

TMDL Implementation Plan for *Escherichia coli* (*E. coli*)

Eaton County, MI

**National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System
(MS4) Permit No. MI0059986**



Submittal Date: July 2019

Summary Table of TMDL sampling plan and locations:

Drain Name	TMDL	Latitude	Longitude
Bollman-Damon Drain	<i>E. coli</i>	42.760774	-84.627383
Carrier Creek	Macro-invertebrates	42.7596	-84.6543
Clements-Underhill Drain	<i>E. coli</i>	42.707737	-84.615898
Hunter and Branches Drain	<i>E. coli</i>	42.689779	-84.630865
Keller Drain	<i>E. coli</i>	42.683384	-84.623962
Watson & Watson Drain	<i>E. coli</i>	42.756419	-84.640317

Carrier Creek includes a drain maintenance inspection from I-496 crossing, north to confluence with the Grand River. This will be completed by the end of 2021.

I. Introduction

The *Escherichia coli* (*E. coli*) Total Maximum Daily Load (TMDL) has been established for the following surface water bodies in Eaton County:

- Grand River – Sections as identified in the Michigan Department of Environment, Great Lakes, and Energy's (EGLE's) ***TMDL for E. coli in Portions of the Red Cedar River and Grand River Watersheds; Including Sycamore, Sullivan, Squaw, and Doan Creeks, August 2012.***

The affected designated use is for “Partial and total body contact recreation” at these locations. The impaired designated uses addressed by this TMDL are total and partial body contact recreation. The designated use rule (R 323.1100 of the Part 4 Rules, Water Quality Standards (WQS), promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended) states that this water body is to be protected for total body contact recreation from May 1st to October 31st and year-round for partial body contact recreation. The target levels for these designated uses are the ambient *E. coli* standards established in Rule 62 of the WQS as follows:

R 323.1062 Microorganisms.

Rule 62. (1) All waters of the state protected for total body contact recreation shall not contain more than 130 CFU/100 mL of E. coli, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at 2 representative locations within a defined sampling area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 CFU/100 mL of E. coli. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

Rule 62. (2) All surface waters of the state protected for partial body contact recreation shall not contain more than a maximum of 1,000 CFU/100 mL of E. coli. Compliance shall be based on the geometric mean of 3 or more samples, taken during the same sampling event, at representative locations within a defined sampling area.

The target for sanitary wastewater discharges is:

Rule 62. (3) Discharges containing treated or untreated human sewage shall not contain more than 200 fecal coliform bacteria per 100 milliliters, based on the geometric mean of all of 5 or more samples taken over a 30-day period, nor more than 400 fecal coliform bacteria per 100 milliliters, based on the geometric mean of all of 3 or more samples taken during any period of discharge not to exceed 7 days. Other indicators of adequate disinfection may be utilized where approved by the department.

The targets for this TMDL are 300 *E. coli* per 100 milliliters (mL) expressed as a daily maximum load and concentration from May 1st to October 31st (i.e., daily target) and 130 *E. coli* per 100 mL as a 30-day geometric mean, expressed as a concentration (i.e., monthly target). An additional target is the partial body contact standard of 1,000 *E. coli* per 100 mL as a daily maximum concentration year-round. Achievement of the total body contact daily maximum target is expected to result in attainment of the partial body contact standard.

II. Procedure for identifying and prioritizing Best Management Practices (BMPs) currently being implemented for the TMDL in the Urbanized Area of Lansing within the jurisdictional boundary of Eaton County. (Q.86)

The procedure to be implemented for identifying and prioritizing BMPs that have an impact on the *E. coli* TMDL in Eaton County is as follows:

1. Eaton County will continue its involvement with the Greater Lansing Regional Committee (GLRC) for Stormwater Management and cooperate with those developing a collaborative plan to address the regional issue of the Grand River's *E. coli* TMDL.
2. Eaton County will also work with local stakeholder groups who are involved in the ongoing Grand River Watershed Management Plan and its associated work to identify and implement economically feasible BMPs.
3. Eaton County will review the existing *E. coli* TMDL adopted by the EGLE in August of 2012 for recommended BMPs.
4. The previously mentioned TMDL document will also be used in the prioritization of BMPs addressing the *E. coli* TMDL on various sub-watersheds or sections of the Grand River **in Eaton County's Urbanized Area.**
5. **Prioritization of Drains** for potential monitoring will be based on the drain's location within the Urbanized Area, location within and/or draining to the Grand River TMDL watershed boundary, land use, and drainage area. Looking at these factors, the five drains for *E. coli* monitoring were selected based off their location, their drainage area and drain length, number of drains that drain to it, and their high priority land use (i.e. residential, commercial, and row crops).
6. Eaton County will cooperate with the GLRC and others, as necessary, to revise this TMDL procedure to assure it can be realistically implemented. This will be done at least once per permit cycle.
7. Once a BMP is implemented, it will be reviewed (this is not to be interpreted as an inspection) at least once per permit cycle to determine its effectiveness. If it is an administrative BMP such as a procedure, policy or operation standard, then updates or revisions will be implemented as necessary.
8. Criteria for review, updates, or revisions of a BMP will be completed during the permit cycle.
9. Any changes in identification of BMPs or prioritization of BMPs will be reported in a progress report during a permit cycle.

III. List of prioritized BMPs currently being implemented during the permit cycle to make progress towards achieving a load reduction. (Q.87)

There are several best management practices available to reduce *E. coli* in waterways and surface waters of the state. They can generally be divided into the following two groups: source control and pre-storm pipe drainage reduction.

As its name implies, strategies based on **source control** have the goal of reducing pollution at the source. They can involve both structural and non-structural controls. Many times, they can be more cost-effective than storm water runoff volume reduction strategies. Examples of source control practices implemented by Eaton County in order to reduce *E. coli* are the following listed in Table 1 below:

Table 1. Existing Source Control Practices

BMPs or Strategies currently in place	Tasks	Targeted TMDL
Illicit Discharge Elimination Program (IDEP)	Outfall sampling, source tracking, dry weather screening, video/TV of drains, smoke/dye testing	<i>E. coli</i>
Runoff volume reduction	Use of green infrastructure to transport stormwater (e.g., bioswales, porous paving, rain gardens, infiltration basins)	<i>E. coli</i>
Pet waste management	Educational programs, pet waste disposal products at county parks	<i>E. coli</i>
Storm sewer maintenance/cleaning	Catch basin cleaning, street sweeping, roadkill pickup	<i>E. coli</i>
Low Impact Development (LID)	LID ordinances, practices for new developments	<i>E. coli</i>
Wildlife/waterfowl management	Population control (especially geese and ducks) at county parks with lakes or riverfront	<i>E. coli</i>

Table 1 is organized in order of high to low priority. If priorities change during the permit cycle, the table will be revised and an updated table with new priority rankings will be submitted to the EGLE with the next scheduled progress report following the change.

Volume reduction BMPs or Strategies are practices that primarily use structural controls to reduce pollution. Methods include intercepting stormwater runoff and using physical or biological BMPs to improve pollutant removal rates, including *E. coli*. Removal rates may vary greatly (20 – 100%) depending on the literature researched. Removal rates are affected by numerous variables, including the BMP size, design, vegetation, and the volume of water designed to be treated.

Examples of current practices for storm water runoff volume and sediment transport reduction strategies are the following listed in Table 2 below:

Table 2. Runoff Volume Reduction Strategies (aka pre-storm pipe drainage practices)

BMPs or Strategies currently in place	Method	Targeted TMDL
Dry Detention Basins	UV Light exposure, settling, infiltration	<i>E. coli</i>
Wet Detention Basins	UV Light exposure, settling, biotic predation	<i>E. coli</i>
Bioswales/Bioretention	UV Light exposure, settling, infiltration, drying	<i>E. coli</i>
Vegetated Filter Strips	Filtration, infiltration	<i>E. coli</i>
Riparian Buffers	Exclusion from streams, drains or rivers, filtration, infiltration	<i>E. coli</i>
Constructed Wetlands	UV Light exposure, settling, infiltration, biotic predation	<i>E. coli</i>
Infiltration Trenches/Swales	Infiltration	<i>E. coli</i>

As other BMPs or strategies are identified and implemented, they will be added to this list and reported to the EGLE during the next scheduled progress report submitted for the NPDES MS4 permit during the permit cycle.

IV. Monitoring Plan for assessing BMP effectiveness currently implemented or to be implemented in making progress towards achieving TMDL pollutant load reduction. (Q88)

It is well established by various sources that monitoring a riverine system is not a practical method to determine if individual best management practices are effective. This is due to many reasons, including too many variables beyond control: weather conditions, temperature, and other conditions upstream of the BMP, among others.

Regarding *E. coli* monitoring, *E. coli* is useful in that it provides insight if there is a potential source of sewer overflow, leaking sanitary system, leaking septic system(s), or problematic and excessive populations of waterfowl (e.g. Geese). However, *E. coli* is only an indicator species of bacteria for sanitary sewer/septic contamination and other analytical methods including microbial source tracking and nutrient analysis or smoke and dye testing are necessary to narrow down the source(s) of the *E. coli*.

Eaton County will take the following approach to ensure County *E. coli* TMDL goals are being met.

1. The County will continue to work with other communities and entities within the Grand River Watershed to monitor the overall health of drainage districts in the Urbanized Area of Eaton County.
2. The Eaton County Drain Commissioner (ECDC) will perform two wet weather sampling events (i.e. collect two grab samples, one in 2020 and one in 2022) for *E. coli* analysis from the selected county drains' outfalls during a permit cycle. Wet weather sampling events will take place during the first 30-60 minutes of a rain event producing runoff. If there are no *E. coli*

issues during the first wet weather sampling event on a drain (based on results from 2020 sampling), an alternate drain will be selected to be screened during 2020.

The county drains were selected based on location, land use, and size. GIS data analysis was used to determine these potentials, shown below in Table 3. Table 4, below, shows a list of alternate drains for sampling in the order in which they would be selected as an alternate for sampling.

Table 3. Initial *E. coli* Wet Weather Sampling Locations

Drain Name	TMDL	Latitude	Longitude
Bollman-Damon Drain	<i>E. coli</i>	42.760774	-84.627383
Clements-Underhill Drain	<i>E. coli</i>	42.707737	-84.615898
Hunter and Branches Drain	<i>E. coli</i>	42.689779	-84.630865
Keller Drain	<i>E. coli</i>	42.683384	-84.623962
Watson & Watson Drain	<i>E. coli</i>	42.756419	-84.640317

Table 4. Alternate *E. coli* Wet Weather Sampling Locations

Drain Name	TMDL	Latitude	Longitude
Dimondale Estates	<i>E. coli</i>	42.654432	-84.645252
Garlock & Foster	<i>E. coli</i>	42.759461	-84.610215
Garlock & Foster	<i>E. coli</i>	42.759464	-84.610357
Cambridge Drain	<i>E. coli</i>	42.760280	-84.630829
Rouse & Thomas Drain	<i>E. coli</i>	42.704772	-84.616745
Walmer Drain	<i>E. coli</i>	42.761299	-84.634911

3. Schedule for sampling:

- The first round of wet weather sampling will be completed by the **end of 2020³**.
- The second round of wet weather sampling will be completed by the **end of 2022³**.

(³) see #3 below for threshold criteria to trigger further investigation.

Sampling Procedure:

1. The following five drains were selected for the initial *E. coli* wet weather sampling at their outfalls: Bollman-Damon, Clements-Underhill Drain, Hunter and Branches Drain, Keller Drain, and Watson & Watson Drain. These were selected based on the prioritization method previously stated.

2. If there are wet or dry detention basins or other BMPs listed in Table 2, which are located on the drains to be tested, then two BMPs will be selected for monitoring also.

A sample of stormwater entering the BMP and a sample of stormwater leaving the BMP will be obtained during a wet weather event and the results provided in a progress report.

3. Threshold criteria for sampling: **1,000 MPN/100 mL** (Rule 62, as previously stated)

E. coli data will be recorded and analyzed with the intent to characterize the Drainage District in the context of *E. coli*. If a sample exceeds the threshold of 1,000 MPN/100 mL, follow up inspection will be completed to determine source(s) location. If no source(s) can be found on inspection, then a water sampling and inspection plan will be implemented to help determine the source / location of the problem.

4. Sampling and analyzation methods shall be to the same standards as the 2012 TMDL study on the Grand River and Red Cedar River, EPA method 1103.1, or an equivalent method recommended by the EGLE to enumerate *E. coli*. A County designated lab will be used for the processing of the samples taken.

At no point will an Intercounty Drain be monitored due to jurisdictional boundaries and associated regulations under the Drain Code. However, if an Intercounty Drain is considered an issue for *E. coli*, the ECDC will invite the EGLE to an Intercounty Drainage Board meeting to present the case to the board for review.

Documentation of the sampling events will use the standard Field Report used by Spicer Group for typical field sampling events. This document can be obtained upon request, however, the EGLE has seen this form documenting many spills and discharge events in Eaton County.

CARRIER CREEK TMDL – 2002

The TMDL for macro-invertebrate was established in 2002. This was for the reach from the confluence with the Grand River upstream to the crossing of I-496 for the Carrier Creek.

The Carrier Creek Watershed is contained entirely within Delta Township on the east side of Eaton County, Michigan. The creek begins as two agricultural drains. Holly Drain begins in section 34 and Moon and Hamilton Drain begins in section 33. Both drains flow in a northerly direction and join to form Carrier Creek in section 22, immediately south of I-496. The creek flows an additional 4 miles north to its confluence with the Grand River in section 3.

Most of the stream channel was modified (straightened and dredged) 50 years ago to support agricultural land use, including wetland drainage and conversion to crop production. Many of these same channels were occasionally re-dredged, with the accompanying dredge spoil disposal producing elevated stream banks which effectively acted as a barrier between the stream and the adjacent floodplain. The combination of enhanced land drainage, the loss of active floodplains and adjacent wetlands, an increase in land development, and the loss of channel sinuosity had produced a flashy hydrology in Carrier Creek accompanied by significant in-stream sedimentation. These unstable flow conditions and an increase in sedimentation had subsequently reduced macroinvertebrate communities to less than acceptable levels.

In summary, the macroinvertebrate community in Carrier Creek downstream from St. Joseph Highway was judged to be poor based on data from the 1997 MDEQ report, Harrington's (2000) description of a macroinvertebrate community that was rated as poor between St. Joseph Highway and Saginaw Highway, and Wuycheck's (2002) report of significant amounts of bedload sediment, severely impairing the biological community downstream from Saginaw Highway.

NUMERIC TARGET

The impaired designated use for Carrier Creek is aquatic life. Rule 100(1)(f) requires that all surface waters of the state are designated for and shall be protected for, among other things, aquatic life and wildlife. Because the quality of the biota in the creek had been reduced due to habitat loss resulting from excessive sediment deposition, achievement of the WQS for designated uses for Carrier Creek per the TMDL document will be demonstrated by using an assessment of the macroinvertebrate community, as well as in-stream habitat as it relates to sediment.

MONITORING PLAN

Per the original TMDL developed, TMDL Monitoring will be conducted by the EGLE to assess progress towards meeting the biota TMDL targets. Following implementation of applicable BMPs, annual sampling of the macroinvertebrate community using Procedure 51 and habitat quality using a modified version of Procedure 51 will be conducted at the proposed stations until the target is met for two consecutive years. Macroinvertebrate samples will be taken during periods of stable flow in a June to August timeframe, with every effort made to duplicate the same sampling period each year.

There has been a substantial amount of work completed on the Carrier Creek upstream of the I-496 crossing with the creation of a substantial network of storm water BMPs to regulate the flow of

runoff from the developments in this section of the Carrier Creek reach. For the downstream section which has a the TMDL in place there has been significant stream rehabilitation completed through the reach downstream of the I-496 crossing to the confluence of the Grand River. The rehabilitation consisted of leveling of stream banks from past dredging projects. Additionally, there has been projects to increase stream sinuosity of the reach in question along with J-hooks, pool riffle sections, and an approved watershed management plan. All considered, there has been over \$1M spent on this reach since the TMDL was implemented.

Per the TMDL, the EGLE is to be responsible for the monitoring events and it is not the responsibility of Eaton County, Eaton County Drain Office or the Drainage District. In review of the studies which have been done, it was noted the testing was not done in consecutive years as was recommended in the TMDL in order to have the TMDL reassessed and removed. It may be beneficial for the EGLE for the ECDC to do its test in a year following a study event on the Carrier Creek.

Table 5. Macroinvertebrate community scores from 2001-2016 at five different stations in Carrier Creek (2016 study MI/DEQ/WRD-17/017)

	2001	2006	2009	2011	2016
Location	Wuycheck (2002)	Holden (2007)	Holden (2011)	Holden (2012)	MI/DEQ/WRD-17/017
Williamsburg St.		-4	-2	-1	-4
Saginaw Hwy	-4				-7
North Ridge Ct			-2	-3	-5
Willow Woods Ln	-2	-3	1	0	-4
Old River Trail				-1	-1

Table 5 above is a summary of the completed studies and reports on the macroinvertebrate communities which were assessed and scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Scores from +4 to -4 are rated acceptable. Negative scores in the acceptable range are considered tending towards a poor rating, while positive scores in the acceptable range are tending towards an excellent rating.

Table 6. Habitat scores from 2006 – 2016 at five different stations in Carrier Creek (2016 study MI/DEQ/WRD-17/017)

	2006	2009	2011	2016
Location	Holden (2007)	Holden (2011)	Holden (2012)	MI/DEQ/WRD-17/017
Williamsburg St.	77	83	80	115
Saginaw Hwy				116
North Ridge Ct		110	123	149
Willow Woods Ln	154	138	136	129
Old River Trail			126	152

A station habitat score of >154 is characterized as having excellent habitat, 105-154 is good, 56-104 is marginal, and <56 is poor. Table 6 above lists the habitat scores from the 2016 study. Per the 2016 Study, the station at Williamsburg Street is the **trending station** for the Carrier Creek, and it seems reasonable this will be utilized as a monitoring site for two monitoring sessions using P-51 survey. Schedule one before the end of 2020 and one before the end of 2022, or if the EGLE

could provide a schedule on when they will be doing another monitoring session, Eaton County could complete their assessment at the trending station in a consecutive year format.

Additionally, there will be one drain maintenance inspection from the I-496 crossing north to the confluence with the Grand River. This will help determine if there is an ongoing issue with sedimentation and if it can be addressed in the maintenance plan for the drain and drainage district.