Report on Spring Lake
Pursuant to ACO-SW08-001
December 1, 2008

Introduction

In June of 2005, the Michigan Department of Environmental Quality (MDEQ) issued a Certificate of Approval to the Spring Lake – Lake Board to treat Spring Lake with aluminum sulfate (alum) to suppress internal phosphorus loading in the lake. The alum treatment was conducted from mid-October to mid-November, 2005. On November 2 and 3 of 2005, approximately 46,000 gallons of liquid aluminum sulfate (alum) was accidently spilled into Spring Lake as alum was being transferred from on-shore tanker trucks to an in-lake holding barge. While the alum was successfully transferred from the tanker trucks to the holding barge, the spill apparently occurred one truckload at a time as the result of the valves on the holding barge discharge hoses being left open.

As a result of the unauthorized spill, an Administrative Consent Order (ACO-SW08-001) was entered in January of 2008 that stipulated that the Spring Lake – Lake Board implement a Work Plan (Appendix A). In accordance with said Administrative Consent Order, annual reports are due to MDEQ on December 1 of each year beginning in 2008 and ending in 2011, that include the following:

- An introduction section that includes the description and details of the incident that includes the date, circumstances, and extent of the spill.
- A method section that includes details and a description of the sampling and techniques used, the USEPA sampling method numbers, the laboratory analysis and credentials of the laboratory used.
- A result section that contains an organized summary of tables and graphs, if applicable, the collected data and a narrative statement summarizing the data.
- A discussion and conclusion section that includes a comparison of reference to non-reference sites, and arguments for or against the need for site remediation.

Methods

Sediment and water samples were collected during spring turnover at three locations in Spring Lake (Figure 1). Site 1 is located at Prospect Point and serves as a reference site; Sites 2 and 3 are located in the vicinity of the alum release.

Temperature was measured in a vertical profile using a YSI Model 550A probe. Water samples were collected from the surface, mid-depth, and bottom at Sites 1 and 3, and from the surface and bottom at Site 2 with a VanDorn bottle and analyzed for dissolved oxygen content, pH, total aluminum, and dissolved aluminum. Dissolved oxygen samples were fixed in the field and then transported to Progressive AE for analysis using the modified Winkler method (Standard Methods Procedure 4500-O C). pH was measured in the field using a YSI EcoSense pH10 meter. Total aluminum and dissolved aluminum samples were placed on ice and transported to Trace Analytical for analysis using EPA methods 6020 and 6010B, respectively.

Sediment samples were collected using a petite Ponar sampler and analyzed by Trace Analytical for percent total solids and aluminum using ASTM D2974-87 and EPA method 6010B, respectively.

Sediment from each of the three locations was used in *Chironomus dilutus (tentans)* and *Hyalella azteca* ten-day acute whole sediment toxicity tests, analyzed by Great Lakes Environmental Center using methods described in Appendix B.

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Laboratories used included Trace Analytical Laboratories, Inc., 2241 Black Creek Road, Muskegon, Michigan; and Great Lakes Environmental Center (GLEC), 739 Hastings Street, Traverse City, Michigan. Trace Analytical's certifications include National Environmental Laboratory Accreditation Program, and Michigan Department of Environmental Quality for microbiology and inorganic chemistry. GLEC participates annually in EPA's Discharge Monitoring Report Quality Assurance Study Program for Whole Effluent Toxicity.

Results

Water testing results are included in Table 1; results of sediment solids and aluminum content are included in Table 2; sediment toxicity results are included in Appendix B. At the time of sampling, Spring Lake water temperatures ranged from 50 to 57 degrees Fahrenheit. pH ranged from 8.2 to 8.9. Total aluminum in the water column ranged from 75 to 160 parts per billion. Dissolved aluminum levels were all below the detection limit of 50 parts per billion. Sediment solids content was 18 percent at the reference site (Site 1) and 70 percent or greater at the two spill sites. Total aluminum content was 10,000 parts per million (ppm) at the reference site compared with 420 and 790 ppm for the spill sites. For the spill sites and the reference site, there was no statistically significant reduction in growth of *Chironomus dilutus* or *Hyalella azteca* compared with the laboratory control, and no statistically significant reduction in survival of *Chironomus dilutus*. However, there was a reduction in survival of *Hyalella azteca* at spill site 2 compared to the laboratory control.

Discussion and Conclusion

Dissolved oxygen content and pH measurements at all sites and depths in Spring Lake were within the State of Michigan Water Quality Standards. Dissolved aluminum concentrations at both the reference site and the spill sites were below 50 µg/L, a level above which is potential toxic to aquatic life (Cooke et al. 1993). None of the total aluminum results from the Spring Lake water samples exceeded the criteria maximum concentration of 750 parts per billion (ppb; USEPA 1988). Two samples from the reference site and one sample from each of the spill sites exceeded the criterion continuous concentration of 87 ppb (USEPA 1988). Of the twelve sediment toxicity tests for survival and growth of *Chironomus dilutus* and *Hyalella azteca* from the two spill sites and reference site, only survival of *Hyalella azteca* was reduced at site 2; the other eleven tests showed no reduction. Since dissolved aluminum levels are low, total aluminum levels in the reference site are similar to or greater than levels at the two spill sites, and toxicity results indicate minimal impact, remediation is not necessary.

References

Cooke, G. D., E. B. Welch, S. A. Peterson, and P. R. Newroth. 1993. Restoration and Management of Lakes and Reservoirs, 2nd ed., Lewis Publishers.

USEPA. 1988. Ambient Water Quality Criteria for Aluminum - 1988. Office of Water, Regulations and Standards Division, Washington, D.C. 20460. EPA 440/5-8-008.

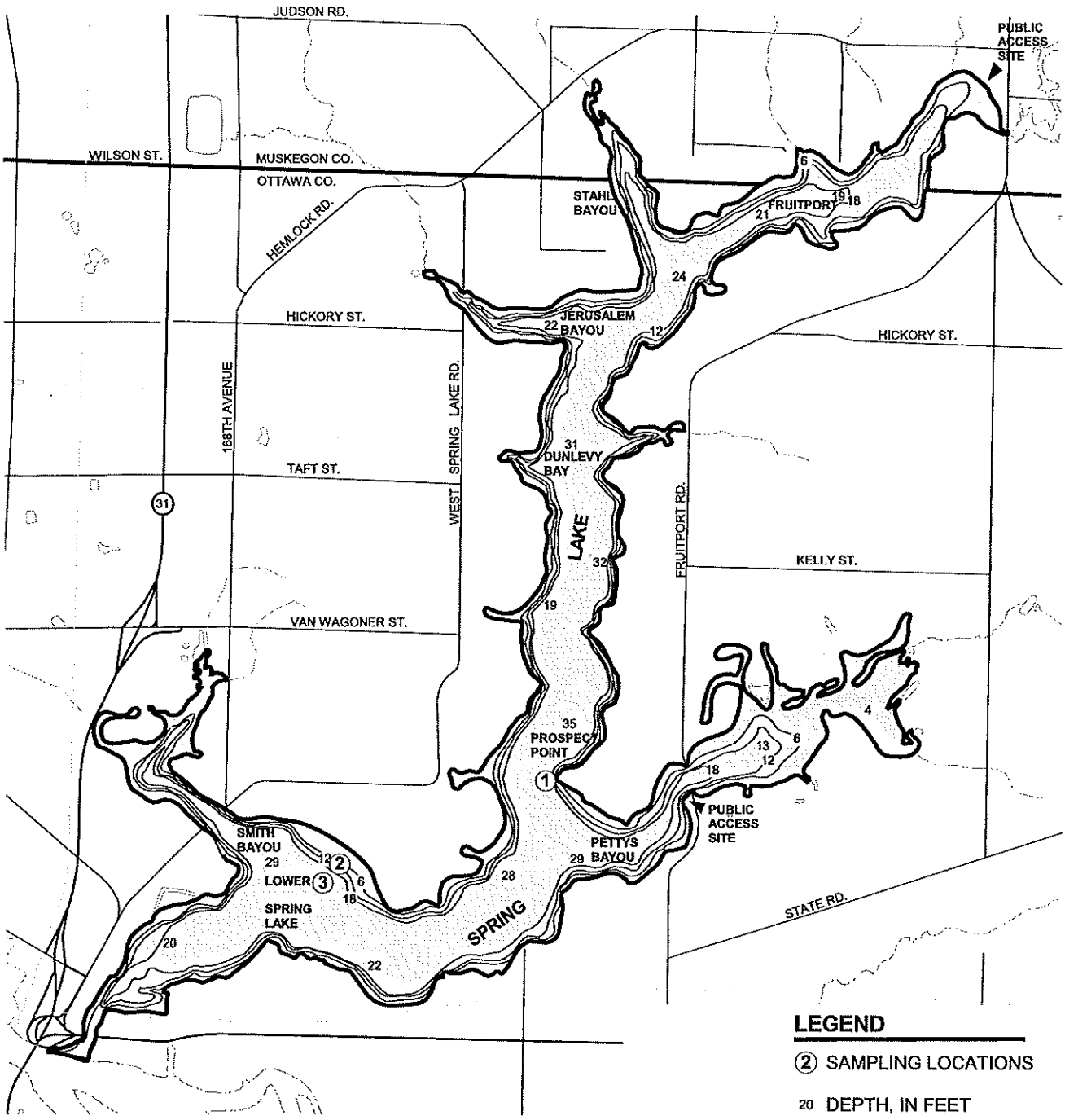

Figure 1. Sampling location map.

TABLE 1
SPRING LAKE WATER SAMPLING DATA

Date	Station	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	pH (S.U.)[2]	Total Aluminum (µg/L)[3]	Dissolved Aluminum (µg/L)
28-Apr-08	1	1	57	12.7	8.9	82	<50
28-Apr-08	1	16	54	10.2	8.5	98	<50
28-Apr-08	1	32	50	8.7	8.2	160	<50
28-Apr-08	2	1	56	13.0	8.9	91	<50
28-Apr-08	2	3	55	11.7	8.8	77	<50
28-Apr-08	3	1	56	12.4	8.8	79	<50
28-Apr-08	3	7	55	12.0	8.8	75	<50
28-Apr-08	3	14	55	11.8	8.7	94	<50

TABLE 2
SPRING LAKE SEDIMENT SAMPLING DATA

Date	Station	Percent Total Solids by Weight	Total Aluminum (mg/Kg)[4]
28-Apr-08	1	18%	10,000
28-Apr-08	2	72%	420
28-Apr-08	3	70%	790

1 mg/L = milligrams per liter = parts per million.
2 S.U. = Standard units.
3 µg/L = micrograms per liter = parts per billion.
4 mg/kg = milligrams per kilogram = parts per million

Appendix A

Work Plan