

MUSKEGON COUNTY  
MS4 NPDES APPLICATION

Total Maximum Daily Load Implementation Plan  
Bear Lake - Phosphorus

I. Procedure to identify and prioritize BMPs being implemented or to be implemented during the permit cycle to achieve TMDL load reductions

BMPs that address phosphorus for Bear Lake were identified using guidance from both the Bear Lake Watershed Management Plan and the Phosphorus TDML Document issued by MDEQ. Causes and sources of phosphorus inputs were identified within each of these respective documents and subsequently prioritized. Percent phosphorus load contribution within the TMDL document was used to prioritize the causes and sources; the highest contributing sources received the highest priority while minor contributors receive less priority. Finally, appropriate BMPs were assigned to each cause using guidance from the Low Impact Development (LID) Manual for Michigan.

Using this approach to identify and prioritize BMPs for phosphorus reduction within the Bear Lake Watershed ensures that the largest contributing factors of phosphorus to the overall system will receive the highest priority.

The Bear Lake Watershed Management Plan is available at:

[http://www.michigan.gov/documents/deq/ess-nps-wmp-bear-creek-lake-1\\_210617\\_7.pdf](http://www.michigan.gov/documents/deq/ess-nps-wmp-bear-creek-lake-1_210617_7.pdf)

II. List of prioritized BMPs being implemented or to be implemented during the permit cycle to achieve TMDL reductions

Multiple initiatives in the Bear Lake Watershed have been making progress toward achieving phosphorus load reductions. In 2006, an ordinance to ban phosphorus in fertilizer was adopted countywide. The adoption of the ordinance will reduce the amount of excess phosphorus entering Bear Lake and the Supstream watershed by means of storm water runoff. In 2014, Delta Institute was awarded a GLRI grant to reduce sediment and nutrients within the Bear Lake Watershed. This project focuses on installing agricultural BMPs, urban BMPs, shoreline restoration, wetland restoration, and conducting public education; with the goal of reducing pollutant loads to a level at which they no longer degrade state designated uses. In 2015, The Great Lakes Commission was awarded a GLRI grant to remove phosphorus laden sediment, restore natural water flow, and create wetlands in Bear Creek; a tributary to Bear Lake. The project will be focused on a 36-acre wetland complex commonly known as the "Celery Flats."

BMPs that MS4 communities conduct result in nutrient load reductions including: street sweeping, catch basin cleaning, and other pollution prevention and good housekeeping practices. Dry weather screening is

conducted once during the permit cycle, which helps in identifying and eliminating nutrient rich illicit discharges.

The Muskegon Area Storm Water Committee has also developed a list of prioritized BMPs that have been, and will be implemented to help achieve TMDL phosphorus load reductions (Table 1). The BMPs listed in Table 1 will be implemented by MS4 communities, local landowners, and other stakeholder groups with the goal of meeting the phosphorus TMDL and restoring water quality in Bear Lake.

### **III. Monitoring plan to assess the effectiveness of BMPs being implemented or to be implemented during the permit cycle to achieve TMDL load reductions**

Multiple ongoing efforts help monitor the effectiveness of BMPs in the Bear Lake Watershed. They include:

#### Dry weather Monitoring- MS4 Permit Holders

Dry weather screening of outfalls has been occurring as part of the Illicit Discharge Elimination Program (IDEP).

#### Water Quality Monitoring-Bear Lake Nutrient Study (GVSU-AWRI, Cadmus)

An investigation of Bear Lake and its watershed was conducted to monitor the loading of nutrients and TSS and fluctuations in hydrology. The investigation examined the external loading of nutrients from four tributaries to Bear Lake. Limnological and sediment chemistry data were collected to examine internal nutrient loading. Finally, land cover and topographic information were analyzed to determine their influence on water quality. The data from this project was used to develop the phosphorus TMDL for Bear Lake.

#### Bear Lake Sediment Study (GVSU-AWRI)

An investigation of internal phosphorus loading using sediment core sampling at four locations. Report: [https://www.gvsu.edu/cms4/asset/DFC9A03B-95B4-19D5F96AB46C60F3F345/final\\_report\\_awri.pdf](https://www.gvsu.edu/cms4/asset/DFC9A03B-95B4-19D5F96AB46C60F3F345/final_report_awri.pdf)

#### Muskegon Lake AOC Habitat Restoration Initiative

GVSU-AWRI will be monitoring the effectiveness of the projects ability to remove phosphorus-laden sediments

Table 1. BMP recommendations to reduce phosphorus nutrient loading from Bear Lake. Listed by priority of source and cause in descending order

Pollutant of Concern	Source of Pollution (by priority)	Cause of Pollution (by priority)	Recommended BMPs
Phosphorous	1. Urban/Residential	1. Impervious surfaces	LID practices, Bioretention, Pervious pavement
		2. Poor storm water management practices	Site plan review, Promote native vegetation, Bioretention, Porous pavement, Rain gardens, LID, etc.
		3. Improper use of fertilizer	Enforce county wide phosphorous ban
		4. Lack of riparian buffers	Zoning ordinances, Riparian overlays
		5. Construction sites	Implement proper SESC measures
	2. Agricultural	1. Lack of maintenance on drain network	Schedules ditch maintenance
		2. Lack of buffer/setbacks	Plant buffer/filter strips
		3. Improper nutrient application	Development of Comprehensive Nutrient Management Plans (CNMP)
	3. Animal Waste	1. Uncontrolled access	Livestock exclusion, Controlled access
		2. Lack of buffer/setbacks	Plant buffer/filter strips
	4. Poorly Maintained Sanitation Systems	1. Lack of septic system maintenance	Repair or replace system, Identify illicit connections
		2. Aging sanitary sewer systems	Promote regular maintenance
	5. Streambanks	1. Altered morphology and hydrology	LID for storm water management, Buffer/filter strips
		2. Removal of vegetation	Riparian restoration