5.000	
5-Day BOD (mg/l)	10.000	assumed
Ult. CBOD / 5-Day BOD	2.300	same as bucyrus
pH (su)	7.000	
Ammonia (mg/l)	0.100	assumed
Alkalinity (mg/l)	-0.000	

Upper Sandusky River Watershed TMDLs

Beginning of Reach Number	6.000		
For Discharge Number 3 (Bucyrus STP)			
Parameter	Value	Comment	
Flow (MGD)	1.600		
Temperature (°C)	23.000		
Dissolved Oxygen (mg/l)	5.000		
5-Day BOD (mg/l)	4.500	ave of 2 days	
Ult. CBOD / 5-Day BOD	2.900		
pH (su)	7.000		
Ammonia (mg/l)	4.000	8/13 conc	
Alkalinity (mg/l)	-0.000		
Beginning of Reach Number	8.000		

For Discharge Number 4 (Swift)			
Parameter	Value	Comment	
Flow (MGD)	0.080	rounded 0.08	
Temperature (°C)	23.000	assumed	
Dissolved Oxygen (mg/l)	5.000	assumed	
5-Day BOD (mg/l)	12.000	LEAPS	
Ult. CBOD / 5-Day BOD	2.300	same as bucyrus	
pH (su)	7.000		
Ammonia (mg/l)	0.600	LEAPS	
Alkalinity (mg/l)	-0.000		
Beginning of Reach Number	10.000		

--*-*-* Reach Information *-*-*-*-*

Number of Reaches = 10
Reaeration Specified Directly

For Reach Number 1			
Parameter	Value	Comment	
Length (mile)	1.700		
Velocity (fps)	0.100		
Slope (ft/mile)	4.700		
Average Depth (ft)	0.460		
Temperature (°C)	22.459	calculated	
BOD Removal Rate (1/day)	0.012		
NH3 Decay Rate (1/day)	0.070		
Sediment Oxygen Demand (g/m ² /day)	0.200	low velocity	
Photosynthesis/respiration (mg/L/day)	-0.000		
Reaeration Coefficient (1/day)	3.180		

Temperature-corrected BOD removal rate (1/day)	0.013
Temperature-corrected NH3 decay rate (1/day)	0.084
Calculated reaeration rate at 20° C (1/day)	3.180
Temperature-corrected reaeration rate (1/day)	3.361
Calculated reach-averaged width (ft)	25.189

For Reach Number 2			
Parameter	Value	Comment	
Length (mile)	1.900		
Velocity (fps)	0.160		
Slope (ft/mile)	15.400		
Average Depth (ft)	0.350		
Temperature (°C)	24.300		
BOD Removal Rate (1/day)	0.024		
NH3 Decay Rate (1/day)	0.059		
Sediment Oxygen Demand (g/m ² /day)	0.000		
Photosynthesis/respiration (mg/L/day)	0.000		
Reaeration Coefficient (1/day)	4.440		

Temperature-corrected BOD removal rate (1/day)	0.029
Temperature-corrected NH3 decay rate (1/day)	0.082

Upper Sandusky River Watershed TMDLs

Calculated reaeration rate at 20° C	(1/day)	4.440
Temperature-corrected reaeration rate	(1/day)	4.919
Calculated reach-averaged width	(ft)	20.691

For Reach Number 3

Parameter		Value	Comment
Length	(mile)	2.800	
Velocity	(fps)	0.090	
Slope	(ft/mile)	15.400	
Average Depth	(ft)	0.410	
Temperature	(°C)	24.700	sonde ave
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	0.000	
Photosynthesis/respiration	(mg/L/day)	0.000	
Reaeration Coefficient	(1/day)	4.700	

Temperature-corrected BOD removal rate	(1/day)	0.030
Temperature-corrected NH3 decay rate	(1/day)	0.085
Calculated reaeration rate at 20° C	(1/day)	4.700
Temperature-corrected reaeration rate	(1/day)	5.257
Calculated reach-averaged width	(ft)	31.402

For Reach Number 4

Parameter		Value	Comment
Length	(mile)	6.500	
Velocity	(fps)	0.040	
Slope	(ft/mile)	3.800	
Average Depth	(ft)	0.630	
Temperature	(°C)	24.342	ave sonde @121
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.500	low velocity
Photosynthesis/respiration	(mg/L/day)	0.000	based on sonde
Reaeration Coefficient	(1/day)	1.630	

Temperature-corrected BOD removal rate	(1/day)	0.013
Temperature-corrected NH3 decay rate	(1/day)	0.082
Calculated reaeration rate at 20° C	(1/day)	1.630
Temperature-corrected reaeration rate	(1/day)	1.808
Calculated reach-averaged width	(ft)	45.981

For Reach Number 5

Parameter		Value	Comment
Length	(mile)	3.100	
Velocity	(fps)	0.020	
Slope	(ft/mile)	3.800	
Average Depth	(ft)	0.675	
Temperature	(°C)	23.700	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	low velocity
Photosynthesis/respiration	(mg/L/day)	0.000	
Reaeration Coefficient	(1/day)	1.530	

Temperature-corrected BOD removal rate	(1/day)	0.013
Temperature-corrected NH3 decay rate	(1/day)	0.078
Calculated reaeration rate at 20° C	(1/day)	1.530
Temperature-corrected reaeration rate	(1/day)	1.671
Calculated reach-averaged width	(ft)	85.831

For Reach Number 6

Parameter		Value	Comment
Length	(mile)	1.900	
Velocity	(fps)	0.060	

Upper Sandusky River Watershed TMDLs

Slope	(ft/mile)	8.200	
Average Depth	(ft)	0.560	
Temperature	(°C)	23.661	Calculated
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	low velocity
Photosynthesis/respiration	(mg/L/day)	0.000	
Reaeration Coefficient	(1/day)	2.660	
Temperature-corrected BOD removal rate	(1/day)	0.039	
Temperature-corrected NH3 decay rate	(1/day)	0.078	
Calculated reaeration rate at 20° C	(1/day)	2.660	
Temperature-corrected reaeration rate	(1/day)	2.895	
Calculated reach-averaged width	(ft)	43.228	

For Reach Number 7

Parameter		Value	Comment
Length	(mile)	2.300	
Velocity	(fps)	0.040	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	0.700	width-based mod
Temperature	(°C)	24.200	
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.300	CSO impact
Photosynthesis/respiration	(mg/L/day)	0.000	
Reaeration Coefficient	(1/day)	1.300	
Temperature-corrected BOD removal rate	(1/day)	0.040	
Temperature-corrected NH3 decay rate	(1/day)	0.082	
Calculated reaeration rate at 20° C	(1/day)	1.300	
Temperature-corrected reaeration rate	(1/day)	1.437	
Calculated reach-averaged width	(ft)	51.873	

For Reach Number 8

Parameter		Value	Comment
Length	(mile)	5.400	
Velocity	(fps)	0.040	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	1.000	width-based mod
Temperature	(°C)	23.814	Calculated
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.920	
Temperature-corrected BOD removal rate	(1/day)	0.016	
Temperature-corrected NH3 decay rate	(1/day)	0.196	
Calculated reaeration rate at 20° C	(1/day)	0.920	
Temperature-corrected reaeration rate	(1/day)	0.999	
Calculated reach-averaged width	(ft)	98.151	

For Reach Number 9

Parameter		Value	Comment
Length	(mile)	5.500	
Velocity	(fps)	0.050	
Slope	(ft/mile)	5.700	
Average Depth	(ft)	0.900	width-based mod
Temperature	(°C)	25.200	ave of 3 sondes
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	0.000	
Reaeration Coefficient	(1/day)	1.350	

Upper Sandusky River Watershed TMDLs

Temperature-corrected BOD removal rate	(1/day)	0.018
Temperature-corrected NH3 decay rate	(1/day)	0.224
Calculated reaeration rate at 20° C	(1/day)	1.350
Temperature-corrected reaeration rate	(1/day)	1.528
Calculated reach-averaged width	(ft)	87.246

For Reach Number 10

Parameter	Value	Comment
Length (mile)	4.900	
Velocity (fps)	0.070	
Slope (ft/mile)	9.400	
Average Depth (ft)	0.850	width-based mod
Temperature (°C)	25.165	Calculated
BOD Removal Rate (1/day)	0.040	
NH3 Decay Rate (1/day)	0.217	
Sediment Oxygen Demand (g/m ² /day)	0.200	
Photosynthesis/respiration (mg/L/day)	0.000	
Reaeration Coefficient (1/day)	1.960	

Temperature-corrected BOD removal rate	(1/day)	0.051
Temperature-corrected NH3 decay rate	(1/day)	0.322
Calculated reaeration rate at 20° C	(1/day)	1.960
Temperature-corrected reaeration rate	(1/day)	2.215
Calculated reach-averaged width	(ft)	68.063

--*-*-* Results for Sandusky *-*-*-*-*

Discharge is to -- Sandusky
Run Title is -- Sandusky DO calibrat

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
131.400	5.500		6.912		0.699	
131.350	5.743		6.909		0.697	
131.300	5.962		6.907		0.696	
131.250	6.160		6.904		0.694	
131.200	6.339	5.600	6.901	7.700	0.692	0.130
131.200	6.339		6.901		0.692	
131.150	6.500		6.898		0.690	
131.100	6.646		6.895		0.689	
131.050	6.777		6.892		0.687	
131.000	6.896		6.890		0.685	
130.950	7.003		6.887		0.683	
130.900	7.099		6.884		0.682	
130.850	7.187		6.881		0.680	
130.800	7.265		6.878		0.678	
130.750	7.336		6.876		0.676	
130.700	7.400		6.873		0.675	
130.650	7.458		6.870		0.673	
130.600	7.510		6.867		0.671	
130.550	7.558		6.864		0.669	
130.500	7.600		6.862		0.668	
130.450	7.639		6.859		0.666	
130.400	7.673		6.856		0.664	
130.350	7.705		6.853		0.663	
130.300	7.733		6.850		0.661	
130.250	7.759		6.848		0.659	
130.200	7.782		6.845		0.658	
130.150	7.803		6.842		0.656	
130.100	7.821		6.839		0.654	
130.050	7.838		6.836		0.653	
130.000	7.854		6.834		0.651	
129.950	7.868		6.831		0.649	
129.900	7.880		6.828		0.648	

Upper Sandusky River Watershed TMDLs

129.850	7.892		6.825		0.646
129.800	7.902		6.823		0.644
129.750	7.911		6.820		0.643
129.700	7.920	7.020	6.817	6.800	0.641
129.700	7.920		6.817		0.641
129.650	7.938		6.813		0.640
129.600	7.954		6.809		0.639
129.550	7.969		6.806		0.638
129.500	7.982		6.802		0.637
129.450	7.995		6.798		0.636
129.400	8.006		6.794		0.635
129.350	8.016		6.790		0.634
129.300	8.026		6.787		0.633
129.250	8.034		6.783		0.632
129.200	8.042		6.779		0.631
129.150	8.049		6.775		0.630
129.100	8.056		6.771		0.629
129.050	8.062		6.768		0.628
129.000	8.067		6.764		0.627
128.950	8.072		6.760		0.626
128.900	8.076		6.756		0.625
128.850	8.080		6.753		0.624
128.800	8.084		6.749		0.623
128.750	8.087		6.745		0.622
128.700	8.091		6.741		0.621
128.650	8.093		6.737		0.620
128.600	8.096		6.734		0.619
128.550	8.098		6.730		0.618
128.500	8.100		6.726		0.617
128.450	8.102		6.722		0.616
128.400	8.104		6.719		0.615
128.350	8.106		6.715		0.614
128.300	8.107		6.711		0.613
128.250	8.109		6.707		0.612
128.200	8.110		6.704		0.611
128.150	8.111		6.700		0.611
128.100	8.112		6.696		0.610
128.050	8.113		6.692		0.609
128.000	8.114		6.689		0.608
127.950	8.115		6.685		0.607
127.900	8.116		6.681		0.606
127.850	8.117		6.678		0.605
127.800	8.117	7.920	6.674	6.600	0.604
127.800	8.117		6.674		0.604
127.700	8.102		6.660		0.600
127.600	8.091		6.647		0.597
127.500	8.084		6.633		0.594
127.400	8.079		6.620		0.590
127.300	8.076		6.607		0.587
127.200	8.074		6.593		0.583
127.100	8.072		6.580		0.580
127.000	8.071		6.567		0.577
126.900	8.071		6.553		0.573
126.800	8.070		6.540		0.570
126.700	8.070		6.527		0.567
126.600	8.070		6.514		0.564
126.500	8.070		6.501		0.560
126.400	8.070		6.488		0.557
126.300	8.071		6.474		0.554
126.200	8.071		6.461		0.551
126.100	8.071		6.448		0.548
126.000	8.071		6.435		0.544
125.900	8.072		6.422		0.541
125.800	8.072		6.409		0.538
125.700	8.072		6.396		0.535

Upper Sandusky River Watershed TMDLs

125.600	8.073		6.383		0.532	
125.500	8.073		6.371		0.529	
125.400	8.073		6.358		0.526	
125.300	8.073	6.400	6.345	6.400	0.523	0.050
125.300	8.073		6.345		0.523	
125.200	8.074		6.332		0.520	
125.100	8.074		6.319		0.517	
125.000	8.074		6.306		0.514	
124.900	7.026		6.293		0.508	
124.800	6.231		6.281		0.501	
124.700	5.628		6.268		0.495	
124.600	5.171		6.255		0.489	
124.500	4.824		6.242		0.483	
124.400	4.562		6.229		0.477	
124.300	4.363		6.217		0.471	
124.200	4.212		6.204		0.465	
124.100	4.099		6.191		0.459	
124.000	4.012		6.178		0.453	
123.900	3.947		6.166		0.448	
123.800	3.898		6.153		0.442	
123.700	3.862		6.140		0.436	
123.600	3.834		6.128		0.431	
123.500	3.813		6.115		0.426	
123.400	3.798		6.103		0.420	
123.300	3.786		6.090		0.415	
123.200	3.778		6.078		0.410	
123.100	3.772		6.065		0.405	
123.000	3.768		6.053		0.400	
122.900	3.764		6.041		0.395	
122.800	3.762		6.028		0.390	
122.700	3.761		6.016		0.385	
122.600	3.761		6.003		0.380	
122.500	3.760		5.991		0.375	
122.400	3.760		5.979		0.371	
122.300	3.761		5.967		0.366	
122.200	3.761		5.954		0.361	
122.100	3.762		5.942		0.357	
122.000	3.762		5.930		0.352	
121.900	3.763		5.918		0.348	
121.800	3.764		5.906		0.344	
121.700	3.765		5.894		0.339	
121.600	3.766		5.882		0.335	
121.500	3.767		5.869		0.331	
121.400	3.768		5.857		0.327	
121.300	3.769		5.845		0.323	
121.200	3.770		5.833		0.319	
121.100	3.771		5.822		0.315	
121.000	3.771		5.810		0.311	
120.900	3.772		5.798		0.307	
120.800	3.773	4.480	5.786	5.800	0.303	0.060
120.800	3.773		5.786		0.303	
120.700	3.774		5.774		0.299	
120.600	3.775		5.762		0.295	
120.500	3.776		5.750		0.292	
120.400	3.777		5.739		0.288	
120.300	3.778		5.727		0.284	
120.200	3.779		5.715		0.281	
120.100	3.779		5.703		0.277	
120.000	3.780		5.692		0.274	
119.900	3.781		5.680		0.270	
119.800	3.782		5.668		0.267	
119.700	3.783		5.657		0.264	
119.600	3.784		5.645		0.260	
119.500	3.784		5.634		0.257	
119.400	3.785		5.622		0.254	

Upper Sandusky River Watershed TMDLs

119.300	3.786		5.610		0.251
119.200	3.787		5.599		0.248
119.100	3.787		5.588		0.245
119.000	3.788		5.576		0.241
118.900	3.789		5.565		0.238
118.800	3.790		5.553		0.235
118.700	3.790		5.542		0.233
118.600	3.791		5.530		0.230
118.500	3.792		5.519		0.227
118.400	4.396		5.497		0.221
118.300	4.759		5.475		0.216
118.200	4.978		5.454		0.211
118.100	5.109		5.432		0.206
118.000	5.189		5.410		0.201
117.900	5.237		5.389		0.196
117.800	5.267		5.367		0.192
117.700	5.285		5.346		0.187
117.600	5.296		5.325		0.183
117.500	5.303		5.304		0.178
117.400	5.308		5.283		0.174
117.300	5.311		5.262		0.170
117.200	5.314		5.241		0.166
117.100	5.315		5.220		0.162
117.000	5.317		5.199		0.158
116.900	5.318		5.178		0.155
116.800	5.319		5.158		0.151
116.700	5.320		5.137		0.147
116.600	5.321		5.117		0.144
116.500	5.322		5.096		0.140
116.400	5.323		5.076		0.137
116.300	5.324		5.056		0.134
116.200	5.325	5.650	5.036	6.200	0.131
116.200	5.325		5.036		0.131
116.100	5.326		5.016		0.128
116.000	5.327		4.996		0.125
115.900	5.328		4.976		0.122
115.800	5.328		4.956		0.119
115.700	5.329		4.937		0.116
115.600	5.330		4.917		0.113
115.500	5.331		4.897		0.110
115.400	5.332	6.240	4.878	7.950	0.108
115.400	5.264		8.543		0.106
115.350	5.389		8.526		0.106
115.300	5.497		8.509		0.105
115.250	5.590		8.492		0.105
115.200	5.670		8.476		0.105
115.150	5.739		8.459		0.104
115.100	5.799		8.442		0.104
115.050	5.851		8.425		0.103
115.000	5.895		8.409		0.103
114.950	5.934		8.392		0.103
114.900	5.967		8.376		0.102
114.850	5.996		8.359		0.102
114.800	6.021		8.342		0.101
114.750	6.042		8.326		0.101
114.700	6.061		8.309		0.101
114.650	6.077		8.293		0.100
114.600	6.091		8.277		0.100
114.550	6.103		8.260		0.099
114.500	6.113		8.244		0.099
114.450	6.122		8.228		0.099
114.400	6.130		8.211		0.098
114.350	6.137		8.195		0.098
114.300	6.143		8.179		0.097
114.250	6.148		8.163		0.097

Upper Sandusky River Watershed TMDLs

114.200	6.152		8.147		0.097
114.150	6.156		8.131		0.096
114.100	6.159		8.114		0.096
114.050	6.162		8.098		0.096
114.000	6.165		8.082		0.095
113.950	6.167		8.066		0.095
113.900	6.169		8.050		0.094
113.850	6.171		8.035		0.094
113.800	6.172		8.019		0.094
113.750	6.174		8.003		0.093
113.700	6.175		7.987		0.093
113.650	6.176		7.971		0.093
113.600	6.177		7.955		0.092
113.550	6.178		7.940		0.092
113.500	6.179	6.180	7.924	6.850	0.091
113.500	6.179		7.924		0.091
113.400	5.698		7.876		0.090
113.300	5.313		7.828		0.089
113.200	5.004		7.780		0.088
113.100	4.756		7.733		0.087
113.000	4.557		7.685		0.086
112.900	4.398		7.639		0.085
112.800	4.271		7.592		0.084
112.700	4.169		7.546		0.083
112.600	4.087		7.500		0.082
112.500	4.022		7.454		0.081
112.400	3.970		7.409		0.080
112.300	3.928		7.363		0.079
112.200	3.895		7.319		0.078
112.100	3.869		7.274		0.077
112.000	3.848		7.230		0.076
111.900	3.832		7.186		0.075
111.800	3.819		7.142		0.074
111.700	3.809		7.098		0.073
111.600	3.801		7.055		0.072
111.500	3.795		7.012		0.071
111.400	3.790		6.969		0.070
111.300	3.787		6.927		0.070
111.200	3.785	4.750	6.885	6.100	0.069
111.200	4.550		10.769		2.546
111.100	4.652		10.742		2.471
111.000	4.748		10.715		2.398
110.900	4.840		10.688		2.327
110.800	4.927		10.662		2.259
110.700	5.011		10.635		2.192
110.600	5.092		10.608		2.128
110.500	5.169		10.582		2.065
110.400	5.243	4.120	10.555	9.850	2.004
110.400	5.243		10.555		2.004
110.300	5.314		10.529		1.946
110.200	5.383		10.503		1.888
110.100	5.449		10.476		1.833
110.000	5.512		10.450		1.779
109.900	5.574		10.424		1.726
109.800	5.633		10.398		1.676
109.700	5.691		10.372		1.626
109.600	5.746		10.346		1.578
109.500	5.800		10.320		1.532
109.400	5.851		10.294		1.487
109.300	5.902		10.268		1.443
109.200	5.950		10.243		1.401
109.100	5.997		10.217		1.359
109.000	6.043		10.192		1.319
108.900	6.087		10.166		1.281
108.800	6.130		10.141		1.243

Upper Sandusky River Watershed TMDLs

108.700	6.172		10.115		1.206	
108.600	6.212		10.090		1.171	
108.500	6.251		10.065		1.136	
108.400	6.289		10.039		1.103	
108.300	6.326	6.940	10.014	7.600	1.070	0.100
108.300	6.326		10.014		1.070	
108.200	6.362		9.989		1.039	
108.100	6.396		9.964		1.008	
108.000	6.430		9.939		0.979	
107.900	6.462		9.914		0.950	
107.800	6.494		9.890		0.922	
107.700	6.525		9.865		0.895	
107.600	6.554		9.840		0.868	
107.500	6.583		9.816		0.843	
107.400	6.611		9.791		0.818	
107.300	6.639		9.767		0.794	
107.200	6.665		9.742		0.771	
107.100	6.691		9.718		0.748	
107.000	6.716		9.693		0.726	
106.900	6.740		9.669		0.705	
106.800	6.764		9.645		0.684	
106.700	6.786		9.621		0.664	
106.600	6.808		9.597		0.644	
106.500	6.830		9.573		0.625	
106.400	6.851		9.549		0.607	
106.300	6.871		9.525		0.589	
106.200	6.891		9.501		0.572	
106.100	6.910		9.477		0.555	
106.000	6.929		9.454		0.539	
105.900	6.947		9.430		0.523	
105.800	6.964	6.510	9.406	6.100	0.507	0.060
105.800	6.964		9.406		0.507	
105.700	6.996		9.386		0.494	
105.600	7.024		9.366		0.480	
105.500	7.049		9.345		0.467	
105.400	7.072		9.325		0.455	
105.300	7.091		9.305		0.442	
105.200	7.109		9.285		0.430	
105.100	7.126		9.264		0.419	
105.000	7.140		9.244		0.408	
104.900	7.154		9.224		0.397	
104.800	7.167		9.204		0.386	
104.700	7.178		9.184		0.375	
104.600	7.189		9.164		0.365	
104.500	7.199		9.144		0.355	
104.400	7.209		9.125		0.346	
104.300	7.218		9.105		0.337	
104.200	7.227		9.085		0.327	
104.100	7.235		9.065		0.319	
104.000	7.243		9.046		0.310	
103.900	7.250		9.026		0.302	
103.800	7.258		9.006		0.294	
103.700	7.265		8.987		0.286	
103.600	7.271		8.967		0.278	
103.500	7.278		8.948		0.270	
103.400	7.284		8.928		0.263	
103.300	7.290		8.909		0.256	
103.200	7.296		8.890		0.249	
103.100	7.301		8.870		0.242	
103.000	7.307		8.851		0.236	
102.900	7.312		8.832		0.229	
102.800	7.317		8.813		0.223	
102.700	7.322		8.794		0.217	
102.600	7.327		8.775		0.211	
102.500	7.332		8.756		0.206	

Upper Sandusky River Watershed TMDLs

102.400	7.337		8.737		0.200	
102.300	7.341		8.718		0.195	
102.200	7.346	7.220	8.699	7.600	0.189	0.050
102.200	7.346		8.699		0.189	
102.100	7.350		8.680		0.184	
102.000	7.354		8.661		0.179	
101.900	7.358		8.642		0.175	
101.800	7.362		8.623		0.170	
101.700	7.366		8.605		0.165	
101.600	7.370		8.586		0.161	
101.500	7.373		8.567		0.156	
101.400	7.377		8.549		0.152	
101.300	7.380		8.530		0.148	
101.200	7.384		8.512		0.144	
101.100	7.387		8.493		0.140	
101.000	7.390		8.475		0.136	
100.900	7.393		8.456		0.133	
100.800	7.396		8.438		0.129	
100.700	7.399		8.420		0.126	
100.600	7.402		8.401		0.122	
100.500	7.405		8.383		0.119	
100.400	7.407		8.365		0.116	
100.300	7.410	7.120	8.347	6.550	0.113	0.040
100.300	7.337		8.935		0.128	
100.200	7.356		8.895		0.124	
100.100	7.373		8.856		0.121	
100.000	7.387		8.817		0.117	
99.900	7.400		8.778		0.114	
99.800	7.410		8.740		0.111	
99.700	7.420		8.701		0.108	
99.600	7.428		8.663		0.105	
99.500	7.435		8.624		0.102	
99.400	7.442		8.586		0.099	
99.300	7.447		8.548		0.096	
99.200	7.453		8.511		0.094	
99.100	7.457		8.473		0.091	
99.000	7.462		8.436		0.088	
98.900	7.466		8.399		0.086	
98.800	7.470		8.362		0.084	
98.700	7.473	6.720	8.325	7.100	0.081	0.050
98.700	7.473		8.325		0.081	
98.600	7.477		8.288		0.079	
98.500	7.480		8.251		0.077	
98.400	7.483		8.215		0.075	
98.300	7.486		8.179		0.073	
98.200	7.488		8.143		0.071	
98.100	7.491		8.107		0.069	
98.000	7.493		8.071		0.067	
97.900	7.496		8.036		0.065	
97.800	7.498		8.000		0.063	
97.700	7.501		7.965		0.061	
97.600	7.503		7.930		0.060	
97.500	7.505		7.895		0.058	
97.400	7.507		7.860		0.056	
97.300	7.509		7.825		0.055	
97.200	7.511		7.791		0.053	
97.100	7.513		7.756		0.052	
97.000	7.515		7.722		0.050	
96.900	7.517		7.688		0.049	
96.800	7.519		7.654		0.048	
96.700	7.521		7.620		0.046	
96.600	7.523		7.587		0.045	
96.500	7.524		7.553		0.044	
96.400	7.526		7.520		0.043	
96.300	7.528		7.487		0.041	

Upper Sandusky River Watershed TMDLs

96.200	7.530		7.454		0.040	
96.100	7.531		7.421		0.039	
96.000	7.533		7.388		0.038	
95.900	7.534		7.356		0.037	
95.800	7.536		7.323		0.036	
95.700	7.538		7.291		0.035	
95.600	7.539		7.259		0.034	
95.500	7.541		7.227		0.033	
95.400	7.542	7.260	7.195	6.820	0.032	0.090
95.400	7.542		7.195		0.032	

D.O. Model Appendix for Upper Sandusky

Multi-SMP Low Flow (7Q10) Simulation

BVC

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*****
*                               SIMPLIFIED METHOD PROGRAM                               *
*                               COMPLETE INPUT LISTING                               *
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--*-*-* Run Information *-*-*-*-*

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Name of receiving stream ----- SANDUSKY
Number of discharges ----- 5
Number of reaches ----- 10
Reaeration type ----- Manually specified
Run title ----- SUM 7Q10  0 AUGMNT

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--*-*-* Upstream Parameters *-*-*-*-*

Parameter	Value	Comment
Flow (cfs)	0.360	
Temperature (°C)	22.500	
Dissolved Oxygen (mg/l)	5.500	
5-Day BOD (mg/l)	3.710	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.620	
Ammonia (mg/l)	0.070	
Alkalinity (mg/l)	-0.000	

--*-*-* Effluent Parameters *-*-*-*-*

Number of Discharges = 5

For Discharge Number 1 (CRESTLINE)

Parameter	Value	Comment
Flow (MGD)	0.950	
Temperature (°C)	22.300	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.600	
Ammonia (mg/l)	0.800	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	1.000	

For Discharge Number 2 (AUGMENTATION)

Parameter	Value	Comment
Flow (MGD)	0.000	
Temperature (°C)	20.000	
Dissolved Oxygen (mg/l)	7.000	
5-Day BOD (mg/l)	2.000	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.600	
Ammonia (mg/l)	0.050	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	2.000	

Upper Sandusky River Watershed TMDLs

For Discharge Number 3 (TIMKEN)

Parameter	Value	Comment
Flow (MGD)	0.400	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	1.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	6.000	

For Discharge Number 4 (BUCYRUS)

Parameter	Value	Comment
Flow (MGD)	3.400	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	2.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	8.000	

For Discharge Number 5 (SWIFT)

Parameter	Value	Comment
Flow (MGD)	0.160	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	2.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	10.000	

----- Reach Information -----

Number of Reaches = 10
Reaeration Specified Directly

For Reach Number 1

Parameter	Value	Comment
Length (mile)	1.700	
Velocity (fps)	0.120	
Slope (ft/mile)	4.700	
Average Depth (ft)	0.600	
Temperature (°C)	22.468	Calculated
BOD Removal Rate (1/day)	0.012	
NH3 Decay Rate (1/day)	0.070	
Sediment Oxygen Demand (g/m ² /day)	0.200	
Photosynthesis/respiration (mg/L/day)	-0.000	
Reaeration Coefficient (1/day)	2.610	PP

Temperature-corrected BOD removal rate (1/day)	0.013
Temperature-corrected NH3 decay rate (1/day)	0.084
Calculated reaeration rate at 20° C (1/day)	2.610
Temperature-corrected reaeration rate (1/day)	2.760
Calculated reach-averaged width (ft)	25.399

For Reach Number 2

Parameter	Value	Comment
Length (mile)	1.900	
Velocity (fps)	0.190	
Slope (ft/mile)	15.400	

Upper Sandusky River Watershed TMDLs

Average Depth	(ft)	0.460	
Temperature	(°C)	22.339	calculated
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	-0.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	5.270	TSIV
Temperature-corrected BOD removal rate	(1/day)	0.027	
Temperature-corrected NH3 decay rate	(1/day)	0.071	
Calculated reaeration rate at 20° C	(1/day)	5.270	
Temperature-corrected reaeration rate	(1/day)	5.572	
Calculated reach-averaged width	(ft)	20.923	

For Reach Number 3

Parameter		Value	Comment
Length	(mile)	2.800	
Velocity	(fps)	0.110	
Slope	(ft/mile)	10.900	
Average Depth	(ft)	0.540	
Temperature	(°C)	24.700	
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	-0.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	3.850	PP
Temperature-corrected BOD removal rate	(1/day)	0.030	
Temperature-corrected NH3 decay rate	(1/day)	0.085	
Calculated reaeration rate at 20° C	(1/day)	3.850	
Temperature-corrected reaeration rate	(1/day)	4.306	
Calculated reach-averaged width	(ft)	30.786	

For Reach Number 4

Parameter		Value	Comment
Length	(mile)	6.500	
Velocity	(fps)	0.050	
Slope	(ft/mile)	4.600	
Average Depth	(ft)	0.830	
Temperature	(°C)	24.342	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.500	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.350	PP
Temperature-corrected BOD removal rate	(1/day)	0.013	
Temperature-corrected NH3 decay rate	(1/day)	0.082	
Calculated reaeration rate at 20° C	(1/day)	1.350	
Temperature-corrected reaeration rate	(1/day)	1.497	
Calculated reach-averaged width	(ft)	44.065	

For Reach Number 5

Parameter		Value	Comment
Length	(mile)	3.100	
Velocity	(fps)	0.020	
Slope	(ft/mile)	2.100	
Average Depth	(ft)	0.890	
Temperature	(°C)	23.700	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.270	KO & NR

Upper Sandusky River Watershed TMDLs

Temperature-corrected BOD removal rate	(1/day)	0.013
Temperature-corrected NH3 decay rate	(1/day)	0.078
Calculated reaeration rate at 20° C	(1/day)	1.270
Temperature-corrected reaeration rate	(1/day)	1.387
Calculated reach-averaged width	(ft)	102.736

For Reach Number 6

Parameter		Value	Comment
Length	(mile)	1.900	
Velocity	(fps)	0.070	
Slope	(ft/mile)	8.200	
Average Depth	(ft)	0.770	
Temperature	(°C)	23.656	Calculated
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	2.050	PP

Temperature-corrected BOD removal rate	(1/day)	0.039
Temperature-corrected NH3 decay rate	(1/day)	0.077
Calculated reaeration rate at 20° C	(1/day)	2.050
Temperature-corrected reaeration rate	(1/day)	2.229
Calculated reach-averaged width	(ft)	45.401

For Reach Number 7

Parameter		Value	Comment
Length	(mile)	2.300	
Velocity	(fps)	0.050	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	0.960	
Temperature	(°C)	24.200	
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.300	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.040	PP

Temperature-corrected BOD removal rate	(1/day)	0.040
Temperature-corrected NH3 decay rate	(1/day)	0.082
Calculated reaeration rate at 20° C	(1/day)	1.040
Temperature-corrected reaeration rate	(1/day)	1.149
Calculated reach-averaged width	(ft)	50.981

For Reach Number 8

Parameter		Value	Comment
Length	(mile)	5.400	
Velocity	(fps)	0.050	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	1.500	
Temperature	(°C)	23.781	Calculated
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.670	PP

Temperature-corrected BOD removal rate	(1/day)	0.016
Temperature-corrected NH3 decay rate	(1/day)	0.195
Calculated reaeration rate at 20° C	(1/day)	0.670
Temperature-corrected reaeration rate	(1/day)	0.726
Calculated reach-averaged width	(ft)	102.713

For Reach Number 9

Parameter		Value	Comment
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Upper Sandusky River Watershed TMDLs

Length	(mile)	5.500	
Velocity	(fps)	0.070	
Slope	(ft/mile)	5.700	
Average Depth	(ft)	1.350	
Temperature	(°C)	25.200	
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.020	PP
Temperature-corrected BOD removal rate	(1/day)	0.018	
Temperature-corrected NH3 decay rate	(1/day)	0.224	
Calculated reaeration rate at 20° C	(1/day)	1.020	
Temperature-corrected reaeration rate	(1/day)	1.154	
Calculated reach-averaged width	(ft)	81.519	
For Reach Number 10			
Parameter	Value	Comment	
Length	(mile)	4.900	
Velocity	(fps)	0.090	
Slope	(ft/mile)	9.400	
Average Depth	(ft)	1.270	
Temperature	(°C)	25.164	Calculated
BOD Removal Rate	(1/day)	0.040	
NH3 Decay Rate	(1/day)	0.217	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.440	PP
Temperature-corrected BOD removal rate	(1/day)	0.051	
Temperature-corrected NH3 decay rate	(1/day)	0.322	
Calculated reaeration rate at 20° C	(1/day)	1.440	
Temperature-corrected reaeration rate	(1/day)	1.627	
Calculated reach-averaged width	(ft)	69.561	

----*--* Results for SANDUSKY *--*--*--*

Discharge is to -- SANDUSKY
Run Title is -- SUM 7Q10 0 AUGMNT

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
131.400	5.902		19.568		0.656	
131.350	6.040		19.561		0.655	
131.300	6.169		19.554		0.653	
131.250	6.289		19.548		0.652	
131.200	6.401		19.541		0.651	
131.150	6.505		19.534		0.649	
131.100	6.602		19.528		0.648	
131.050	6.693		19.521		0.647	
131.000	6.778		19.515		0.645	
130.950	6.856		19.508		0.644	
130.900	6.930		19.501		0.642	
130.850	6.998		19.495		0.641	
130.800	7.062		19.488		0.640	
130.750	7.122		19.481		0.638	
130.700	7.177		19.475		0.637	
130.650	7.229		19.468		0.636	
130.600	7.278		19.461		0.634	
130.550	7.323		19.455		0.633	
130.500	7.365		19.448		0.632	
130.450	7.404		19.442		0.630	
130.400	7.440		19.435		0.629	

Upper Sandusky River Watershed TMDLs

130.350	7.474	19.428	0.628
130.300	7.506	19.422	0.626
130.250	7.536	19.415	0.625
130.200	7.563	19.409	0.624
130.150	7.589	19.402	0.622
130.100	7.613	19.395	0.621
130.050	7.636	19.389	0.620
130.000	7.656	19.382	0.618
129.950	7.676	19.376	0.617
129.900	7.694	19.369	0.616
129.850	7.711	19.362	0.614
129.800	7.727	19.356	0.613
129.750	7.742	19.349	0.612
129.700	7.756	19.343	0.610
129.650	7.810	19.334	0.610
129.600	7.860	19.326	0.609
129.550	7.905	19.318	0.608
129.500	7.947	19.309	0.608
129.450	7.985	19.301	0.607
129.400	8.020	19.293	0.606
129.350	8.052	19.285	0.606
129.300	8.081	19.276	0.605
129.250	8.108	19.268	0.604
129.200	8.132	19.260	0.603
129.150	8.155	19.251	0.603
129.100	8.175	19.243	0.602
129.050	8.194	19.235	0.601
129.000	8.211	19.227	0.601
128.950	8.226	19.218	0.600
128.900	8.241	19.210	0.599
128.850	8.254	19.202	0.599
128.800	8.266	19.194	0.598
128.750	8.276	19.185	0.597
128.700	8.286	19.177	0.597
128.650	8.296	19.169	0.596
128.600	8.304	19.161	0.595
128.550	8.312	19.152	0.595
128.500	8.319	19.144	0.594
128.450	8.325	19.136	0.593
128.400	8.331	19.128	0.593
128.350	8.336	19.120	0.592
128.300	8.341	19.111	0.591
128.250	8.346	19.103	0.591
128.200	8.350	19.095	0.590
128.150	8.354	19.087	0.589
128.100	8.357	19.079	0.589
128.050	8.360	19.070	0.588
128.000	8.363	19.062	0.587
127.950	8.366	19.054	0.587
127.900	8.368	19.046	0.586
127.850	8.371	19.038	0.585
127.800	8.373	19.029	0.585
127.700	8.286	18.998	0.582
127.600	8.218	18.967	0.579
127.500	8.164	18.935	0.576
127.400	8.122	18.904	0.574
127.300	8.089	18.873	0.571
127.200	8.063	18.841	0.568
127.100	8.043	18.810	0.566
127.000	8.027	18.779	0.563
126.900	8.014	18.748	0.560
126.800	8.005	18.717	0.558
126.700	7.997	18.686	0.555
126.600	7.991	18.655	0.552
126.500	7.987	18.624	0.550

Upper Sandusky River Watershed TMDLs

126.400	7.983	18.594	0.547
126.300	7.981	18.563	0.545
126.200	7.979	18.532	0.542
126.100	7.977	18.502	0.540
126.000	7.976	18.471	0.537
125.900	7.976	18.440	0.535
125.800	7.975	18.410	0.532
125.700	7.975	18.380	0.530
125.600	7.975	18.349	0.527
125.500	7.975	18.319	0.525
125.400	7.975	18.289	0.522
125.300	7.975	18.258	0.520
125.200	7.975	18.228	0.517
125.100	7.975	18.198	0.515
125.000	7.976	18.168	0.512
124.900	7.303	18.138	0.507
124.800	6.743	18.108	0.502
124.700	6.277	18.079	0.497
124.600	5.889	18.049	0.492
124.500	5.566	18.019	0.487
124.400	5.298	17.990	0.482
124.300	5.074	17.960	0.478
124.200	4.888	17.931	0.473
124.100	4.734	17.902	0.468
124.000	4.606	17.872	0.463
123.900	4.499	17.843	0.459
123.800	4.410	17.814	0.454
123.700	4.337	17.784	0.450
123.600	4.276	17.755	0.445
123.500	4.225	17.726	0.441
123.400	4.183	17.697	0.436
123.300	4.148	17.668	0.432
123.200	4.120	17.639	0.427
123.100	4.096	17.610	0.423
123.000	4.077	17.581	0.419
122.900	4.061	17.552	0.415
122.800	4.048	17.524	0.411
122.700	4.037	17.495	0.406
122.600	4.028	17.466	0.402
122.500	4.021	17.438	0.398
122.400	4.016	17.409	0.394
122.300	4.011	17.380	0.390
122.200	4.008	17.352	0.386
122.100	4.005	17.323	0.383
122.000	4.003	17.295	0.379
121.900	4.001	17.267	0.375
121.800	4.000	17.238	0.371
121.700	4.000	17.210	0.367
121.600	3.999	17.182	0.364
121.500	3.999	17.154	0.360
121.400	3.999	17.126	0.357
121.300	3.999	17.098	0.353
121.200	4.000	17.069	0.349
121.100	4.000	17.041	0.346
121.000	4.001	17.014	0.342
120.900	4.002	16.986	0.339
120.800	4.003	16.958	0.336
120.700	4.003	16.930	0.332
120.600	4.004	16.902	0.329
120.500	4.005	16.875	0.326
120.400	4.006	16.847	0.322
120.300	4.007	16.819	0.319
120.200	4.008	16.792	0.316
120.100	4.009	16.764	0.313
120.000	4.010	16.737	0.310

Upper Sandusky River Watershed TMDLs

119.900	4.011	16.709	0.307
119.800	4.012	16.682	0.303
119.700	4.013	16.654	0.300
119.600	4.014	16.627	0.297
119.500	4.015	16.600	0.294
119.400	4.016	16.573	0.292
119.300	4.017	16.545	0.289
119.200	4.018	16.518	0.286
119.100	4.019	16.491	0.283
119.000	4.020	16.464	0.280
118.900	4.021	16.437	0.277
118.800	4.022	16.410	0.274
118.700	4.023	16.383	0.272
118.600	4.024	16.356	0.269
118.500	4.025	16.330	0.266
118.400	4.508	16.265	0.260
118.300	4.825	16.200	0.254
118.200	5.034	16.136	0.248
118.100	5.171	16.071	0.242
118.000	5.261	16.008	0.236
117.900	5.321	15.944	0.231
117.800	5.361	15.881	0.225
117.700	5.388	15.817	0.220
117.600	5.406	15.755	0.215
117.500	5.419	15.692	0.210
117.400	5.428	15.629	0.205
117.300	5.434	15.567	0.200
117.200	5.439	15.505	0.195
117.100	5.443	15.444	0.190
117.000	5.446	15.382	0.186
116.900	5.449	15.321	0.181
116.800	5.451	15.260	0.177
116.700	5.453	15.200	0.173
116.600	5.455	15.139	0.169
116.500	5.457	15.079	0.165
116.400	5.458	15.019	0.161
116.300	5.460	14.959	0.157
116.200	5.462	14.900	0.153
116.100	5.463	14.841	0.150
116.000	5.465	14.782	0.146
115.900	5.466	14.723	0.143
115.800	5.468	14.664	0.139
115.700	5.469	14.606	0.136
115.600	5.471	14.548	0.133
115.500	5.472	14.490	0.130
115.400	5.607	16.598	0.347
115.350	5.650	16.570	0.346
115.300	5.690	16.541	0.345
115.250	5.726	16.514	0.344
115.200	5.758	16.486	0.343
115.150	5.788	16.458	0.342
115.100	5.815	16.430	0.340
115.050	5.839	16.402	0.339
115.000	5.862	16.374	0.338
114.950	5.882	16.347	0.337
114.900	5.901	16.319	0.336
114.850	5.917	16.291	0.335
114.800	5.933	16.264	0.334
114.750	5.947	16.236	0.332
114.700	5.960	16.209	0.331
114.650	5.971	16.181	0.330
114.600	5.982	16.154	0.329
114.550	5.992	16.127	0.328
114.500	6.000	16.099	0.327
114.450	6.008	16.072	0.326

Upper Sandusky River Watershed TMDLs

114.400	6.016	16.045	0.325
114.350	6.023	16.018	0.324
114.300	6.029	15.991	0.322
114.250	6.035	15.964	0.321
114.200	6.040	15.937	0.320
114.150	6.045	15.910	0.319
114.100	6.049	15.883	0.318
114.050	6.053	15.856	0.317
114.000	6.057	15.829	0.316
113.950	6.060	15.802	0.315
113.900	6.063	15.775	0.314
113.850	6.066	15.749	0.313
113.800	6.069	15.722	0.312
113.750	6.072	15.695	0.311
113.700	6.074	15.669	0.310
113.650	6.076	15.642	0.309
113.600	6.078	15.616	0.308
113.550	6.080	15.590	0.307
113.500	6.082	15.563	0.306
113.400	5.773	15.487	0.302
113.300	5.504	15.412	0.299
113.200	5.272	15.336	0.297
113.100	5.070	15.262	0.294
113.000	4.895	15.187	0.291
112.900	4.744	15.113	0.288
112.800	4.612	15.039	0.285
112.700	4.499	14.966	0.282
112.600	4.401	14.893	0.279
112.500	4.316	14.820	0.277
112.400	4.243	14.748	0.274
112.300	4.179	14.676	0.271
112.200	4.125	14.604	0.268
112.100	4.078	14.533	0.266
112.000	4.038	14.462	0.263
111.900	4.003	14.392	0.260
111.800	3.973	14.321	0.258
111.700	3.948	14.251	0.255
111.600	3.926	14.182	0.253
111.500	3.908	14.113	0.250
111.400	3.893	14.044	0.248
111.300	3.879	13.975	0.245
111.200	5.323	20.112	1.442
111.100	5.342	20.071	1.408
111.000	5.364	20.031	1.375
110.900	5.387	19.991	1.343
110.800	5.412	19.951	1.311
110.700	5.437	19.912	1.280
110.600	5.464	19.872	1.250
110.500	5.492	19.832	1.221
110.400	5.520	19.793	1.192
110.300	5.549	19.753	1.164
110.200	5.579	19.714	1.137
110.100	5.609	19.674	1.110
110.000	5.639	19.635	1.084
109.900	5.670	19.596	1.058
109.800	5.700	19.557	1.034
109.700	5.731	19.518	1.009
109.600	5.761	19.479	0.986
109.500	5.792	19.440	0.962
109.400	5.822	19.401	0.940
109.300	5.852	19.362	0.918
109.200	5.882	19.324	0.896
109.100	5.912	19.285	0.875
109.000	5.941	19.246	0.854
108.900	5.970	19.208	0.834

Upper Sandusky River Watershed TMDLs

108.800	5.999	19.170	0.815
108.700	6.027	19.131	0.796
108.600	6.055	19.093	0.777
108.500	6.083	19.055	0.759
108.400	6.110	19.017	0.741
108.300	6.137	18.979	0.723
108.200	6.163	18.941	0.706
108.100	6.189	18.903	0.690
108.000	6.215	18.866	0.674
107.900	6.240	18.828	0.658
107.800	6.265	18.790	0.642
107.700	6.289	18.753	0.627
107.600	6.313	18.715	0.612
107.500	6.336	18.678	0.598
107.400	6.359	18.641	0.584
107.300	6.382	18.604	0.570
107.200	6.404	18.566	0.557
107.100	6.425	18.529	0.544
107.000	6.447	18.492	0.531
106.900	6.467	18.455	0.519
106.800	6.488	18.419	0.506
106.700	6.508	18.382	0.494
106.600	6.527	18.345	0.483
106.500	6.547	18.308	0.472
106.400	6.565	18.272	0.460
106.300	6.584	18.235	0.450
106.200	6.602	18.199	0.439
106.100	6.619	18.163	0.429
106.000	6.637	18.126	0.419
105.900	6.654	18.090	0.409
105.800	6.670	18.054	0.399
105.700	6.704	18.026	0.391
105.600	6.736	17.998	0.384
105.500	6.765	17.970	0.376
105.400	6.792	17.942	0.369
105.300	6.817	17.915	0.362
105.200	6.840	17.887	0.355
105.100	6.862	17.859	0.348
105.000	6.882	17.831	0.341
104.900	6.901	17.804	0.335
104.800	6.919	17.776	0.328
104.700	6.935	17.748	0.322
104.600	6.951	17.721	0.316
104.500	6.965	17.693	0.310
104.400	6.979	17.666	0.304
104.300	6.992	17.639	0.298
104.200	7.004	17.611	0.292
104.100	7.016	17.584	0.286
104.000	7.027	17.557	0.281
103.900	7.038	17.529	0.275
103.800	7.047	17.502	0.270
103.700	7.057	17.475	0.265
103.600	7.066	17.448	0.260
103.500	7.075	17.421	0.255
103.400	7.083	17.394	0.250
103.300	7.091	17.367	0.245
103.200	7.099	17.340	0.240
103.100	7.106	17.313	0.236
103.000	7.113	17.286	0.231
102.900	7.120	17.260	0.227
102.800	7.127	17.233	0.222
102.700	7.133	17.206	0.218
102.600	7.139	17.179	0.214
102.500	7.145	17.153	0.209
102.400	7.151	17.126	0.205

Upper Sandusky River Watershed TMDLs

102.300	7.156	17.100	0.201
102.200	7.162	17.073	0.198
102.100	7.167	17.047	0.194
102.000	7.172	17.020	0.190
101.900	7.177	16.994	0.186
101.800	7.182	16.967	0.183
101.700	7.187	16.941	0.179
101.600	7.191	16.915	0.176
101.500	7.196	16.889	0.172
101.400	7.200	16.862	0.169
101.300	7.205	16.836	0.166
101.200	7.209	16.810	0.162
101.100	7.213	16.784	0.159
101.000	7.217	16.758	0.156
100.900	7.221	16.732	0.153
100.800	7.225	16.706	0.150
100.700	7.229	16.680	0.147
100.600	7.232	16.654	0.145
100.500	7.236	16.629	0.142
100.400	7.239	16.603	0.139
100.300	7.204	16.777	0.194
100.200	7.190	16.719	0.190
100.100	7.178	16.662	0.186
100.000	7.168	16.605	0.182
99.900	7.160	16.548	0.178
99.800	7.153	16.491	0.174
99.700	7.147	16.434	0.170
99.600	7.143	16.378	0.167
99.500	7.139	16.322	0.163
99.400	7.137	16.266	0.160
99.300	7.135	16.210	0.156
99.200	7.133	16.154	0.153
99.100	7.133	16.099	0.149
99.000	7.133	16.044	0.146
98.900	7.133	15.988	0.143
98.800	7.134	15.934	0.140
98.700	7.136	15.879	0.137
98.600	7.137	15.824	0.134
98.500	7.139	15.770	0.131
98.400	7.141	15.716	0.128
98.300	7.144	15.662	0.125
98.200	7.146	15.608	0.123
98.100	7.149	15.555	0.120
98.000	7.152	15.501	0.117
97.900	7.155	15.448	0.115
97.800	7.158	15.395	0.112
97.700	7.161	15.342	0.110
97.600	7.164	15.290	0.108
97.500	7.167	15.237	0.105
97.400	7.171	15.185	0.103
97.300	7.174	15.133	0.101
97.200	7.177	15.081	0.099
97.100	7.181	15.029	0.096
97.000	7.184	14.977	0.094
96.900	7.188	14.926	0.092
96.800	7.191	14.875	0.090
96.700	7.194	14.824	0.088
96.600	7.198	14.773	0.086
96.500	7.201	14.722	0.085
96.400	7.205	14.672	0.083
96.300	7.208	14.621	0.081
96.200	7.211	14.571	0.079
96.100	7.215	14.521	0.078
96.000	7.218	14.471	0.076
95.900	7.221	14.422	0.074

Upper Sandusky River Watershed TMDLs

95.800	7.224	14.372	0.073
95.700	7.228	14.323	0.071
95.600	7.231	14.274	0.070
95.500	7.234	14.225	0.068
95.400	7.237	14.176	0.067

D.O. Model Appendix for Upper Sandusky

Multi-SMP Low Flow (7Q10) Simulation with 0.5 cfs Augmentation Flow

BVC

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*****
*                               SIMPLIFIED METHOD PROGRAM                               *
*                               COMPLETE INPUT LISTING                               *
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--*-*-* Run Information *-*-*-*-*

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Name of receiving stream ----- SANDUSKY
Number of discharges ----- 5
Number of reaches ----- 10
Reaeration type ----- Manually specified
Run title ----- SUM 7Q0 0.5 AUGMT

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--*-*-* Upstream Parameters *-*-*-*-*

Parameter	Value	Comment
Flow (cfs)	0.360	
Temperature (°C)	22.500	
Dissolved Oxygen (mg/l)	5.500	
5-Day BOD (mg/l)	3.710	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.620	
Ammonia (mg/l)	0.070	
Alkalinity (mg/l)	-0.000	

--*-*-* Effluent Parameters *-*-*-*-*

Number of Discharges = 5

For Discharge Number 1 (CRESTLINE)

Parameter	Value	Comment
Flow (MGD)	0.950	
Temperature (°C)	22.300	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.600	
Ammonia (mg/l)	0.800	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	1.000	

For Discharge Number 2 (AUGMENTATION)

Parameter	Value	Comment
Flow (MGD)	0.320	
Temperature (°C)	20.000	
Dissolved Oxygen (mg/l)	7.000	
5-Day BOD (mg/l)	2.000	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.600	
Ammonia (mg/l)	0.050	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	2.000	

Upper Sandusky River Watershed TMDLs

For Discharge Number 3 (TIMKEN)

Parameter	Value	Comment
Flow (MGD)	0.400	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	1.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	6.000	

For Discharge Number 4 (BUCYRUS)

Parameter	Value	Comment
Flow (MGD)	3.400	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	2.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	8.000	

For Discharge Number 5 (SWIFT)

Parameter	Value	Comment
Flow (MGD)	0.160	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	2.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	10.000	

----- Reach Information -----

Number of Reaches = 10
Reaeration Specified Directly

For Reach Number 1

Parameter	Value	Comment
Length (mile)	1.700	
Velocity (fps)	0.120	
Slope (ft/mile)	4.700	
Average Depth (ft)	0.600	
Temperature (°C)	22.470	Calculated
BOD Removal Rate (1/day)	0.012	
NH3 Decay Rate (1/day)	0.070	
Sediment Oxygen Demand (g/m ² /day)	0.200	
Photosynthesis/respiration (mg/L/day)	-0.000	
Reaeration Coefficient (1/day)	2.610	PP

Temperature-corrected BOD removal rate (1/day)	0.013
Temperature-corrected NH3 decay rate (1/day)	0.084
Calculated reaeration rate at 20° C (1/day)	2.610
Temperature-corrected reaeration rate (1/day)	2.760
Calculated reach-averaged width (ft)	25.399

For Reach Number 2

Parameter	Value	Comment
Length (mile)	1.900	
Velocity (fps)	0.210	
Slope (ft/mile)	15.400	

Upper Sandusky River Watershed TMDLs

Average Depth	(ft)	0.530	
Temperature	(°C)	22.225	calculated
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	-0.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	5.820	TSIV
Temperature-corrected BOD removal rate	(1/day)	0.026	
Temperature-corrected NH3 decay rate	(1/day)	0.068	
Calculated reaeration rate at 20° C	(1/day)	5.820	
Temperature-corrected reaeration rate	(1/day)	6.081	
Calculated reach-averaged width	(ft)	20.875	

For Reach Number 3

Parameter		Value	Comment
Length	(mile)	2.800	
Velocity	(fps)	0.120	
Slope	(ft/mile)	10.900	
Average Depth	(ft)	0.620	
Temperature	(°C)	24.700	
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	-0.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	3.470	PP
Temperature-corrected BOD removal rate	(1/day)	0.030	
Temperature-corrected NH3 decay rate	(1/day)	0.085	
Calculated reaeration rate at 20° C	(1/day)	3.470	
Temperature-corrected reaeration rate	(1/day)	3.881	
Calculated reach-averaged width	(ft)	31.229	

For Reach Number 4

Parameter		Value	Comment
Length	(mile)	6.500	
Velocity	(fps)	0.050	
Slope	(ft/mile)	4.600	
Average Depth	(ft)	0.960	
Temperature	(°C)	24.342	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.500	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.170	PP
Temperature-corrected BOD removal rate	(1/day)	0.013	
Temperature-corrected NH3 decay rate	(1/day)	0.082	
Calculated reaeration rate at 20° C	(1/day)	1.170	
Temperature-corrected reaeration rate	(1/day)	1.297	
Calculated reach-averaged width	(ft)	48.405	

For Reach Number 5

Parameter		Value	Comment
Length	(mile)	3.100	
Velocity	(fps)	0.030	
Slope	(ft/mile)	2.100	
Average Depth	(ft)	1.030	
Temperature	(°C)	23.700	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.400	KO & NR

Upper Sandusky River Watershed TMDLs

Temperature-corrected BOD removal rate	(1/day)	0.013
Temperature-corrected NH3 decay rate	(1/day)	0.078
Calculated reaeration rate at 20° C	(1/day)	1.400
Temperature-corrected reaeration rate	(1/day)	1.529
Calculated reach-averaged width	(ft)	75.192

For Reach Number 6

Parameter		Value	Comment
Length	(mile)	1.900	
Velocity	(fps)	0.080	
Slope	(ft/mile)	8.200	
Average Depth	(ft)	0.860	
Temperature	(°C)	23.660	Calculated
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.930	PP

Temperature-corrected BOD removal rate	(1/day)	0.039
Temperature-corrected NH3 decay rate	(1/day)	0.078
Calculated reaeration rate at 20° C	(1/day)	1.930
Temperature-corrected reaeration rate	(1/day)	2.100
Calculated reach-averaged width	(ft)	42.759

For Reach Number 7

Parameter		Value	Comment
Length	(mile)	2.300	
Velocity	(fps)	0.050	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	1.070	
Temperature	(°C)	24.200	
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.300	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.930	PP

Temperature-corrected BOD removal rate	(1/day)	0.040
Temperature-corrected NH3 decay rate	(1/day)	0.082
Calculated reaeration rate at 20° C	(1/day)	0.930
Temperature-corrected reaeration rate	(1/day)	1.028
Calculated reach-averaged width	(ft)	54.987

For Reach Number 8

Parameter		Value	Comment
Length	(mile)	5.400	
Velocity	(fps)	0.050	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	1.560	
Temperature	(°C)	23.807	Calculated
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.640	PP

Temperature-corrected BOD removal rate	(1/day)	0.016
Temperature-corrected NH3 decay rate	(1/day)	0.195
Calculated reaeration rate at 20° C	(1/day)	0.640
Temperature-corrected reaeration rate	(1/day)	0.694
Calculated reach-averaged width	(ft)	105.105

For Reach Number 9

Parameter		Value	Comment
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Upper Sandusky River Watershed TMDLs

Length	(mile)	5.500	
Velocity	(fps)	0.070	
Slope	(ft/mile)	5.700	
Average Depth	(ft)	1.400	
Temperature	(°C)	25.200	
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.980	PP
Temperature-corrected BOD removal rate	(1/day)	0.018	
Temperature-corrected NH3 decay rate	(1/day)	0.224	
Calculated reaeration rate at 20° C	(1/day)	0.980	
Temperature-corrected reaeration rate	(1/day)	1.109	
Calculated reach-averaged width	(ft)	83.655	
For Reach Number	10		
Parameter	Value	Comment	
Length	(mile)	4.900	
Velocity	(fps)	0.090	
Slope	(ft/mile)	9.400	
Average Depth	(ft)	1.320	
Temperature	(°C)	25.167	Calculated
BOD Removal Rate	(1/day)	0.040	
NH3 Decay Rate	(1/day)	0.217	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.380	PP
Temperature-corrected BOD removal rate	(1/day)	0.051	
Temperature-corrected NH3 decay rate	(1/day)	0.322	
Calculated reaeration rate at 20° C	(1/day)	1.380	
Temperature-corrected reaeration rate	(1/day)	1.560	
Calculated reach-averaged width	(ft)	71.091	

----*--* Results for SANDUSKY *--*--*--*

Discharge is to -- SANDUSKY
Run Title is -- SUM 7Q0 0.5 AUGMT

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
131.400	5.902		19.568		0.656	
131.350	6.040		19.561		0.655	
131.300	6.169		19.554		0.653	
131.250	6.289		19.548		0.652	
131.200	6.401		19.541		0.651	
131.150	6.505		19.534		0.649	
131.100	6.602		19.528		0.648	
131.050	6.693		19.521		0.647	
131.000	6.778		19.515		0.645	
130.950	6.856		19.508		0.644	
130.900	6.930		19.501		0.642	
130.850	6.998		19.495		0.641	
130.800	7.062		19.488		0.640	
130.750	7.122		19.481		0.638	
130.700	7.177		19.475		0.637	
130.650	7.229		19.468		0.636	
130.600	7.278		19.461		0.634	
130.550	7.323		19.455		0.633	
130.500	7.365		19.448		0.632	
130.450	7.404		19.442		0.630	
130.400	7.440		19.435		0.629	

Upper Sandusky River Watershed TMDLs

130.350	7.474	19.428	0.628
130.300	7.506	19.422	0.626
130.250	7.536	19.415	0.625
130.200	7.563	19.409	0.624
130.150	7.589	19.402	0.622
130.100	7.613	19.395	0.621
130.050	7.636	19.389	0.620
130.000	7.656	19.382	0.618
129.950	7.676	19.376	0.617
129.900	7.694	19.369	0.616
129.850	7.711	19.362	0.614
129.800	7.727	19.356	0.613
129.750	7.742	19.349	0.612
129.700	7.595	15.863	0.491
129.650	7.672	15.857	0.491
129.600	7.743	15.851	0.490
129.550	7.808	15.845	0.490
129.500	7.867	15.839	0.489
129.450	7.921	15.833	0.489
129.400	7.971	15.827	0.488
129.350	8.017	15.821	0.488
129.300	8.058	15.815	0.487
129.250	8.097	15.809	0.487
129.200	8.131	15.803	0.486
129.150	8.163	15.797	0.486
129.100	8.193	15.791	0.485
129.050	8.220	15.785	0.485
129.000	8.244	15.779	0.484
128.950	8.267	15.773	0.484
128.900	8.287	15.767	0.483
128.850	8.306	15.761	0.483
128.800	8.323	15.755	0.482
128.750	8.339	15.749	0.482
128.700	8.353	15.743	0.481
128.650	8.367	15.737	0.481
128.600	8.379	15.731	0.480
128.550	8.390	15.725	0.480
128.500	8.400	15.719	0.480
128.450	8.409	15.713	0.479
128.400	8.418	15.707	0.479
128.350	8.426	15.701	0.478
128.300	8.433	15.695	0.478
128.250	8.439	15.689	0.477
128.200	8.445	15.683	0.477
128.150	8.451	15.677	0.476
128.100	8.456	15.671	0.476
128.050	8.460	15.665	0.475
128.000	8.465	15.659	0.475
127.950	8.468	15.653	0.474
127.900	8.472	15.647	0.474
127.850	8.475	15.641	0.473
127.800	8.478	15.635	0.473
127.700	8.389	15.612	0.471
127.600	8.316	15.588	0.469
127.500	8.256	15.564	0.467
127.400	8.207	15.541	0.465
127.300	8.167	15.517	0.463
127.200	8.134	15.494	0.461
127.100	8.107	15.470	0.459
127.000	8.085	15.447	0.457
126.900	8.067	15.423	0.455
126.800	8.053	15.400	0.453
126.700	8.041	15.377	0.451
126.600	8.031	15.353	0.449
126.500	8.023	15.330	0.447

Upper Sandusky River Watershed TMDLs

126.400	8.016	15.307	0.445
126.300	8.011	15.284	0.443
126.200	8.007	15.261	0.441
126.100	8.003	15.237	0.439
126.000	8.001	15.214	0.438
125.900	7.998	15.191	0.436
125.800	7.997	15.168	0.434
125.700	7.995	15.145	0.432
125.600	7.994	15.122	0.430
125.500	7.994	15.099	0.428
125.400	7.993	15.077	0.426
125.300	7.993	15.054	0.425
125.200	7.992	15.031	0.423
125.100	7.992	15.008	0.421
125.000	7.992	14.985	0.419
124.900	7.403	14.961	0.415
124.800	6.901	14.936	0.411
124.700	6.473	14.912	0.407
124.600	6.107	14.887	0.403
124.500	5.796	14.863	0.399
124.400	5.530	14.839	0.395
124.300	5.304	14.814	0.391
124.200	5.111	14.790	0.387
124.100	4.946	14.766	0.383
124.000	4.806	14.741	0.379
123.900	4.686	14.717	0.375
123.800	4.585	14.693	0.371
123.700	4.498	14.669	0.368
123.600	4.424	14.645	0.364
123.500	4.362	14.621	0.360
123.400	4.308	14.597	0.357
123.300	4.263	14.573	0.353
123.200	4.224	14.549	0.350
123.100	4.192	14.525	0.346
123.000	4.164	14.501	0.343
122.900	4.141	14.478	0.339
122.800	4.121	14.454	0.336
122.700	4.104	14.430	0.332
122.600	4.090	14.407	0.329
122.500	4.078	14.383	0.326
122.400	4.068	14.359	0.323
122.300	4.060	14.336	0.319
122.200	4.053	14.312	0.316
122.100	4.047	14.289	0.313
122.000	4.042	14.265	0.310
121.900	4.039	14.242	0.307
121.800	4.035	14.219	0.304
121.700	4.033	14.195	0.301
121.600	4.031	14.172	0.298
121.500	4.029	14.149	0.295
121.400	4.028	14.126	0.292
121.300	4.028	14.102	0.289
121.200	4.027	14.079	0.286
121.100	4.027	14.056	0.283
121.000	4.027	14.033	0.280
120.900	4.027	14.010	0.277
120.800	4.027	13.987	0.275
120.700	4.027	13.964	0.272
120.600	4.028	13.941	0.269
120.500	4.028	13.919	0.266
120.400	4.029	13.896	0.264
120.300	4.029	13.873	0.261
120.200	4.030	13.850	0.258
120.100	4.031	13.827	0.256
120.000	4.032	13.805	0.253

Upper Sandusky River Watershed TMDLs

119.900	4.032	13.782	0.251
119.800	4.033	13.760	0.248
119.700	4.034	13.737	0.246
119.600	4.035	13.714	0.243
119.500	4.036	13.692	0.241
119.400	4.037	13.670	0.238
119.300	4.038	13.647	0.236
119.200	4.039	13.625	0.234
119.100	4.039	13.602	0.231
119.000	4.040	13.580	0.229
118.900	4.041	13.558	0.227
118.800	4.042	13.536	0.224
118.700	4.043	13.513	0.222
118.600	4.044	13.491	0.220
118.500	4.045	13.469	0.218
118.400	4.583	13.433	0.214
118.300	4.977	13.398	0.211
118.200	5.266	13.362	0.208
118.100	5.478	13.327	0.204
118.000	5.633	13.291	0.201
117.900	5.747	13.256	0.198
117.800	5.831	13.221	0.195
117.700	5.893	13.186	0.192
117.600	5.938	13.151	0.189
117.500	5.972	13.116	0.186
117.400	5.997	13.081	0.183
117.300	6.015	13.047	0.180
117.200	6.029	13.012	0.177
117.100	6.039	12.977	0.174
117.000	6.047	12.943	0.171
116.900	6.053	12.909	0.169
116.800	6.058	12.875	0.166
116.700	6.061	12.840	0.163
116.600	6.064	12.806	0.161
116.500	6.067	12.772	0.158
116.400	6.069	12.738	0.156
116.300	6.070	12.705	0.153
116.200	6.072	12.671	0.151
116.100	6.073	12.637	0.148
116.000	6.074	12.604	0.146
115.900	6.075	12.570	0.144
115.800	6.076	12.537	0.141
115.700	6.077	12.504	0.139
115.600	6.078	12.471	0.137
115.500	6.079	12.438	0.135
115.400	6.063	14.632	0.315
115.350	6.073	14.610	0.314
115.300	6.081	14.589	0.313
115.250	6.090	14.567	0.312
115.200	6.097	14.545	0.311
115.150	6.104	14.524	0.310
115.100	6.111	14.502	0.309
115.050	6.117	14.481	0.309
115.000	6.122	14.459	0.308
114.950	6.128	14.438	0.307
114.900	6.132	14.416	0.306
114.850	6.137	14.395	0.305
114.800	6.141	14.374	0.304
114.750	6.145	14.352	0.303
114.700	6.149	14.331	0.302
114.650	6.152	14.310	0.301
114.600	6.156	14.289	0.300
114.550	6.159	14.267	0.300
114.500	6.161	14.246	0.299
114.450	6.164	14.225	0.298

Upper Sandusky River Watershed TMDLs

114.400	6.167	14.204	0.297
114.350	6.169	14.183	0.296
114.300	6.171	14.162	0.295
114.250	6.173	14.141	0.294
114.200	6.175	14.120	0.293
114.150	6.177	14.099	0.293
114.100	6.179	14.078	0.292
114.050	6.180	14.057	0.291
114.000	6.182	14.036	0.290
113.950	6.183	14.016	0.289
113.900	6.185	13.995	0.288
113.850	6.186	13.974	0.287
113.800	6.188	13.953	0.287
113.750	6.189	13.933	0.286
113.700	6.190	13.912	0.285
113.650	6.191	13.891	0.284
113.600	6.192	13.871	0.283
113.550	6.193	13.850	0.282
113.500	6.194	13.830	0.281
113.400	5.901	13.762	0.279
113.300	5.642	13.695	0.276
113.200	5.415	13.628	0.273
113.100	5.215	13.562	0.270
113.000	5.039	13.496	0.268
112.900	4.884	13.430	0.265
112.800	4.748	13.364	0.263
112.700	4.628	13.299	0.260
112.600	4.523	13.234	0.257
112.500	4.431	13.169	0.255
112.400	4.350	13.105	0.252
112.300	4.279	13.041	0.250
112.200	4.216	12.978	0.247
112.100	4.162	12.914	0.245
112.000	4.114	12.851	0.242
111.900	4.072	12.789	0.240
111.800	4.036	12.726	0.238
111.700	4.004	12.664	0.235
111.600	3.977	12.602	0.233
111.500	3.953	12.541	0.231
111.400	3.932	12.480	0.228
111.300	3.914	12.419	0.226
111.200	5.246	19.181	1.363
111.100	5.271	19.143	1.331
111.000	5.298	19.105	1.299
110.900	5.326	19.066	1.268
110.800	5.354	19.028	1.239
110.700	5.384	18.990	1.209
110.600	5.414	18.952	1.181
110.500	5.445	18.914	1.153
110.400	5.476	18.876	1.126
110.300	5.508	18.839	1.099
110.200	5.540	18.801	1.073
110.100	5.572	18.763	1.048
110.000	5.604	18.726	1.023
109.900	5.636	18.688	0.999
109.800	5.668	18.651	0.976
109.700	5.700	18.614	0.953
109.600	5.732	18.576	0.930
109.500	5.763	18.539	0.908
109.400	5.795	18.502	0.887
109.300	5.826	18.465	0.866
109.200	5.857	18.428	0.845
109.100	5.887	18.391	0.825
109.000	5.917	18.354	0.806
108.900	5.947	18.318	0.787

Upper Sandusky River Watershed TMDLs

108.800	5.976	18.281	0.768
108.700	6.005	18.244	0.750
108.600	6.034	18.208	0.733
108.500	6.062	18.171	0.715
108.400	6.090	18.135	0.698
108.300	6.117	18.099	0.682
108.200	6.144	18.063	0.666
108.100	6.170	18.026	0.650
108.000	6.196	17.990	0.635
107.900	6.221	17.954	0.620
107.800	6.246	17.918	0.605
107.700	6.271	17.883	0.591
107.600	6.295	17.847	0.577
107.500	6.319	17.811	0.563
107.400	6.342	17.775	0.550
107.300	6.365	17.740	0.537
107.200	6.387	17.704	0.524
107.100	6.409	17.669	0.512
107.000	6.430	17.634	0.500
106.900	6.451	17.598	0.488
106.800	6.472	17.563	0.477
106.700	6.492	17.528	0.465
106.600	6.512	17.493	0.454
106.500	6.531	17.458	0.444
106.400	6.550	17.423	0.433
106.300	6.569	17.388	0.423
106.200	6.587	17.353	0.413
106.100	6.605	17.319	0.403
106.000	6.622	17.284	0.394
105.900	6.639	17.249	0.384
105.800	6.656	17.215	0.375
105.700	6.691	17.188	0.368
105.600	6.723	17.161	0.361
105.500	6.753	17.135	0.354
105.400	6.781	17.108	0.347
105.300	6.806	17.082	0.340
105.200	6.830	17.055	0.334
105.100	6.853	17.029	0.327
105.000	6.874	17.002	0.321
104.900	6.893	16.976	0.315
104.800	6.912	16.950	0.309
104.700	6.929	16.923	0.303
104.600	6.945	16.897	0.297
104.500	6.960	16.871	0.291
104.400	6.975	16.845	0.286
104.300	6.988	16.819	0.280
104.200	7.001	16.793	0.275
104.100	7.013	16.767	0.269
104.000	7.024	16.741	0.264
103.900	7.035	16.715	0.259
103.800	7.046	16.689	0.254
103.700	7.055	16.663	0.249
103.600	7.065	16.637	0.244
103.500	7.074	16.611	0.240
103.400	7.082	16.585	0.235
103.300	7.091	16.560	0.230
103.200	7.098	16.534	0.226
103.100	7.106	16.508	0.222
103.000	7.113	16.483	0.217
102.900	7.120	16.457	0.213
102.800	7.127	16.432	0.209
102.700	7.133	16.406	0.205
102.600	7.140	16.381	0.201
102.500	7.146	16.355	0.197
102.400	7.152	16.330	0.193

Upper Sandusky River Watershed TMDLs

102.300	7.157	16.305	0.189
102.200	7.163	16.279	0.186
102.100	7.168	16.254	0.182
102.000	7.174	16.229	0.179
101.900	7.179	16.204	0.175
101.800	7.183	16.179	0.172
101.700	7.188	16.154	0.168
101.600	7.193	16.128	0.165
101.500	7.197	16.103	0.162
101.400	7.202	16.078	0.159
101.300	7.206	16.054	0.156
101.200	7.210	16.029	0.153
101.100	7.215	16.004	0.150
101.000	7.219	15.979	0.147
100.900	7.223	15.954	0.144
100.800	7.226	15.929	0.141
100.700	7.230	15.905	0.139
100.600	7.234	15.880	0.136
100.500	7.237	15.855	0.133
100.400	7.241	15.831	0.131
100.300	7.208	16.017	0.183
100.200	7.195	15.962	0.179
100.100	7.183	15.907	0.175
100.000	7.173	15.853	0.171
99.900	7.165	15.798	0.168
99.800	7.158	15.744	0.164
99.700	7.152	15.690	0.160
99.600	7.148	15.636	0.157
99.500	7.144	15.582	0.154
99.400	7.141	15.529	0.150
99.300	7.139	15.476	0.147
99.200	7.138	15.423	0.144
99.100	7.137	15.370	0.141
99.000	7.137	15.317	0.138
98.900	7.137	15.264	0.135
98.800	7.138	15.212	0.132
98.700	7.139	15.160	0.129
98.600	7.140	15.108	0.126
98.500	7.142	15.056	0.123
98.400	7.144	15.004	0.121
98.300	7.146	14.953	0.118
98.200	7.149	14.901	0.116
98.100	7.151	14.850	0.113
98.000	7.154	14.799	0.111
97.900	7.157	14.748	0.108
97.800	7.159	14.698	0.106
97.700	7.162	14.647	0.104
97.600	7.166	14.597	0.101
97.500	7.169	14.547	0.099
97.400	7.172	14.497	0.097
97.300	7.175	14.447	0.095
97.200	7.178	14.398	0.093
97.100	7.182	14.348	0.091
97.000	7.185	14.299	0.089
96.900	7.188	14.250	0.087
96.800	7.192	14.201	0.085
96.700	7.195	14.152	0.083
96.600	7.198	14.104	0.081
96.500	7.202	14.055	0.080
96.400	7.205	14.007	0.078
96.300	7.208	13.959	0.076
96.200	7.212	13.911	0.075
96.100	7.215	13.863	0.073
96.000	7.218	13.816	0.071
95.900	7.221	13.768	0.070

Upper Sandusky River Watershed TMDLs

95.800	7.225	13.721	0.068
95.700	7.228	13.674	0.067
95.600	7.231	13.627	0.065
95.500	7.234	13.580	0.064
95.400	7.237	13.533	0.063

D.O. Model Appendix for Upper Sandusky

Multi-SMP Low Flow (7Q10) Simulation with 1.5 cfs Augmentation Flow

BVC

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*                               SIMPLIFIED METHOD PROGRAM                               *
*                               COMPLETE INPUT LISTING                               *
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--*-*-* Run Information *-*-*-*-*

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Name of receiving stream ----- SANDUSKY
Number of discharges ----- 5
Number of reaches ----- 10
Reaeration type ----- Manually specified
Run title ----- SUM 7Q10 1.5 AUGMT

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--*-*-* Upstream Parameters *-*-*-*-*

Parameter	Value	Comment
Flow (cfs)	0.360	
Temperature (°C)	22.500	
Dissolved Oxygen (mg/l)	5.500	
5-Day BOD (mg/l)	3.710	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.620	
Ammonia (mg/l)	0.070	
Alkalinity (mg/l)	-0.000	

--*-*-* Effluent Parameters *-*-*-*-*

Number of Discharges = 5

For Discharge Number 1 (CRESTLINE)

Parameter	Value	Comment
Flow (MGD)	0.950	
Temperature (°C)	22.300	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.600	
Ammonia (mg/l)	0.800	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	1.000	

For Discharge Number 2 (AUGMENTATION)

Parameter	Value	Comment
Flow (MGD)	0.970	
Temperature (°C)	20.000	
Dissolved Oxygen (mg/l)	7.000	
5-Day BOD (mg/l)	2.000	
Ult. CBOD / 5-Day BOD	1.500	
pH (su)	7.600	
Ammonia (mg/l)	0.050	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	2.000	

Upper Sandusky River Watershed TMDLs

For Discharge Number 3 (TIMKEN)

Parameter	Value	Comment
Flow (MGD)	0.400	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	1.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	6.000	

For Discharge Number 4 (BUCYRUS)

Parameter	Value	Comment
Flow (MGD)	3.400	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	2.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	8.000	

For Discharge Number 5 (SWIFT)

Parameter	Value	Comment
Flow (MGD)	0.160	
Temperature (°C)	23.000	
Dissolved Oxygen (mg/l)	6.000	
5-Day BOD (mg/l)	10.000	
Ult. CBOD / 5-Day BOD	2.300	
pH (su)	7.000	
Ammonia (mg/l)	2.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	10.000	

----- Reach Information -----

Number of Reaches = 10
Reaeration Specified Directly

For Reach Number 1

Parameter	Value	Comment
Length (mile)	1.700	
Velocity (fps)	0.120	
Slope (ft/mile)	4.700	
Average Depth (ft)	0.600	
Temperature (°C)	22.472	Calculated
BOD Removal Rate (1/day)	0.012	
NH3 Decay Rate (1/day)	0.070	
Sediment Oxygen Demand (g/m ² /day)	0.200	
Photosynthesis/respiration (mg/L/day)	-0.000	
Reaeration Coefficient (1/day)	2.610	PP

Temperature-corrected BOD removal rate (1/day)	0.013
Temperature-corrected NH3 decay rate (1/day)	0.084
Calculated reaeration rate at 20° C (1/day)	2.610
Temperature-corrected reaeration rate (1/day)	2.760
Calculated reach-averaged width (ft)	25.399

For Reach Number 2

Parameter	Value	Comment
Length (mile)	1.900	
Velocity (fps)	0.240	
Slope (ft/mile)	15.400	

Upper Sandusky River Watershed TMDLs

Average Depth	(ft)	0.660	
Temperature	(°C)	22.051	calculated
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	-0.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefffficient	(1/day)	6.660	TSIV
Temperature-corrected BOD removal rate	(1/day)	0.025	
Temperature-corrected NH3 decay rate	(1/day)	0.065	
Calculated reaeration rate at 20° C	(1/day)	6.660	
Temperature-corrected reaeration rate	(1/day)	6.867	
Calculated reach-averaged width	(ft)	21.012	

For Reach Number 3

Parameter		Value	Comment
Length	(mile)	2.800	
Velocity	(fps)	0.140	
Slope	(ft/mile)	10.900	
Average Depth	(ft)	0.770	
Temperature	(°C)	24.700	
BOD Removal Rate	(1/day)	0.024	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	-0.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefffficient	(1/day)	2.960	PP
Temperature-corrected BOD removal rate	(1/day)	0.030	
Temperature-corrected NH3 decay rate	(1/day)	0.085	
Calculated reaeration rate at 20° C	(1/day)	2.960	
Temperature-corrected reaeration rate	(1/day)	3.311	
Calculated reach-averaged width	(ft)	30.875	

For Reach Number 4

Parameter		Value	Comment
Length	(mile)	6.500	
Velocity	(fps)	0.060	
Slope	(ft/mile)	4.600	
Average Depth	(ft)	1.190	
Temperature	(°C)	24.342	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.500	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefffficient	(1/day)	1.010	PP
Temperature-corrected BOD removal rate	(1/day)	0.013	
Temperature-corrected NH3 decay rate	(1/day)	0.082	
Calculated reaeration rate at 20° C	(1/day)	1.010	
Temperature-corrected reaeration rate	(1/day)	1.120	
Calculated reach-averaged width	(ft)	46.615	

For Reach Number 5

Parameter		Value	Comment
Length	(mile)	3.100	
Velocity	(fps)	0.030	
Slope	(ft/mile)	2.100	
Average Depth	(ft)	1.280	
Temperature	(°C)	23.700	
BOD Removal Rate	(1/day)	0.011	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefffficient	(1/day)	1.200	KO & NR

Upper Sandusky River Watershed TMDLs

Temperature-corrected BOD removal rate	(1/day)	0.013
Temperature-corrected NH3 decay rate	(1/day)	0.078
Calculated reaeration rate at 20° C	(1/day)	1.200
Temperature-corrected reaeration rate	(1/day)	1.311
Calculated reach-averaged width	(ft)	86.675

For Reach Number 6

Parameter		Value	Comment
Length	(mile)	1.900	
Velocity	(fps)	0.090	
Slope	(ft/mile)	8.200	
Average Depth	(ft)	1.020	
Temperature	(°C)	23.666	Calculated
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.000	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.700	PP

Temperature-corrected BOD removal rate	(1/day)	0.039
Temperature-corrected NH3 decay rate	(1/day)	0.078
Calculated reaeration rate at 20° C	(1/day)	1.700
Temperature-corrected reaeration rate	(1/day)	1.852
Calculated reach-averaged width	(ft)	42.993

For Reach Number 7

Parameter		Value	Comment
Length	(mile)	2.300	
Velocity	(fps)	0.060	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	1.280	
Temperature	(°C)	24.200	
BOD Removal Rate	(1/day)	0.033	
NH3 Decay Rate	(1/day)	0.059	
Sediment Oxygen Demand	(g/m ² /day)	1.300	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.830	PP

Temperature-corrected BOD removal rate	(1/day)	0.040
Temperature-corrected NH3 decay rate	(1/day)	0.082
Calculated reaeration rate at 20° C	(1/day)	0.830
Temperature-corrected reaeration rate	(1/day)	0.917
Calculated reach-averaged width	(ft)	51.390

For Reach Number 8

Parameter		Value	Comment
Length	(mile)	5.400	
Velocity	(fps)	0.060	
Slope	(ft/mile)	3.400	
Average Depth	(ft)	1.670	
Temperature	(°C)	23.850	Calculated
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.640	PP

Temperature-corrected BOD removal rate	(1/day)	0.016
Temperature-corrected NH3 decay rate	(1/day)	0.197
Calculated reaeration rate at 20° C	(1/day)	0.640
Temperature-corrected reaeration rate	(1/day)	0.696
Calculated reach-averaged width	(ft)	91.848

For Reach Number 9

Parameter		Value	Comment
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Upper Sandusky River Watershed TMDLs

Length	(mile)	5.500	
Velocity	(fps)	0.070	
Slope	(ft/mile)	5.700	
Average Depth	(ft)	1.500	
Temperature	(°C)	25.200	
BOD Removal Rate	(1/day)	0.014	
NH3 Decay Rate	(1/day)	0.150	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	0.920	PP
Temperature-corrected BOD removal rate	(1/day)	0.018	
Temperature-corrected NH3 decay rate	(1/day)	0.224	
Calculated reaeration rate at 20° C	(1/day)	0.920	
Temperature-corrected reaeration rate	(1/day)	1.041	
Calculated reach-averaged width	(ft)	87.649	
For Reach Number	10		
Parameter	Value	Comment	
Length	(mile)	4.900	
Velocity	(fps)	0.100	
Slope	(ft/mile)	9.400	
Average Depth	(ft)	1.420	
Temperature	(°C)	25.170	Calculated
BOD Removal Rate	(1/day)	0.040	
NH3 Decay Rate	(1/day)	0.217	
Sediment Oxygen Demand	(g/m ² /day)	0.200	
Photosynthesis/respiration	(mg/L/day)	-0.000	
Reaeration Coefficient	(1/day)	1.340	PP
Temperature-corrected BOD removal rate	(1/day)	0.051	
Temperature-corrected NH3 decay rate	(1/day)	0.322	
Calculated reaeration rate at 20° C	(1/day)	1.340	
Temperature-corrected reaeration rate	(1/day)	1.515	
Calculated reach-averaged width	(ft)	66.553	

----*--* Results for SANDUSKY *--*--*--*

Discharge is to -- SANDUSKY
Run Title is -- SUM 7Q10 1.5 AUGMT

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
131.400	5.902		19.568		0.656	
131.350	6.040		19.561		0.655	
131.300	6.169		19.554		0.653	
131.250	6.289		19.548		0.652	
131.200	6.401		19.541		0.651	
131.150	6.505		19.534		0.649	
131.100	6.602		19.528		0.648	
131.050	6.693		19.521		0.647	
131.000	6.778		19.515		0.645	
130.950	6.856		19.508		0.644	
130.900	6.930		19.501		0.642	
130.850	6.998		19.495		0.641	
130.800	7.062		19.488		0.640	
130.750	7.122		19.481		0.638	
130.700	7.177		19.475		0.637	
130.650	7.229		19.468		0.636	
130.600	7.278		19.461		0.634	
130.550	7.323		19.455		0.633	
130.500	7.365		19.448		0.632	
130.450	7.404		19.442		0.630	
130.400	7.440		19.435		0.629	

Upper Sandusky River Watershed TMDLs

130.350	7.474	19.428	0.628
130.300	7.506	19.422	0.626
130.250	7.536	19.415	0.625
130.200	7.563	19.409	0.624
130.150	7.589	19.402	0.622
130.100	7.613	19.395	0.621
130.050	7.636	19.389	0.620
130.000	7.656	19.382	0.618
129.950	7.676	19.376	0.617
129.900	7.694	19.369	0.616
129.850	7.711	19.362	0.614
129.800	7.727	19.356	0.613
129.750	7.742	19.349	0.612
129.700	7.415	11.979	0.358
129.650	7.517	11.975	0.358
129.600	7.611	11.972	0.357
129.550	7.697	11.968	0.357
129.500	7.775	11.964	0.357
129.450	7.847	11.960	0.356
129.400	7.913	11.956	0.356
129.350	7.974	11.952	0.356
129.300	8.029	11.948	0.356
129.250	8.080	11.944	0.355
129.200	8.126	11.940	0.355
129.150	8.169	11.937	0.355
129.100	8.208	11.933	0.354
129.050	8.244	11.929	0.354
129.000	8.277	11.925	0.354
128.950	8.307	11.921	0.353
128.900	8.334	11.917	0.353
128.850	8.359	11.913	0.353
128.800	8.383	11.910	0.353
128.750	8.404	11.906	0.352
128.700	8.423	11.902	0.352
128.650	8.441	11.898	0.352
128.600	8.457	11.894	0.351
128.550	8.472	11.890	0.351
128.500	8.486	11.886	0.351
128.450	8.498	11.883	0.351
128.400	8.510	11.879	0.350
128.350	8.521	11.875	0.350
128.300	8.530	11.871	0.350
128.250	8.539	11.867	0.349
128.200	8.547	11.863	0.349
128.150	8.555	11.859	0.349
128.100	8.561	11.856	0.349
128.050	8.568	11.852	0.348
128.000	8.573	11.848	0.348
127.950	8.579	11.844	0.348
127.900	8.583	11.840	0.347
127.850	8.588	11.836	0.347
127.800	8.592	11.833	0.347
127.700	8.513	11.817	0.346
127.600	8.444	11.802	0.344
127.500	8.384	11.787	0.343
127.400	8.333	11.771	0.342
127.300	8.289	11.756	0.340
127.200	8.250	11.741	0.339
127.100	8.217	11.725	0.338
127.000	8.188	11.710	0.337
126.900	8.164	11.695	0.335
126.800	8.142	11.680	0.334
126.700	8.124	11.665	0.333
126.600	8.108	11.649	0.332
126.500	8.094	11.634	0.331

Upper Sandusky River Watershed TMDLs

126.400	8.082	11.619	0.329
126.300	8.072	11.604	0.328
126.200	8.063	11.589	0.327
126.100	8.055	11.574	0.326
126.000	8.049	11.559	0.324
125.900	8.043	11.544	0.323
125.800	8.038	11.529	0.322
125.700	8.034	11.514	0.321
125.600	8.031	11.499	0.320
125.500	8.028	11.484	0.319
125.400	8.025	11.469	0.317
125.300	8.023	11.454	0.316
125.200	8.021	11.439	0.315
125.100	8.019	11.424	0.314
125.000	8.018	11.410	0.313
124.900	7.614	11.394	0.310
124.800	7.254	11.378	0.307
124.700	6.932	11.363	0.305
124.600	6.646	11.347	0.302
124.500	6.390	11.332	0.300
124.400	6.162	11.316	0.297
124.300	5.959	11.301	0.295
124.200	5.777	11.285	0.292
124.100	5.616	11.270	0.290
124.000	5.472	11.255	0.287
123.900	5.343	11.239	0.285
123.800	5.229	11.224	0.283
123.700	5.127	11.209	0.280
123.600	5.036	11.193	0.278
123.500	4.955	11.178	0.276
123.400	4.883	11.163	0.273
123.300	4.819	11.147	0.271
123.200	4.761	11.132	0.269
123.100	4.710	11.117	0.267
123.000	4.665	11.102	0.264
122.900	4.624	11.087	0.262
122.800	4.589	11.071	0.260
122.700	4.557	11.056	0.258
122.600	4.528	11.041	0.256
122.500	4.503	11.026	0.253
122.400	4.480	11.011	0.251
122.300	4.461	10.996	0.249
122.200	4.443	10.981	0.247
122.100	4.427	10.966	0.245
122.000	4.413	10.951	0.243
121.900	4.401	10.936	0.241
121.800	4.390	10.921	0.239
121.700	4.380	10.906	0.237
121.600	4.372	10.891	0.235
121.500	4.365	10.876	0.233
121.400	4.358	10.862	0.231
121.300	4.352	10.847	0.229
121.200	4.347	10.832	0.227
121.100	4.343	10.817	0.225
121.000	4.339	10.802	0.224
120.900	4.335	10.787	0.222
120.800	4.332	10.773	0.220
120.700	4.330	10.758	0.218
120.600	4.328	10.743	0.216
120.500	4.326	10.729	0.214
120.400	4.324	10.714	0.213
120.300	4.323	10.699	0.211
120.200	4.322	10.685	0.209
120.100	4.321	10.670	0.207
120.000	4.320	10.656	0.206

Upper Sandusky River Watershed TMDLs

119.900	4.320	10.641	0.204
119.800	4.319	10.626	0.202
119.700	4.319	10.612	0.200
119.600	4.319	10.597	0.199
119.500	4.319	10.583	0.197
119.400	4.319	10.568	0.195
119.300	4.319	10.554	0.194
119.200	4.319	10.540	0.192
119.100	4.319	10.525	0.191
119.000	4.320	10.511	0.189
118.900	4.320	10.496	0.187
118.800	4.320	10.482	0.186
118.700	4.321	10.468	0.184
118.600	4.321	10.453	0.183
118.500	4.322	10.439	0.181
118.400	4.760	10.411	0.178
118.300	5.096	10.384	0.175
118.200	5.354	10.356	0.173
118.100	5.552	10.329	0.170
118.000	5.703	10.301	0.167
117.900	5.819	10.274	0.165
117.800	5.909	10.247	0.162
117.700	5.977	10.220	0.159
117.600	6.030	10.193	0.157
117.500	6.071	10.166	0.154
117.400	6.102	10.139	0.152
117.300	6.126	10.112	0.150
117.200	6.145	10.085	0.147
117.100	6.159	10.058	0.145
117.000	6.171	10.031	0.143
116.900	6.180	10.005	0.140
116.800	6.187	9.978	0.138
116.700	6.192	9.952	0.136
116.600	6.197	9.925	0.134
116.500	6.200	9.899	0.132
116.400	6.203	9.873	0.130
116.300	6.206	9.847	0.127
116.200	6.208	9.821	0.125
116.100	6.210	9.795	0.123
116.000	6.211	9.769	0.122
115.900	6.212	9.743	0.120
115.800	6.214	9.717	0.118
115.700	6.215	9.691	0.116
115.600	6.216	9.665	0.114
115.500	6.217	9.640	0.112
115.400	6.184	11.712	0.250
115.350	6.190	11.696	0.249
115.300	6.196	11.681	0.248
115.250	6.202	11.665	0.248
115.200	6.207	11.650	0.247
115.150	6.212	11.634	0.247
115.100	6.217	11.619	0.246
115.050	6.222	11.604	0.245
115.000	6.226	11.588	0.245
114.950	6.230	11.573	0.244
114.900	6.234	11.558	0.243
114.850	6.238	11.543	0.243
114.800	6.241	11.527	0.242
114.750	6.244	11.512	0.241
114.700	6.247	11.497	0.241
114.650	6.250	11.482	0.240
114.600	6.253	11.467	0.239
114.550	6.256	11.451	0.239
114.500	6.258	11.436	0.238
114.450	6.261	11.421	0.238

Upper Sandusky River Watershed TMDLs

114.400	6.263	11.406	0.237
114.350	6.265	11.391	0.236
114.300	6.267	11.376	0.236
114.250	6.269	11.361	0.235
114.200	6.271	11.346	0.234
114.150	6.272	11.331	0.234
114.100	6.274	11.316	0.233
114.050	6.276	11.301	0.233
114.000	6.277	11.286	0.232
113.950	6.279	11.271	0.231
113.900	6.280	11.256	0.231
113.850	6.282	11.242	0.230
113.800	6.283	11.227	0.230
113.750	6.284	11.212	0.229
113.700	6.285	11.197	0.228
113.650	6.286	11.182	0.228
113.600	6.287	11.168	0.227
113.550	6.289	11.153	0.227
113.500	6.290	11.138	0.226
113.400	6.087	11.093	0.224
113.300	5.902	11.048	0.222
113.200	5.735	11.003	0.220
113.100	5.582	10.958	0.219
113.000	5.444	10.913	0.217
112.900	5.318	10.869	0.215
112.800	5.203	10.825	0.213
112.700	5.099	10.781	0.211
112.600	5.004	10.737	0.210
112.500	4.918	10.693	0.208
112.400	4.840	10.650	0.206
112.300	4.770	10.606	0.205
112.200	4.705	10.563	0.203
112.100	4.647	10.520	0.201
112.000	4.594	10.477	0.199
111.900	4.546	10.435	0.198
111.800	4.503	10.392	0.196
111.700	4.463	10.350	0.195
111.600	4.428	10.308	0.193
111.500	4.395	10.266	0.191
111.400	4.366	10.224	0.190
111.300	4.340	10.183	0.188
111.200	5.278	17.486	1.222
111.100	5.313	17.456	1.198
111.000	5.348	17.427	1.174
110.900	5.383	17.398	1.151
110.800	5.417	17.369	1.128
110.700	5.451	17.340	1.106
110.600	5.485	17.311	1.084
110.500	5.518	17.282	1.063
110.400	5.551	17.253	1.041
110.300	5.584	17.224	1.021
110.200	5.616	17.195	1.001
110.100	5.648	17.166	0.981
110.000	5.679	17.137	0.961
109.900	5.710	17.109	0.942
109.800	5.741	17.080	0.924
109.700	5.771	17.052	0.905
109.600	5.801	17.023	0.887
109.500	5.831	16.995	0.870
109.400	5.860	16.966	0.852
109.300	5.888	16.938	0.836
109.200	5.916	16.909	0.819
109.100	5.944	16.881	0.803
109.000	5.971	16.853	0.787
108.900	5.998	16.824	0.771

Upper Sandusky River Watershed TMDLs

108.800	6.024	16.796	0.756
108.700	6.050	16.768	0.741
108.600	6.076	16.740	0.726
108.500	6.101	16.712	0.712
108.400	6.126	16.684	0.698
108.300	6.150	16.656	0.684
108.200	6.174	16.628	0.670
108.100	6.197	16.600	0.657
108.000	6.220	16.573	0.644
107.900	6.243	16.545	0.631
107.800	6.265	16.517	0.619
107.700	6.287	16.490	0.607
107.600	6.309	16.462	0.594
107.500	6.330	16.434	0.583
107.400	6.351	16.407	0.571
107.300	6.371	16.379	0.560
107.200	6.391	16.352	0.549
107.100	6.411	16.325	0.538
107.000	6.430	16.297	0.527
106.900	6.449	16.270	0.517
106.800	6.468	16.243	0.507
106.700	6.486	16.216	0.496
106.600	6.504	16.188	0.487
106.500	6.522	16.161	0.477
106.400	6.539	16.134	0.468
106.300	6.556	16.107	0.458
106.200	6.573	16.080	0.449
106.100	6.590	16.053	0.440
106.000	6.606	16.026	0.432
105.900	6.621	16.000	0.423
105.800	6.637	15.973	0.415
105.700	6.667	15.948	0.407
105.600	6.694	15.923	0.399
105.500	6.720	15.899	0.391
105.400	6.745	15.874	0.383
105.300	6.768	15.849	0.376
105.200	6.790	15.825	0.369
105.100	6.810	15.800	0.362
105.000	6.829	15.776	0.355
104.900	6.848	15.751	0.348
104.800	6.865	15.727	0.341
104.700	6.881	15.702	0.334
104.600	6.897	15.678	0.328
104.500	6.912	15.654	0.322
104.400	6.926	15.630	0.315
104.300	6.939	15.605	0.309
104.200	6.952	15.581	0.303
104.100	6.964	15.557	0.297
104.000	6.976	15.533	0.292
103.900	6.987	15.509	0.286
103.800	6.998	15.485	0.280
103.700	7.008	15.461	0.275
103.600	7.018	15.437	0.270
103.500	7.028	15.413	0.265
103.400	7.037	15.389	0.259
103.300	7.046	15.365	0.254
103.200	7.054	15.341	0.249
103.100	7.063	15.317	0.245
103.000	7.071	15.294	0.240
102.900	7.078	15.270	0.235
102.800	7.086	15.246	0.231
102.700	7.093	15.223	0.226
102.600	7.100	15.199	0.222
102.500	7.107	15.175	0.218
102.400	7.114	15.152	0.213

Upper Sandusky River Watershed TMDLs

102.300	7.120	15.128	0.209
102.200	7.126	15.105	0.205
102.100	7.132	15.081	0.201
102.000	7.138	15.058	0.197
101.900	7.144	15.035	0.193
101.800	7.150	15.011	0.190
101.700	7.155	14.988	0.186
101.600	7.161	14.965	0.182
101.500	7.166	14.942	0.179
101.400	7.171	14.919	0.175
101.300	7.176	14.895	0.172
101.200	7.181	14.872	0.169
101.100	7.186	14.849	0.165
101.000	7.190	14.826	0.162
100.900	7.195	14.803	0.159
100.800	7.199	14.780	0.156
100.700	7.204	14.757	0.153
100.600	7.208	14.734	0.150
100.500	7.212	14.712	0.147
100.400	7.216	14.689	0.144
100.300	7.189	14.884	0.190
100.200	7.180	14.838	0.186
100.100	7.174	14.792	0.183
100.000	7.168	14.747	0.179
99.900	7.163	14.701	0.176
99.800	7.159	14.656	0.172
99.700	7.156	14.610	0.169
99.600	7.153	14.565	0.166
99.500	7.151	14.520	0.162
99.400	7.150	14.475	0.159
99.300	7.149	14.430	0.156
99.200	7.149	14.386	0.153
99.100	7.149	14.341	0.150
99.000	7.149	14.297	0.147
98.900	7.150	14.253	0.144
98.800	7.151	14.209	0.142
98.700	7.152	14.165	0.139
98.600	7.154	14.121	0.136
98.500	7.156	14.077	0.133
98.400	7.158	14.034	0.131
98.300	7.160	13.991	0.128
98.200	7.162	13.947	0.126
98.100	7.165	13.904	0.123
98.000	7.167	13.861	0.121
97.900	7.170	13.818	0.119
97.800	7.173	13.776	0.116
97.700	7.176	13.733	0.114
97.600	7.179	13.691	0.112
97.500	7.182	13.648	0.110
97.400	7.185	13.606	0.107
97.300	7.188	13.564	0.105
97.200	7.191	13.522	0.103
97.100	7.194	13.480	0.101
97.000	7.197	13.439	0.099
96.900	7.200	13.397	0.097
96.800	7.204	13.356	0.095
96.700	7.207	13.314	0.094
96.600	7.210	13.273	0.092
96.500	7.213	13.232	0.090
96.400	7.216	13.191	0.088
96.300	7.219	13.151	0.086
96.200	7.223	13.110	0.085
96.100	7.226	13.069	0.083
96.000	7.229	13.029	0.082
95.900	7.232	12.989	0.080

Upper Sandusky River Watershed TMDLs

95.800	7.235	12.949	0.078
95.700	7.238	12.909	0.077
95.600	7.241	12.869	0.075
95.500	7.244	12.829	0.074
95.400	7.247	12.789	0.072