

Michigan Department of Environmental Quality

Water Division

June 2003

Total Maximum Daily Load for *Escherichia coli* for the Grand River
Jackson County

INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) 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 waterbodies that are not meeting Water Quality Standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide 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 Grand River located in Jackson County, Michigan.

PROBLEM STATEMENT

This TMDL listing addresses approximately 25 miles of the Grand River downstream of the city of Jackson. The TMDL reach is on the Section 303(d) list as:

GRAND RIVER AND PORTAGE RIVER

WBID#: **082816H**

County: JACKSON

HUC: 4050004

Size: 25 M

Location: Grand River from Tompkins Road upstream to the city of Jackson and Portage River from the Grand River confluence upstream to Wooster Road.

Problem: **Untreated sewage discharge, pathogens (Rule 100); WQS exceedances for DO; Macroinvertebrate and fish communities rated poor.**

TMDL YEAR(s): 2003

RF3RchID: 4050004

The current 303(d) listing for the Grand River includes a listing for pathogens, macroinvertebrate and fish communities, and WQS exceedances for dissolved oxygen. This TMDL only covers the pathogen portion of the listing. The remaining TMDLs will also be completed in 2003.

The Grand River (Figure 1) was placed on the Section 303(d) list (Creal and Wuycheck, 2002) due to impairment of recreational uses as indicated by the presence of elevated levels of *E. coli*. Recent monitoring data collected by the Michigan Department of Environmental Quality (MDEQ) for the 2002 monitoring season documented exceedances of the WQS at several stations sampled. Grand River stations in the city of Jackson documented exceedances of the WQS at two of three stations (Table 1). Thirty-day geometric mean *E. coli* concentrations in this segment of the river ranged from 31 *E. coli* per 100 milliliters (ml) in July at east High Street to 582 *E. coli* per 100 ml in October at Ganson Street (Figure 2). The east crossing of High Street met WQS for the entire sampling season. The two remaining stations, Ganson Street and

Monroe Street, exceeded WQS consistently from mid-August through the end of sampling in October. Particularly high exceedances at these two stations include daily geometric mean *E. coli* concentrations of 13,737 *E. coli* per 100 ml and 5,076 *E. coli* per 100 ml on September 11, respectively (Table 1). Other high *E. coli* concentrations were noted on September 19, when concentrations greater than 2,000 *E. coli* per 100 ml were observed.

Sampling the Grand River downstream of the city of Jackson documented exceedances of the WQS at every location sampled (Table 2 and Figure 3). Thirty-day geometric means ranged from 44 *E. coli* per 100 ml at Rives/Eaton Road on June 26, to 790 *E. coli* per 100 ml at Berry Road on September 11. The three stations immediately downstream from the city of Jackson appear to respond to precipitation events. The Berry Road station had a daily geometric mean of greater than 11,000 *E. coli* per 100 ml on August 14, while all three stations exhibited elevated concentrations of *E. coli* during rain events. Later in the sampling season, the Maple Grove Road site had a daily geometric mean greater than 19,000 *E. coli* per 100 ml on September 11 – both of these exceedances occurred within 24 hours of a rain event. The stations furthest downstream from the city of Jackson, Churchill Road, Rives/Eaton Road, and Tompkins Road, exceeded standards beginning the end of July and continued through the end of the sampling season (Table 2).

The Portage River and Albrow Creek were also sampled as part of this TMDL monitoring. Albrow Creek contained the highest concentrations of *E. coli* (Table 3 and Figure 4) of the two tributaries. This stream exceeded the 30-day geometric mean on each sampling event with particularly high concentrations July through September. Thirty-day geometric means ranged from 204 *E. coli* per 100 ml on June 12, to 939 *E. coli* per 100 ml on August 14 (Table 2). Both locations on the Portage River met the 30-day geometric mean until early August. Sampling conducted after mid-August documented exceedances for the remainder of the season. Thirty-day geometric mean concentrations ranged from 42 *E. coli* per 100 ml at Cooper/M-106 on July 10, to 483 *E. coli* per 100 ml on September 11 at the same location.

NUMERIC TARGET

The impaired designated use addressed by this TMDL is total body contact recreation. Rule 100 of the Michigan WQS requires that this waterbody be protected for total body contact recreation from May 1 to October 31. The target levels for this designated use 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 *Escherichia coli* (*E. coli*) per 100 ml, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at 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 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

In addition, 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 5 or more samples taken over a 30-day period, nor more than 400 fecal coliform bacteria per 100 ml, based on the on the geometric mean of all of 3 or more samples

taken during any period of discharge not to exceed 7 days. Other indicators of adequate disinfection may be utilized where approved by the department.

Sanitary wastewater discharges are considered in compliance with the WQS of 130 *E. coli* per 100 ml if their National Pollutant Discharge Elimination System (NPDES) permit limit of 200 fecal coliforms per 100 ml as a monthly average is met. This is assumed because *E. coli* are a subset of fecal coliform (American Public Health Association, 1995). Fecal coliform is substantially higher than *E. coli* (Whitman, 2001) when the wastewater of concern is sewage. It can reasonably be assumed that there are less than 130 *E. coli* per 100 ml in the effluent when the point source discharge is meeting its limit of 200 fecal coliform per 100 ml.

The WQS of 130 per 100 ml as a 30-day geometric mean is the target level for this TMDL reach from May 1 to October 31. The 2002 monitoring data indicated exceedances of WQS at all but one of the stations sampled as previously stated.

SOURCE ASSESSMENT

The Grand River Watershed covered by this TMDL is located in Jackson and Ingham Counties. The *E. coli* TMDL reach is the Grand River from Tompkins Road upstream to the city of Jackson (Figure 1). The Grand River has relatively high flows in this reach (Table 4). Municipalities in the TMDL watershed include the city of Jackson and Waterloo, Henrietta, Rives, Sandstone, Leoni, Bunkerhill, Blackman, Leslie, Tompkins, Spring Arbor, Summit, Grass Lake, Stockbridge, Onondaga, Ingham, Parma, and Napoleon Townships (Figure 5). It should be noted that both the city of Leslie and Springport Township have land in the TMDL watershed; however, their percentage of the watershed was much less than 1% each and was not considered a contributor. Table 5 shows the distribution of land for each municipality.

The primary pathogen sources for this waterbody are typical of urban and agricultural land uses. Storm water runoff, illicit connections, and agricultural inputs are all possible sources of *E. coli* to the Grand River. Elevated *E. coli* concentrations within the city limits of Jackson coincide with the rain events previously mentioned and may be due to storm water runoff.

There are 141 permitted point source discharges in the Grand River TMDL reach (Tables 6 and 7 and Figure 6). Eighty are covered by general storm water permits and 39 are active NPDES permit Notices of Coverage for construction sites in Jackson County. An additional 14 are covered by other general permits, 7 of which are noncontact cooling water discharges and 1 is a discharge containing gasoline and/or related petroleum products. Five of the remaining 6 general permits are for wastewater stabilization lagoons or land applications of biosolids. A lagoon discharge permit contains fecal coliform limits and allows for a seasonal discharge between March and May and October and December. The biosolid permit allows for bulk land application of treated wastes. The last of the general permits covers hydrostatic test waters.

There are eight individual NPDES permits in addition to the above permits in the Grand River TMDL Watershed for the following facilities: Leslie Wastewater Treatment Plant (WWTP) (MI0020796), Jackson WWTP (MI0023256), Marathon Ashland Petro-Jackson (MI0045403), Citgo Corp-Jackson (MI0046809), Mechanical Products (MI0051683), MDC-SPSM-GWCU (MI0054976), Plastigage Corp (MI0055042), and TRW Inc-Jackson (MI0056006). The discharges from these facilities, except those from the Leslie and Jackson WWTPs, generally consist of treated groundwater, noncontact cooling water, storm water, and hydrostatic test water and are not considered to contain treated or untreated human sewage. Therefore, the discharges are not a source of *E. coli* to the Grand River TMDL Watershed and the requirements of Rule 62(3) do not apply.

The city of Jackson had five Sanitary Sewer Overflows (SSOs) besides the WWTP outfall. Two have been bulk headed since 1995. Three were bulk headed under Administrative Consent Order SW98-004 and completed in January 2001. A heavy rain event in August 2002 caused basement flooding to several businesses in the downtown area of Jackson. The city of Jackson notified the DEQ of its intent to reestablish an overflow that had previously been closed since 2000 to alleviate the problem. Difficulties with removing the bulkhead prompted the city of Jackson to create a new overflow in September 2002 (Dowling, 2002). The city of Jackson's overflow correction plan will redirect wet weather flows to a sanitary sewer interceptor with more capacity eliminating the need to use the SSO by October 31, 2003. The city of Jackson has not reported a wet weather discharge to-date from the new SSO.

Other possible downstream source of pathogens to the TMDL reach could be agricultural, given the land use in the area, or illicit connections, such as those noted in Albrow Creek. Albrow Creek is a tributary to the Grand River downstream of Jackson. Rives Township has been cited by the MDEQ (NC-10-01-01-001J) for the discharge of raw sewage to Albrow Creek from the unincorporated village of Rives Junction - a documented problem since the late 1970s. As indicated in Table 3 and Figure 4, Albrow Creek exceeded the 30-day geometric mean WQS for *E. coli* on every sampling event.

LINKAGE ANALYSIS

The link between the *E. coli* concentrations in the Grand River and the potential sources is the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators and the sources. This provides the basis for estimating the total assimilative capacity of the stream and any needed load reductions. A significant amount of the pathogen load for this TMDL likely enters the Grand River by both wet and dry weather sources such as storm water, agricultural run-off, and illicit connections.

The guiding water quality management principle used to develop the TMDL was that compliance with the numeric pathogen target in the Grand River depends on the control of *E. coli* from storm water, agriculture influences, and, to a lesser extent, illicit connections. Total body contact recreation in the Grand River will be protected if the *E. coli* inputs can be controlled.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving WQS. The target for this pathogen TMDL is the WQS of 130 *E. coli* per 100 ml as indicated in the Numeric Target section. TMDL development also defines the environmental conditions that will be used when defining allowable levels concurrent with the selection of a numeric concentration endpoint. Many TMDLs are designed around the concept of a "critical condition." The "critical condition" is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other conditions. The critical conditions for the control of point sources in Michigan are given in R 323.1082 and R 323.1090, for example. The lowest monthly 95% exceedance flow for streams in general is used as a design condition for point source discharges. However, levels are restricted to a monthly average limit of 200 fecal coliform per 100 ml regardless of stream flow for pathogens in point source discharges of treated or untreated human sewage. Therefore, the design stream flow is not a critical condition for determining the allowable loading of pathogen for WWTPs. Other sources to the Grand River arise from a mixture of wet and dry weather driven nonpoint sources. There is no single critical condition that is protective for all other conditions. There are a number of different allowable loads for these sources that will ensure compliance as long as they are distributed properly throughout the watershed.

TMDLs are expressed on a mass loading basis (e.g., pounds per day) for most pollutants. However, mass is not an appropriate measure for *E. coli*. The USEPA allows pathogen TMDLs to be expressed in terms of organism counts (or resulting concentration) (USEPA, 2001). Therefore, this pathogen TMDL is concentration-based consistent with R 323.1062, and the TMDL is equal to the target concentration of 130 *E. coli* per 100 ml in all portions of the TMDL reach for each month of the recreational season (May through October).

ALLOCATIONS

TMDLs are comprised of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. The TMDL 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 waterbody. This definition is denoted conceptually by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

The term TMDL 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, LAs for nonpoint sources, and the MOS. This pathogen TMDL will not be expressed on a mass loading basis and is concentration based consistent with USEPA regulations in 40 CFR, Section 130.2(i), as previously indicated.

WLAs

There are a total of 141 permitted point source discharges to the listed reach of the Grand River as previously mentioned. Eighty are storm water permits and 39 are construction permits involving earth disturbances. Fifteen of the remaining 22 permits are not permitted to treat and discharge human waste and Rule 62(3) does not apply. The last seven, two WWTPs and five Wastewater Sewage Lagoons (WWSLs), are permitted to treat and discharge human waste. Each of these facilities has a limit for fecal coliform and, as previously stated, when the WWTPs are meeting their fecal coliform permit limit, it is assumed the WQS will be met in the discharge. The WWSLs are permitted to discharge during the months of March through May and October to December. The discharge period overlaps the recreational season in May and October only and will be considered in compliance with the WQS of 130 *E. coli* per 100 ml if their NPDES permit limit of 200 fecal coliform per 100 ml as a monthly average is met. The WLA for the above facilities, including the 80 storm water permits and 39 construction permits, will therefore be equal to 130 *E. coli* per 100 ml during the recreation season between May 1 and October 31. The city of Jackson has one temporary SSO. This SSO has not had a reported discharge since its creation in September of 2002; however, the WLA will be 130 *E. coli* per 100 ml until the closure of the SSO.

LAs

The LA incorporates the pathogen sources for this waterbody, including those typically associated with urban and suburban runoff, as well as illicit connections. This TMDL is concentration-based. Therefore, the LA is equal to 130 *E. coli* per 100 ml. The determination of individual LAs will be based on the assumption of equal bacteria loads per unit area for all lands in the watershed. 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 the various units of local government in the watershed. This gives a clear indication of the relative amount of effort that will be required by each entity to restore and maintain the total body contact designated uses in the Grand River.

The government entity with the largest percent land area in the Grand River TMDL Watershed is Waterloo Township (11%). The remaining percentage of the watershed is made up of the city of Jackson (3%) and Henrietta (9%), Rives (9%), Leoni (9%), Sandstone (8%), Bunkerhill (8%), Blackman (8%), Leslie (7%), Tompkins (6%), Spring Arbor (5%), Summit (5%), Grass Lake (4%), Stockbridge (4%), Onondaga (1%), Ingham (1%), Napoleon (1%), and Parma Townships (1%).

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 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 because no rate of decay is used. The MDEQ has determined that the use of the WQS of 130 *E. coli* per 100 ml is a more conservative approach, although pathogen organisms have a limited capability of surviving outside of their hosts and a rate of decay would normally be used. Applying a rate of decay could result in a discharge limit that would be greater than the WQS, thus no rate of decay is applied in order to provide for a greater protection of water quality. Applying the WQS to be met under all flow conditions also adds to the assurance of the MOS.

SEASONALITY

Seasonality in the TMDL is addressed by expressing the TMDL in terms of a total body contact recreation season that is defined as May 1 through October 31 by R 323.1100 of the WQS. There is no total body contact during the remainder of the year primarily due to cold weather. WQS will be met regardless of flow conditions in the applicable season because this is a concentration-based TMDL.

MONITORING

Pathogens were monitored at a total of 12 stations from May through September 2002. Nine of those stations were located on the Grand River, and 3 were on selected tributaries. Future monitoring will take place during the rotating, 5-year basin monitoring. When these results indicate that the waterbody may be meeting WQS, sampling will be conducted at the appropriate frequency to determine if the 30-day geometric mean value of 130 *E. coli* per 100 ml is being met.

REASONABLE ASSURANCE ACTIVITIES

The WWTPs and WWSLs are responsible for meeting their NPDES permit limits for fecal coliform. Compliance is based on review of Discharge Monitoring Report data by the MDEQ. The WWTPs are presently meeting their permit limits for fecal coliform. Progress on closing the SSO created by the city of Jackson to alleviate basement flooding is underway. The city of Jackson and the MDEQ have signed a District Compliance Agreement dated February 5, 2003, to resolve the SSO in the downtown area of Jackson. This agreement contains activities that will redirect flow from an overloaded interceptor to a higher capacity interceptor by March 31, 2003. This activity will greatly reduce the probability of an overflow due to low capacity in the interceptor. The main goal of the agreement is a plan that includes the closure of the SSO by October 31, 2003.

Rives Township has responded to their Notice of Noncompliance and several different treatment alternatives have been discussed. Potential funding of a new sewer system may be possible from a Rural Development Grant. The most likely alternative is a connection to the city of

Jackson's existing collection system. However, Rives Township may not be able to afford the project due to high costs of connecting to the existing collection system.

The city of Jackson, as well as Blackman, Leoni, Rives, Spring Arbor, and Summit Townships, are all entities that will be required to obtain a Phase II Storm Water permit. These permits will require activities that reduce *E. coli* inputs through the public education, storm water management plan, and illicit connection identification and elimination requirements.

The Jackson County Drain Commissioner's Office has been awarded a Section 319 Grant (#2000-0128) to develop an Upper Grand River Watershed Planning Initiative. This grant has multiple goals, one of which aims to reduce nonpoint sources of pathogenic materials to the Upper Grand River Watershed. The Jackson and Ingham County Health Departments have monitored 36 locations on the Grand River and its tributaries under this grant. The monitoring took place upstream and downstream of the city of Jackson in an effort to identify sources of pathogen input. This study, along with the other objectives of the watershed plan, will be incorporated in the Jackson County Master Plan currently under development.

Prepared by: Christine Alexander, Aquatic Biologist
Surface Water Quality Assessment Section
Water Division
Michigan Department of Environmental Quality
June 20, 2003

REFERENCES

American Public Health Association. 1995. Standard Methods for the Examination of Water and Wastewater. 19th Edition.

Creal, W. and J. Wuycheck. 2002. Federal CWA Section 303(d) List – Michigan's Submittal for Year 2002. MDEQ, Surface Water Quality Division, Report #MI/DEQ/SWQ-02/013.

Dowling, J. 2002. Correspondence to Jon Russell, Jackson District Supervisor, MDEQ.

USEPA. 2001. Protocol for Developing Pathogen TMDLs. USEPA, 841-R-00-002.

Whitman, R. Personal Communication. United States Geological Survey, October 2001.

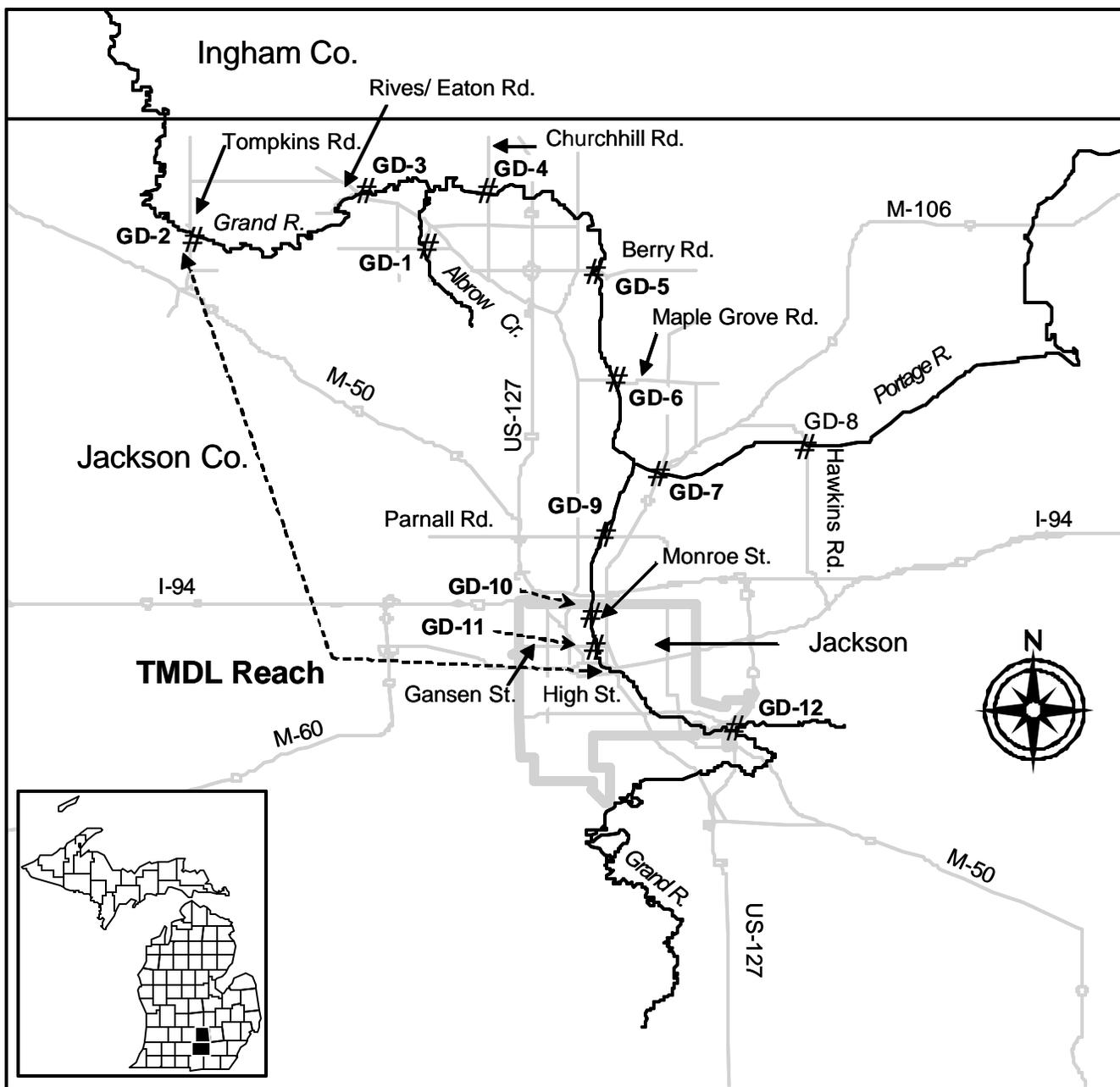


Figure 1. The Grand River *E. coli* sampling locations, vicinity of Jackson, Michigan, 2002.

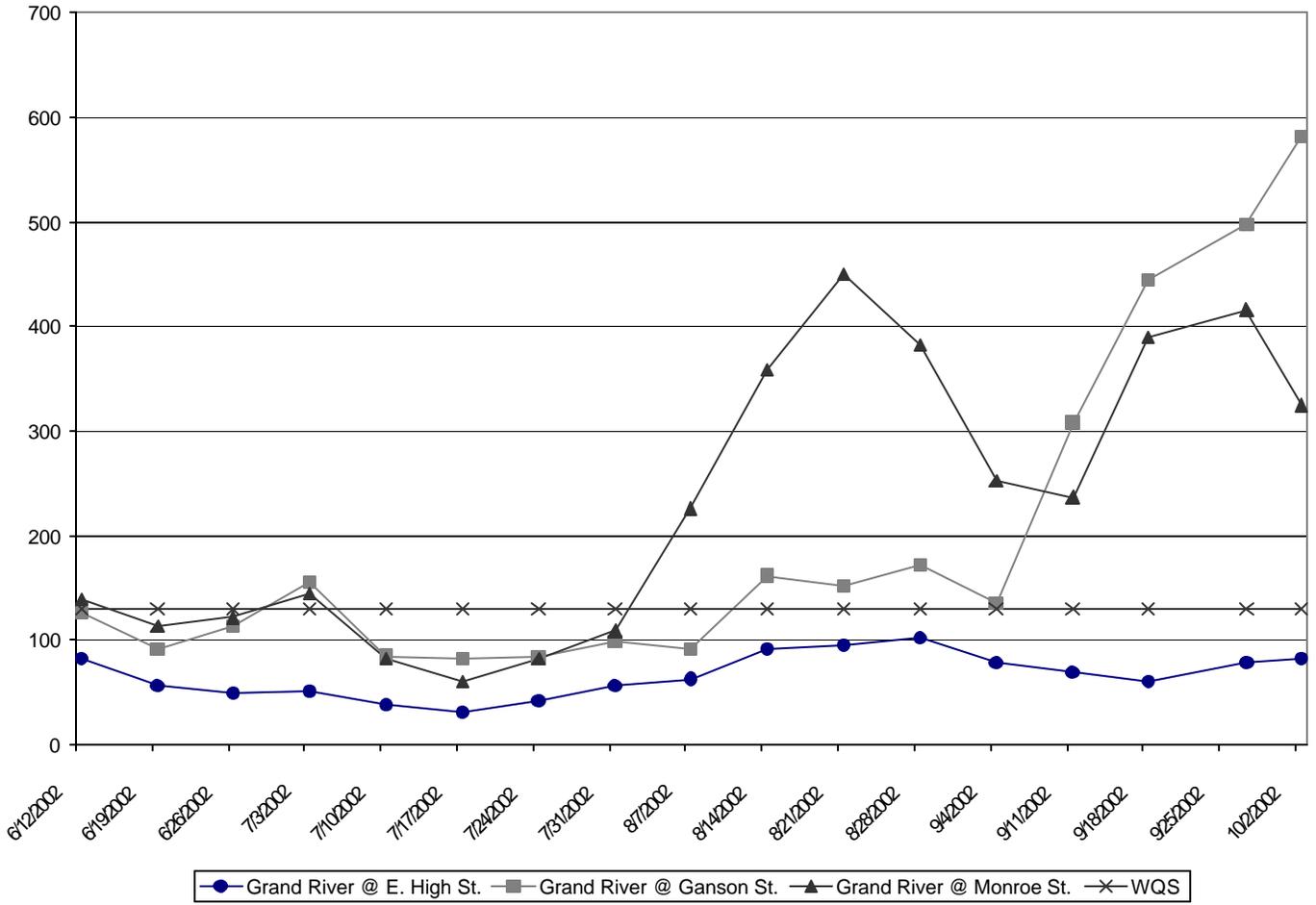


Figure 2. Thirty-day Geometric mean for *E. coli* in the Grand River in the city of Jackson, Michigan, 2002.

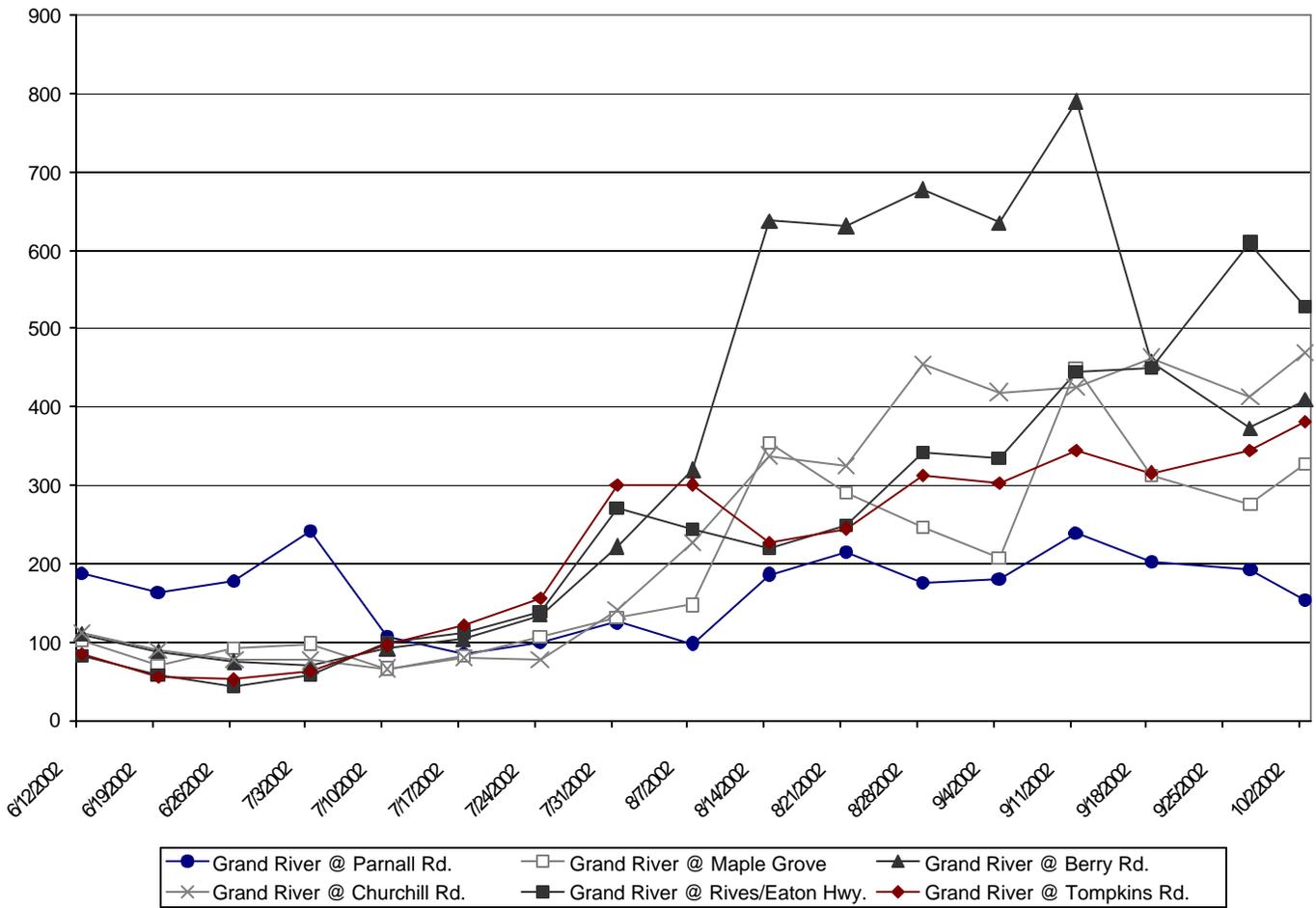


Figure 3. Thirty-day Geometric mean *E. coli* concentrations downstream of the city of Jackson, Michigan, 2002.

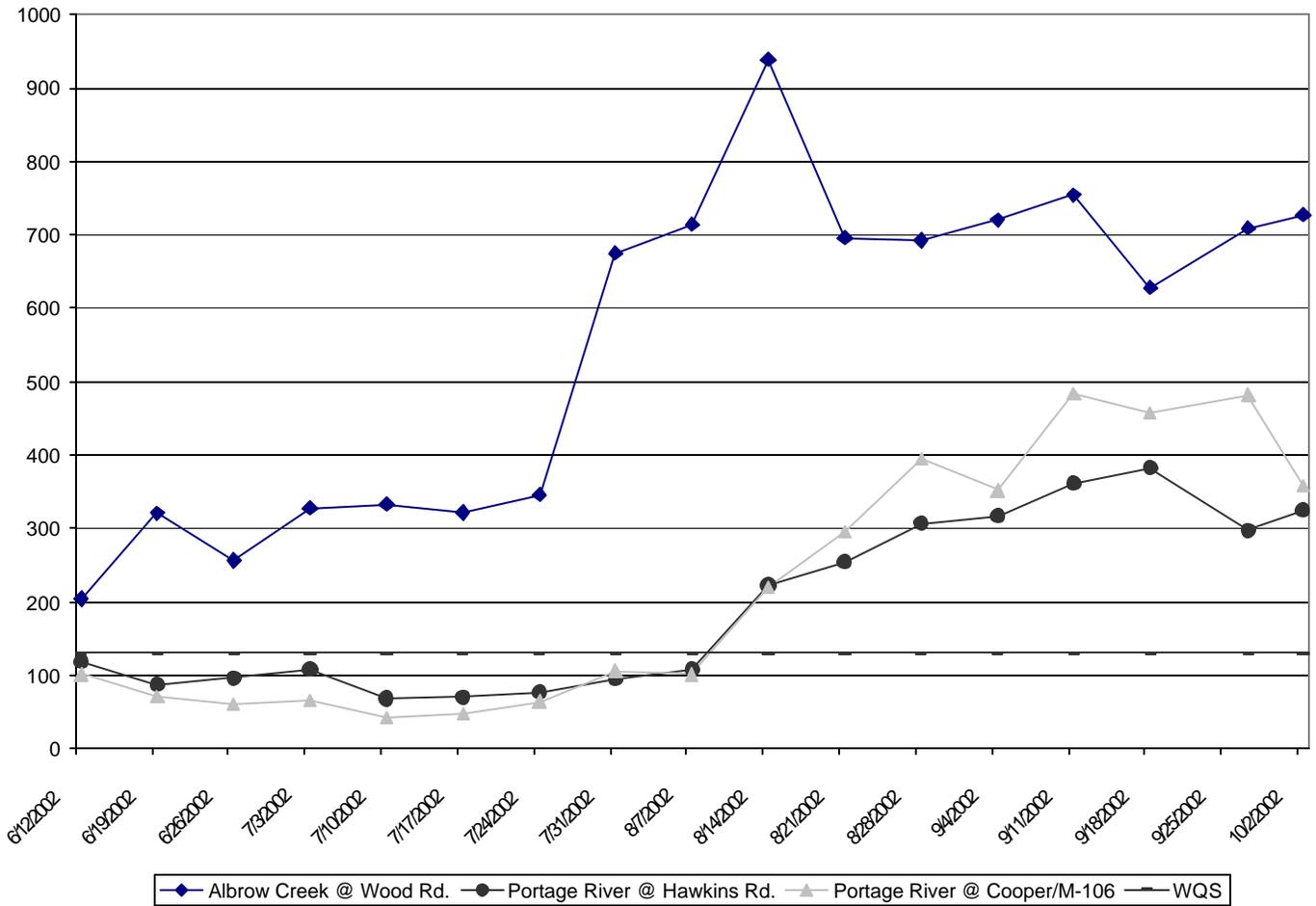


Figure 4. Thirty-day Geometric mean *E. coli* concentrations on selected tributaries of the Grand River, Jackson County, Michigan.

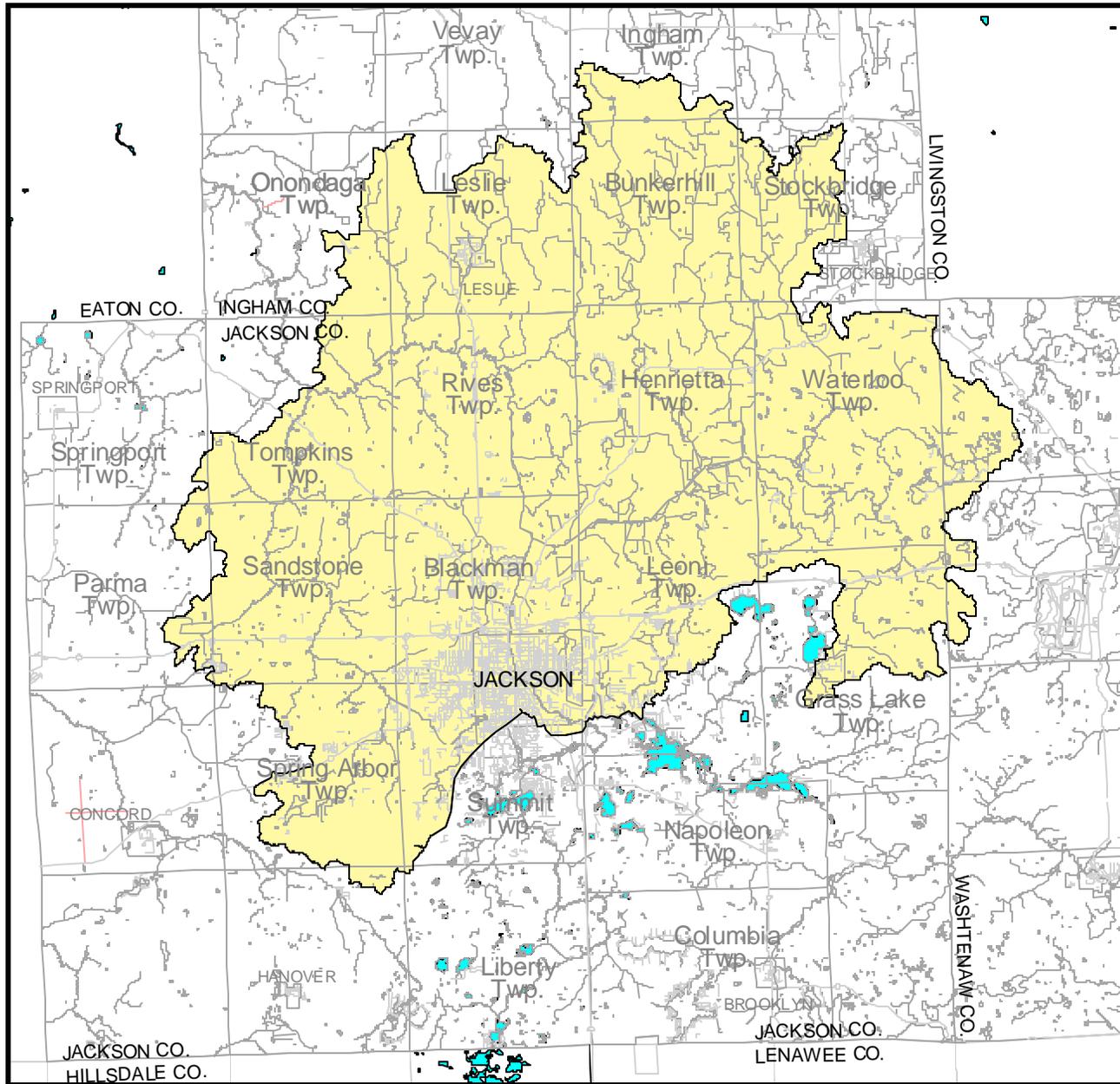


Figure 5. Shaded areas represent municipalities in the Grand River TMDL Watershed.

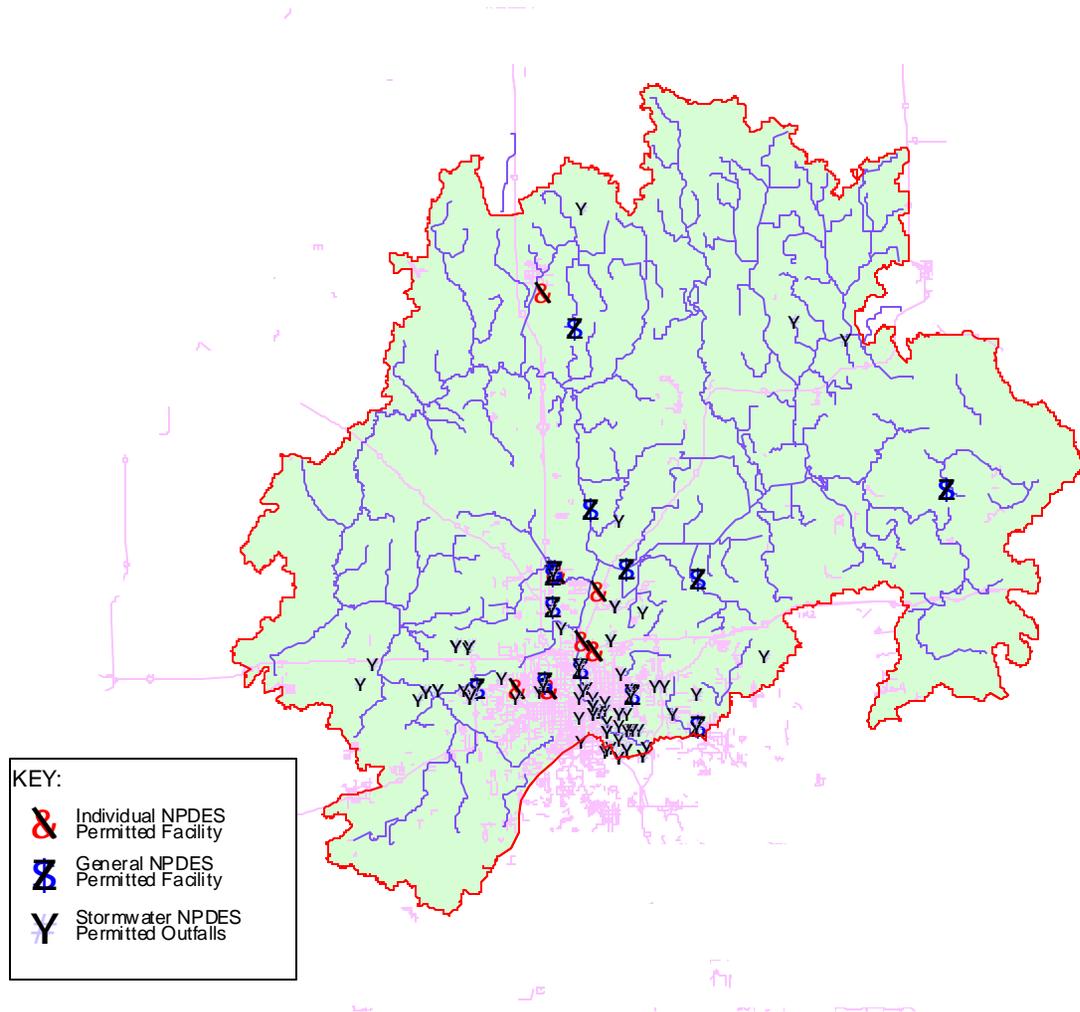


Figure 6. NPDES permitted (individual, general, and storm water) discharges in the Grand River TMDL Watershed, vicinity of Jackson, Michigan.

Table 1. MDEQ 2002 *E. coli* monitoring data for the Grand River in the city of Jackson (*E. coli*/100 ml). Shaded areas indicate exceedances of the Water Quality Standard. Data are presented upstream to downstream.

DATE	Grand River @ E. crossing of High St. GD-12A			Grand River @ Ganson St. GD-11A			Grand River @ Monroe St. GD-10A			Weather 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	
5/15/2002	220	138	---	320	197	---	140	156	---	sunny, 60°
	200			100			80			
	60			240			340			
5/21/2002	60	66	---	20	34	---	80	58	---	sunny, 60°
	60			100			120			
	80			20			20			
5/29/2002	80	88	---	60	66	---	120	83	---	overcast, 65°
	60			80			80			
	140			60			60			
6/5/2002	20	85	---	600	416	---	400	312	---	rain, 70°
	140			200			380			
	220			600			200			
6/12/2002	20	58	83	180	179	127	260	218	139	overcast, 75°
	160			200			200			
	60			160			200			
6/19/2002	20	20	56	140	38	92	20	58	114	sunny, 70°
	20			20			20			
	20			20			500			
6/26/2002	20	32	49	20	100	114	40	82	122	overcast, 85°
	80			280			140			
	20			180			100			
7/3/2002	100	112	51	340	325	156	300	188	144	sunny, 85°
	100			280			100			
	140			360			220			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ E. crossing of High St. GD-12A			Grand River @ Ganson St. GD-11A			Grand River @ Monroe St. GD-10A			Weather 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	
7/10/2002	20	20	38	20	20	85	20	20	83	sunny, 75°
	20			20			20			
	20			20			20			
7/17/2002	20	20	31	520	146	82	100	43	60	sunny, 80°
	20			100			20			
	20			60			40			
7/24/2002	280	96	42	220	44	84	440	294	83	sunny, 65°
	40			20			160			
	80			20			360			
7/31/2002	120	132	56	300	227	99	400	330	109	humid, 85°
	120			140			300			
	160			280			300			
8/7/2002	120	190	63	240	218	92	7200	7129	226	sunny, 70°
	260			180			6800			
	220			240			7400			
8/14/2002	560	135	92	480	346	162	480	197	358	rain, 75°
	20			360			200			
	220			240			80			
8/21/2002	40	25	96	20	105	152	280	135	450	sunny, 70°
	20			240			220			
	20			240			40			
8/28/2002	180	129	102	100	84	172	120	132	383	sunny, 70°
	100			100			120			
	120			60			160			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ E. crossing of High St. GD-12A			Grand River @ Ganson St. GD-11A			Grand River @ Monroe St. GD-10A			Weather 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	
9/4/2002	20	34	78	120	66	135	60	42	253	sunny, 75°
	100			20		60				
	20			120		20				
9/11/2002	200	104	69	9000	13737	308	2800	5076	237	sunny, 70°
	20			16000		3200				
	280			18000		14600				
9/18/2002	20	71	61	1800	2175	445	7200	2400	390	cloudy, 75°
	100			4400		640				
	180			1300		3000				
9/27/2002	20	96	79	3800	183	497	400	186	416	cloudy, 65°
	100			80		40				
	440			20		400				
10/2/2002	100	165	83	180	185	582	20	38	325	sunny, 70°
	320			160		20				
	140			220		140				

Table 2. MDEQ 2002 *E. coli* monitoring data for the Grand River downstream of the city of Jackson (*E. coli*/100 ml). Shaded areas indicate exceedances of the Water Quality Standard. Data are presented upstream to downstream.

DATE	Grand River @ Parnall Rd. GD-9A			Grand River @ Maple Grove Rd. GD-6A			Grand River @ Berry Rd. GD-5A			Weather 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	
5/15/2002	280	287	---	220	219	---	200	200	---	sunny, 60°
	280			200			200			
	300			240			200			
5/21/2002	20	54	---	80	32	---	100	78	---	sunny, 60°
	100			20			80			
	80			20			60			
5/29/2002	200	106	---	180	159	---	80	92	---	overcast, 65°
	100			160			80			
	60			140			120			
6/5/2002	960	1169	---	200	142	---	140	85	---	rain, 70°
	1040			80			20			
	1600			180			220			
6/12/2002	60	119	187	20	66	101	80	131	110	overcast, 75°
	200		120	200						
	140		120	140						
6/19/2002	160	142	163	100	34	70	20	66	88	sunny, 70°
	300		20	180						
	60		20	80						
6/26/2002	280	82	177	60	128	92	20	34	75	overcast, 85°
	100		160	100						
	20		220	20						
7/3/2002	1000	509	242	140	222	98	60	64	69	sunny, 85°
	600		300	20						
	220		260	220						

Table 2. continued (*E. coli*/100 ml).

DATE	Grand River @ Parnall Rd. GD-9A			Grand River @ Maple Grove Rd. GD-6A			Grand River @ Berry Rd. GD-5A			Weather 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	
7/10/2002	20	20	107	20	20	66	580	354	92	sunny, 75°
	20			20			240			
	20			20			320			
7/17/2002	20	36	85	120	201	83	440	233	104	sunny, 80°
	20			280			360			
	120			240			80			
7/24/2002	180	331	100	40	115	106	340	239	134	sunny, 65°
	420			100			400			
	480			380			100			
7/31/2002	160	248	125	400	366	130	440	424	222	humid, 85°
	340			360			360			
	280			340			480			
8/7/2002	200	150	98	520	403	147	260	403	320	sunny, 70°
	140			420			600			
	120			300			420			
8/14/2002	400	500	186	600	1641	354	12000	11114	638	rain, 75°
	520			800			11000			
	600			9200			10400			
8/21/2002	20	76	215	120	76	291	240	221	631	sunny, 70°
	120			180			160			
	180			20			280			
8/28/2002	80	121	176	320	50	247	420	343	678	sunny, 70°
	80			20			300			
	280			20			320			

Table 2. continued (*E. coli*/100 ml).

DATE	Grand River @ Parnall Rd. GD-9A			Grand River @ Maple Grove Rd. GD-6A			Grand River @ Berry Rd. GD-5A			Weather 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	
9/4/2002	280	278	180	300	148	206	420	304	635	sunny, 75°
	480			180			240			
	160			60			280			
9/11/2002	20	592	238	20000	19730	449	600	1200	790	sunny, 70°
	2000			24000			1600			
	5200			16000			1800			
9/18/2002	620	222	202	1800	269	313	860	721	457	cloudy, 75°
	880			20			640			
	20			540			680			
9/27/2002	20	59	192	20	40	275	60	80	373	cloudy, 65°
	20			40			60			
	520			80			140			
10/2/2002	20	40	154	280	119	327	520	546	409	sunny, 70°
	20			300			540			
	160			20			580			

Table 2. continued (*E. coli*/100 ml).

DATE	Grand River @ Churchill Rd. GD-4A			Grand River @ Rives/Eaton Rd. GD-3A			Grand River @ Tompkins Rd. GD-2A			Weather 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	
5/15/2002	220	219	---	260	218	---	220	239	---	sunny, 60°
	200			200			260			
	240			200			240			
5/21/2002	100	43	---	100	68	---	20	29	---	sunny, 60°
	20			160			60			
	40			20			20			
5/29/2002	100	62	---	80	73	---	80	80	---	overcast, 65°
	60			80			80			
	40			60			80			
6/5/2002	360	226	---	180	93	---	160	142	---	rain, 70°
	160			20			60			
	200			220			300			
6/12/2002	220	125	111	40	40	83	40	58	85	overcast, 75°
	220			20			80			
	40			80			60			
6/19/2002	280	77	90	20	32	57	60	29	56	sunny, 70°
	80			20			20			
	20			80			20			
6/26/2002	20	20	77	20	20	44	20	20	52	overcast, 85°
	20			20			20			
	20			20			20			
7/3/2002	260	59	76	320	290	58	180	198	62	sunny, 85°
	40			380			240			
	20			200			180			

Table 2. continued (*E. coli*/100 ml).

DATE	Grand River @ Churchill Rd. GD-4A			Grand River @ Rives/Eaton Rd. GD-3A			Grand River @ Tompkins Rd. GD-2A			Weather 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	
7/10/2002	20	113	66	2000	1308	99	1140	1243	96	sunny, 75°
	720			400			1360			
	100			2800			1240			
7/17/2002	200	312	80	20	70	111	100	183	121	sunny, 80°
	400			40			140			
	380			420			440			
7/24/2002	200	68	78	100	99	139	140	100	155	sunny, 65°
	20			60			40			
	80			160			180			
7/31/2002	320	370	140	360	559	271	360	538	300	humid, 85°
	360			640			800			
	440			760			540			
8/7/2002	760	663	226	1000	173	244	280	201	301	sunny, 70°
	480			20			160			
	800			260			180			
8/14/2002	1200	836	338	880	771	220	240	296	226	rain, 75°
	760			100			300			
	640			5200			360			
8/21/2002	280	257	325	220	130	249	280	276	245	sunny, 70°
	380			500			340			
	160			20			220			
8/28/2002	400	365	454	480	473	341	360	339	313	sunny, 70°
	380			480			300			
	320			460			360			

Table 2. continued (*E. coli*/100 ml).

DATE	Grand River @ Churchill Rd. GD-4A			Grand River @ Rives/Eaton Rd. GD-3A			Grand River @ Tompkins Rd. GD-2A			Weather 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	
9/4/2002	460	249	419	440	504	334	380	450	302	sunny, 75°
	560			660			800			
	60			440			300			
9/11/2002	680	711	425	700	733	445	460	391	345	sunny, 70°
	660			740			360			
	800			760			360			
9/18/2002	880	1274	463	920	815	450	320	190	316	cloudy, 75°
	980			840			20			
	2400			700			1080			
9/27/2002	640	145	413	600	593	610	800	425	344	cloudy, 65°
	40			620			120			
	120			560			800			
10/2/2002	760	702	470	600	229	527	620	565	381	sunny, 70°
	760			1000			520			
	600			20			560			

Table 3. MDEQ 2002 *E. coli* monitoring data for tributaries of the Grand River (*E. coli*/100 ml). Shaded areas indicate exceedances of the Water Quality Standard.

DATE	Albrow Creek @ Wood Rd. GD-1A			Portage River @ Hawkins Rd. GD-8A			Portage River @ Cooper/M-106 GD-7A			Weather 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	
5/15/2002	60	46	---	180	226	---	200	169	---	sunny, 60°
	40			200			240			
	40			320			100			
5/21/2002	40	62	---	20	40	---	80	58	---	sunny, 60°
	100			80			60			
	60			40			40			
5/29/2002	320	306	---	60	84	---	160	180	---	overcast, 65°
	320			100			260			
	280			100			140			
6/5/2002	440	369	---	100	193	---	180	205	---	rain, 70°
	380			360			340			
	300			200			140			
6/12/2002	840	1089	204	80	153	118	20	29	101	overcast, 75°
	1600			160			20			
	960			280			60			
6/19/2002	200	448	321	100	49	87	20	29	71	sunny, 70°
	660			60			60			
	680			20			20			
6/26/2002	20	20	256	60	66	96	20	25	60	overcast, 85°
	20			120			40			
	20			40			20			
7/3/2002	1200	1048	328	200	150	108	320	295	66	sunny, 85°
	800			140			200			
	1200			120			400			

Table 3. continued (*E. coli*/100 ml).

DATE	Albrow Creek @ Wood Rd. GD-1A			Portage River @ Hawkins Rd. GD-8A			Portage River @ Cooper/M-106 GD-7A			Weather 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	
7/10/2002	280	401	333	20	20	68	20	20	42	sunny, 75°
	320			20			20			
	720			20			20			
7/17/2002	920	916	322	120	175	70	40	58	48	sunny, 80°
	820			160			120			
	1020			280			40			
7/24/2002	840	645	346	20	80	77	160	127	64	sunny, 65°
	800			260			80			
	400			100			160			
7/31/2002	680	564	675	120	182	95	200	306	106	humid, 85°
	440			120			420			
	600			420			340			
8/7/2002	1400	1390	714	420	289	108	320	234	101	sunny, 70°
	1200			220			200			
	1600			260			200			
8/14/2002	2000	1570	939	600	727	222	840	959	219	rain, 75°
	2200			640			1220			
	880			1000			860			
8/21/2002	680	206	696	400	343	254	240	259	296	sunny, 70°
	640			420			280			
	20			240			260			
8/28/2002	560	631	693	480	210	307	420	537	395	sunny, 70°
	700			40			560			
	640			480			660			

Table 3. continued (*E. coli*/100 ml).

DATE	Albrow Creek @ Wood Rd. GD-1A			Portage River @ Hawkins Rd. GD-8A			Portage River @ Cooper/M-106 GD-7A			Weather 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	
9/4/2002	400	682	720	260	211	317	420	173	352	sunny, 75°
	1200			200			620			
	660			180			20			
9/11/2002	6600	1753	754	600	557	361	2400	1133	483	sunny, 70°
	1200			400			740			
	680			720			820			
9/18/2002	20	632	628	3000	974	383	680	733	458	cloudy, 75°
	4200			220			580			
	3000			1400			1000			
9/27/2002	480	377	709	200	96	297	560	335	482	cloudy, 65°
	560			20			840			
	200			220			80			
10/2/2002	560	714	727	400	330	325	320	121	358	sunny, 70°
	740			560			280			
	880			160			20			

Table 4. The Grand River average flows (cfs) at Tompkins Road, Jackson County, Michigan.

May	June	July	August	September	October
440	270	150	120	110	140

Table 5. Distribution of land for each municipality in the TMDL reach.

Municipality	Square miles	Percent
Waterloo Township	47.1	11
Henrietta Township	36.8	9
Rives Township	36.0	9
Leoni Township	35.9	9
Sandstone Township	35.5	8
Bunkerhill Township	32.4	8
Blackman Township	32.0	8
Leslie Township	28.7	7
Tompkins Township	24.1	6
Spring Arbor Township	23.5	5
Summit Township	22.5	5
Grass Lake Township	17.1	4
Stockbridge Township	15.3	4
City of Jackson	10.3	3
Onondaga Township	7.2	1
Ingham Township	5.6	1
Parma Township	4.2	1
Napoleon Township	4.2	1
TOTAL	418.4	100

Table 6. Permitted outfalls to the Grand River and Portage River Watersheds in the vicinity of Jackson.
Source: MDEQ/WD's NPDES Permit Management System (NMS); *MGY = million gallons per year.

Permit Number	Facility	Receiving Waters	Design Flow (MGY*)	Latdd	Longdd
Individual NPDES permits:					
MI0020796	Leslie WWTP	Huntoon Creek	17.20	42.44305	-84.42861
MI0023256	Jackson WWTP	Grand River	6935.00	42.27611	-84.40611
MI0045403	Marathon Ashland Petro-Jackson	Grand River via Tobin Snyder Dr.	39.00	42.31028	-84.42361
MI0046809	Citgo Corp-Jackson	Grand River via Tobin Snyder Dr.	171.00	42.30889	-84.42250
MI0051683	Mechanical Products	Grand River via storm water	33.00	42.27167	-84.39861
MI0054976	MDC-SPSM-GWCU	Grand River	26.00	42.30000	-84.39583
MI0055042	Plastigage Corp	Hurd Marvin Dr. via storm sewer	64.00	42.25417	-84.45000
MI0056006	TRW Inc-Jackson	Grand River	18.30	42.25417	-84.42917
General Permits:					
MIG080265	Wolverine Pipeline Co-Jackson	Tobin Snyder Dr.	10.50	42.30722	-84.42528
MIG250003	Legends Mfg Inc	Sandstone/Blackman Dr.	8.00	42.25389	-84.47583
MIG250042	Industrial Steel Treating Co	Grand River	100.40	42.25583	-84.43194
MIG250355	ADCO Products Inc	Grand River	27.40	42.23417	-84.33389
MIG250359	Elco Prod Welding Inc	Grand River	26.30	42.42472	-84.40833
MIG250360	Lefere Forge & Machine	Grand River	4.40	42.25000	-84.37500
MIG250365	Mid-American Products	Grand River	21.90	42.26250	-84.40833
MIG250396	B & H Machine Inc	Tobin Snyder Dr.	18.30	42.29167	-84.42556
MIG580001	MDC-Waterloo WWSL	unnamed trib. to Portage River	10.95	42.34361	-84.17000
MIG580258	MDC-SPSM-Wing WWSL	Portage River	3.00	42.30972	-84.37778
MIG580259	MDC-SPSM-Dale Foltz TC WWSL	Wildcat Creek	0.50	42.30417	-84.33194
MIG580274	Sherman Oaks MHP WWSL	Grand River	34.00	42.33750	-84.40000
MIG670278	Equilon Enterprises-Jackson	Rives-Blackman Dr.	307.00	42.30861	-84.42444
MIG960019	MDC-Waterloo WWSL			42.34361	-84.17000
Storm Water NPDES Permits:					
MIR011138	Mullins Auto Parts & Towing	Industrial Storm Water Only		42.48194	-84.40167
MIR011220	Wolverine Vinyl Siding	Industrial Storm Water Only		42.24417	-84.39250
MIR011324	Jackson County Airport	Industrial Storm Water Only		42.25972	-84.45917
MIR011327	Thompson-McCully Co-Jackson	Industrial Storm Water Only		42.27722	-84.38833
MIR011332	Legends Mfg Inc	Standard		42.25389	-84.47583
MIR011339	Midbrook Inc	Industrial Storm Water Only		42.22444	-84.39306
MIR011340	Camshaft Machine Co	Industrial Storm Water Only		42.28306	-84.41972

Table 6. continued

Permit Number	Facility	Receiving Waters	Design Flow (MGY*)	Latdd	Longdd
MIR011341	Fourway Machine	Industrial Storm Water Only		42.25528	-84.36028
MIR011342	Hydraulic Systems Inc	Industrial Storm Water Only		42.22611	-84.38917
MIR011343	USF Holland Inc-Jackson	Industrial Storm Water Only		42.25222	-84.47833
MIR011344	C & K Box Company	Industrial Storm Water Only		42.25306	-84.43528
MIR011348	Mich Auto Compressor Inc	Industrial Storm Water Only		42.26722	-84.54167
MIR011350	Blu-Surf Inc.	Industrial Storm Water Only		42.25833	-84.55000
MIR011351	Pioneer Foundry Co Inc	Industrial Storm Water Only		42.24278	-84.39750
MIR011353	Edscha Jackson	Industrial Storm Water Only		42.25306	-84.37611
MIR011418	United Metal Technology Inc	Industrial Storm Water Only		42.26750	-84.28861
MIR011419	Willbee Transit Mix	Industrial Storm Water Only		42.25417	-84.50833
MIR011441	Crankshaft Machine Group	Industrial Storm Water Only		42.24972	-84.40833
MIR011445	Michner Plating-Angling Road	Industrial Storm Water Only		42.22917	-84.38333
MIR011447	Elm Plating Co Plt 2	Industrial Storm Water Only		42.23333	-84.37639
MIR011448	Elm Plating Co-Plt 1	Industrial Storm Water Only		42.22500	-84.39167
MIR011449	H & M Welding & Fab	Industrial Storm Water Only		42.24167	-84.35000
MIR011450	McGill Road Landfill	Industrial Storm Water Only		42.28944	-84.36750
MIR011451	Jackson Co Dalton Road LF	Industrial Storm Water Only		42.29306	-84.38472
MIR011452	Jackson Co RRF	Industrial Storm Water Only		42.29306	-84.38472
MIR011453	Conway Central Express-XJA	Industrial Storm Water Only		42.25000	-84.33333
MIR011455	Mich ARNG Jack Armory OMS12	Industrial Storm Water Only		42.25000	-84.40000
MIR011457	Miller Tool & Die Co	Industrial Storm Water Only		42.23333	-84.39167
MIR011459	Allied Chucker & Engr Co	Industrial Storm Water Only		42.27500	-84.48750
MIR011460	Way Bakery Div	Industrial Storm Water Only		42.23333	-84.37083
MIR011461	Dawn Food Products	Industrial Storm Water Only		42.22500	-84.36667
MIR011462	Advance Packaging Corp-Jac	Industrial Storm Water Only		42.23333	-84.37500
MIR011464	Michner Plating-N Mechanic	Industrial Storm Water Only		42.25417	-84.40417
MIR011465	Worthington Steel	Industrial Storm Water Only		42.24167	-84.38333
MIR011466	TAC Manufacturing	Industrial Storm Water Only		42.27500	-84.47917
MIR011467	Wolverine Metal Specialties	Standard		42.25417	-84.48333
MIR011468	Dawlen Corp	Industrial Storm Water Only		42.22500	-84.36667
MIR011469	John Crowley Inc	Industrial Storm Water Only		42.24167	-84.40000
MIR011470	Mich Extruded Aluminum	Industrial Storm Water Only		42.25417	-84.35417
MIR011471	C & H Stamping Inc	Industrial Storm Water Only		42.41667	-84.23333
MIR011473	Michigan Seat Co	Industrial Storm Water Only		42.22083	-84.38333
MIR011474	Chemical Technologies	Industrial Storm Water Only		42.23333	-84.37917

Table 6. continued

Permit Number	Facility	Receiving Waters	Design Flow (MGY*)	Latdd	Longdd
MIR011476	Jackson Iron & Metal #1	Industrial Storm Water Only		42.24167	-84.37917
MIR011477	Jackson Iron & Metal #2	Industrial Storm Water Only		42.23750	-84.39167
MIR011478	Andys Airport Auto Parts	Industrial Storm Water Only		42.25000	-84.45000
MIR011482	Miller Truck & Storage	Industrial Storm Water Only		42.24167	-84.38333
MIR011483	Boone's Welding & Fab	Industrial Storm Water Only		42.22917	-84.40833
MIR011485	Norfolk Southern Jackson	Industrial Storm Water Only		42.24583	-84.40000
MIR011486	Jackson Auto Salvage	Industrial Storm Water Only		42.25417	-84.50000
MIR011491	International Foam & Trim	Industrial Storm Water Only		42.25000	-84.47917
MIR011512	Riverside Grinding Co	Industrial Storm Water Only		42.22472	-84.37917
MIR011520	Lefere Forge & Machine	Standard		42.25000	-84.37500
MIR011526	B & H Machine Inc	Standard		42.29167	-84.42556
MIR011527	Mid-American Products	Standard		42.26250	-84.40833
MIR011563	Jackson Iron & Metal-Elm Div	Industrial Storm Water Only		42.23556	-84.38417
MIR011609	Orbitform	Industrial Storm Water Only		42.22139	-84.36861
MIR011617	Emmons Service Inc	Industrial Storm Water Only		42.23972	-84.40972
MIR011618	Linear Automatic Systems	Industrial Storm Water Only		42.25389	-84.40639
MIR011619	Industrial Steel Treating Co	Standard		42.25583	-84.43194
MIR011641	Bailey Sand & Gravel Co	Industrial Storm Water Only		42.25000	-84.51278
MIR011659	Sams Iron & Metal Co	Industrial Storm Water Only		42.26583	-84.40833
MIR011673	Kaneka Texas Corp	Industrial Storm Water Only		42.27417	-84.48056
MIR011708	Messners Auto Salvage	Industrial Storm Water Only		42.42639	-84.26556
MIR011710	Eaton Aeroquip Inc	Industrial Storm Water Only		42.24694	-84.39250
MIR011712	Miller Industrial Products	Industrial Storm Water Only		42.24278	-84.39583
MIR011727	D-CO Limestone LLC	Industrial Storm Water Only		42.33292	-84.38182
MIR020005	Equilon Enterprises-Jackson	Standard		42.30861	-84.42444
MIR020014	Koch Materials Co-Jackson	Industrial Storm Water Only		42.24583	-84.40000
MIR020016	ADCO Products Inc	Standard		42.23417	-84.33389
MIR020032	Jackson Power Facility	Industrial Storm Water Only		42.26022	-84.38192
MIS310004	Allied Chucker & Engr Co	Industrial Storm Water Only		42.27500	-84.48750
MIS310007	International Foam & Trim	Industrial Storm Water Only		42.25000	-84.47917
MIS310010	Miller Tool & Die Co	Industrial Storm Water Only		42.23333	-84.39167
MIS310012	Riverside Grinding Co	Industrial Storm Water Only		42.22472	-84.37917
MIS310013	Orbitform	Industrial Storm Water Only		42.22139	-84.36861
MIS310022	Willbee Transit Mix	Industrial Storm Water Only		42.25417	-84.50833
MIS310023	Jackson Auto Salvage	Industrial Storm Water Only		42.25417	-84.50000

Table 6. continued

Permit Number	Facility	Receiving water	Design Flow (MGY*)	Latdd	Longdd
MIS310030	Thompson-McCully Co-Jackson	Industrial Storm Water Only		42.27722	-84.38833
MIS310032	John Crowley Inc	Industrial Storm Water Only		42.24167	-84.40000
MIS310033	Michigan Seat Co	Industrial Storm Water Only		42.22083	-84.38333

Table 7. Active NPDES permit notices of coverage for construction sites in Jackson County, Michigan.

PERMIT NUMBER	FACILITY	LOCATION	TWP.	RANGE	SECTION	DATE RECEIVED	EFFECTIVE DATE
MIR102805	SCHOTT-HICKORY HILLS GOLF CLUB	2540 PAR VIEW DR, JACKSON				01/30/1998	01/30/1998
MIR102912	MDOT-M60-JACKSON COUNTY	SPRING ARBOR, SUMMT, AND BLACKMAN TWPS				03/24/1998	03/24/1998
MIR103006	IPL TOLEDO-HANNAWALD STRG YD	M-52, WATERLOO	T1S	R2E	1	05/11/1998	05/11/1998
MIR103095	WATERLOO GOLF COURSE EXPANSION	11800 TRIST RD, GRASS LAKE	T1S	R2E	33	06/17/1998	06/17/1998
MIR103498	KARVOL-TIMS LAKE PRESERVE	KNIGHT RD - MT HOPE RD, GRASS LAKE	T2S	R2E	21	12/15/1998	12/15/1998
MIR103980	GILLESPIE-GALLERY PLACE	PARNALL RD, NE CORNER OF PARNALL AND LANSING RD	T2S	R1W	15	08/11/1999	08/11/1999
MIR104072	STERLING-ASHTON RIDGE APTS	2905 BLAKE RD, JACKSON BETWEEN N ELM AND DETTMAN RD	T2S	R1W	25	09/28/1999	09/28/1999
MIR104174	JMK-ART MOEHN CHEVROLET/HONDA	SEYMOUR RD N OR I-94				11/29/1999	11/29/1999
MIR104208	NORFOLK-SUMMIT GLEN/RIDGE CNDO	BETWEEN MC CAIN AND MORRELL ST NEAR ROBINSON	T3S	R1E	5	11/17/1999	12/29/1999
MIR104362	JCRC-BOARDMAN ROAD EXTENSION	LONGFELLOW TO MAYNARD TO AIRPORT RD				03/08/2000	03/20/2000
MIR104382	JCRC-WILDWOOD/GANSON RECONST	MICHIGAN AVE TO BROWN	T2S	R1W	32,33	03/24/2000	03/24/2000
MIR104492	SUMMIT GLEN/SUMMIT RIDGE	MCCAIN RD, JACKSON	T3S	R1E	5	04/19/2000	05/15/2000
MIR104558	COLBROOK-COLBROOK MEADOWS	JEFFERSON RD AND TIFFANY RD	T4S	R1E	24	06/05/2000	06/05/2000
MIR104644	MOLTON GROUP-CORONADO	NAPOLEON RD & DORRELL RD	T3S	R1E	14	07/07/2000	07/11/2000
MIR104814	BULLINGER/WANDERING CK CONDO	S JACKSON RD S OF FERGUSON	T3S	R1W	21	09/19/2000	09/19/2000
MIR104943	KIRK MERCER	8049 S JACKSON RD	T4S	R1W	3	11/17/2000	11/29/2000
MIR105057	KINDER MORGAN-ORION PLANT	2219 CHAPIN ST, JACKSON	T3S	R1W	36	01/22/2001	01/22/2001
MIR105198	JACKSON CON ENRGY HEADQUARTER	BETWEEN FRANCIS ST ON AIRLINE DR	T3S	R1W	2	03/28/2001	03/28/2001
MIR105197	PENMARK GOODYR TIRE DEMOLITION	1304 PAGE ST, JACKSON	T2S	R1W	36	03/28/2001	03/28/2001
MIR105238	ECCLESIA RIDGE VIEW ESTATES	MICHIGAN AVE, MT. HOPE ROAD, GRASS LAKE TWP	T2S	R2E	33	04/24/2001	04/24/2001
MIR105297	MDOT CS 38111	JN 55900A				05/17/2001	05/17/2001
MIR105301	SCENIC HILLS	SCENIC HILLS DRIVE	T2S	R1E	29	05/18/2001	05/21/2001
MIR105498	DRS-MYSTIC HILLS-GRANDE GOLF	FLOYD RD NEAR US-127			24, 25	07/30/2001	08/24/2001
MIR105566	GANTON'S-TERRACE HILLS 1A & 1B	ROBINSON & SPRING ARBOR RD, JACKSON	T3S	R1W	7	09/21/2001	09/21/2001
MIR105586	LEFERE-SPEEDWAY-KART TRACK	PAGE AVE, JACKSON	T3S	R1E	6	09/17/2001	10/03/2001
MIR105614	MDOT-US127 RECONSTRUCTION		T3S	R1E		10/17/2001	10/17/2001
MIR105665	SUN COMM-WINDHAM HILLS	COUNTY FARM RD, JACKSON	T2S	R1W	19	11/20/2001	11/20/2001
MIR105695	JACKSON CO-FRANCIS ST RECONST	FRANCIS ST MCDEVITT TO SOUTH ST, JACKSON	T3S	R1W	10,11,14,22,23	11/26/2001	12/04/2001
MIR105704	TAC-MFG PLANT ADDITION	4111 COUNTY FARM RD	T2S	R1W	30	11/30/2001	12/07/2001
MIR105886	MJ FARMS-GREENBRIAR PH 2	KING RD, SPRING ARBOR	T3S	R2W	9	03/25/2002	03/25/2002
MIR105925	MDOT-M50 / US127 BL	NORTH ST TO BOARDMAN RD	T2S	R1W	27,28,33,4	04/05/2002	04/05/2002
MIR105996	VISTA GRANDE VILLA EXPANSION	2251 SPRINGPORT RD	T20S	R1W	28	05/08/2002	05/08/2002
MIR106096	HOME DEPOT-INSTALLMENTS	1400 W MONROE ST	T2N	R1W	28	06/14/2002	06/14/2002
MIR106113	SD-ARBORS @ THE WOODS	DETLMAN & AMOS, JACKSON	T2S	R1W	36	06/19/2002	06/19/2002
MIR106173	HOME DEPOT STORE 2770-JACKSON	NW CORNER OF MONROE & WISNER ST	T2N	R1W	28	07/18/2002	07/18/2002
MIR106172	NORFOLK-SUMMIT GLEN/OAK GROVE	BARRINGTON CIRCLE, JACKSON	T3S	R1E	5	07/18/2002	07/18/2002
MIR106194	SANCTUARY OF BRILLS LK PH 2	3650 WHIPPLE RD, JACKSON	T2S	R1E	22	07/30/2002	07/30/2002
MIR106265	WELHOFF-BRENDAN ESTATES	M-50, NAPOLEON	T4S	R1E	1	08/21/2002	08/21/2002
MIR106529	MDOT-US127, JACKSON		T4S	R1W	13	01/16/2003	01/16/2003