

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
DECEMBER 2013

STAFF REPORT

UNNAMED TRIBUTARY TO PLATTE LAKE
DISSOLVED OXYGEN STUDY
AUGUST 2013

INTRODUCTION

Staff of the Water Resources Division (WRD), Surface Water Assessment Section (SWAS), monitored in-stream dissolved oxygen (DO) on an unnamed tributary to Platte Lake (Figure 1) in Benzie County during August 2013. The unnamed tributary (Assessment Unit Identification [AUID] number 040601040206-02 [west branch]), is currently listed on the Section 303(d) list as not attaining the coldwater fishery designated use due to DO, and the other indigenous aquatic life and wildlife designated use due to DO, bacterial slimes, and organic enrichment.

The primary purpose of the monitoring was to collect site-specific concentration data during the critical season to see if the 7 milligrams per liter (mg/l) minimum DO water quality standard (WQS) was met.

Grab (instantaneous) sampling data were collected. Several grab samples were also taken at a reference reach (AUID 040601040206-01) to the northeast of the impaired tributary. This unimpacted reach (east branch) is not on the Section 303(d) list and, because of its proximity to the impaired reach, is a good control site for comparison purposes.



Figure 1. Sampling sites for the unnamed tributary to Platte Lake (note: the impaired reach does not show up on the NHD layer, but does exist).

SUMMARY - IMPAIRED WEST BRANCH* UNNAMED TRIBUTARY TO PLATTE LAKE (Appendix A)

1. The DO ranged from 11.0 mg/l at 11.0°C to 11.3 mg/l at 11.7°C on August 22, 2013 (a.m.).
2. The DO ranged from 6.98 mg/l at 11.9°C to 10.5 mg/l at 12.6°C on August 22, 2013 (p.m.).
3. The DO ranged from 6.3 mg/l at 10.9°C to 10.2 mg/l at 10.7 °C on August 23, 2013 (a.m.).
4. One grab sample violated the 7 mg/l minimum DO WQS on the west branch during this study. A duplicate sample, taken at the same spot that violated the WQS, was consistent with the original result.

*The control site (east branch) had no violations of the 7 mg/l minimum DO WQS.

BACKGROUND AND RECENT WATER QUALITY STUDIES

In February 2003, SWAS staff responded to a water quality complaint filed in the WRD's Cadillac District Office. The complaint noted strong odors and a color change in the western portion of the stream (Smith, 2003). The stream's headwaters consist of an east and west branch that arise from groundwater springs erupting from the northern sides of a high moraine ridge. These two branches converge just downstream of US-31, where eventually it flows into the southeast corner of Platte Lake. The unnamed tributary evaluated in this survey is a designated coldwater stream in the North Central Hardwood Forest ecoregion.

The 2003 study found that the unnamed tributary (west branch) had an orange coloring. The orange color was evident downstream to US-31. According to Brian Meyers (formerly of the Cadillac District Office), the expected source of the west branch contamination was a large quantity of improperly disposed fruit waste at the top of the moraine ridge. These wastes apparently had leached down and contaminated the venting groundwater with high concentrations of biochemical oxygen demand (BOD). No visual evidence of fruit waste-related contamination was observed at any of the sampling stations located on the east branch of the unnamed tributary (unimpacted reach).

Several samples taken in February 2003 showed high levels of BOD in the west branch of the stream (greater than 140 mg/l), while the east branch contained normal background levels. BOD represents the level of organic matter in a stream that consumes DO during decomposition, thus creating an oxygen demand in the stream (Smith, 2003). During the warm summer months with low flow situations, BOD-related oxygen demand can decrease in-stream DO and affect aquatic life.

A model was developed according to Procedure 80 (MDEQ, 1995b), to simulate average summer conditions starting from the point where the east branch and west branch meet, and then continuing downstream in 0.2 mile increments to the point where the unnamed tributary discharges to Platte Lake. The results of the model showed that the DO concentration is above the 7.0 mg/l minimum DO WQS for the first 0.2 miles. From that point until the stream reaches Platte Lake, the DO concentration is predicted to steadily drop and therefore not meet WQS.

Fishbeck, Thompson, Carr & Huber, Inc. (2012) submitted an annual groundwater and surface water monitoring report, which is required to comply with Section 6.4.c of the Consent Judgment in Case No. 08-8279-CE, filed on July 18, 2008. The report summarizes groundwater and

surface water data in the impaired reach and unimpacted reach. Groundwater samples were collected and analyzed for the following parameters: alkalinity, BOD, Chemical Oxygen Demand, Chloride, Nitrogen series (ammonia, nitrate, nitrite), Phosphorus (total), sulfate, Total metals (arsenic, calcium, iron, lead, magnesium, manganese, and sodium) and Total Organic Carbon. Biological monitoring was also conducted using the SWAS Procedure WRD-SWAS-051 (MDEQ, 1990).

The Fishbeck, Thompson, Carr & Huber, Inc. report indicates that while iron concentrations in the groundwater remain above the drinking water criteria (Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended) at the site, decreases have been seen in groundwater and surface water for BOD, Chemical Oxygen Demand, iron, and manganese since the original disposal a decade ago. The report also indicates improving habitat conditions.

SWAS staff conducted the 2013 study, which consisted of grab sampling for DO at several sites along the impaired reach. Monitoring was also conducted along the unimpacted reach. The impaired reach was still visibly colored at several of the impaired sites; a decade after the improper disposal. For example, the reach had a noticeable odor and the sediment was coated with an orange layer of bacterial slime (Figure 2) similar to findings in 2003. No color or odor was observed in the unimpacted reach in the 2013 study.



Figure 2. Impaired reach on an unnamed tributary to Platte Lake.

FIELD METHODS, OBSERVATIONS, AND RESULTS

A YSI 600 XLM sonde was used for the grab sampling. Monitoring was performed using the SWAS Procedure WRD-SWAS-015 (MDEQ, 1995a). Sampling was conducted on August 22 and 23, 2013. The sonde was calibrated in the field on the morning of August 22, 2013. During precalibration, the sonde had a DO concentration of 8.41 mg/l with a DO gain of 1.056. During postcalibration the sonde had a DO concentration of 9.45 mg/l and a DO gain of 0.9579. All calibration parameters were within the manufacturer's guidelines. All of the calibration samples were in the acceptable range.

All DO data are in Appendix A. On August 23, 2013, some samples were below the 7 mg/l minimum DO WQS. All samples collected from the unimpacted stream were above the 7 mg/l minimum DO WQS.

In addition to DO grab sampling, two ammonia samples were collected from the impaired reach, along with four BOD samples. While ammonia was detected in both samples, BOD was non-detect in all four samples. Although the ammonia level increased upstream towards the disposal site, no WQS violations were found.

CONCLUSION

The improper fruit waste disposal occurred over a decade ago and although we have seen some improvement in the BOD levels, the DO level is still not always attaining the 7 mg/l minimum DO WQS. In addition, the color and odor still remain a problem.

The unnamed tributary to Platte Lake is currently listed on the Section 303(d) list as not attaining the coldwater fishery designated use due to DO and also for not attaining the other indigenous aquatic life and wildlife designated use due to DO, bacterial slimes, and organic enrichment. Biological assessment results from 2013 sampling will be summarized in a separate report.

REFERENCES

- Fishbeck, Thompson, Carr and Huber, Inc. 2012. Groundwater and Surface Water Monitoring Report, November 2012.
- MDEQ. 1990. SWAS Procedure WRD-SWAS-051 - Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers, April 24, 1990. Revised June 1991, August 1996, January 1997, May 2002, and December 2008.
- MDEQ. 1995a. Procedure WRD-SWAS-015. Operation of YSI Model 56 Continuous Dissolved Oxygen Meter. July 11, 1995.
- MDEQ, 1995b. Great Lakes Environmental Assessment Section Procedure 80. Guidance on Water Quality-Based Effluent Limit Recommendations for Oxygen Demanding Substances. Revised August 14, 1997.
- Smith, J. 2003. A Water Quality Survey of an Unnamed Tributary of the Platte Lake, Benzie County (Report number MI/DEQ/WD-03/053, February 2003.

Appendix A.

Date	DO (mg/l)	DO Sat	Time	Temp	Cond	pH	Weather	Latitude	Longitude	Description
8/22/2013	11.53	104.6	8:12	10.97	0.429	7.91	cloudy	44.665	86.0516	Reference Reach on East Branch by US-31
8/22/2013	11.27	104	8:22	11.27	0.47	7.79	cloudy	44.6637	86.0541	By Site 6
8/22/2013	10.36	94.1	8:52	11	0.441	7.57	cloudy	44.6629	86.0545	By Site 8
8/22/2013	11.01	99.7	9:05	10.78	0.48	7.63	cloudy	44.6627	86.0543	By Site 12
8/22/2013	10.53	99.1	3:52	12.57	0.412	8.04	sun/pt cloudy	44.665	86.0516	Reference Reach on East Branch by US-31
8/22/2013	9.68	90.8	4:01	12.39	0.468	7.86	sun/pt cloudy	44.6637	86.0541	By Site 6
8/22/2013	9.09	83.5	4:08	11.61	0.479	7.61	sun/pt cloudy	44.6629	86.0545	By Site 8
8/22/2013	9.327	87.9	4:12	11.43		7.57	sun/pt cloudy	44.6627	86.0543	By Site 12
8/22/2013	9.13	83.7	4:17	11.39	0.459	7.56	sun/pt cloudy	44.6625	86.0543	New site upstream of Site 12
8/22/2013	6.98	66.1	4:22	11.94	0.492	7.45	sun/pt cloudy	44.6626	86.0544	New site on other branch from Site 12--close to Site 9
8/22/2013	8.47	79	4:30	12.2	0.491	7.52	sun/pt cloudy	44.6628	86.0546	New site futher upstream from previous--close to Site 9
8/23/2013	11.27	99.5	8:45	9.72	0.413	7.97	pt cloudy	44.665	86.0516	Reference Reach on East Branch by US-31
8/23/2013	10.19	91.9	8:56	10.73	0.468	7.8	pt cloudy	44.6637	86.0541	By Site 6
8/23/2013	9.39	83.8	9:07	10.25	0.482	7.6	pt cloudy	44.66298	86.0545	By Site 8
8/23/2013	9.79	86.8	9:11	10	0.473	7.56	pt cloudy	44.6627	86.0543	By Site 12
8/23/2013	7.16	65	9:19	10.93	0.493	7.4	pt cloudy	44.6626	86.0544	New site upstream on other branch from Site 12
8/23/2013	6.32	57.3	9:23	10.91	0.492	7.36	pt cloudy	44.6627	86.0546	Other side of reach--close to Site 9

Note: 0.71 inches of rain fell from 11:00 pm on August 21, 2013 (11:00 p.m.) to August 22, 2013 (early morning).