

**Michigan Department of Natural Resources and Environment
Water Resources Division
December 2010**

REVISED

**Total Maximum Daily Load for *E. coli* for
East Branch Coon Creek
Macomb and St. Clair Counties**

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations [CFR], Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states with a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify the allowable levels of *Escherichia coli* (*E. coli*) that will result in the attainment of the applicable WQS in the East Branch Coon Creek, tributary of the Clinton River, located in Macomb and St. Clair Counties, Michigan.

PROBLEM STATEMENT

The East Branch Coon Creek *E. coli* TMDL reach appears on the draft 2010 303(d) list (LeSage and Smith, 2010) as:

Water Body Name: **COON CREEK, E. BR.** **AUID:** 040900030303-01
Impaired designated uses: Warm water fishery, total body contact recreation, partial body contact recreation, fish consumption
Cause: Dissolved oxygen, *E. coli*, PCB in water column
Size: 13.5 miles
Location description: East Branch Coon Creek, New Haven Road upstream to McPhall Road.
TMDL YEAR(s): 2006

East Branch Coon Creek was first placed on the Section 303(d) list due to impairment of recreational uses as indicated by the presence of elevated levels of *E. coli* (Creal and Wuycheck, 1998). *E. coli* sampling by the Macomb County Health Department (MCHD) has revealed frequent and persistent problems with bacterial contamination in many lakes and streams in Macomb County, including East Branch Coon Creek (MCHD, 2009). Monitoring data collected by the Michigan Department of Natural Resources and Environment (DNRE) in 2004 documented exceedances of the total body contact (TBC) at all stations and partial body contact (PBC) WQS for *E. coli* at five of seven sampling locations during the TBC recreational season of May 1 through October 31 (Figures 1-2b; Tables 1 and 2). Weekly monitoring data, collected by the DNRE in 2008, to support the 2010 Lower Clinton River *E. coli* TMDL continued to document exceedances of the TBC and PBC WQS (Table 6).

An *E. coli* TMDL for this reach of East Branch Coon Creek was originally approved by the USEPA in September 2006. This TMDL is being revised to account for a newly proposed National Pollutant Discharge Elimination System (NPDES)-permitted point source, the Berville

Wastewater Stabilization Lagoon (WWSL), which is expected to discharge seasonally to a tributary of East Branch Coon Creek upstream of the TMDL reach (see Figure 1). The facility and associated sewer construction will eliminate raw sewage discharges from failed septic systems in the community, and should improve water quality in the drainage basin. The Berville WWSL's pollutant loads will be included in this TMDL's waste load allocation (WLA). The TMDL has also been updated to reflect the current status of the TMDL reach and pollutant sources.

NUMERIC TARGET

The impaired designated uses addressed by this TMDL are TBC and PBC recreation. The designated use rule (Rule 100 [R 323.1100] of the Part 4 rules, 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 be protected for TBC recreation from May 1 through October 31 and PBC recreation year-round. 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 *E. coli* per 100 milliliters (mL), as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during five or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of three or more samples taken at 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 *E. coli* per 100 mL. Compliance shall be based on the geometric mean of three or more samples taken during the same sampling event at representative locations within a defined sampling area.

(2) All surface waters of the state protected for partial body contact recreation shall not contain more than a maximum of 1,000 *E. coli* per 100 ml. 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.

Sanitary wastewater discharges have an additional target:

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

For this TMDL, the WQS of 130 *E. coli* per 100 mL as a 30-day geometric mean and 300 *E. coli* per 100 mL as a daily maximum to protect the TBC use are the target levels for the TMDL reach from May 1 through October 31, and 1,000 *E. coli* per 100 mL as a daily maximum year-round to protect the PBC use. The 2004 monitoring data indicated exceedances of daily maximum WQS at all locations sampled, and exceedances of the PBC WQS at five of eight stations.

DATA DISCUSSION

The East Branch Coon Creek and Highbank Creek, a tributary to the East Branch Coon Creek, were sampled at eight locations in 2004 to address this TMDL listing (Figure 1). Five of the seven sampling stations in the East Branch Coon Creek exceeded the 30-day geometric mean

WQS on multiple occasions (Figures 2a and 2b; Tables 1 and 2). Thirty-day geometric mean *E. coli* concentrations in East Branch Coon Creek ranged from 22 *E. coli* per 100 ml in June at Armada Center Road (EBC2) to 672 *E. coli* per 100 ml in August at Main Street west of Fulton (EBC3) (Figures 2a and 2b; Table 1). The daily maximum TBC WQS was also exceeded at least once at every sampling location on East Branch Coon Creek. Daily maximum concentrations ranged from a low of 20 *E. coli* per 100 ml at Stations EBC2 downstream to EBC6 to a high of 9,706 *E. coli* per 100 ml in August at EBC-3. *E. coli* concentrations of greater than the PBC WQS of 1,000 per 100 ml were found five times on the East Branch Coon Creek and exceedances occurred twice at EBC3.

E. coli concentrations in Highbank Creek were relatively low throughout the 2004 sampling season with only one exceedance of the daily maximum TBC WQS. Thirty-day geometric means ranged from 27 *E. coli* per 100 ml on July 15, 2004, to 118 *E. coli* per 100 ml on August 5, 2004. Daily maximums ranged from 20 *E. coli* per 100 ml on numerous occasions to 623 *E. coli* per 100 ml on July 22, 2004 (Figure 2b; Table 2).

Follow-up monitoring was conducted at a new location, at North Road, just north of the 26-Mile Road intersection on East Branch Coon Creek (EBC9), for 16 weeks in 2008 (Figure 1; Table 6). This sampling revealed 9 exceedances of the TBC WQS and 1 exceedance of the PBC WQS. Notably, 4 of these TBC WQS exceedances occurred during dry weather (Table 6). More exceedances of the TBC WQS occurred in the 2008 sampling at EBC9 than at any of the sites in the 2004 sampling, indicating that WQS violations and concerns found in 2004 are continuing.

SOURCE ASSESSMENT

The official listed reach for the East Branch Coon Creek is from the Highbank Creek confluence to upstream of Armada. This 12-mile reach of the TMDL watershed falls within 6 municipalities as shown by the shaded area in Figure 1. Table 3 shows the distribution of land for each municipality.

The primary pathogen sources for this water body are largely nonpoint source pollution related. Failing or poorly operating on-site sewage disposal systems (OSDS), agricultural runoff, illicit connections, and unregulated urban runoff are all possible sources of *E. coli* to the TMDL watershed.

Residential land uses make up a portion (2.5 percent) of the TMDL watershed (Purdue University and USEPA, 2005). Research indicates that bacterial levels in urban runoff exceed public health standards for water contact recreation almost without exception (Schueler, 1987). Source area sampling in Marquette, Michigan, indicated that commercial parking lots, streets, residential lawns, and residential driveways were major source areas for bacteria (Steuer et al., 1997). A large portion of Macomb County utilizes OSDS for waste treatment. These systems become a potential source of *E. coli* to surface waters when they fail or are poorly designed. Failures occur at varying degrees, resulting in a range of contamination severity, with major failures such as sewage on the ground surface and tanks connected directly to surface waters (also considered illicit discharges) at one end of the scale, and minor failures such as laundry or sinks bypassing the treatment systems at the other end of the scale. One hundred fifty OSDS suspected of failing were investigated in Macomb County in 2003 (Macomb County, 2003). Thirteen percent of all OSDS evaluations in Macomb County in 2004 and 2005 failed inspection (Macomb County, 2005) and the overall rate of OSDS failure for Macomb County was 12 percent during 2008 (this figure does not include laundry and sink violations) (personal communication with MCHD). In St. Clair County, it is estimated that there are between 30-40 OSDS per square mile (*E. coli* Work Group, 2008). The St. Clair County Health Department (SCCHD) does not maintain point-of-sale OSDS records. Thus, there is no indication of the

failure rate for the upper East Branch Coon Creek watershed. Based on information obtained from other county health departments statewide, the OSDS failure rate across Michigan reportedly averages between 5-10 percent (*E. coli* Work Group, 2008). In a study by Francy et al. (2000), the presence of OSDS near a surface water sampling site was positively correlated with the detection of coliforms.

Agriculture, including grass/pasture, accounts for approximately 80 percent of the land use in the TMDL watershed (Table 4) and can cause bacterial contamination in streams (Purdue University and USEPA, 2005). *E. coli* have been shown to enter water bodies from pastureland runoff and land applications of manure via field drainage systems, such as tiles, and surface runoff (Abu-Ashour and Lee, 2000). Many factors affect the amount of *E. coli* transported from fields when manure is land applied or deposited by grazing animals; chief among them is the amount of *E. coli* present in the manure at the time of application. Liquid cattle manure has been shown to contain *E. coli* concentrations from 4,500 to 15,000,000 *E. coli* per mL (Unc and Goss, 2004). Enteric bacteria in agricultural soil amended by manure usually decline to preapplication levels within 1 to 6 months depending on conditions (Stoddard et al., 1998; Jamieson et al., 2002; Unc and Goss, 2004; and Oliver et al., 2005); however, under laboratory conditions, *E. coli* has survived for 231 days in manure amended soils (Jiang et al., 2002). According to the 2007 Census of Agriculture (United States Department of Agriculture [USDA], 2007), in Macomb County there are 4,271 cattle, 1,356 horses, and 301 swine; and in St. Clair County there are 8,223 cattle, 2,157 horses, and 244 swine. Manure from grazing animals and agricultural manure land application is a potential source of *E. coli* WQS exceedances in the East Branch Coon Creek watershed.

There are five NPDES permitted discharges (existing or proposed) to the East Branch Coon Creek, or its tributaries, in the TMDL reach (Table 5, Figure 1). The individual permit for the Armada Wastewater Treatment Plant (WWTP) authorizes the discharge of treated sanitary waste. The proposed Berville WWSL has yet to be constructed at the time of the drafting of this TMDL. The SCCHD discovered a cluster of septic tanks in the small town of Berville (Berlin Township) that were improperly connected to the town's storm sewers, and were likely a significant source of *E. coli* to the TMDL reach during monitoring in 2004 (Tables 1 and 2) and follow-up monitoring in 2008 (Table 6). The discharge from the Berville storm sewers was being directed to a roadside ditch approximately 5 miles upstream of site EBC1, the furthest upstream monitoring site (Figure 1). The proposed facility will address untreated discharges from failing or failed septic systems in the vicinity of Berville which may contribute to *E. coli* standard violations in East Branch Coon Creek. The permits for the WWTP and WWSL contain limits for fecal coliform and when the facilities are meeting their fecal coliform permit limits, it is assumed the WQS for *E. coli* will be met in the discharge (see Numeric Target section).

Table 5 contains information on the individual and general permits. There are no combined sewers or concentrated animal feeding operations in the East Branch Coon Creek TMDL watershed. It is not expected that industrial storm water discharges listed in Table 5 would be a source of *E. coli* due to the nature of the discharge (e.g., parking lot and rooftop runoff) and because the discharge of this contaminant is prohibited by the permit.

To further investigate the potential sources mentioned above, a load duration curve analysis was developed for each sampling station as outlined in a paper by Cleland (2002). A load duration curve considers how flow conditions relate to a variety of pollutant sources (point and nonpoint sources).

The load duration curves for each station sampled on East Branch Coon Creek in 2004 are included in Appendix A, while the curve for the follow-up site sampled in 2008 is located in Appendix B. The United States Geological Survey gage used to determine the load duration curves discussed here is located on East Branch Coon Creek at Armada, downstream of

Prospect Avenue (gage number 04164300). The data indicate that exceedances of the WQS are noted during both wet and dry events. The WQS exceedances observed during higher flow events at EBC1 may be indicative of agricultural runoff upstream of Armada or a flush of contaminated storm water from the Berville area (Appendix A1). Exceedances observed at EBC3 in Armada and immediately downstream at EBC4 and EBC5 are likely due to urban runoff from Armada (Appendices A3-A5). Several exceedances, or near exceedances, are observed during dry weather events, such as those found at EBC1-EBC5 in the 2004 data (Appendices A1-A5) (note that dots above the curve to the middle and right side of the figures indicate WQS exceedances during dry weather conditions [lower flows] and dots above the curve on the left side of the figure are indicative of WQS exceedances during wet weather conditions [higher flows]). Dry weather exceedances are much more evident in the 2008 follow-up site (EBC9) at East Branch Coon Creek at North Road. The curve for this site indicates that 5 exceedances of the WQS occurred in dry conditions (Appendix B). The results found during low flow periods may be the result of the illicit discharges and failing septic systems identified in Berville, and/or illicit connections elsewhere in the watershed.

LOADING CAPACITY (LC) DEVELOPMENT

The LC represents the maximum loading that can be assimilated by the water body while still achieving WQS. As indicated in the Numeric Target section, the targets for this pathogen TMDL are the TBC 30-day geometric mean WQS of 130 *E. coli* per 100 mL, daily maximum of 300 *E. coli* per 100 mL, and the PBC daily maximum WQS of 1000 *E. coli* per 100 mL. Concurrent with the selection of a numeric concentration endpoint, development of the LC requires identification of the critical condition. The “critical condition” is defined as the set of environmental conditions (e.g., flow) used in development of the TMDL that results in attaining WQS and has an acceptably low frequency of occurrence.

For most pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For *E. coli*, however, mass is not an appropriate measure, and the USEPA allows pathogen TMDLs to be expressed in terms of organism counts (or resulting concentration). Therefore, this pathogen TMDL is concentration-based, consistent with R 323.1062, and the TMDL is equal to the TBC target concentrations of 130 *E. coli* per 100 mL as a 30-day geometric mean and daily maximum of 300 *E. coli* per 100 mL in all portions of the TMDL reach for each month of the recreational season (May through October) and PBC target concentration of 1000 *E. coli* per 100 mL as a daily maximum year-round. Expressing the TMDL as a concentration equal to the WQS ensures that the WQS will be met under all flow and loading conditions; therefore, a critical condition is not applicable for this TMDL.

LC

The LC is the sum of individual WLAs for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the LC must include a margin of safety (MOS), either implicitly within the WLA or LA, or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$LC = \sum WLA_s + \sum LA_s + MOS$$

The LC represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. Because this TMDL is concentration-based, the total loading for this TMDL is equal to the TBC WQS of 130 *E. coli* per 100 mL as a 30-day geometric mean and 300 *E. coli* per 100 mL as a daily maximum during the recreation season and PBC WQS of 1000 *E. coli* per 100 mL as a daily maximum year-round.

WLAs

The WLA for the facilities listed in Table 5 are equal to 130 *E. coli* per 100 mL as a 30-day geometric mean and 300 *E. coli* per 100 mL as a daily maximum during the recreational season between May 1 and October 31, and 1000 *E. coli* per 100 mL as a daily maximum the remainder of the year. There is 1 individual NPDES permit included in the WLA, and 4 Certificates of Coverage (COCs) issued under general NPDES permits, which include: 1 wastewater stabilization lagoon (MIG589000), 2 storm water from industrial activities (MIS110000), and 1 watershed-based Municipal Separate Storm Sewer System (MS4) permit (MIG610000).

LAs

Because this TMDL is concentration-based, the LA is also equal to 130 *E. coli* per 100 mL as a 30-day geometric mean and 300 *E. coli* per 100 mL as a daily maximum during the recreational season and 1000 *E. coli* per 100 mL as a daily maximum year-round. This LA is based on the assumption that all land, regardless of use, will be required to meet the WQS. Therefore, the relative responsibility for achieving the necessary reductions of bacteria and maintaining acceptable conditions will be determined by the amount of land under the jurisdiction of the local unit of government in the watershed (Table 3). The majority of the TMDL reach lies in Macomb County. The municipalities making up the largest portion of the watershed are Richmond (30.8 percent) and Armada Townships (28.2 percent).

MOS

This section addresses the incorporation of an MOS in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between the load and WLAs and water quality in this TMDL. The application of the TBC WQS of 130 *E. coli* per 100 mL as a 30-day geometric mean and 300 *E. coli* per 100 mL as a daily maximum during the recreational season, and the PBC WQS of 1,000 *E. coli* per 100 mL as a daily maximum year-round to all sources under the WLA and LA is a conservative approach because it ensures that the WQS are met at all points in the receiving water. The result is that there is no uncertainty as to whether or not the WQS will be met at the source or within the receiving water.

SEASONALITY

The WQS for *E. coli* are expressed in terms of seasons, e.g., TBC from May 1 through October 31 and PBC year-round. Allocations and controls developed for the more protective TBC season are also expected to assure attainment of the daily maximum PBC WQS of 1000 *E. coli* per 100 mL, year-round. Because this is a concentration-based TMDL, WQS must be met regardless of flow conditions in the applicable season.

MONITORING

Pathogens were monitored weekly at a total of seven stations on East Branch Coon Creek and one station on Highbank Creek, a tributary to the East Branch Coon Creek, from May through September 2004 (Table 1). Follow-up monitoring in East Branch Coon Creek was conducted in May-August of 2008 at EBC9 at North Road (Table 6) and indicated continued exceedances of the TBC and PBC WQS, particularly in dry weather. Future monitoring will take place as part of the five-year rotating basin monitoring as resources allow. When these results indicate that the water body may be meeting WQS, sampling will be conducted at the appropriate frequency (as defined in the Numeric Target section) to determine if the daily maximum TBC and PBC WQS, and the 30-day geometric mean value of 130 *E. coli* per 100 ml are being met.

REASONABLE ASSURANCE ACTIVITIES

Armada WWTP and Berville WWSL is, or will be, respectively, responsible for meeting their NPDES permit limits for fecal coliform. Michigan regulates discharges containing treated or untreated human waste (i.e., sanitary wastewater) using fecal coliform. Sanitary wastewater discharges are required to meet 200 fecal coliform per 100 mL as a monthly average and 400 fecal coliform per 100 mL as a maximum. Michigan's WQS for *E. coli* are based upon criteria in the USEPA's 1986 criteria document (USEPA, 1986). Specifically, the USEPA criterion of 126 *E. coli* per 100 mL is the basis for Michigan's 30-day geometric mean TBC WQS of 130 *E. coli* per 100 mL. This criterion is intended to provide a level of protection of producing no more than 8 illnesses per 1,000 swimmers and approximates the degree of protection provided by the fecal coliform indicator of 200 fecal coliform per 100 mL bacteria standard recommended by the USEPA prior to the adoption of the 1986 criteria. The sanitary discharges are expected to be in compliance with the ambient *E. coli* PBC and TBC WQS if their NPDES permit limits for fecal coliform are met. All WWTPs provide disinfection, providing another level of confidence that the WQS for *E. coli* will be met. Compliance is determined based on review of discharge monitoring report data by the DNRE. The Armada WWTP is presently meeting its permit limits for fecal coliform.

The COCs for the general industrial storm water permit (MIS110000) listed in Table 5, specify that if a TMDL is established by the Department for the receiving water that restricts the discharge of any of the identified significant materials or constituents of those materials, then the Storm Water Pollution Prevention Plan (SWPPP) shall identify the level of control for those materials necessary to comply with the TMDL, and an estimate of the current annual load of those materials via storm water discharges to the receiving stream. In addition, storm water permit authorization requires facilities to obtain a certified operator who will have supervision and control over the control structures at the facility, eliminate any unauthorized non-storm water discharges, and develop and implement the SWPPP for the facility.

Under Macomb County's MS4 permit (COC# MIG610052), the county and their nested jurisdictions are required to reduce the discharge of pollutants (including *E. coli*) from their MS4 to the maximum extent practicable through the development and implementation of a Public Involvement and Participation Process, a storm water-related Public Education Plan, an Illicit Discharge Elimination Program (IDEP), a post-construction Storm Water Control Program for new development and redevelopment project, a Construction Storm Water Runoff Control Program, and a Pollution Prevention/Good Housekeeping Program for municipal operations.

The implementation of Macomb County's IDEP, as required by their MS4 permit, will have a great potential to contribute to reduction of *E. coli* levels in the East Branch Coon Creek. The IDEP requirements require Macomb County to develop a program to find and eliminate illicit connections and discharges to their MS4. This includes a plan to conduct dry-weather screening of each MS4 discharge point at least once every five years (unless an alternative schedule or approach is approved by the DNRE). Dry-weather screening does not require *E. coli* sampling; however, if the permittee observes evidence of any illicit connection or discharge they are required to investigate and eliminate them.

The MS4 permit also requires Macomb County to identify and prioritize actions to be consistent with the requirements and assumptions of the TMDL. Through prioritizing TMDL actions, the county is able to focus their efforts, which will help to make progress towards meeting Michigan's WQS.

Macomb County's MS4 permit covers all county-owned outfalls, including the County Road Commission's and Public Works Office's drains, and many Macomb County school districts,

which are nest jurisdictions under the County's MS4 permit. For efficiency, Macomb County coordinates IDEP efforts between the county departments (MCHD, Public Works Office, and Road Commission) and the nested school districts. Macomb County has been conducting IDEP activities from 2001 through 2010. Through this IDEP effort, Macomb County estimates that approximately 42 million gallons per year of wastewater have been excluded from the Clinton River and Lake St. Clair due to their efforts since 2003 (Macomb County, 2008). During the reporting period from October 2007 to September 2008, 163 illicit discharge investigations were conducted by Macomb County and resulted in the identification of 20 illicit discharges (14 of these were corrected during the reporting period) (Macomb County, 2008). From September 2008 through the end of 2009, the MCHD has identified an additional 20 illicit discharges of sewage (includes septic failures); 11 of which have been corrected.

St. Clair County has conducted road drain inspections (October 2008 through 2009) along all county roads in Berlin Township (17 percent of the TMDL watershed area) and sampled suspect outfalls for *E. coli*. As a result of this survey, 4 outfall violations in the East Branch Coon Creek watershed were found and 3 of those have been corrected (St. Clair County, 2009). The remaining and largest illicit discharge is attributed to the town of Berville as described in the Source Assessment section of this TMDL (St. Clair County, 2009). The community of Berville applied for an NPDES permit in June 2010 after applying for a grant under the USDA's Rural Development Water and Wastewater Loans and Grants Program to construct a WWSL system and sewers to remediate failed septic systems in the community of Berville. The elimination of failed septic systems with replacement by effective wastewater treatment is expected to benefit to *E. coli* standard attainment in the East Branch Coon Creek watershed.

Unpermitted discharges of pollutants to waters of the state (illicit connections), whether direct or indirect, are illegal in the state of Michigan. Section 3109(1) of Part 31 states that a person shall not directly or indirectly discharge into the waters of the state a substance that is or may become injurious to public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other uses that may be made of such waters. Section 3109(2) further specifically prohibits the discharge of raw sewage of human origin, directly or indirectly, into any of the waters of the state. The municipality in which that discharge originates is responsible for the violation, unless the discharge is regulated by an NPDES permit issued to another party. The elimination of illicit discharges of raw human sewage to the East Branch Coon Creek watershed will significantly improve water quality by removing a public health threat.

When OSDS are not functioning properly or are poorly designed or maintained, they are a potential source of *E. coli* contamination to nearby streams. The MCHD has a Point of Sale Ordinance, which requires the inspection of OSDS prior to property transfer, and requires the remediation of failing systems. Owners of systems that are found to be failing have 180 days to correct the problem after the submission of a corrective action plan to the MCHD. The MCHD responded to 77 complaints resulting in the correction of 19 violations in 2008 (Macomb County, 2008). In 2008, the MCHD issued OSDS repair permits to the following townships; Armada (9 permits), Bruce (3 permits), Ray (10 permits), and Richmond (8 permits). It should be noted that the issuance of a repair permit does not assure that the repair was actually completed. While the SCCHD does not maintain point of sale records, they do conduct sanitary surveys in response to complaints and issues referred by the county drain office, and issued 13 permits for replacement OSDS in 2008-2009 in Berlin Township (Michael Malcolm, personal communication). Failing OSDS have the potential to contaminate ground and surface water; therefore, the repair of failing systems is critical to reducing *E. coli* in the East Branch Coon Creek watershed.

Nonpoint source pollution from unpermitted agricultural operations is generally not regulated by the DNRE, but is mitigated through voluntary programs such as the Clean Michigan Initiative

and federal Clean Water Act Section 319 funded grants for watershed management plan development and implementation. Unregulated animal feeding operations may be required to apply for an NPDES permit in accordance with the circumstances set forth within R 323.2196 of the Part 21 administrative rules. This authority allows the DNRE to impose pollution controls and conduct inspections, thereby reducing pollutant contamination (i.e., *E. coli*) from agricultural operations that have been determined to be significant contributors of pollutants.

The village of Armada completed a sewer mapping project as part of the village's storm sewer separation project that involved video reconnaissance of their entire storm sewer collection system. This process identified a number of illicit sewer collections that have been or are in the process of being removed from the village's storm water collection system. In addition, an illicit sewer connection was found and removed from the Woodbeck Drain, which is tributary to the East Branch Coon Creek.

In 2008, the Macomb County Public Works Office was awarded a federal Clean Water Act Section 319 grant to develop a Watershed Management Plan for the North Branch Clinton River. This Watershed Management Plan has been submitted to the DNRE and is currently under review for approval. A major aspect of this project involves modeling different land management scenarios to predict future pollutant loadings in the watershed.

A Great Lakes Restoration Initiative proposal, "Developing TMDL Implementation Plan for Coon Creek Michigan," authored by Michigan State University, was selected by the USEPA for funding in May 2010. The overall goal of this project is to improve water quality through development of a TMDL implementation plan for the East Branch Coon Creek to address the 2004 *E. Coli* TMDL by building on a Clean Water Act Section 319 plan currently under development by the Macomb County Department of Public Works for the North Branch Clinton River watershed. The goals include identifying high priority source areas within the watershed through intensive modeling, developing best management practice implementation plans in order to examine pollution load reductions under alternative scenarios to achieve TMDL reduction targets, estimating the costs associated with best management practice scenarios, creating an implementation schedule, milestones, and evaluating the effectiveness of the plan.

The entire Clinton River watershed is designated as a Great Lakes Area of Concern. The lower section of the river was first designated by the International Joint Commission in 1985 and was then expanded to the entire basin in 1995. Part of the reason for the Area of Concern designation was the concern for high bacterial counts entering Lake St. Clair from combined sewer overflows in the watershed. In 1985, the Remedial Action Plan was developed by the DNRE listing beach closings as a beneficial use impairment. The goal of the Remedial Action Plan is to identify environmental problems, establish water use goals, and provide cleanup solutions that will restore the Area of Concern's beneficial uses. In 1998, the Remedial Action Plan was updated and identified fecal contamination due to failing septic tanks and illicit connections to storm sewers, and the contamination of storm water surface runoff as pollution concerns that remained for the Area of Concern. The designation of the Clinton River as an Area of Concern gives priority to planning and implementation projects in the watershed for funding through sources such as the Great Lakes Restoration Initiative and Section 319 federal funds.

The Clinton River watershed is part of the Adopt-A-Stream Program, implemented by the Clinton River Watershed Council. The Adopt-A-Stream Program monitors water quality throughout the Clinton River watershed. This program does not specifically monitor for *E. coli*, but distributes educational materials and promotes a sense of public and personal responsibility to maintain water quality. Other volunteer actions include promoting proper lawn care, pet waste cleanup, investigating pollution sources, education, and land use planning.

The MCHD conducts weekly *E. coli* monitoring at 61 locations in the county, four of which are located on East Branch Coon Creek and one on High Bank Creek. Samples are collected in relation to rain events or in areas where potential water quality problems are anticipated (i.e., combined sewer overflows). These data were used by the DNRE to choose sample locations for the development of this document and is available to the public at the following internet address: <http://www.macombcountymi.gov/publichealth/EH/SurfaceWaterTestData.htm>.

PUBLIC PARTICIPATION

For the original approved TMDL, a stakeholder meeting was held on April 11, 2006, at the Lenox Township Hall in New Haven, Michigan. Stakeholders were determined by identifying municipalities (i.e., counties, townships, and cities) in the TMDL watershed. Copies of the draft TMDL were also sent out with the stakeholder meeting invitations and available at the stakeholder meeting. For the revised TMDL, stakeholders were notified of the 30-day public comment period via a mailing. Copies of the draft revised TMDL were available upon request and posted on the DNRE's Web site.

Original TMDL Prepared by:

Jeff Cooper and Christine Alexander, Aquatic Biologists
Surface Water Assessment Section
Water Resources Division
March 31, 2006

TMDL Revised by:

Molly B. Rippke, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division
November 29, 2010

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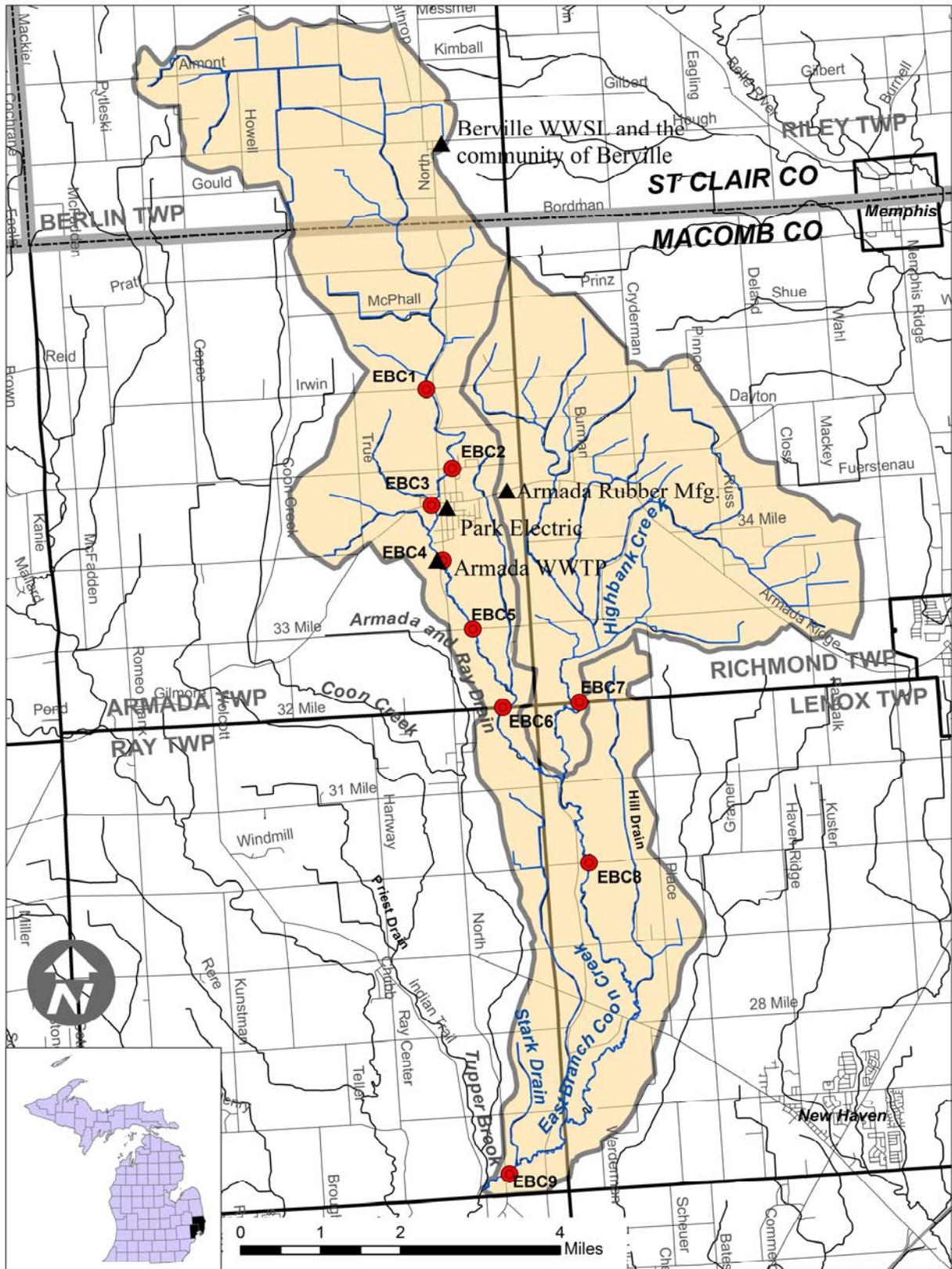


Figure 1. Locations of 2004 East Branch Coon Creek and Highbank Creek *E. coli* sampling locations (EBC1-EBC8), and station EBC9, sampled in 2008. Black triangles indicate the locations of NPDES permits.

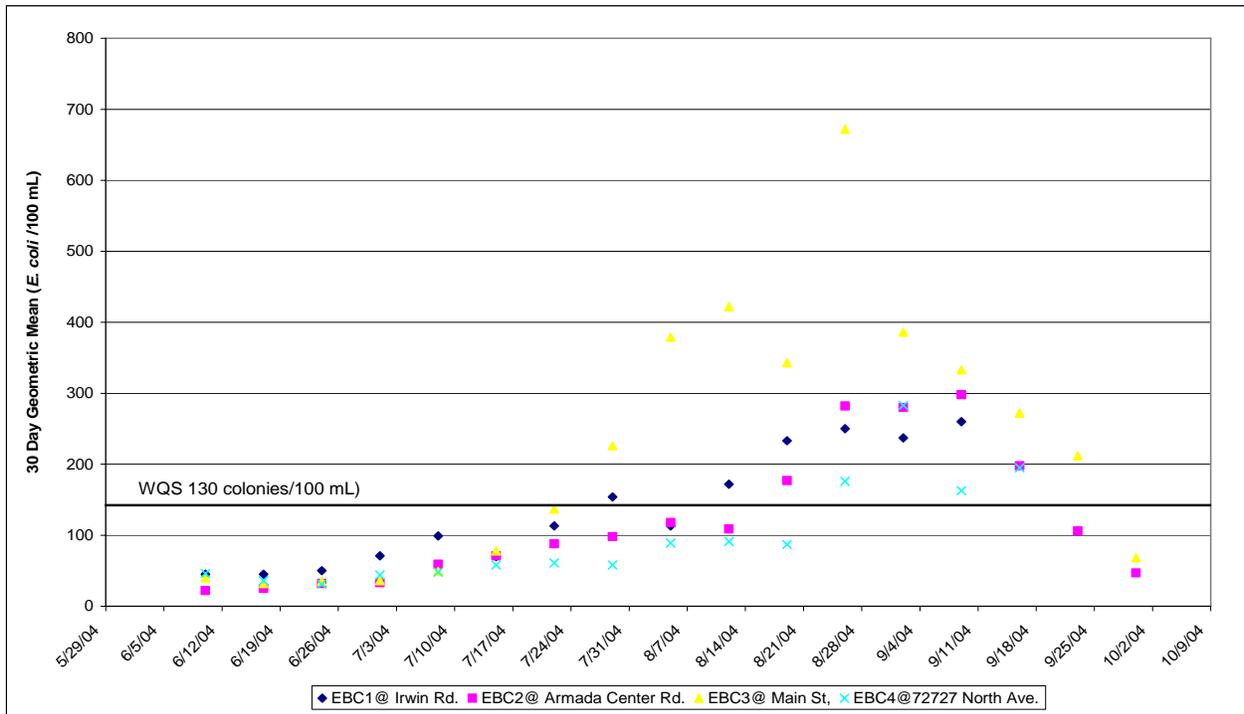


Figure 2a. Thirty-day geometric mean for *E. coli* in the East Branch Coon Creek in Macomb County Michigan, 2004 at stations EBC1-EBC4.

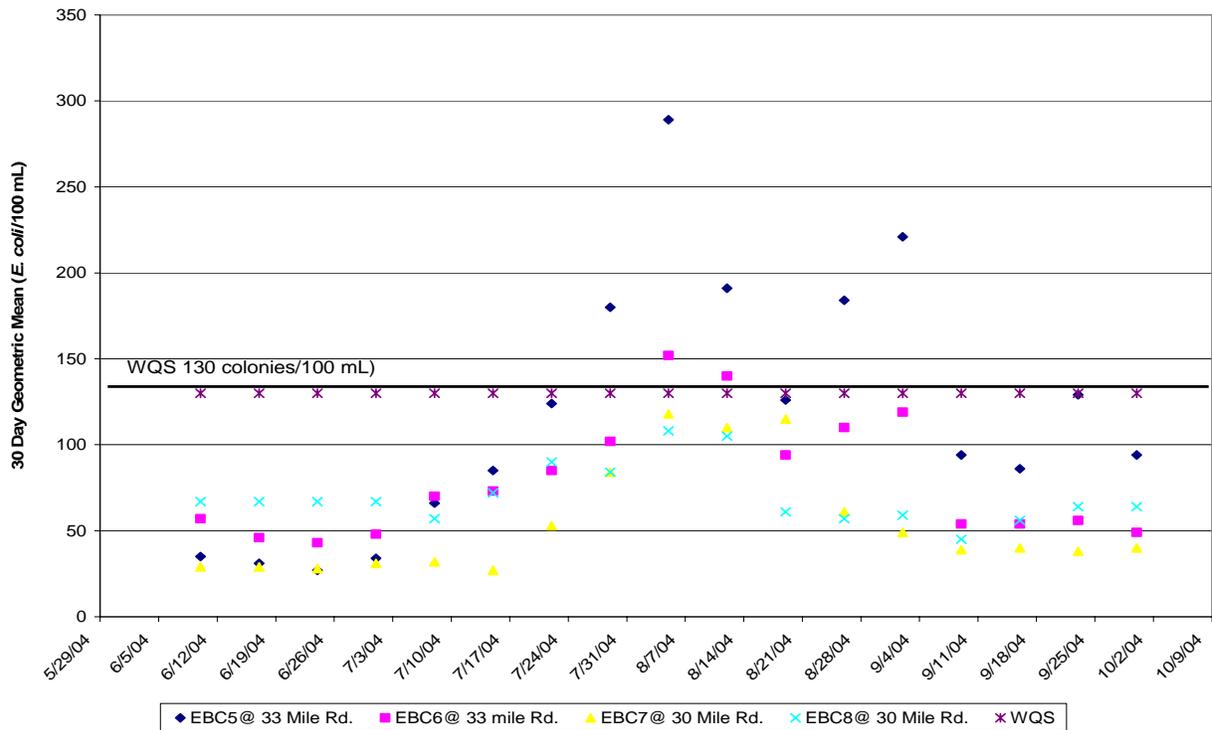


Figure 2b. Thirty-day geometric mean for *E. coli* at sampling Stations EBC5, EBC6, and EBC8 in the East Branch Coon Creek, and Station EBC7 in Highbank Creek, all in Macomb County, 2004.

Table 1. DNRE 2004 *E. coli* monitoring data (*E. coli*/100 ml) for East Branch Coon Creek in northern Macomb County. Shaded areas indicate exceedances of the TBC and PBC WQS. Exceedances of the PBC WQS are in bold. Data are presented upstream to downstream. Note: precipitation (in inches) is noted for 24 hours preceding sampling.

DATE	East Branch Coon Ck. EBC1@Irwin Rd.			East Branch Coon Ck. EBC2@ Armada Center Rd.			East Branch Coon Ck. EBC3@Main St. west of Fulton			Precip. Data
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	
5/12/2004	29	33		20	20	---	20	62		0.04
	60			20			100			
	20			20			120			
5/18/2004	20	25	---	20	20	---	20	52	---	0.2
	40			20			360			
	20			20			20			
5/28/2004	20	29	---	20	29	---	160	83	---	0
	20			20			180			
	60			60			20			
6/3/2004	20	71	---	20	20	---	20	20	---	0
	180			20			20			
	100			20			20			
6/10/2004	20	113	45	20	20	22	20	20	40	1.06
	200			20			20			
	360			20			20			
6/17/2004	80	32	45	20	40	25	20	20	32	0.24
	20			80			20			
	20			40			20			
6/24/2004	20	42	50	20	68	32	20	80	35	0
	20			80			80			
	180			200			320			
7/1/2004	20	172	71	20	36	33	20	100	36	0
	800			120			20			
	320			20			2500			
7/8/2004	280	379	99	400	372	59	180	93	49	0.51
	1620			340			20			
	120			380			220			
7/15/2004	20	20	70	20	49	71	20	197	78	0.08
	20			300			660			
	20			20			580			

Table 1 cont.

DATE	East Branch Coon Ck. EBC1@Irwin Rd.			East Branch Coon Ck. EBC2@ Armada Center Rd.			East Branch Coon Ck. EBC3@Main St. west of Fulton			Precip. data			
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN				
7/22/2004	360	123	92	360	117	88	440	336	137	0.59			
	20			220			180						
	260			20			480						
7/29/2004	160	114	113	20	116	98	600	968	226	0.04			
	460			120			1180						
	20			650			1280						
8/5/2004	380	824	154	20	93	118	1220	1324	379	0.91			
	1840			60			2800						
	800			680			680						
8/12/2004	60	78	113	200	241	109	20	158	422	0.08			
	100			320			300						
	80			220			660						
8/19/2004	140	168	172	560	565	177	60	70	343	0			
	240				460				20				
	140				700				280				
8/26/2004	500	564	233	5400	1208	282	5400	9706	672	0			
	620			480			10200						
	580			680			16600						
9/2/2004	60	160	250	20	113	280	20	61	386	0			
	200					890					560		
	340					80					20		
9/9/2004	480	629	237	20	126	298	980	632	333	0.08			
	740			20				560					
	700			5000				460					
9/16/2004	60	125	260	20	32	198	120	58	272	0			
	180					80					20		
	180					20					80		
9/23/2004	*	*	*	20	25	106	20	20	212	0			
				40							20		
				20							20		
9/30/2004	20	20	**	20	20	47	20	32	68	0			
	20						20						20
	20						20						80

*Site not sampled due to stagnant conditions

** 30 day geometric mean not calculated

Table 1 cont.

DATE	East Branch Coon Ck. EBC4@72727 North Ave.			East Branch Coon Ck. EBC5@ 33 Mile Rd. East of North Ave.			East Branch Coon Ck. EBC6@33 Mile Rd. West of OMO Rd.			Precip. data
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	
5/12/2004	120	66		20	36	---	20	61		
	120			60			140			
	20			40			80			
5/18/2004	20	88	---	140	38	---	100	34	---	1.3"
	80			20			20			
	420			20			20			
5/28/2004	20	25	---	20	42	---	120	81	---	0.5"
	40			180			20			
	20			20			220			
6/3/2004	480	58	---	20	20	---	60	29	---	0.9"
	20			20			20			
	20			20			20			
6/10/2004	20	25	46	20	43	35	320	124	57	0.6"
	20			20			300			
	40			200			20			
6/17/2004	20	20	36	20	20	31	20	20	46	0
	20			20			20			
	20			20			20			
6/24/2004	140	38	31	20	20	27	20	25	43	0.5"
	20			20			40			
	20			20			20			
7/1/2004	40	146	44	80	134	34	200	142	48	2.3"
	300			380			60			
	260			80			240			
7/8/2004	20	90	48	260	549	66	220	188	70	0
	20			600			500			
	1800			1060			60			
7/15/2004	760	67	58	440	147	85	600	150	73	0
	20			360			20			
	20			20			280			

Table 1 cont.

East Branch Coon Ck. EBC4@72727 North Ave.			East Branch Coon Ck. EBC5@ 33 Mile Rd. East of North Ave.			East Branch Coon Ck. EBC6@33 Mile Rd. West of OMO Rd.				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
7/22/2004	40	25	61	20	137	124	20	44	85	0
	20			360			220			
	20			360			20			
7/29/2004	20	29	58	260	125	180	20	63	102	0
	60			380		620				
	20			20		20				
8/5/2004	1480	1256	89	1400	1456	289	1460	1046	152	0
	1340			1620		800				
	1000			1360		980				
8/12/2004	20	104	91	20	68	191	300	124	140	0
	400			200		320				
	140			80		20				
8/19/2004	20	52	87	20	20	126	20	20	94	0
	360			20			20			
	20			20			20			
8/26/2004	700	849	176	700	849	184	140	100	110	0
	1120		1120		120					
	780		780		60					
9/2/2004	640	313	283	640	313	221	20	90	119	0
	100		100		600					
	480		480		60					
9/9/2004	40	50	163	20	20	94	20	20	54	0
	20		20	20						
	160		20	20						
9/16/2004	*	*	195	20	44	86	60	129	54	0
	*		20	180						
	*		220	200						
9/23/2004	320	160	**	400	447	129	20	25	56	0
	640		700	40						
	20		320	20						
9/30/2004	200	353	**	300	113	94	80	50	49	0
	380		20	40						
	580		240	40						

*Site not sampled due to stagnant conditions

** 30 day geometric mean not calculated

Table 1 cont.

East Branch Coon Ck. EBC8@30 Mile Rd. east of OMO Rd.				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
5/12/2004	40	32	---	
	40			
	20			
5/18/2004	140	106	---	1.3"
	140			
	60			
5/28/2004	20	42	---	0.5"
	180			
	20			
6/3/2004	20	98	---	0.9"
	140			
	340			
6/10/2004	20	101	67	0.6"
	20			
	2600			
6/17/2004	40	32	67	0
	40			
	20			
6/24/2004	140	106	67	0.5"
	140			
	60			
7/1/2004	20	40	67	2.3"
	20			
	160			
7/8/2004	20	44	57	0
	220			
	20			
7/15/2004	300	326	72	0
	580			
	200			

Table 1 cont.

East Branch Coon Ck. EBC8@30 Mile Rd. east of OMO Rd.				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
7/22/2004	40 120 180	95	90	0.59
7/29/2004	520 40 20	75	84	0.04
8/5/2004	580 20 260	144	108	0.91
8/12/2004	20 140 20	38	105	0.08
8/19/2004	20 20 100	34	61	0
8/26/2004	20 20 200	43	57	0
9/2/2004	400 80 20	86	59	0
9/9/2004	20 160 20	40	45	0.08
9/16/2004	240 280 20	110	56	0
9/23/2004	60 240 20	66	64	0
9/30/2004	20 200 20	43	64	0

Table 2. DNRE 2004 *E. coli* monitoring data (*E. coli*/100 ml) for Highbank Creek, a tributary of East Branch Coon Creek, in northern Macomb County, Michigan. Shaded areas indicate exceedances of the WQS. Note: precipitation (in inches) is noted for 24 hours preceding sampling.

Highbank Creek EBC7@30 Mile Rd. east of OMO Rd.				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
5/12/2004	20 20 20	20		
5/18/2004	20 20 20	20	---	1.3"
5/28/2004	20 40 20	25	---	0.5"
6/3/2004	20 20 180	42	---	0.9"
6/10/2004	20 280 20	48	29	0.6"
6/17/2004	20 20 20	20	29	0
6/24/2004	20 20 20	20	28	0.5"
7/1/2004	120 20 20	36	31	2.3"
7/8/2004	20 20 280	48	32	0
7/15/2004	20 20 20	20	27	0

Table 2 cont.

Highbank Creek EBC7@30 Mile Rd. east of OMO Rd.				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
7/22/2004	260 1080 860	623	53	0.59
7/29/2004	80 280 340	197	84	0.04
8/5/2004	140 2600 20	194	118	0.91
8/12/2004	100 20 20	34	110	0.08
8/19/2004	20 20 40	25	115	0
8/26/2004	40 20 20	25	61	0
9/2/2004	80 20 220	71	49	0
9/9/2004	220 40 20	56	39	0.08
9/16/2004	40 40 40	40	40	
9/23/2004	20 20 20	20	38	
9/30/2004	40 20 40	32	40	

Table 3. Distribution of land for each municipality in the East Branch Coon Creek TMDL reach.

Municipality	County	Square Miles	Percent
Richmond Township	Macomb	14.2	30.8
Armada Township	Macomb	13.0	28.2
Berlin Township	St. Clair	7.6	16.5
Lenox Township	Macomb	7.6	16.5
Ray Township	Macomb	2.9	6.3
Armada	Macomb	0.8	1.7
TOTAL		46.1	100

Table 4. Distribution of land use in the East Branch Coon Creek TMDL reach.

Land use Classification	Hydrologic Soil Group*	Area (acres)	Percent of Watershed
Water	n/a	488	4.0%
Commercial	C	20	0.1%
Agriculture	C	7944	64.0%
High Density Residential	C	40	0.3%
Low Density Residential	C	267	2.2%
Grass / Pasture	C	2002	16.1%
Forest	C	1651	13.3%
Total TMDL Watershed Area (acres)		12,412	

*Group C soils have low infiltration rates when wet and consist chiefly of soils having a layer that impedes downward movement of water with moderately fine to fine texture (USDA, 1986).

Table 5. Permitted discharges to the East Branch Coon Creek TMDL watershed. Source: DNRE, NPDES Permit Management System. Outfall locations are illustrated in Figure 1.

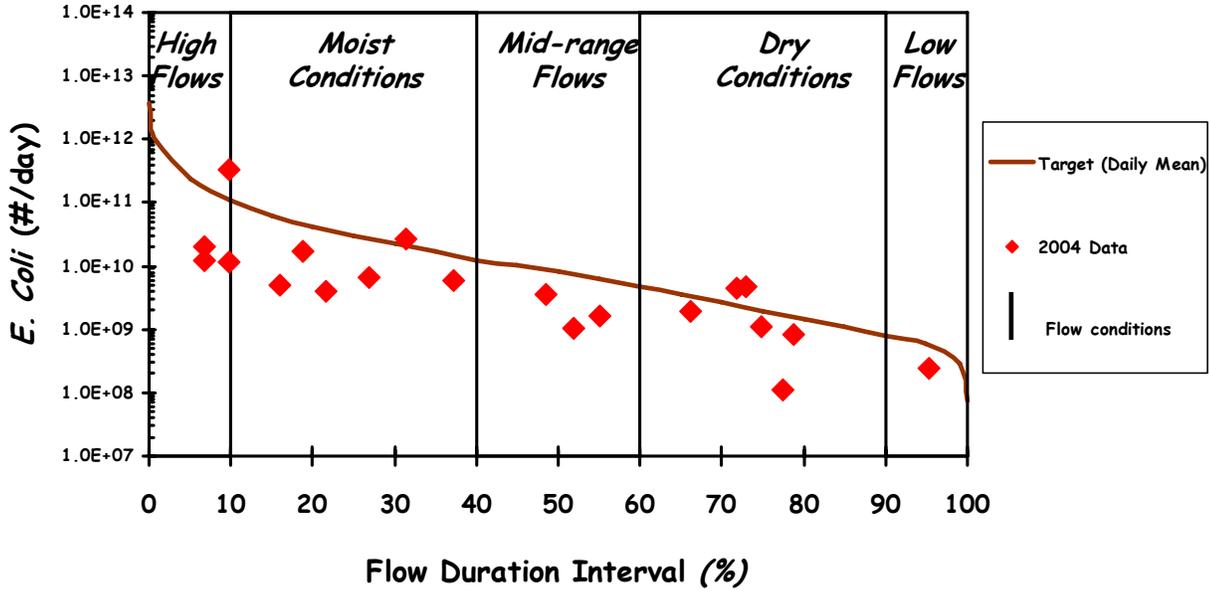
Facility	Number	County	Receiving Water	Latitude	Longitude
Individual Permit					
Armada WWTP	MI0022225	Macomb	East Branch Coon Ck.	42.8358	-82.8861
MIG589000 General Permit Wastewater Stabilization Lagoons					
Berville WWSL (proposed)	MIG580416	St. Clair	East Branch Coon Ck. tributary	42.9104	-82.8807
MIS110000 General Permit Storm water from industrial activities					
Armada Rubber Mfg.	MIS110066	Macomb	East Branch Coon Ck.	42.8463	-82.8677
Park Electric	MIS110962	Macomb	East Branch Coon Ck.	42.8436	-82.8833
MIG610000 General Permit Municipal Separate Storm Sewer System					
Macomb County MS4	MIG610052	Macomb	Countywide		

Table 6. Follow-up monitoring at East Branch Coon Creek at North Road (near 26-Mile Road) (EBC9), conducted in 2008. Shaded cells indicate an exceedance of the TBC WQS, while a shaded cell with a bold outline indicates an exceedance of both the TBC and PBC WQS.

Sample Date	E. Br. Coon Creek at North Rd (near 26-Mile)					2-day prior precip. In inches (Romeo, MI)
	Left	Center	Right	Daily Max	30-Day Geomean	
6/5/2008	240	200	60	142		0.24
6/11/2008	1520	3200	1600	1982		0.65
6/19/2008	240	260	100	184		0.07
6/25/2008	480	900	300	506		0.15
7/2/2008	600	200	200	288	377	0
7/9/2008	800	80	340	279	431	0
7/16/2008	280	480	500	407	314	0
7/23/2008	300	300	200	262	337	0
7/30/2008	600	820	520	635	353	0.29
8/6/2008	460	500	200	358	368	0
8/12/2008	80	60	120	83	289	0
8/20/2008	60	<20	80	69	203	0
8/27/2008	140	140	140	140	179	0
9/3/2008	120	120	140	126	130	0
9/10/2008	580	740	600	636	145	1.1
9/19/2008	760	480	200	418	201	0
9/25/2008	400	1600	600	727	321	0
10/1/2008	260	480	320	342	384	0.14

APPENDIX A

E. Br. Coon Creek at Irwin Rd. Load Duration Curve (2004 Monitoring Data) Site: EBC1

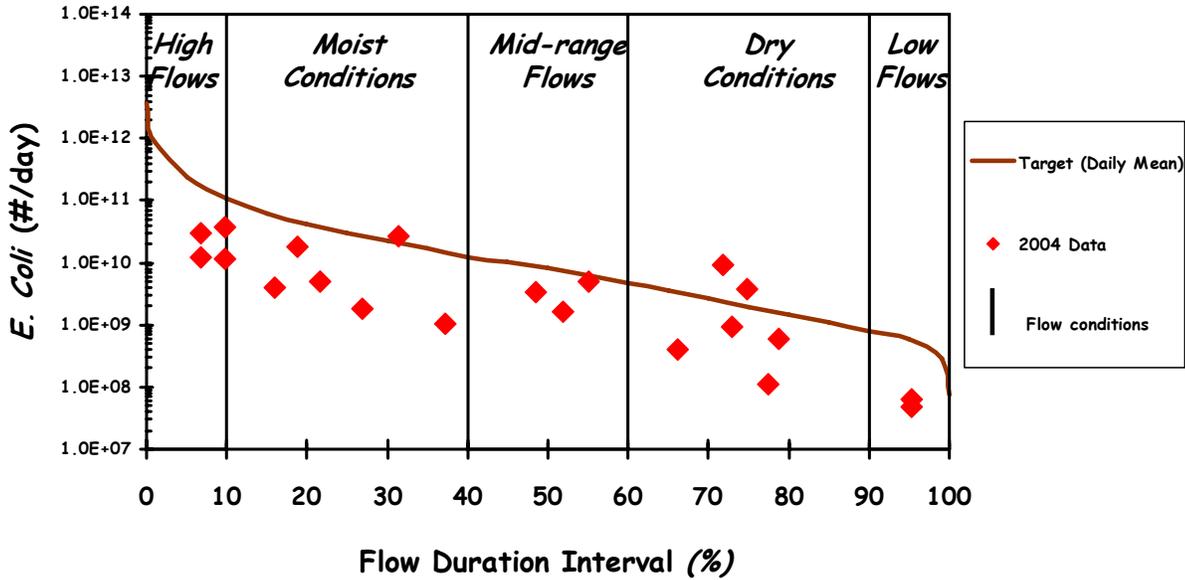


E. Coli Data & USGS Gage Duration Interval

13 square miles

A-1. East Branch Coon Creek at Irwin Road. Load duration curve based on daily maximums. Site: EBC1.

E. Br. Coon Creek at Armada Center Rd. Load Duration Curve (2004 Monitoring Data) Site: EBC2

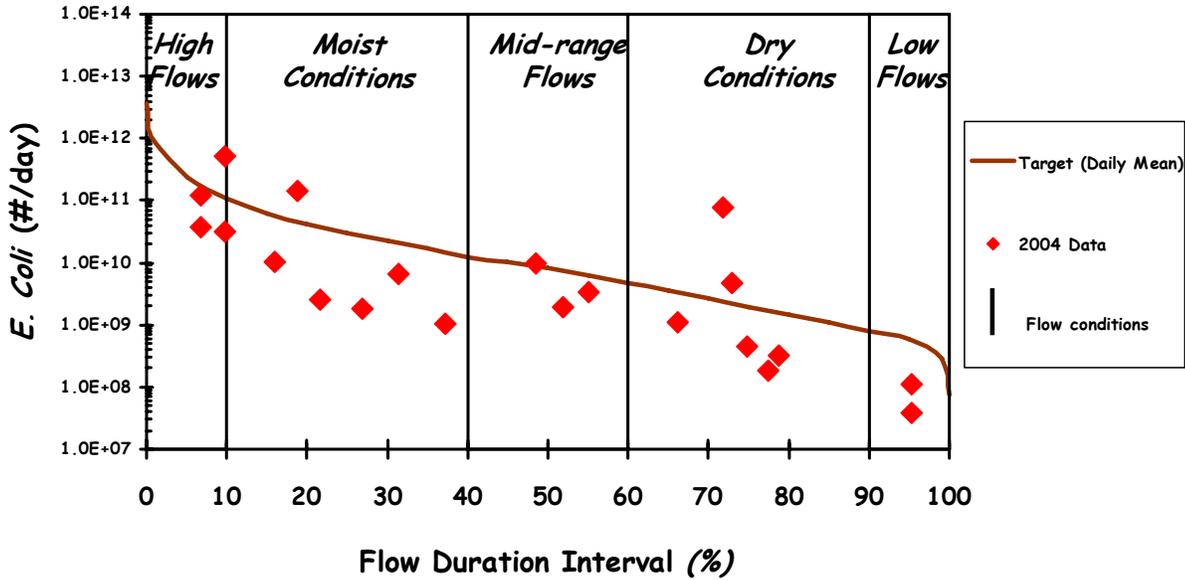


E. Coli Data & USGS Gage Duration Interval

13 square miles

A-2. East Branch Coon Creek at Armada Center Road. Load duration curve based on daily maximums. Site: EBC2.

E. Br. Coon Creek at Main St. Load Duration Curve (2004 Monitoring Data) Site: EBC3

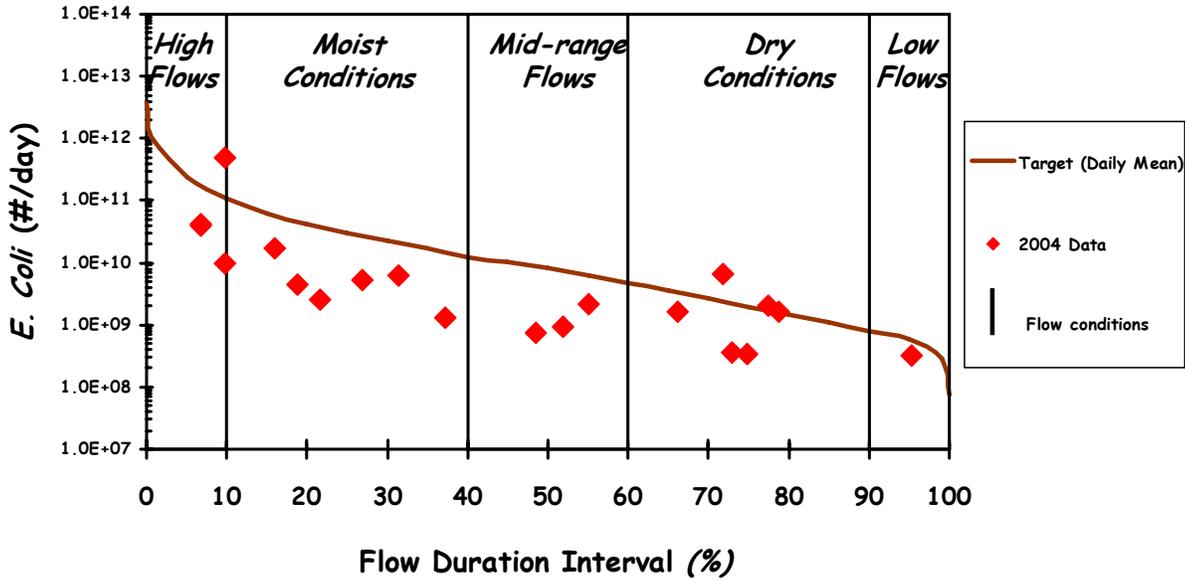


E. Coli Data & USGS Gage Duration Interval

13 square miles

A-3. East Branch Coon Creek at Main Street. Load duration curve based on daily maximums. Site: EBC3.

E. Br. Coon Creek at 72727 North Ave. Load Duration Curve (2004 Monitoring Data) Site: EBC4

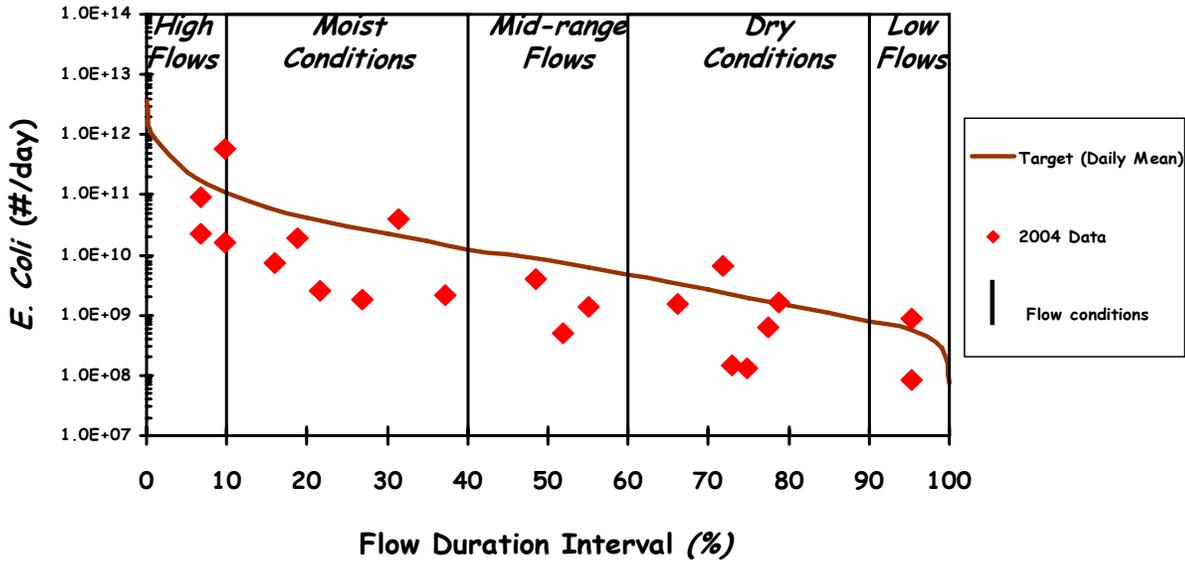


E. Coli Data & USGS Gage Duration Interval

13 square miles

A-4. East Branch Coon Creek at 72727 North Avenue. Load duration curve based on daily maximums. Site: EBC4.

**E. Br. Coon Creek at 33 Mile Rd. east of North Ave.
 Load Duration Curve (2004 Monitoring Data)
 Site: EBC5**

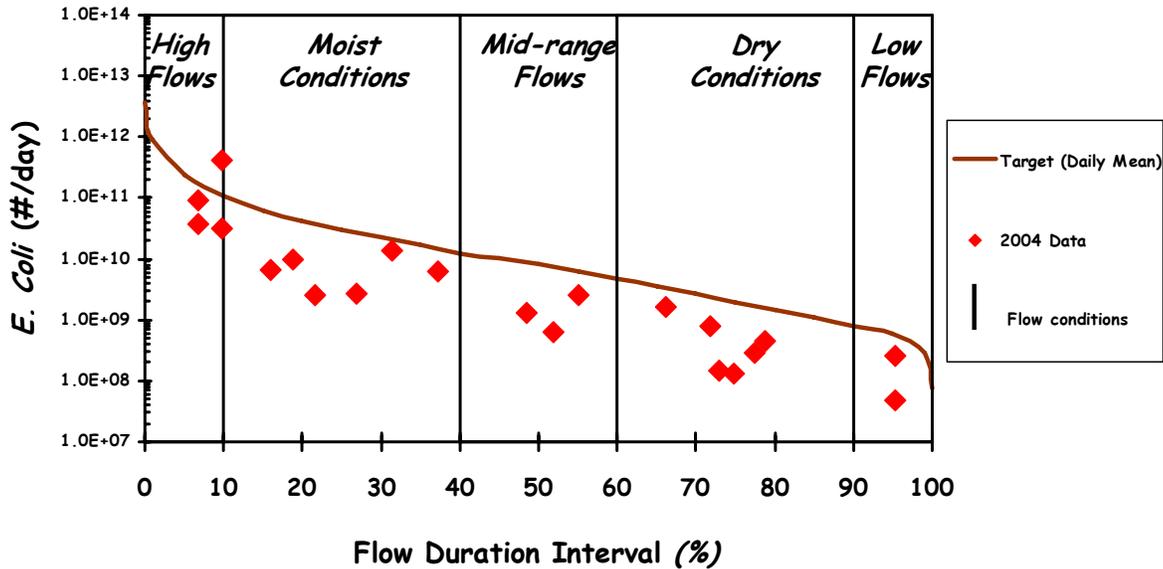


E. coli Data & USGS Gage Duration Interval

13 square miles

A-5. East Branch Coon Creek at 33 Mile Road east of North Avenue. Load duration curve based on daily maximums.
 Site: EBC5.

**E. Br. Coon Creek at 33 Mile Rd. west of Omo Rd.
Load Duration Curve (2004 Monitoring Data)
Site: EBC6**

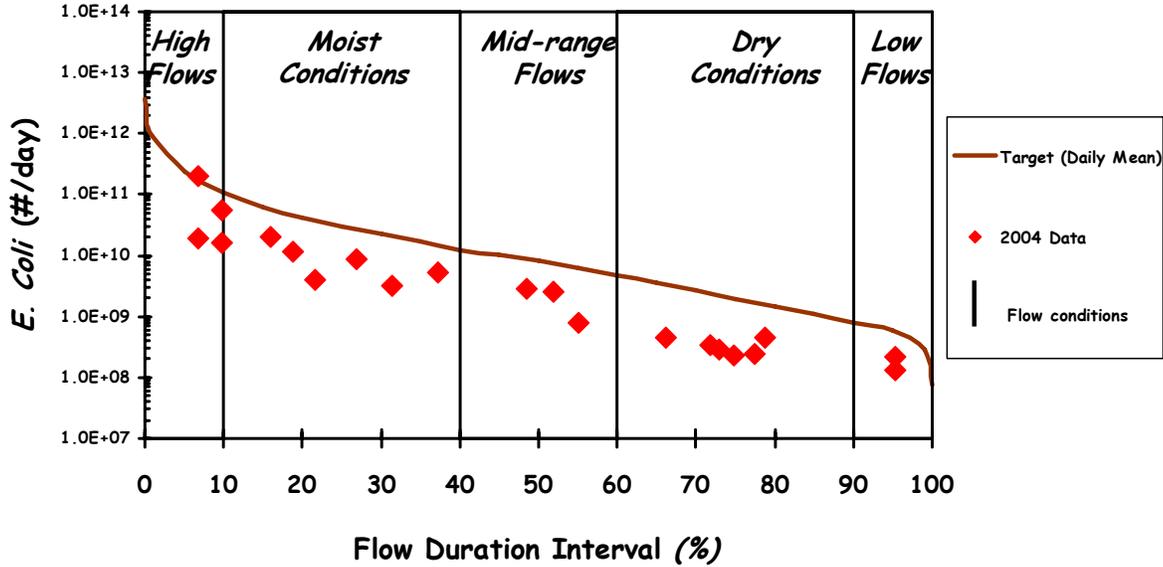


E. Coli Data & USGS Gage Duration Interval

13 square miles

- A-6. East Branch Coon Creek at 33 Mile Road west of Omo Road. Load duration curve based on daily maximums.
Site: EBC6.

E. Br. Coon Creek at 30 Mile Rd. Load Duration Curve (2004 Monitoring Data) Site: EBC8



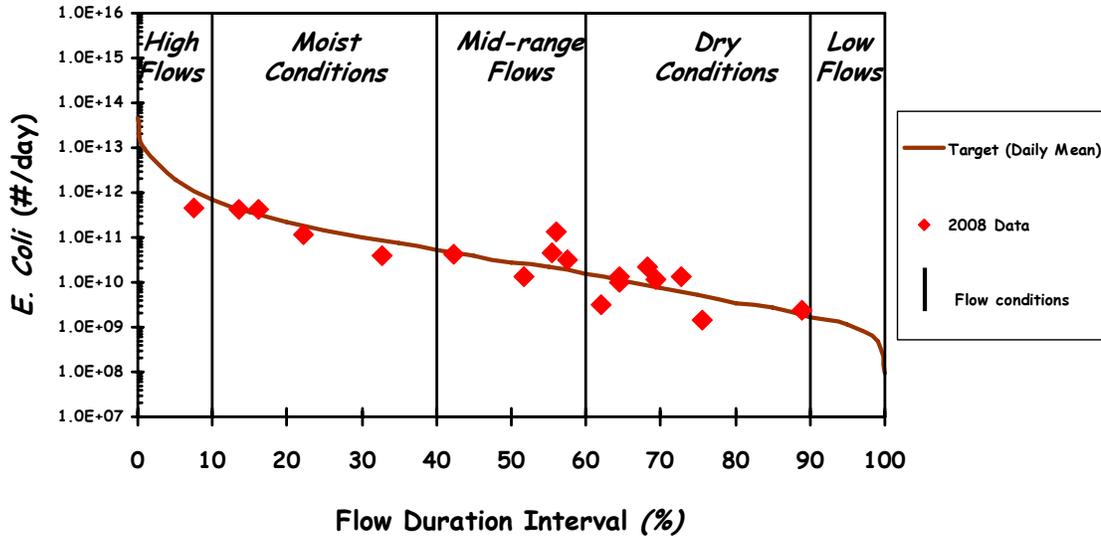
E. Coli Data & USGS Gage Duration Interval

13 square miles

A-7. East Branch Coon Creek at 30 Mile Road. Load duration curve based on daily maximums. Site: EBC8.

APPENDIX B.

East Branch Coon Creek at North Rd (near 26-Mile)
Load Duration Curve (2008 Monitoring Data)
Site: EBC9



E. Coli Data & USGS Gage 4164300 Duration Interval

45.2 square miles

- B. East Branch Coon Creek at North Road. Load duration curve based on daily maximums. Site: EBC9.