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

REVISED

Total Maximum Daily Load for Dissolved Oxygen 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, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting Michigan's Water Quality Standards (WQS) pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). 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 a basis for determining the pollutant reductions necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify the sources of dissolved oxygen (D.O.) standard nonattainment in East Branch Coon Creek near Armada (Figure 1), and to quantify reductions in these sources necessary for attainment of the standard. East Branch Coon Creek is designated as a warmwater stream with a D.O. standard of 5 milligrams per liter (mg/l) as a minimum. East Branch Coon Creek is located in Macomb and St. Clair Counties.

Historically, East Branch Coon Creek water quality was adversely impacted by combined sewer overflow (CSO) discharges. The village of Armada's combined sewer system was separated in 1993, at which time the CSOs were eliminated. Continuous and instantaneous measurements of D.O. were conducted in East Branch Coon Creek in the summers of 1999 and 2005. Full details of this work are contained in Trapp (1999) and Limno-Tech (2005 draft). Figure 1 shows monitoring locations from the 2005 study. The monitoring showed that periods of dry weather nonattainment and significant wet weather D.O. depressions continue to occur in the creek in the vicinity of Armada despite the removal of CSOs.

Table 1 defines the extent and length of the East Branch Coon Creek D.O. TMDL reach as defined on the draft 2010 Section 303(d) list (LeSage and Smith, 2010), based on results of the 2005 monitoring. Note that the reach start is a downstream location, while the end is an upstream location. A total of 13.5 river miles are addressed by this TMDL. The TMDL reach is located in Macomb and St. Clair Counties (Figure 1).

Table 1. East Branch Coon Creek D.O. TMDL Reach

River	Reach start	Reach end	Distance (mi.)
E. Br. Coon Creek	New Haven Road (T4N, R14E, Section 19)	McPhall Road, (T5N, R13E, Section 11)	13.5

East Branch Coon Creek has a drainage area of approximately 39.3 square miles at New Haven Road. Summer season 50 percent and 95 percent exceedance flows (cubic feet per second [cfs]) for East Branch Coon Creek at this location are 0.4 and 0.0 cfs, respectively. All low flows were computed from a United States Geological Survey Grand River flow gage (04164300) located on Prospect Street in Armada.

A D.O. 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 Lagoons (WWSLs), which is expected to discharge seasonally to a tributary of East Branch Coon Creek upstream of the TMDL reach (Figure 2). 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 listing status of the TMDL reach and pollutant sources.

PROBLEM STATEMENT

The East Branch Coon Creek D.O. TMDL reach appears on the draft 2010 Section 303(d) list 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

This TMDL addresses only the D.O. standard nonattainment in East Branch Coon Creek near Armada. A TMDL addressing the pathogen concerns (Cooper and Alexander, 2006) was developed by the Michigan Department of Natural Resources and Environment (DNRE) and approved by the USEPA in July 2006.

NUMERIC TARGETS

Rule 100 (designated uses) of the WQS requires that East Branch Coon Creek be protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption. The impaired designated uses for East Branch Coon Creek addressed by this TMDL are the warmwater fish and other indigenous aquatic life and wildlife uses. The D.O. standard was developed to provide protection of these designated uses. Attainment of the warmwater D.O. standard of 5 mg/l as a daily minimum will be the target of this TMDL. The D.O. WQS is defined as follows:

> R 323.1064 Dissolved oxygen in Great Lakes, connecting waters, and inland streams.
> Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected

for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained. These standards do not apply for a limited warmwater fishery use subcategory or limited coldwater fishery use subcategory established pursuant to R 323.1100(11) or during those periods when the standards specified in subrule (2) of this rule apply.

(2) Surface waters of the state which do not meet the standards set forth in subrule (1) of this rule shall be upgraded to meet those standards. The department may issue permits pursuant to R 323.2145 which establish schedules to achieve the standards set forth in subrule (1) of this rule for point source discharges to surface waters which do not meet the standards set forth in subrule (1) of this rule and which commenced discharge before December 2, 1986. For point source discharges which commenced before December 2, 1986, the dischargers may demonstrate to the department that the dissolved oxygen standards specified in subrule (1) of this rule are not attainable through further feasible and prudent reductions in their discharges or that the diurnal variation between the daily average and daily minimum dissolved oxygen concentrations in those waters exceeds 1 milligram per liter, further reductions in oxygen-consuming substances from such discharges will not be required, except as necessary to meet the interim standards specified in this subrule, until comprehensive plans to upgrade these waters to the standards specified in subrule (1) of this rule have been approved by the department and orders, permits, or other actions necessary to implement the approved plans have been issued by the department. In the interim, all of the following standards apply:

(a) For surface waters of the state designated for use for coldwater fish, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 6 milligrams per liter at the design flow during the warm weather season in accordance with R 323.1090(2) and (3). At the design flows during other seasonal periods, as provided in R 323.1090(3), a minimum of 7 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(b) For surface waters of the state designated for use for warmwater fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(3), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(c) For surface waters of the state designated for use for warmwater fish and other aquatic life, but also designated as principal migratory routes for anadromous salmonids, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below 5 milligrams per liter as a minimum during periods of migration.

(3) The department may cause a comprehensive plan to be prepared to upgrade waters to the standards specified in subrule (1) of this rule taking into consideration all factors affecting dissolved oxygen in these waters and the cost effectiveness of control measures to upgrade these waters and, after notice and hearing, approve the plan. After notice and hearing, the department may amend a comprehensive plan for cause. In undertaking the comprehensive planning effort the department shall provide for and encourage participation by interested and impacted persons in the affected area. Persons directly or indirectly discharging substances which contribute towards these waters not meeting the standards specified in subrule (1) of this rule may be required after notice and order to provide necessary information to assist in the development or

amendment of the comprehensive plan. Upon notice and order, permit, or other action of the department, persons directly or indirectly discharging substances which contribute toward these waters not meeting the standards specified in subrule (1) of this rule shall take the necessary actions consistent with the approved comprehensive plan to control these discharges to upgrade these waters to the standards specified in subrule (1) of this rule.

This TMDL will be considered the Comprehensive Plan referred to in Rule 64(3) for this water body.

SOURCE ASSESSMENT

Potential sources of D.O. demanding pollutants to East Branch Coon Creek (such as carbonaceous biochemical oxygen demand [CBOD], ammonia nitrogen, sediments, and indirectly, nutrients) include point and NPS. CBOD and ammonia can be oxidized in the water column, depleting levels of D.O. Decay of deposited organic sediments can also negatively affect in-stream D.O. concentrations. This process is known as sediment oxygen demand (SOD). Nutrients such as phosphorus and nitrogen can stimulate plant growths, which in turn can reduce D.O. levels through respiration.

There is one existing individual NPDES permitted direct point source discharge to the East Branch Coon Creek watershed in the vicinity of Armada, the Armada Wastewater Treatment Plant (WWTP; MI0022225). The proposed Berville WWSL discharge is expected to be covered under the Wastewater Stabilization Lagoon General Permit (NPDES permit MIG589000, Certificate of Coverage (COC) MIG580416). There are two industrial storm water permitted facilities, and one facility permitted for stormwater associated with construction. Macomb County holds a countywide Municipal Separate Storm Sewer System (MS4) Watershed-Based General Permit (MIG610000, COC MIG610052). See Table 2 for a listing of all permitted facilities. Figure 2 indicates the location of individual permit and storm water permit discharges.

The Armada WWTP, with a design flow of 0.35 million gallons per day (MGD), is permitted to discharge treated municipal wastewaters to East Branch Coon Creek in Section 23, T5N, R13E of Macomb County. See Table A.1 of Appendix A for Armada WWTP NPDES permit effluent limits effective as of the date of this revised TMDL. New, more restrictive permit limits for $CBOD_5$ and ammonia took effect on October 1, 2010, partly as a result of the prior approval by the USEPA of the East Branch Coon Creek D.O. TMDL in September 2006. Those limits are contained in Table A.2.

It is anticipated that the Berville WWSL will be permitted to discharge 4.7 million gallons per year of treated municipal wastewaters seasonally to a tributary to East Branch Coon Creek in Section 33, T6N, R13E of St. Clair County. The Load and WLAs in the East Branch Coon Creek D.O. TMDL, originally approved by the USEPA in September 2006, have been modified to account for this new proposed discharge. The community of Berville applied for an NPDES permit in June 2010 after applying for a grant under the United States Department of Agriculture'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 D.O. and *E. coli* standard attainment in the East Branch Coon Creek watershed. Note that the Berville WWSL proposes to discharge upstream of the listed D.O. and *E. coli* TMDL reaches. See Table A.3 of Appendix A for proposed Berville WWSL NPDES permit effluent limits.

Table 2. Permitted discharges to the East Branch Coon Creek TMDL watershed. Source: DNRE, Water Resource Division's NPDES Permit Management System. Outfall locations are illustrated in Figure 2.

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 Lagoon**				
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	**Watershed Based Municipal Separate Storm Sewer System (MS4)**				
Macomb County MS4	MIG610052	Macomb	Countywide		
Permit-by-Rule (R323.2190)	**Storm water discharges from construction activities**				
Ansana Castle Court	MIR109178	Macomb	---	---	---

Table 3 contains current and proposed permitted daily conventional pollutant loads for the Armada WWTP and Berville WWSL. The loads are calculated from the facilities' monthly NPDES permit load limits. For parameters not limited by load, daily loads were estimated from concentration permit limits or estimates of effluent concentrations, and the facility design flows. Note that the facilities may, in fact, be discharging significantly lower loads of these pollutants than they are permitted to discharge. Loads for the Berville WWSL are based on proposed permit limits outlined in Table A.3.

Table 3. Permitted Conventional Pollutant Loads for the Armada WWTP and Berville WWSL.

	Armada WWTP		Berville WWSL	
Pollutant	**Daily Load (lbs/day)**	**Annual load (lbs/yr)**	**Daily Load (lbs/day)**	**Annual load (lbs/yr)**
$CBOD_5$	44	15,909	3.2	1,176
Total suspended solids	70	25,700	5.9	2,156
Ammonia nitrogen	17	6,210	1.6	588
Total phosphorus	2.9	1,059	0.1	39

Table 4 contains estimates of East Branch Coon Creek conventional pollutant loads from existing NPDES municipal and industrial storm water permitted facilities. Storm water loads in Table 4 were estimated based on commercial and residential land use data contained in the Long-Term Hydrologic Impact Assessment (L-THIA) Web-based software created by Purdue University and the USEPA (Purdue University and USEPA, 2001), and currently maintained by Purdue University. This geographic information system-based application uses the event mean concentration (EMC) and curve number (CN) procedures to calculate annual pollutant loads

based on land use, soil type, and meteorological data. All East Branch Coon Creek watershed land areas in Macomb County were included in the NPDES-permitted land use load calculations, given that county's coverage under its countywide MS4 permit.

Table 4. Estimated East Branch Coon Creek conventional pollutant loads from existing municipal and industrial storm water permitted facilities.

Pollutant	Daily Load (lbs/day)	Annual load (lbs/yr)
Biochemical Oxygen Demand (BOD)	154	56,200
Total suspended solids	3,493	1,275,009
Ammonia nitrogen	148	54,180
Total phosphorus	42	15,484

Potential non-NPDES land use sources of pollutants were evaluated based on land uses in the drainage basin. Land use proportions were derived using the L-THIA application and are presented in Table 5. It is possible that the urban land use proportions (e.g., commercial and residential) are in fact higher than indicated in Table 5 due to residential development in this area. However, these possible increases in residential and/or commercial development are not expected to significantly affect the TMDL as the overall residential and commercial land use in the watershed are relatively minor when compared to other uses, e.g., agriculture.

Table 5. East Branch Coon Creek basin land use categories as percentages.

Land use category	Percent land use category
Water	4.0
Commercial	0.1
Agriculture	64
High density residential	0.3
Low density residential	2.2
Grass/pasture	16
Forest	13

The 1999 and 2005 summer D.O. surveys indicate that certain pollutants contribute toward D.O. standard nonattainment in East Branch Coon Creek near Armada. Land use-related inputs of various oxygen demanding pollutants (e.g., ammonia, total phosphorus, BOD ($CBOD_5$ + nitrogenous BOD) appear to cause the documented wet weather-related D.O. depressions in East Branch Coon Creek near Armada. Land use-related inputs also likely contribute toward D.O. standard nonattainment through SOD and respiration from abundant plant growths observed throughout the TMDL reach (Limno-Tech, 2005 draft).

Estimates of NPDES and non-NPDES land use-related annual loads of BOD, total suspended solids (TSS), total phosphorus, and total nitrogen to East Branch Coon Creek were estimated using the L-THIA application. Estimates of loads to East Branch Coon Creek at New Haven Road (Station 14 in Figure 1) appear in Table 6. These loads include all East Branch Coon Creek tributaries, and are based on non-site-specific data and represent a best approximation using software default EMC and CN values. These estimates include construction site contributions based on commercial land use, as well as the estimated loads from storm water permitted facilities contained in Table 4. Note that the load estimates presented in Table 4 constitute only 0.2 percent of the estimated loadings to the TMDL reach..

Table 6. Estimated annual land use conventional pollutant loads, including East Branch Coon Creek storm water permitted facilities.

Pollutant	Daily Load (lbs/d)	Annual Load (lbs/yr)
BOD	186	67,719
Total suspended solids	4,269	1,558,263
Total nitrogen	181	66,136
Total phosphorus	52	18,922

In accordance with USEPA guidelines, runoff from lands covered under MS4 NPDES permits will be considered in the WLA portion of this TMDL. Municipal and industrial storm water permitted facilities will also be considered in the WLA portion of the TMDL. NPDES storm water permittees in the vicinity of Armada are listed in Table 2. Macomb County's countywide MS4 permit is the only Phase II municipal storm water permittee in the drainage area of the TMDL reach. There are no known Concentrated Animal Feeding Operations in the TMDL reach drainage area.

LINKAGE ANALYSIS

The observed D.O. standard nonattainment in East Branch Coon Creek can be attributed to a number of factors which were assessed using mathematical D.O. models of the reaches of concern. The model chosen was the O'Connor-DiToro multi-reach, steady-state D.O. model (O'Connor and DiToro, 1970), based on the modified Streeter-Phelps equation. This model has the capability of simulating diurnal D.O. variation resulting from plant photosynthesis and respiration. The respiration term includes D.O. depletion due to SOD. The O'Connor-DiToro model is considered appropriate for use in the TMDL as it can represent the system without being unnecessarily complex or too data-intensive. Modeling was conducted in accordance with guidance described in the Great Lakes and Environmental Assessment Section Procedure 80 (DNRE, 1995). The models were calibrated to data collected in the summer of 2005.

Plant Respiration: The presence of aquatic plants in a water body can have a very significant effect on levels of D.O. Plants, such as rooted macrophytes and algae, utilize photosynthesis during daylight hours to convert carbon dioxide and water into glucose, a process that releases oxygen. The oxygen is released to the surrounding water increasing levels of D.O. Throughout the day and night, plants also respire aerobically. This process removes D.O. from the water column. D.O. concentrations vary throughout the day in response to photosynthesis and respiration. Since the photosynthetic contribution of D.O. occurs only with sunlight, and respiration is relatively constant, levels of D.O. are most often lowest just before sunrise. Plant growth can be encouraged by the addition of nutrients, such as phosphorus, to a water body. This increased growth causes increases in photosynthesis and respiration rates, resulting in exaggerated daytime D.O. concentration peaks and potentially problematic early morning lows.

Phosphorus is an important nutrient of concern when considering D.O. problems in aquatic systems, such as East Branch Coon Creek. Phosphorus can exist in dissolved and particulate forms. When dissolved, some of the phosphorus is available for use by aquatic plants and increased growth can result. Phosphorus, in the particulate form in river sediments, can be released to the water column as dissolved phosphorus under certain conditions, contributing to increased plant growth. Solids that run off of land into water bodies or that are discharged

directly to a stream typically have particulate phosphorus associated with them. Substantial loads of TSS can therefore result in substantial inputs of phosphorus available for plant use in a stream.

Prolific growths of rooted and detached macrophytes were noted in East Branch Coon Creek during the summers of 1999 and 2005 (Trapp, 1999; Limno-Tech, 2005 draft). During routine maintenance visits to deployed monitoring instruments, D.O. sensors were found to be fouled with relatively heavy algal biofilm growths. This heavy plant growth results in high rates of photosynthesis and respiration. Very high D.O. diurnal variations were measured in 1999 (Trapp, 1999) and 2005, and early morning D.O. standard nonattainment was common throughout the TMDL reach (Stations 1-14, Figure 1) (Limno-Tech, 2005 draft). One round of dry weather chemistry sampling on August 26, 2005, showed that total phosphorus concentrations exceeded 0.1 mg/l in eight of the nine sampled locations on East Branch Coon Creek and its tributaries (Limno-Tech, 2005 draft).

SOD: Substrates in nonattaining reaches of East Branch Coon Creek within and downstream of the city of Armada are characterized primarily by fine sediments. In 2005, black, anoxic sludge beds were encountered in East Branch Coon Creek at both North Avenue stations (Stations 3 and 7) and at 33 Mile Road (Station 8) indicating that SOD is likely a contributing factor in D.O. standard nonattainment in East Branch Coon Creek in the vicinity of Armada. East Branch Coon Creek is characterized by low channel slopes and resulting low velocities. This appears to cause deposition of sediments from the water column, exacerbating SOD. The low velocities also result in relatively low rates of reaeration.

SOD was measured in 2005 at transects at North Avenue (Stations 3 and 7), just upstream of the Armada WWTP outfall (Station 6), and 33 Mile Road (Station 8). SOD ranged from 0.9 to 2.3 g / m^2-d, with an overall average of 1.5 g / m^2-d. These values are typical of SOD in sediments downstream of a treated municipal sewage discharge (Chapra, 1997). The city of Armada CSOs, which previously discharged to East Branch Coon Creek, likely contributed to higher levels of SOD downstream of Armada. SOD and sediment deposits are typically highly variable spatially and temporally due to varying flow regimes affecting deposition and scour (Bowie et. al., 1985).

Observations made during the 1999 and 2005 surveys indicate that stream bank erosion contributes a substantial amount of sediments and SOD to East Branch Coon Creek. Numerous log jams, formed from fallen riparian trees, were noted in East Branch Coon Creek below Armada. Soil surveys by the Soil Conservation Service indicate that poorly drained, highly erodable organic soils pervade the banks of East Branch Coon Creek below Armada (USDA, 1971).

LOADING CAPACITY DEVELOPMENT

The Loading Capacity (LC) represents the maximum loading of oxygen demanding substances, or other parameters that can indirectly cause oxygen demand (sediments, nutrients) that can be assimilated by the water body while still achieving WQS. As indicated in the Numeric Target section, the target for this D.O. TMDL is the WQS of 5 mg/l minimum D.O. TMDL development also defines the environmental conditions that will be used when defining allowable levels.

The “critical condition” is the set of environmental conditions (e.g., flow) used in developing the TMDL that result in attaining WQS and has an acceptably low frequency of occurrence. For example, the critical conditions for the control of point sources in Michigan are given in

R 323.1082 (Mixing Zones) and R 323.1090 (Applicability of WQS). In general, the lowest monthly 95 percent exceedance flow and 90 percent occurrence temperature for streams are used as design conditions for conventional pollutant loadings.

D.O. models were used to quantify reductions in river D.O. sinks necessary to attain the D.O. standard at critical conditions. Calibration data show that along the 13.5 mile length of the East Branch Coon Creek D.O. TMDL reach, D.O. deficits were, on average, caused by SOD (45 percent), plant respiration (40 percent), and the Armada WWTP (15 percent). There are reaches in East Branch Coon Creek where the D.O. deficit is due entirely to either plant respiration or SOD. The calculated relative contributions to the D.O. deficit from plant respiration and SOD will vary depending on the conditions to which the models are calibrated. Direct negative impacts on stream D.O. during the critical season are not expected from the Berville WWSL discharge as that facility will not discharge during those months.

In order to decrease SOD and nutrient loads, the loading of suspended sediments to the rivers must be reduced. Summer 2005, and past East Branch Coon Creek monitoring, has documented significant D.O. sags during wet weather events. It is likely that most nutrient inputs to the system are transported with the suspended sediment loads likely to accompany runoff. This is supported by wet weather water chemistry sampling conducted in other watersheds similar to the East Branch Coon Creek basin (Sunday, 2003). Wet weather sampling conducted in development of the Grand River at Jackson D.O. TMDL (Sunday, 2003) showed that except for one wet weather event, total phosphorus concentrations are significantly higher than orthophosphate concentrations. These data indicate that most land use-related phosphorus loads are adsorbed to solids rather than being in a dissolved form. TSS reduction is therefore the best overall strategy to improve D.O. in the stream.

ALLOCATIONS

The LC is comprised of the sum of individual WLAs for NPDES permitted point sources and land uses, and LAs for non-NPDES permitted land use loads and natural background levels. LAs and WLAs are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL result in WQS attainment. The LC must include a margin of safety (MOS), either implicitly 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:

$$LC = \sum WLAs + \sum LAs + MOS$$

The LC represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources and NPDES-permitted land-use sources, LAs for non-NPDES land-use sources, and the MOS.

This D.O. TMDL targets a 50 percent reduction in land use-related TSS loads (NPDES and non-NPDES) to East Branch Coon Creek in the vicinity of Armada. The 50 percent TSS load reduction was chosen in part due to the results of D.O. modeling which indicates that SOD and plant activity in the reaches of concern should be reduced by approximately 50 to 95 percent, depending on the reach under consideration, in order to achieve the D.O. standard. The existence of considerable uncertainties which make it difficult to quantify the effects of TSS loads on in-stream D.O. levels make the proposed 50 percent reduction a reasonable objective. In addition, the 5.9 pounds per day anticipated to be discharged by the Berville WWSL has been

removed from non-NPDES NPS land use load contributions (the load allocation [LA]) in the target TSS load. The load reduction in this category still rounds to 50 percent (49.9 percent) due to the very small load contributed by the Berville WWSL in comparison to the non-NPDES NPS land use load contributions.

WLAs

D.O. standard nonattainment in the relevant water bodies has been documented during the summer months only. Armada WWTP is the most significant point source of oxygen demanding substances to the nonattaining reaches during that season. Subsequent to USEPA approval of the East Branch Coon Creek D.O. TMDL in September 2006, the reissued Armada WWTP permit included effluent limitations necessary to meet the D.O. standard of 5 mg/l. Water quality modeling of East Branch Coon Creek indicates that in order to meet the D.O. standard of 5 mg/l, the Armada WWTP must employ advanced waste treatment (AWT). The AWT effluent limits (Table A.2), which become effective October 1, 2010, are the most restrictive limits that the State of Michigan imposes on municipal wastewater treatment facilities, and effluent of this quality is considered to exert no oxygen demand in-stream (stable effluent). Requiring Armada WWTP to meet AWT limits results in a 74 percent reduction in the permitted ammonia nitrogen loading and a 59 percent reduction in $CBOD_5$ from the facility (based on permitted monthly average load limits). Reductions in TSS limits were not recommended for this facility as they are already permitted at AWT levels for this constituent throughout the year. The high level of treatment required at the Armada WWTP will lead to high conventional pollutant removal rates in all seasons.

The proposed Berville WWSL has yet to be constructed at the time of the drafting of this TMDL. The facility's discharge of treated sanitary wastewater will replace untreated effluent from failing or failed septic systems in the vicinity of Berville, which may contribute to D.O. standard violations in East Branch Coon Creek. This facility's individual NPDES permit will allow discharge only during the spring and fall seasons at conditions of high background flows in the receiving water. Discharge will not be permitted during the critical summer season during which D.O. standard nonattainment has been documented. Therefore, the Berville WWSL is not expected to exacerbate any D.O. standard nonattainment in East Branch Coon Creek. This proposed facility's permitted daily load of 5.9 pounds of TSS (the annual load divided by 365 days) is included in the individual NPDES permitted facilities' portion of the target WLA.

TSS loads for the remaining NPDES permitted facilities are allocated using the existing loads contained in Table 4 and reducing these land use-related loads by 50 percent. Table 7 contains proposed TSS WLAs for East Branch Coon Creek.

LAs

TSS inputs resulting from both NPDES permitted and non-NPDES permitted land use-related sediment loads will be the primary targets for reduction in East Branch Coon Creek in this TMDL. Table 7 lists the non-NPDES land use source LAs for East Branch Coon Creek. The target LA values in Table 7 represent 50 percent of the loads of the existing estimated TSS loads contributed by those land uses classified as nonurban (e.g., agriculture, forest, grass/pasture) and not covered under storm water permits. The target LA is further reduced by 5.9 pounds per day to account for the increase in TSS load from the proposed Berville WWSL.

Lands contributing TSS loads to East Branch Coon Creek are located in Armada, Berlin, Lenox, Ray, and Richmond Townships, and Macomb and St. Clair Counties.

Table 7. Daily TSS load source allocations and numeric targets.

Water Body	Current Daily TSS Load (pounds/day)	Daily TSS Load Numeric Target (pounds/day)	NPDES Permitted TSS Loads (pounds/day)	WLA Daily TSS Load (pounds/day)	LA Daily TSS Load (pounds/day)	Percent Reduction
East Branch Coon Ck.						
Industrial/Municipal NPDES Storm Water Permitted Outfalls*	3,493	1,747		1,747		50
Indiv. NPDES Permitted Facilities (Armada WWTP and Berville WWSL)**	70	76	76	76		0
NPS Land Use Related Sources***	776	382			382	51
East Branch Coon Creek Total Daily Loads	4,340	2,205		1,823	382	49

Attributed to all commercial and industrial land uses in the watershed, and all watershed land uses in Macomb County covered under the countywide MS4 permit.
** Average annual permitted load over 365 days. Note that permit loads are consistent with this WLA.
***Attributed to nonurbanized/built-up land uses in the townships of Armada, Berlin, Lenox, Ray, and Richmond.

The TMDL for TSS is calculated to be 2,205 pounds per day, based on the year-round standard for the designated uses of warmwater fisheries, and other indigenous aquatic life and wildlife.

MOS

The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can be either implicit (i.e., incorporated into the TMDL analysis through conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings).

This TMDL uses an implicit MOS due to very conservative assumptions incorporated in D.O. modeling used to determine appropriate load reductions for TSS. Background flows and tributary inflows are represented at the 95 percent exceedance summer low flow as determined by the DNRE, Land and Water Management Division. The summer 95 percent exceedance flow is a stream flow that would be expected only during periods of severe drought. Stream flows would be expected to be this low for only 5 percent or less of the time during the summer season. Michigan WQS (R 323.1090) specify that WQS apply at all flows equal to or exceeding the 12-month 95 percent exceedance low flow. This is the stream flow employed in the modeling of the critical summer season, the minimum flow at which WQS are to be applied. Similarly, river temperatures are represented at the highest monthly 90 percent occurrence temperature for the summer season as defined in the Effluent Limit Coordination Procedure No. 15 (Buda, 1980). This temperature would be expected to be exceeded only 10 percent of the time during the summer months. This design temperature is derived from R 323.1075 of the WQS. Such high temperatures result in lower D.O. saturation concentrations and increased rates of in-stream oxygen utilization. The conservative assumptions regarding stream flow and water temperature are the same as those employed in the determination of Water Quality-Based Effluent Limits in NPDES WLAs at critical design conditions. For design condition TMDL modeling, the Armada WWTP was represented as discharging its maximum design flow and maximum permitted concentrations of oxygen demanding substances. This is an extremely unlikely scenario and further lends to the conservative assumptions of the

modeling. A large degree of uncertainty in the D.O. modeling is also removed as the models used were calibrated to observed data.

SEASONALITY

Monitoring and modeling indicates that design conditions occurring during the summer season represents the most critical conditions for D.O. standard attainment in East Branch Coon Creek. Modeling of East Branch Coon Creek in other seasons using appropriate 95 percent exceedance low flows and 90 percent occurrence temperatures shows no predicted instances of D.O. standard nonattainment.

MONITORING

This TMDLs approach requires that future monitoring be conducted to assess whether activities implemented under the TMDL result in water quality improvements. This monitoring will be conducted as resources allow. Typically, the DNRE monitors watersheds in accordance with the five-year NPDES permit review process. East Branch Coon Creek will be reevaluated in 2015 when the Clinton River basin is next scheduled for monitoring. Limited D.O. monitoring (instantaneous measurements similar to those of the 1999 and 2005 surveys) may be conducted in the meantime.

REASONABLE ASSURANCE ACTIVITIES

Under the NPDES Permit Program, the Armada WWTP and the proposed Berville WWSL are responsible for meeting their effluent limits for oxygen demanding substances and TSS. Compliance is determined based on review of discharge monitoring report data by the DNRE. Existing discharge monitoring report data reviewed by the DNRE indicates that the Armada WWTP is meeting those permit limits. Consistent with this TMDL and the previously approved East Branch Coon Creek TMDL, the Armada WWTP began treating their effluent to AWT beginning October 2010. Compared to the previously effective permit limits, this will result in 74 percent and 59 percent reductions in permitted ammonia nitrogen and $CBOD_5$ loadings, respectively, from the facility, which will result in reduced D.O. demand in East Branch Coon Creek.

As discussed in the Source Assessment section of this TMDL, elimination of untreated sewage discharges from failed septic systems by construction of the Berville WWSL and associated sewer system should reduce loads of very high oxygen demanding substances from the East Branch Coon Creek watershed. The Berville WWSL is expected to begin discharging some time after 2010 pending approval of this revised TMDL and issuance of the NPDES permit.

The COCs for the general industrial storm water permit (MIS110000) identified in Table 2 require that if there is a TMDL established by the DNRE for the receiving water that restricts a material that could impair or degrade water quality, then the required Storm Water Pollution Prevention Plan 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 Storm Water Pollution Prevention Plan for the facility.

The TMDL watershed receives storm water discharges from one regulated Watershed-Based MS4 (Macomb County; COC #MIG610052). This regulated MS4 is required to obtain permit coverage for the discharge of storm water to waters of the state. Under the Watershed-Based General Permit and Individual MS4 Permit, permittees are required to reduce the discharge of pollutants 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. In addition, permittees are required to identify and prioritize actions to be consistent with the requirements and assumptions of the TMDL. 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.

The implementation of Macomb County's IDEP, as required by their MS4 permit, will have a great potential to contribute to reduction of D.O. demanding materials and sediments in 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). If the permittee observes evidence of any illicit connection or discharge they are required to investigate and eliminate them.

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 (Macomb County Health Department (MCHD), Department of Public Works, 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 that may also contribute D.O. demanding substances and sediment to the receiving water. 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. The remaining and largest illicit discharge is attributed to the town of Berville (St. Clair County, 2009). As described in the Source Assessment section of this TMDL, the community of Berville is attempting to obtain federal funding to remediate failed septic systems through the construction of effective wastewater treatment, which is expected to benefit D.O. 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, and reducing loads of oxygen demanding substances and sediments.

When on-site sewage disposal systems (OSDS) are not functioning properly or are poorly designed or maintained, they are a potential source of D.O. demanding substances and sediment 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, 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 St. Clair County Health Department 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, St. Clair County Health Department - personal communication). Failing OSDS have the potential to contaminate groundwater and surface water; therefore, the repair of failing systems is critical to reducing oxygen demanding substance and sediment loads in the East Branch Coon Creek watershed.

NPS pollution from unpermitted agricultural operations is generally not regulated by the DNRE, but is mitigated through voluntary programs such as 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 Part 21, of the NREPA. This authority allows the DNRE to impose pollution controls and conduct inspections, thereby reducing pollutant contamination 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.

East Branch Coon Creek is located in the North Branch Clinton River subwatershed (Macomb County, 2005) and has a subwatershed advisory group that consists of representatives from communities, departments, and organizations that are located in the watershed. In 2008, Macomb County was awarded a Section 319 grant to develop a Watershed Management Plan for the North Branch of the Clinton River. As part of this grant, the subwatershed advisory group conducted social surveys and field assessments to evaluate the current conditions of the

North Branch Clinton River watershed. The 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 the amount of $202,268 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 D.O. and *E. Coli* TMDLs 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; indentifying 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. The goal of a 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 failing septic tanks, 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 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.

Macomb and St. Clair Counties administer the Part 91, Soil Erosion and Sedimentation Control Program, of the NREPA. This program aims to reduce sedimentation in rivers, lakes, and streams by controlling sediments in runoff from construction sites greater than 1 acre, or those located within 500 feet of a water of the state. Temporary (silt fences) and permanent control measures (such as fully vegetated buffer strips) are employed. The DNRE, Water Resources Division oversees the counties' programs to ensure that they are effectively enforcing Soil Erosion and Sedimentation Control regulations.

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: Matt Staron
Surface Water Assessment Section
Water Resources Division
August 10, 2006

TMDL revised by: Erik Sunday
Surface Water Assessment Section
Water Resources Division
November 30, 2010

REFERENCES

Bowie, B.L., Mills, W.B., Porcella, D.B., Campbell, C.L., Pagenkoph, J.R., Rupp, G.L., Johnson, K.M., Chan, P.W.H., Gherini, S.A. and Chamberlin , C.E. 1985. Rates, Constants, and Kinetic Formulations in Surface Water Quality Modeling. USEPA. ORD, Athens, GA. ERL, EPA/600/3-85/040.

Buda, S. 1980. Effluent Limit Coordination Procedure No. 15. Comprehensive Studies Section, Water Quality Division.

Chapra, S.C. 1997. Surface Water Quality Modeling. McGraw-Hill. New York.

Cooper, J. and Alexander, C. 2006. Pathogen TMDL for East Branch Coon Creek near Armada, MI. DNRE, Water Resources Division.

DNRE. 1995. Great Lakes and Environmental Assessment Section Procedures Manual, Vol. II. Procedure 80: Guidance on Water Quality-Based Effluent Limit Recommendations for Oxygen Demanding Substances. DNRE, Water Resources Division.

LeSage and Smith. 2010. Draft Water Quality and Pollution Control in Michigan 2010 Sections 303(d), 305(b), and 314 Integrated Report. DNRE Staff Report.

Limno-Tech, Inc. 2005. Draft East Branch Coon Creek 2005 Dissolved Oxygen and Water Chemistry Study, Macomb County, Michigan. June 12-September 23, 2005.

Macomb County. 2005. NPDES Phase 2 Watershed Permit Annual Report-Year 2 (October 1, 2004– September 30, 2005). Certificate of Coverage MIG610052.

Macomb County. 2008. NPDES Phase 2 Watershed Permit Annual Report. Certificate of Coverage MIG610052.

O'Connor, D.J. and D.M. DiToro. 1970. Photosynthesis and Oxygen Balance in Streams. Journal of the Sanitary Engineering Division. ASCE 96(2): 547-571.

Purdue University and USEPA. 2001. Long-Term Hydrological Impact Assessments (L-THIA) Web site, November 12, 2003. <http://www.ecn.purdue.edu/runoff/lthianew>

St. Clair County. 2009. NPDES Phase 2 Watershed Permit Annual Report-Certificate of Coverage MIG610055.

Trapp, D. 1999. East Branch Coon Creek Dissolved Oxygen Study. Macomb County, Michigan. June-July 1999. DNRE Staff Report #MI/DNRE/SWQ-02/048.

Sunday, Erik. 2003. Total Maximum Daily Load for Dissolved Oxygen for the Grand River. Jackson County. DNRE.

USDA. 1971. Soil Survey of Macomb County, Michigan. Soil Conservation Service.

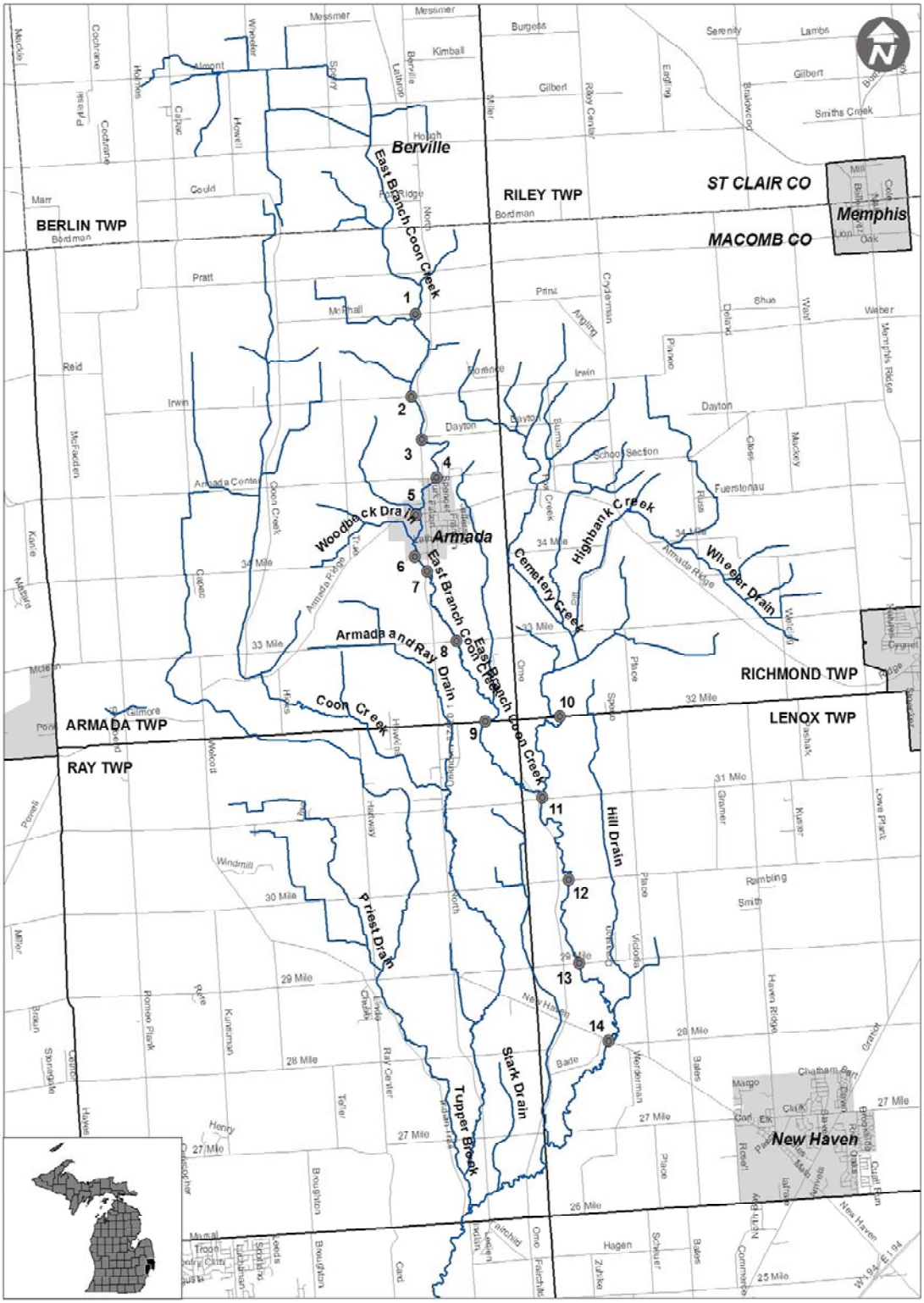

Figure 1. East Branch Coon Creek study sampling sites, including Highbank Creek, in the vicinity of Armada, Macomb County, Michigan, 2005

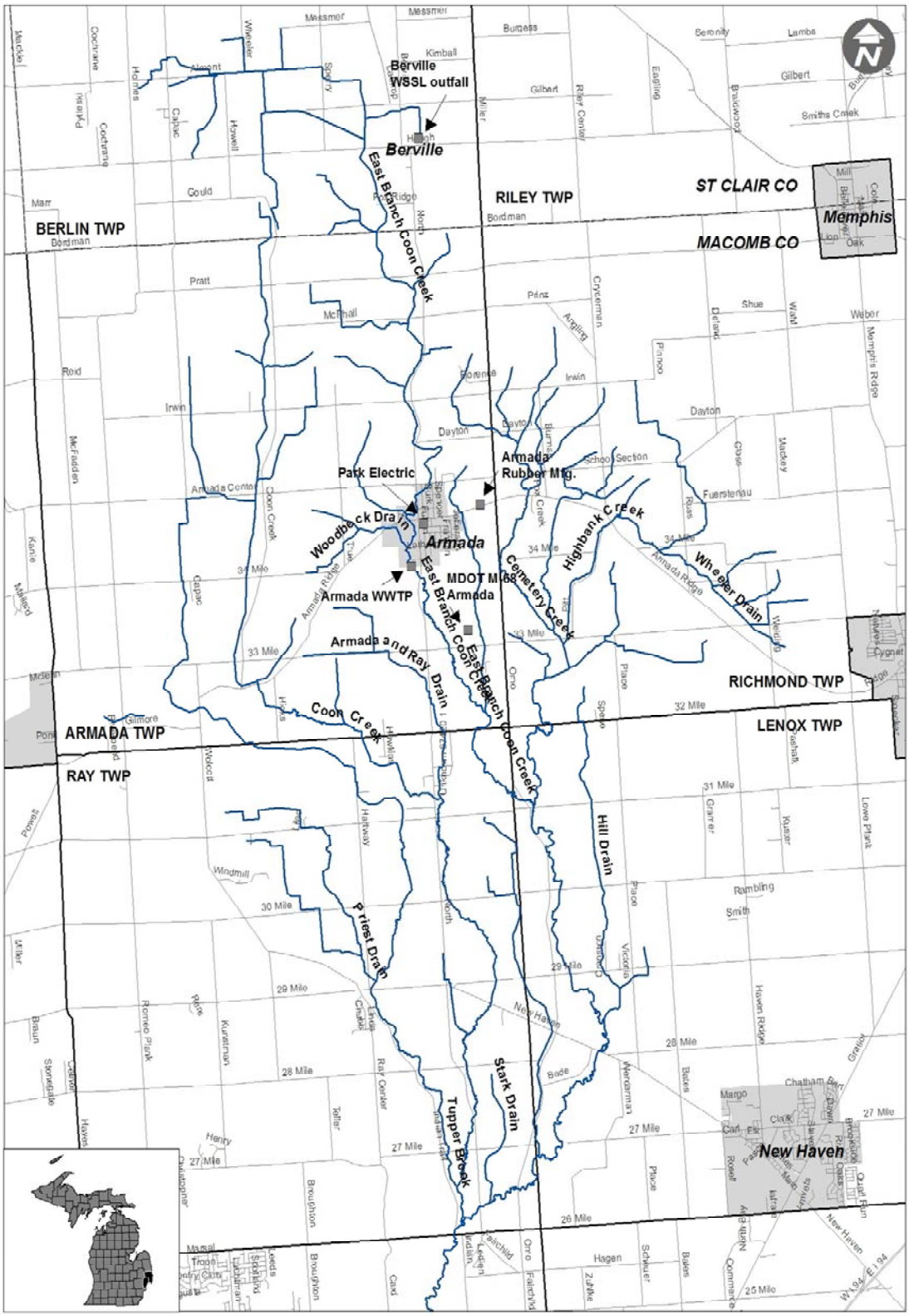

Figure 2. East Branch Coon Creek, NPDES permitted facilities in the vicinity of Armada, Macomb County, Michigan, 2010

APPENDIX A – ARMADA WWTP (MI0022225) AND BERVILLE WWSL (MIG580416)
CONVENTIONAL PARAMETER NPDES PERMIT LIMITS

TABLE A.1
Armada WWTP NPDES conventional parameter permit limits (design flow 0.35 MGD)
Limits effective through September 30, 2010

		Maximum loading (lbs/d)		Maximum concentration (mg/l)		
Parameter	Period	Monthly	7-day	Monthly	7-day	Daily
$CBOD_5$ (mg/l)	5/1 – 11/30	20	29	7	-	10
	12/1 – 4/30	73	120	25	40	-
Total suspended solids (mg/l)	5/1 – 9/30	58	88	20	30	-
	12/1 – 4/30	88	130	30	45	-
Ammonia Nitrogen (mg/l)	5/1 – 9/30	5.8	10	2.0	-	3.5
	10/1 – 11/30	14	29	4.7	-	9.9
	12/1 – 4/30	29	44	10	-	15
Total phosphorus (mg/l)	Year round	2.9	-	-	1.0	-
D.O. (min., mg/l)	5/1 – 11/30	-	-	-	-	6.0
	12/1 – 4/30	-	-	-	-	5.0

TABLE A.2
Armada WWTP NPDES conventional parameter permit limits (design flow 0.35 MGD)
Limits effective October 1, 2010

		Maximum loading (lbs/d)		Maximum concentration (mg/l)		
Parameter	Period	Monthly	7-day	Monthly	7-day	Daily
$CBOD_5$ (mg/l)	5/1 – 9/30	12	29	4	-	10
	10/1 – 11/30	20	29	7	-	10
	12/1 – 4/30	73	120	25	40	-
Total suspended solids (mg/l)	5/1 – 9/30	58	88	20	30	-
	12/1 – 4/30	88	130	30	45	-
Ammonia Nitrogen (mg/l)	5/1 – 9/30	1.5	5.8	0.5	-	2.0
	10/1 – 11/30	14	20	4.7	-	6.8
	12/1 – 4/30	29	44	10	-	15
Total phosphorus (mg/l)	Year round	2.9	-	-	1.0	-
D.O. (min., mg/l)	5/1 – 11/30	-	-	-	-	6.0
	12/1 – 4/30	-	-	-	-	5.0

TABLE A.3
Anticipated Berville WWSL NPDES conventional parameter permit limits (design flow 4.7 million gallons per year).

Parameter	Period	Maximum loading (lbs/d)		Maximum concentration (mg/l)		
		Monthly	7-day	Monthly	7-day	Daily
BOD_5 (mg/l)	3/1 – 5/31 10/1 – 12/31	-	-	30	45	-
Total suspended solids (mg/l)	3/1 – 5/31 10/1 – 12/31	-	-	70	100	-
		-	-	40	45	-
Ammonia Nitrogen (mg/l)	3/1 – 5/31 10/1 – 12/31	-	-	Report	-	-
Total phosphorus (mg/l)	Year round	-	-	1.0	-	-
D.O. (min., mg/l)	Year round	-	-	5.0	-	-