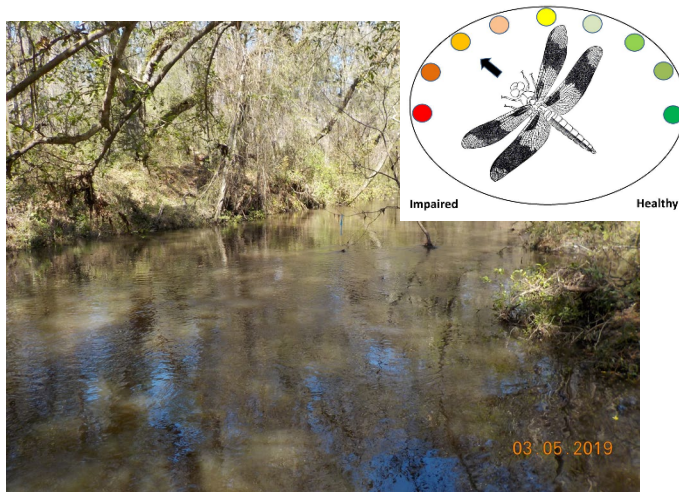


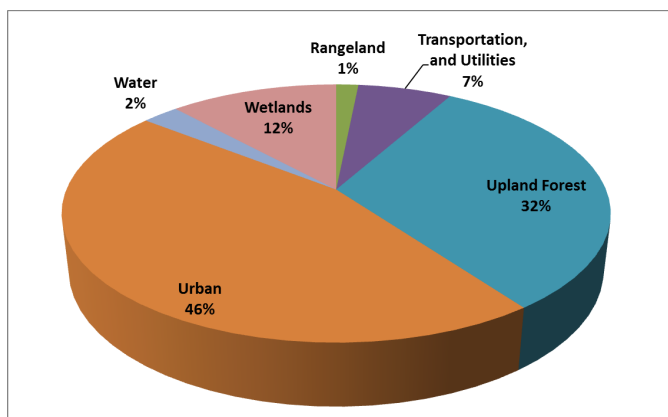
Waterbody: Munson Slough



Basin: Lake Munson

The heavily urbanized Munson Slough and its tributaries are located in central Leon County and drain a portion of the City of Tallahassee. The Slough flows south into and out of Lake Munson, then continues to Eight Mile Pond. After exiting Eight Mile Pond, the Slough flows under Oak Ridge Road and enters Ames Sink, which is known to be connected to Wakulla Springs.

As shown in the figure below, approximately 54% of land use in the 38,790-acre basin is residential, commercial, industrial or transportation. Increases in stormwater runoff and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (e.g., recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

Total Maximum Daily Load (TMDL)

The Florida Department of Environmental Protection (FDEP) issued several TMDLs for Munson Slough including both upstream and downstream of Lake Munson. The TMDLs are as follows:

TMDLs upstream of Lake Munson

The dissolved oxygen TMDL targets are 5-day biological oxygen demand (BOD₅) of 2.00 mg/L, total nitrogen (TN) of 0.72 mg/L, and total phosphorus (TP) of 0.15 mg/L and are allocated as follows. To meet the dissolved oxygen TMDL criterion, water chemistry concentrations will require a 50 percent reduction for BOD₅, an 8.35 percent reduction for TN, and a 17.53 percent reduction for TP at sources contributing to exceedances of the TMDLs.

The fecal coliform TMDL for portions of Munson Slough would require a 96.9 percent reduction at sources contributing to exceedances of the criteria where the Slough crosses under Springhill Road, and a 91.5 percent reduction at the Slough where it crosses under Capital Circle southwest. However, the fecal coliform standard in Florida has been supplanted by standards developed for *Escherichia coli*. The Florida Department of Environmental Protection (FDEP) has not established a clear path forward into how fecal coliform TMDLs are to be resolved.

TMDLs downstream of Lake Munson

The dissolved oxygen TMDL is an in-stream concentration for BOD₅ of 2.00 mg/L and is allocated as follows. In-stream concentrations must meet the dissolved oxygen criterion and BOD₅ TMDL concentrations will require a 52.9 percent reduction at sources contributing to exceedances.

The un-ionized ammonia impairment will be addressed by reductions in total ammonia. The total ammonia TMDL is an in-stream concentration of 0.32 mg/L and is allocated as follows. The in-stream un-ionized ammonia concentrations must meet the water quality criterion, which requires a 33.3 percent reduction of total ammonia at sources contributing to exceedances. However, the un-ionized ammonia criterion has been replaced with the Total Ammonia Nitrogen (TAN) criterion. Staff is unsure how the TMDL will be implemented but it is probable that the listed waterbodies will eventually be delisted for un-ionized ammonia.

Methods

Surface water samples were collected to determine the health of Munson Slough and met the requirements of the FDEP.

Results

Due to drought, several stations were dry or “puddled” during the sampling period. When viewing tables and figures, the absence of data means there was not enough data collected (due to lack of water or in the case of Station MS2, activities related to the Lake Munson Dam project) to fulfill data requirements. FDEP’s current numeric nutrient data requirements state “that there shall be at least four temporally independent samples per year . . .”. Due to low water conditions, four temporally independent samples per year could not be collected from stations during some years with the latest being in 2019. As of 2010, Station MS3 is no longer sampled.

Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three-year period. The nutrient thresholds and results are found in Tables 1 and 2.

Table 1. FDEP’s total nitrogen criteria for streams applied to Munson Slough. Results in bold signify exceedances of the State criteria.

Munson Slough	Instream Protection Criteria				
	TN (1.03 mg/L)				
Year	MS1	MS2	MS3	MS4	MS5
2006	0.75	1.44	1.32	1.43	-
2007	1.36	1.59	-	-	-
2008	0.89	0.73	-	-	0.87
2009	0.62	0.73	0.74	-	-
2010	1.09	1.35	-	1.35	1.14
2011	0.80	-	-	-	-
2012	0.90	-	-	1.02	-
2013	1.27	-	-		
2014	0.97	1.08	-	1.16	1.08
2015	0.81	1.41	-	1.39	-
2016	-	0.89	-	0.89	-
2017	0.73	-	-	-	-
2018	0.69	0.63	-	0.60	-
2019	-	-	-	-	-

Table2. FDEP’s total phosphorus criteria for streams applied to Munson Slough. Results in bold signify exceedances of the State criteria.

Munson Slough	Instream Protection Criteria				
	TP (0.18 mg/L)				
Year	MS1	MS2	MS3	MS4	MS5
2006	0.16	0.24	0.19	0.22	-
2007	0.21	0.28	-	-	-
2008	0.12	0.25	-	-	0.28
2009	0.11	0.18	0.18	-	-
2010	0.13	0.16	-	0.17	0.18
2011	0.11	-	-	-	-
2012	0.20	-	-	0.17	-
2013	0.17	-	-	-	-
2014	0.14	0.23	-	0.23	0.21
2015	0.11	0.23	-	0.23	-
2016	-	0.19	-	0.18	-
2017	0.09	-	-	-	-
2018	0.11	0.09	-	0.08	-
2019	-	-	-	-	-

The Munson Slough total nitrogen and phosphorus levels exceeded the NNC at all stations during the

period of record. However, recent trends suggest that nutrient levels are dropping in the Slough. The 2017 and 2018 nitrogen and phosphorus levels for station MS1 both met the NNC. Stations MS2 and MS4 met the NNC for both nitrogen and phosphorus in 2018. While nitrogen levels occasionally exceeded TMDL levels in recent years (2017-2018), overall, levels appear to be decreasing. No total nitrogen exceedances were noted in 2019 (Figure 1). Total phosphorus has not exceeded the TMDL limit since 2016 (Figure 2).

Total Ammonia Nitrogen (TAN)

The TAN criterion (0.29 mg/L and based on water temperature and pH) was exceeded (0.57 mg/L) during the 2nd quarter of 2015 at Station MS2. No exceedances were noted from 2016-2019.

Since the Munson Slough watershed is heavily urbanized, and the Slough itself has been significantly altered over the years, there are elevated nutrients in this system for several reasons. Urban runoff tends to have high nutrient loads due to fertilizers, lawn clippings, sediments, animal droppings, sewer overflows, etc. However, improvements in upstream stormwater facilities and Best Management Practices (BMPs) have contributed to lower nutrient levels in Munson Slough.

Escherichia coli

The *E. coli* water quality limit of > 126 in 10% of samples collected over a 30-day period was exceeded at Station MS4 (270/100 mL) during the 4th quarter of 2015. No exceedances were noted in 2016 while Station MS5 (200/100 mL) exceeded the standard during the 3rd quarter of 2017. The June 2018 result at Station MS4 was unexpected. The result, 6,900/100 mL, was extremely unusual since other water quality parameters that could be associated with bacterial contamination (e.g. total suspended solids, biological oxygen demand) appeared normal for this site. Staff expects that it was an abnormal event, either related to wildlife, or

possibly, a sampling or laboratory error. No other *E. coli* exceedances were noted in 2018 or in 2019.

Dissolved Oxygen (DO) and Chlorophyll-a

FDEP's DO criterion shows very few results that did not meet the threshold (Figure 3). However, this does not in any way invalidate the TMDL. Algal blooms represented by chlorophyll-a (Figure 4) can produce large amounts of oxygen during daylight hours via photosynthesis. Conversely, during nighttime hours, respiration occurs and algal blooms remove DO from the water, which may lead to little or no oxygen in the water column. The chlorophyll-a result (503 µg/L) from Station MS2 during the February 2013 sampling event is the highest chlorophyll-a value recorded from any Leon County water quality station.

Biological Oxygen Demand (BOD)

Elevated BOD levels (Figure 5) during some sampling events showed that elevated microbiological activity may be contributing to changes in DO. The microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

Metals

Stations MS1 and MS4 exceeded Class III water quality criteria for lead during the 1st quarter of 2019. Relict anthropogenic sources (e.g., leaded gasoline) are most likely to be the cause of these exceedances.

[Click here for more information on metal levels in Leon County waterbodies.](#)

Conclusions

Based on ongoing sampling, the more recent results suggest that Munson Slough meets the nutrient thresholds for the East Panhandle Region.

Nitrogen levels occasionally exceeded TMDL levels in recent years, but overall, nitrogen levels appear to be decreasing. Total phosphorus has not exceeded the TMDL limit since 2016 and, like phosphorus, appears to be on a downward trend.

While nutrient levels have decreased in recent years, elevated BOD levels during some sampling events suggest that microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

Stations MS1 and MS4 exceeded Class III water quality criteria for lead during the 1st quarter of 2019. Relict anthropogenic sources (e.g., leaded gasoline) are most likely to be the cause of these exceedances.

Since the Munson Slough watershed is heavily urbanized and the Slough itself altered over the years, there are several reasons why the system is degraded. Urban runoff tends to have high nutrient loads due to fertilizers, lawn clippings, sediments, animal droppings, sewer overflows, etc. While the County and the City of Tallahassee have made strides in reducing non-point source pollution with various stormwater facilities and projects in the City and County,, work will need to continue to further improve water quality in the Lake Munson system.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyFL.gov/WaterResources

[Click here to access the results for all water quality stations sampled in 2019.](#)

[Click here for a map of the watershed – Sample Sites MS1, MS2, MS4 and MS5.](#)

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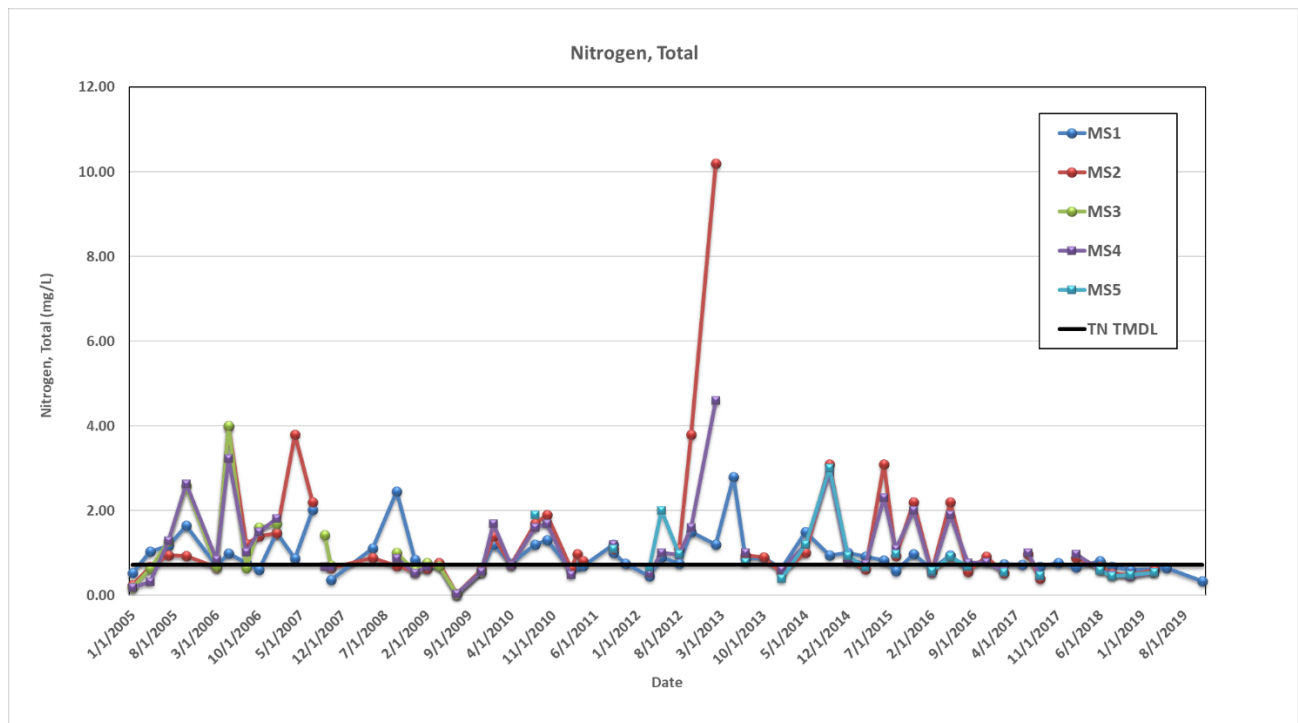


Figure 1. Total nitrogen results for Munson Slough.

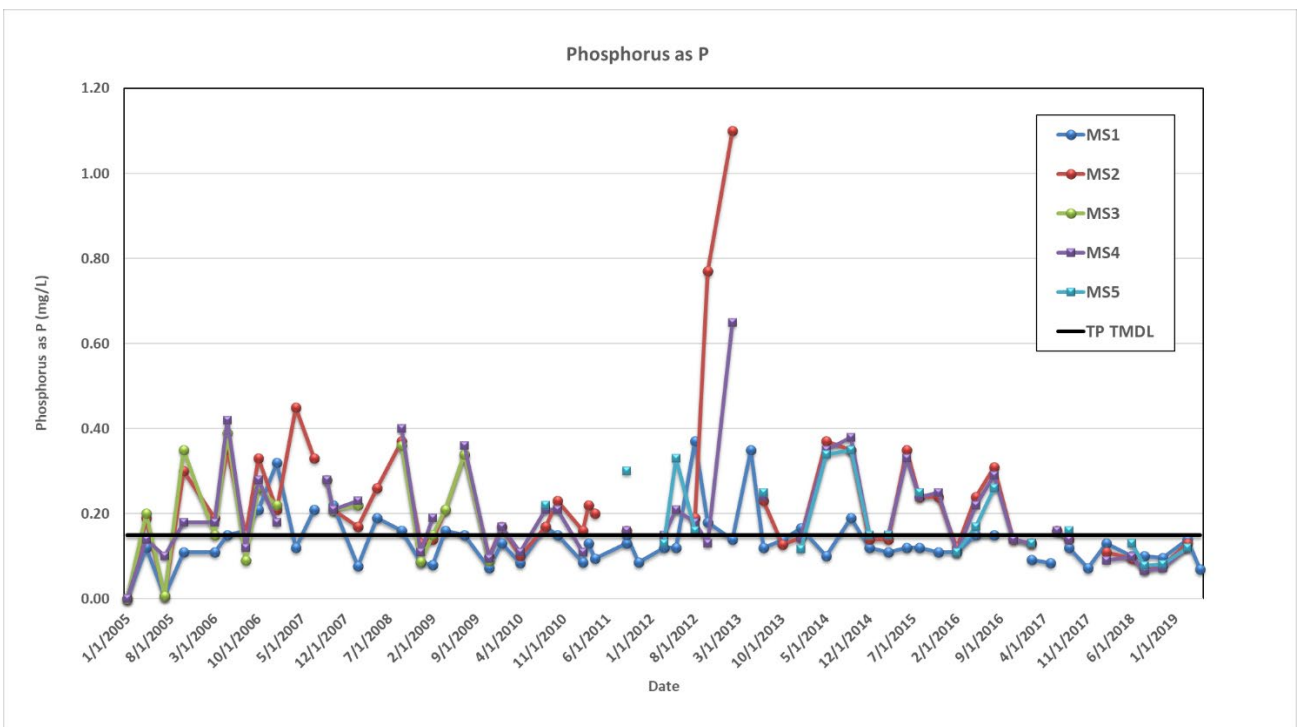


Figure 2. Total phosphorus results for Munson Slough.

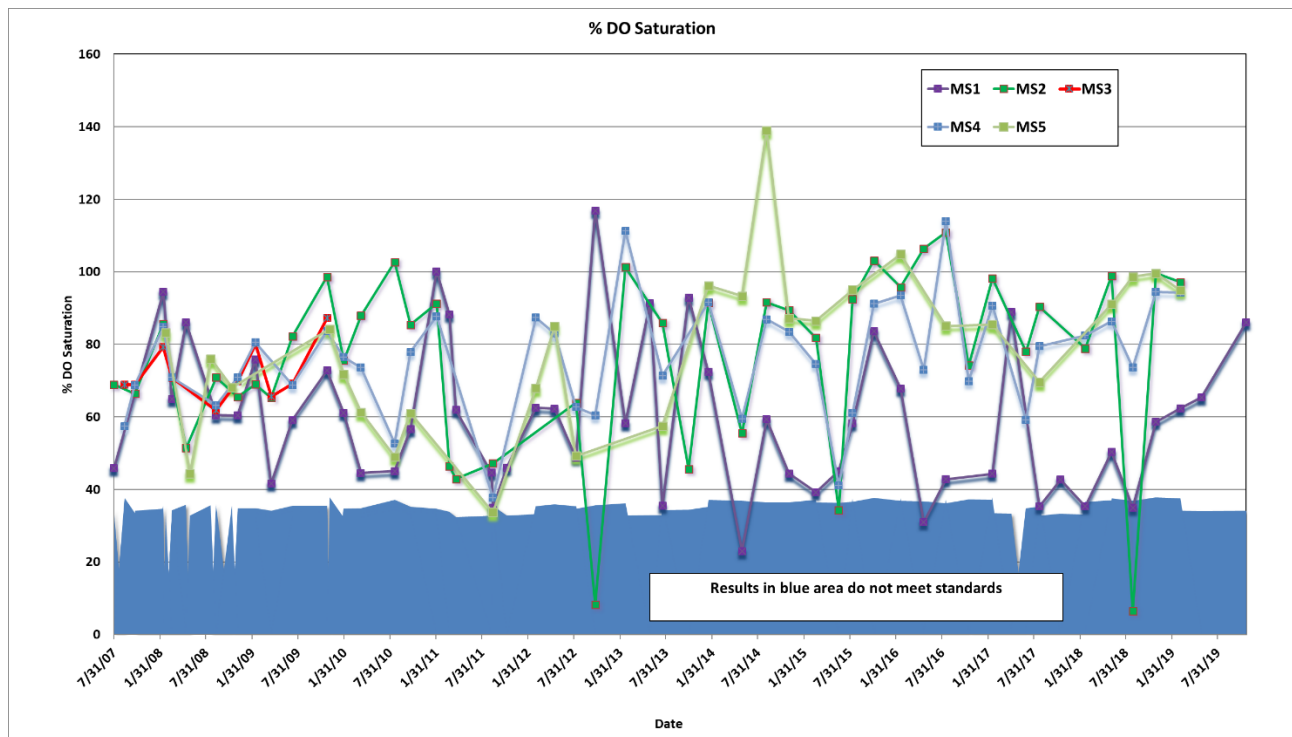


Figure 3. Dissolved Oxygen Percent Saturation results for Munson Slough.

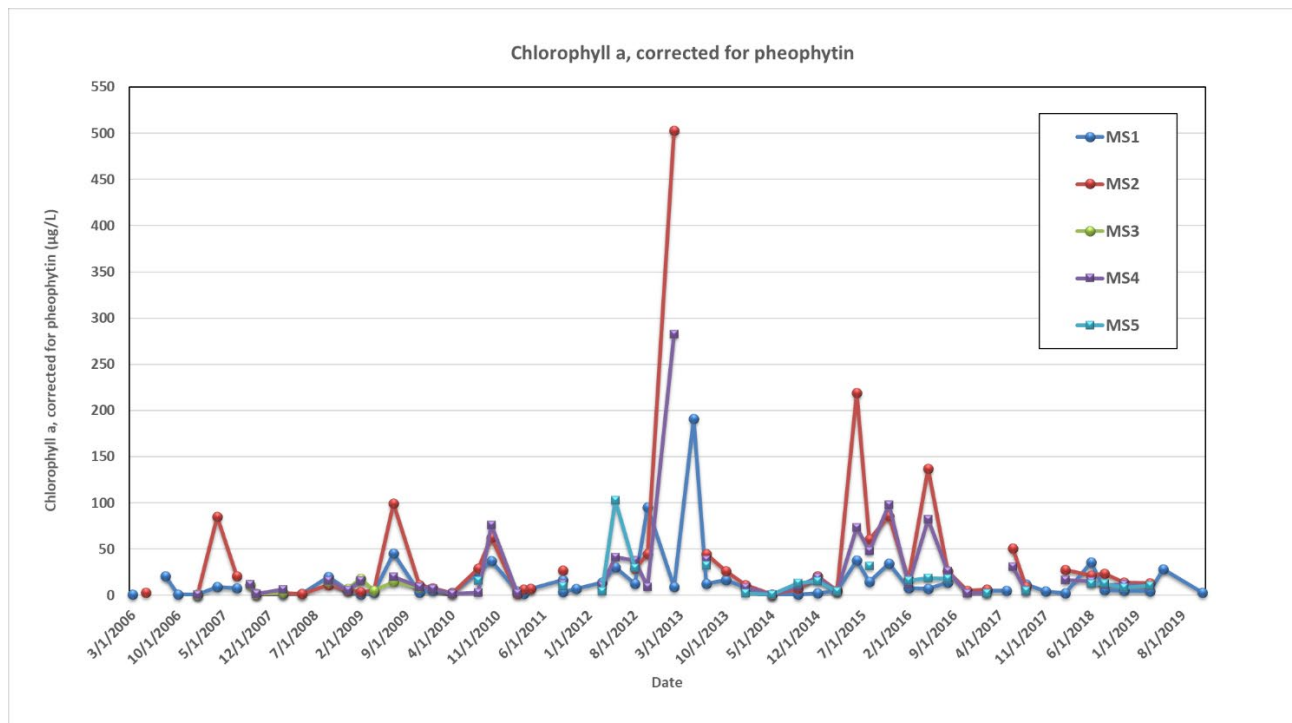


Figure 4. Chlorophyll-a results for Munson Slough.

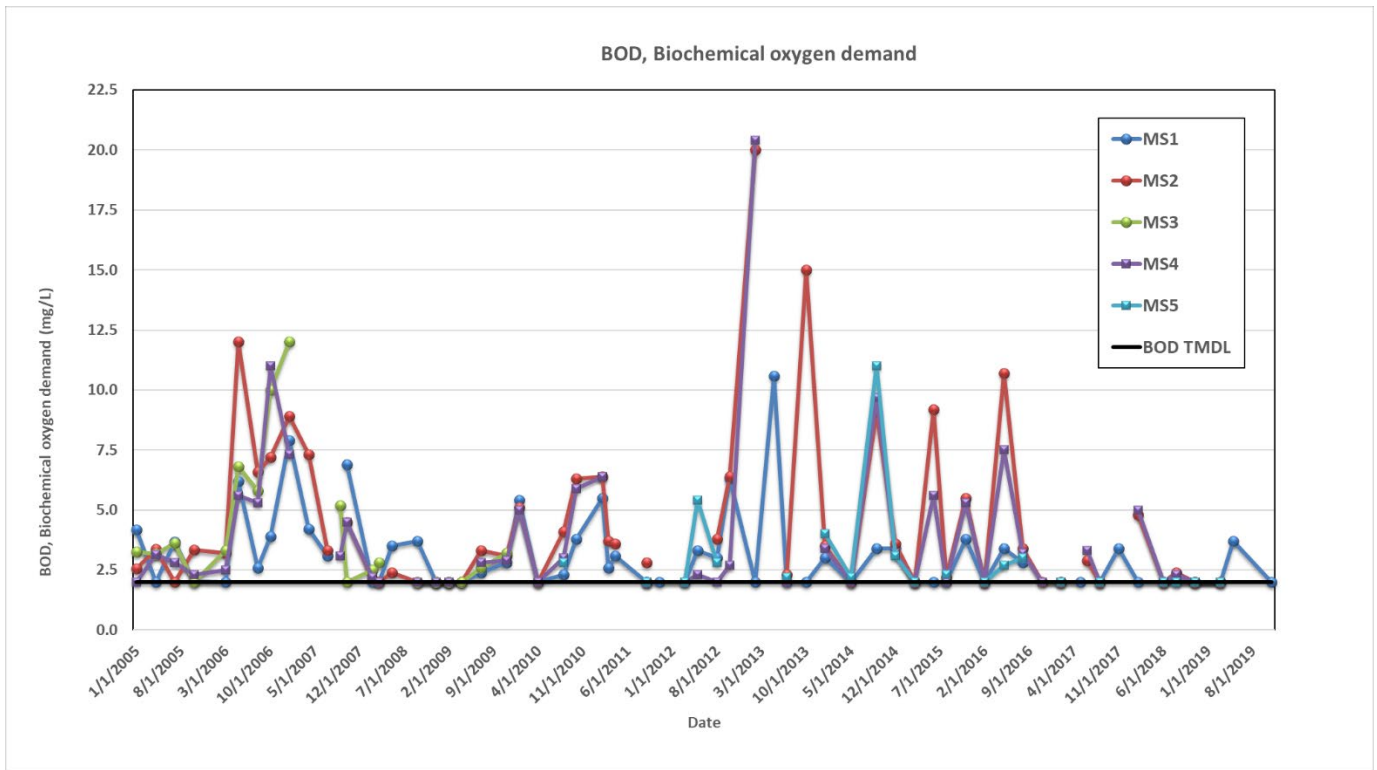


Figure 5. Biological Oxygen Demand results for Munson Slough.