> 2022 Rouge River Water Quality Assessment
Final Report

December 31, 2022
ECT No. 220015

ALLIANCE OF ROUGE COMMUNITIES
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Summary

The Rouge River watershed was assessed for *Escherichia Coli* (*E. coli*) and total suspended solids (TSS) concentrations, while Johnson Creek was assessed for dissolved oxygen (DO) concentrations in 2022. The purpose of these assessments was to determine the effectiveness of best management practices implemented as part of the municipal separate storm sewer system (MS4) permits held by Alliance of Rouge Communities (ARC) members. This was completed by comparing 2022 water quality data to data collected between 2015 and 2018.

The results indicate that there have been significant improvements (88% reduction) in dry weather *E. coli* concentrations at 25 stormwater outfalls that were investigated for illicit connections between 2017 and 2022. The original mean *E. coli* concentration at these outfalls was 11,591 Most Probable Number (MPN)/100 milliliter (mL). It was reduced to 1,379 MPN/100 mL in 2022 due to the identification of illicit connections and other illicit discharges in various drainage areas. However, 10 outfalls and 6 county drains still have elevated *E. coli* levels (>5,000 MPN/100 mL). These 16 locations include a few sites whose previous *E. coli* concentrations were low. Additional illicit discharge investigations are recommended in these 16 areas.

With 97% of the values above the water quality standard of 7 mg/l, DO concentrations in Johnson Creek remained consistent with historic concentrations. Low DO events occurred in early August but were not correlated with stream temperature. Given these results, it is recommended that the State be petitioned to remove Johnson Creek from the impaired waters list.

Most (82%) of the 2022 wet weather TSS concentrations were below the target value of 120 mg/l which the State selected to be protective of aquatic habitat. This is better than 2017 peak values which were all above the target value. Sediment control best management practices should continue with an emphasis on applying the new post-construction stormwater standards to new development and redevelopment sites. This should eventually reduce peak stream flows and volumes which is expected to lower TSS concentrations.

Introduction

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) required MS4 permittees to develop a Total Maximum Daily Load (TMDL) Implementation Plan as part of their permit applications in 2016. ARC members chose to develop a collaborative plan to address all TMDL impairments. The plan was approved by EGLE in 2019 with an update approved in 2020. The plan outlines best management practices to be completed by the permittees to improve water quality. It also outlines the need for two sampling events at select locations to evaluate improvements in water quality.

The first sampling event was conducted in 2017 and is summarized in the 2017 Rouge River Ecosystem Monitoring and Assessment Report (ARC, 2018). The second sampling event was completed in 2022 and is summarized herein. This report compares the 2017 and 2022 sampling data to determine the status of water quality improvements.

Background

There are three TMDL assessments that are covered by the Rouge River Collaborative TMDL Implementation Plan (ARC, 2020a):

- TMDL for *E. coli* in the Rouge River[1];
- TMDL for Biota in the Rouge River Watershed including Bishop and Tonquish Creeks; and
- TMDL for Dissolved Oxygen in Johnson Creek.

In these assessments, EGLE established primary and secondary targets for municipal stormwater permittees as shown in Table 1 (EGLE, 2019; MDEQ, 2007a); MDEQ, 2007b). When the primary target is met, the waterbody has achieved the goals of the TMDL and the waterbody would be eligible for removal from the State's impaired waters list. The secondary target parameters are surrogates that will be useful in determining the success of the selected best management practices that are needed to reduce pollutant loads. In all three assessments, EGLE opted to assign collective targets to the MS4 permittees rather than individual targets. This would seem to indicate that EGLE recognizes that demonstration of progress can be shown on a watershed-basis rather than within jurisdictional boundaries.

Table 1. TMDL Targets for Municipal Stormwater Permittees

Parameter	Extent of the TMDL	TMDL Targets for MS4 Permittees Primary (1°) and Secondary (2°)	Notes
E. coli	Watershed-wide	300 colony forming units (cfu)/100 mL* 130 cfu/100 mL 1,000 cfu/100 mL	Daily geometric mean value (May 1 – Oct 31) 30 day geometric mean value (May 1 – Oct 31) Daily maximum (Nov 1 – Apr 30)
Biota	Watershed-wide	1°: Procedure 51 scores ≥ Acceptable 2°: Suspended solids ≤ 80 mg/l	For 2 successive years Annual average during wet weather
Dissolved Oxygen	Johnson Creek between the Middle Rouge confluence & 6 Mile Road	1°: 7 mg/L 2°: Suspended solids ≤ 80 mg/l**	Johnson Creek is considered a cold-water stream, thus has a target of 7 mg/L; all other reaches of the Rouge River have a target of 5 mg/L.

*CFU and MPN results are comparable when used to report *E. coli* concentrations.

**This concentration is presumed for the purposes of this document, but it was not explicitly listed in the DO TMDL.

[1] The TMDL for *E. coli* in the Rouge River was replaced by the Statewide *E. coli* TMDL in 2019. However, there were no change to the TMDL targets for MS4 permittees (MDEQ, 2019).

Methodology

The sampling methodology for each of the parameters is described below. Further details on sampling procedures can be found in the ARC TMDL Study Sampling Plan (ARC, 2022a).

Instream Dissolved Oxygen Monitoring

Monitoring for DO was conducted in Johnson Creek on the south side of 7 Mile Road/Hines Drive just east of Sheldon Road (historical Rouge site D03/USGS site 04166700). This was the only site monitored because the DO TMDL is limited to Johnson Creek. A YSI 6600 water quality sonde was placed in the creek and secured in a 4" PVC conduit previously installed by the United States Geological Survey (USGS). The sonde was in place for two months (July 26 – September 26, 2022) and recorded DO and temperature readings every 15 minutes.

Outfall and Instream *E. coli* Sampling

Dry weather *E. coli* sampling took place at outfalls and initial priority drainage areas as described in the Rouge River Collaborative IDEP Plan (ARC, 2020b)[2]. The selected outfalls were those that had *E. coli* concentrations >1,000 cfu/100 mL during outfall screening conducted in 2018 (all Category A, B and C outfalls) (Figures 1 and 2). The initial priority areas were locations that had elevated *E. coli* concentrations prior to 2018. The Wayne County priority area sites were instream locations (Figure 3), while the Oakland County sites were outlets of enclosed storm drains (Figure 4). The last group of sampling sites were located at 38 of the Category D outfalls (*E. coli* concentrations <1,000 cfu/100 mL during outfall screening). These sites were selected to meet the minimum number of sites (100) set by EGLE. The last group of sampling sites were located so there was a somewhat even distribution of sampling sites across the watershed. Table 2 contains a summary of sampling locations.

Outfall sampling was completed by Environmental Consulting & Technology, Inc. (ECT), while sampling for the priority areas was completed by Oakland County Water Resources Commission (WRC) and Wayne County Department of Public Services (DPS) staff.

Instream TSS

Suspended sediment sampling was conducted during wet weather conditions at 28 instream sites (Figure 5) where the average wet weather TSS values exceeded 80 mg/L or where single sample values exceeded 120 mg/L in 2017, as specified in the Collaborative TMDL Plan. These locations are described in Appendix A. This sampling occurred one time during wet weather, which was defined as a rain event of at least 0.25" over 24 hours prior to sampling, which was preceded by 48 hours of dry

[2] Dry weather was defined as no more than 0.05" of precipitation over the 48 hours prior to sampling. An absence of rainfall was confirmed prior to sample collection using rainfall data from www.iweathernet.com.

weather. Wet weather conditions were determined using rainfall data from www.iweathernet.com to ensure that sufficient rain had fallen in the target areas prior to sampling.

Table 2. Summary of E. coli Sampling Locations

Description	Number of Sites
E. coli >10,000 cfu/100 mL or unexplained physical characteristics (Category A. Outfalls)	11
E. coli between 5,001 and 10,000 cfu/100 mL (Category B Outfalls)	10
E. coli between 1,001 and 5,000 cfu/100 mL (Category C Outfalls)	24
E. coli ≤1,000 cfu/100 mL (Category D Outfalls)	38
Priority Areas (instream)	17
Total	**100**

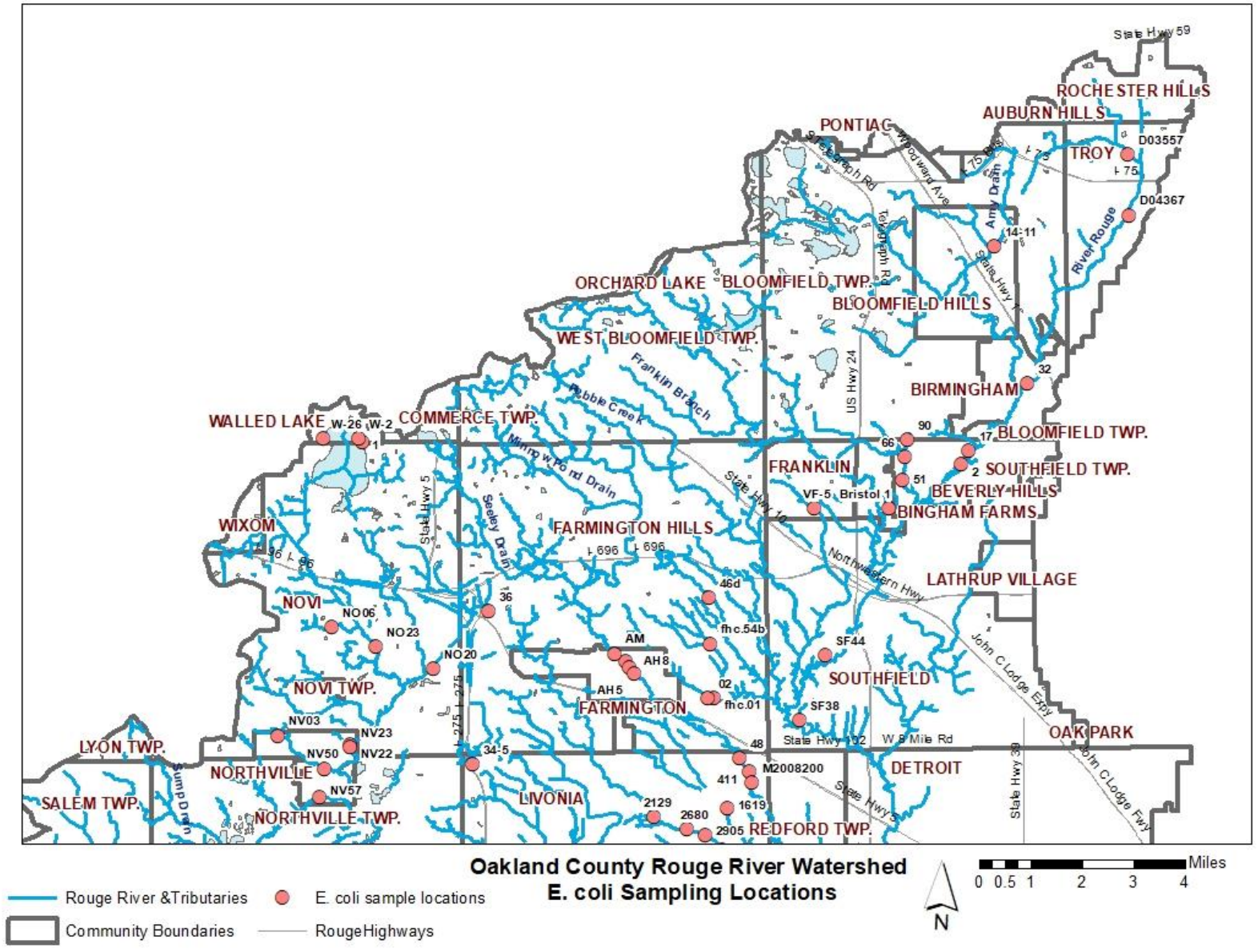

Figure 1. Oakland County Priority Outfall E. coli Sampling Sites

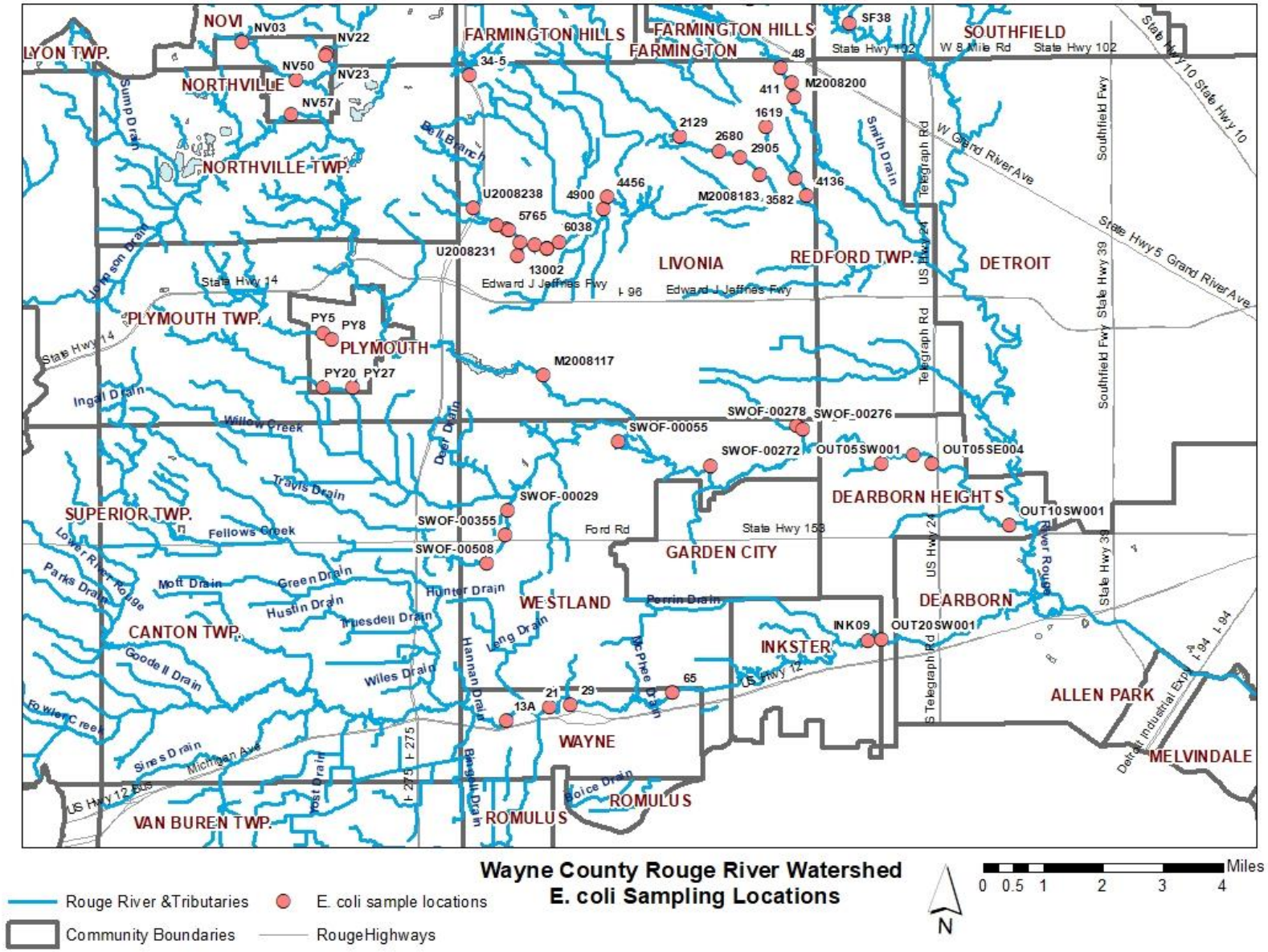

Figure 2. Wayne County Priority Outfall E. coli Sampling Sites

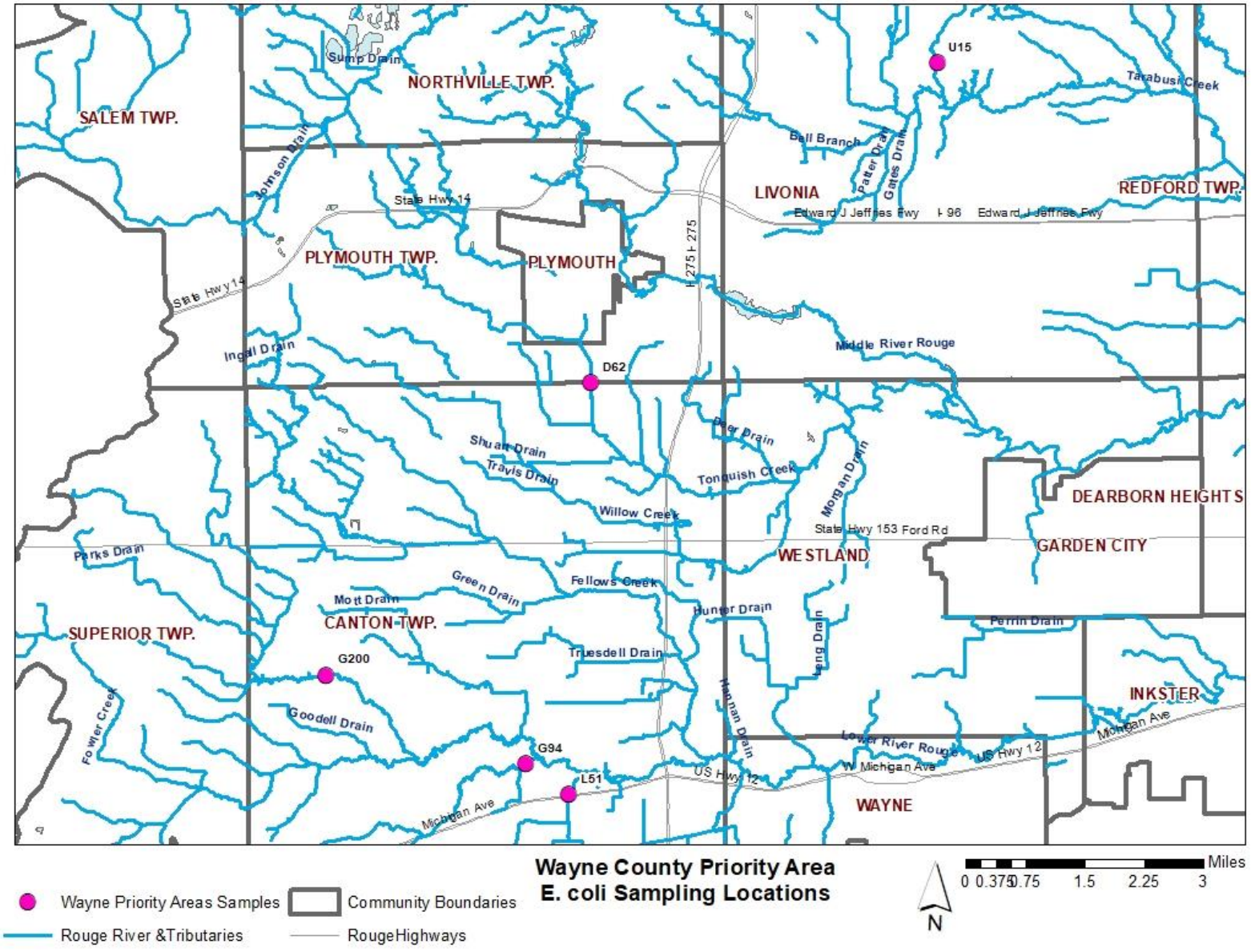

Figure 3. Wayne County Priority Area Instream E. coli Sampling Sites

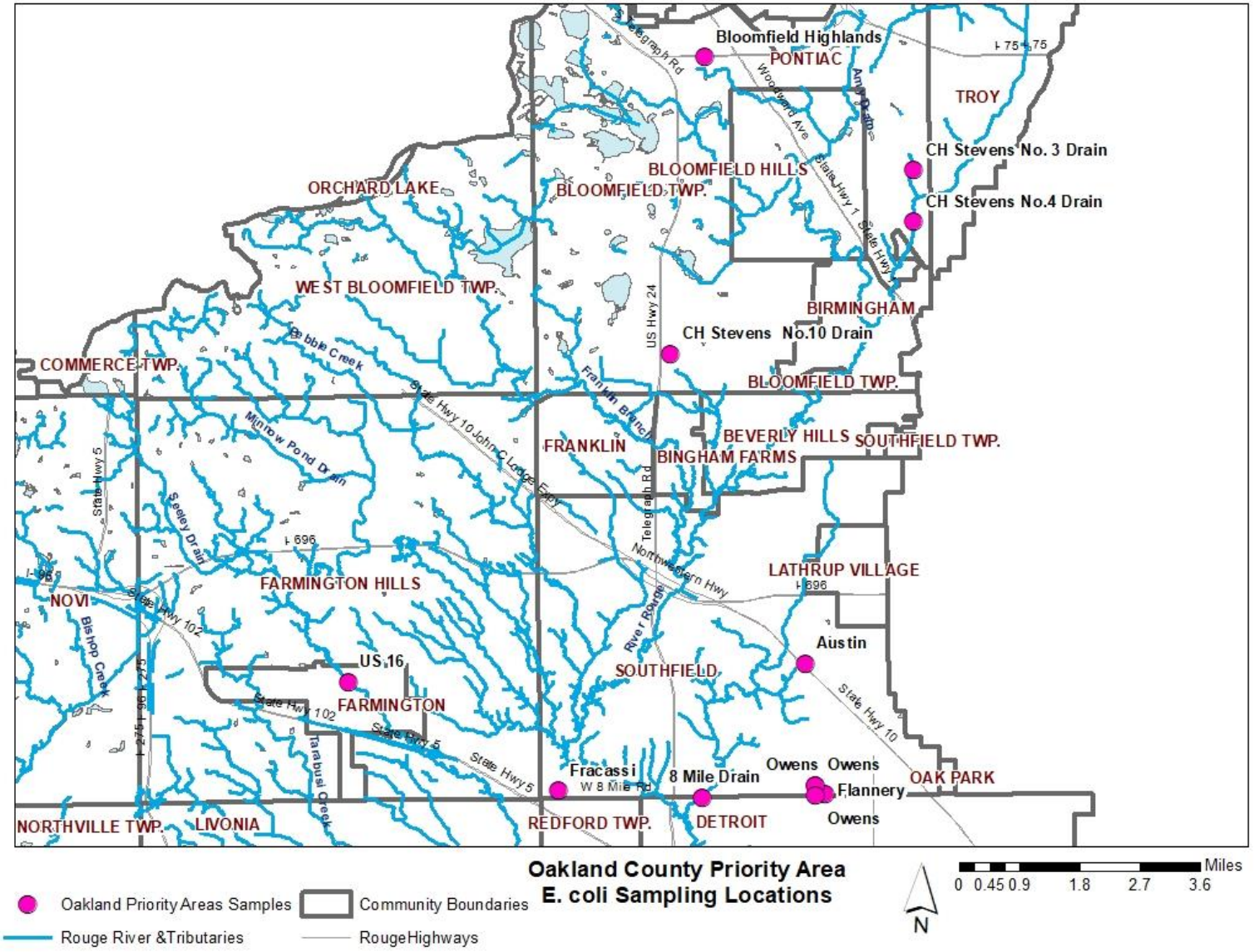

Figure 4. Oakland County Priority Area Drain Outlet E. coli Sampling Sites

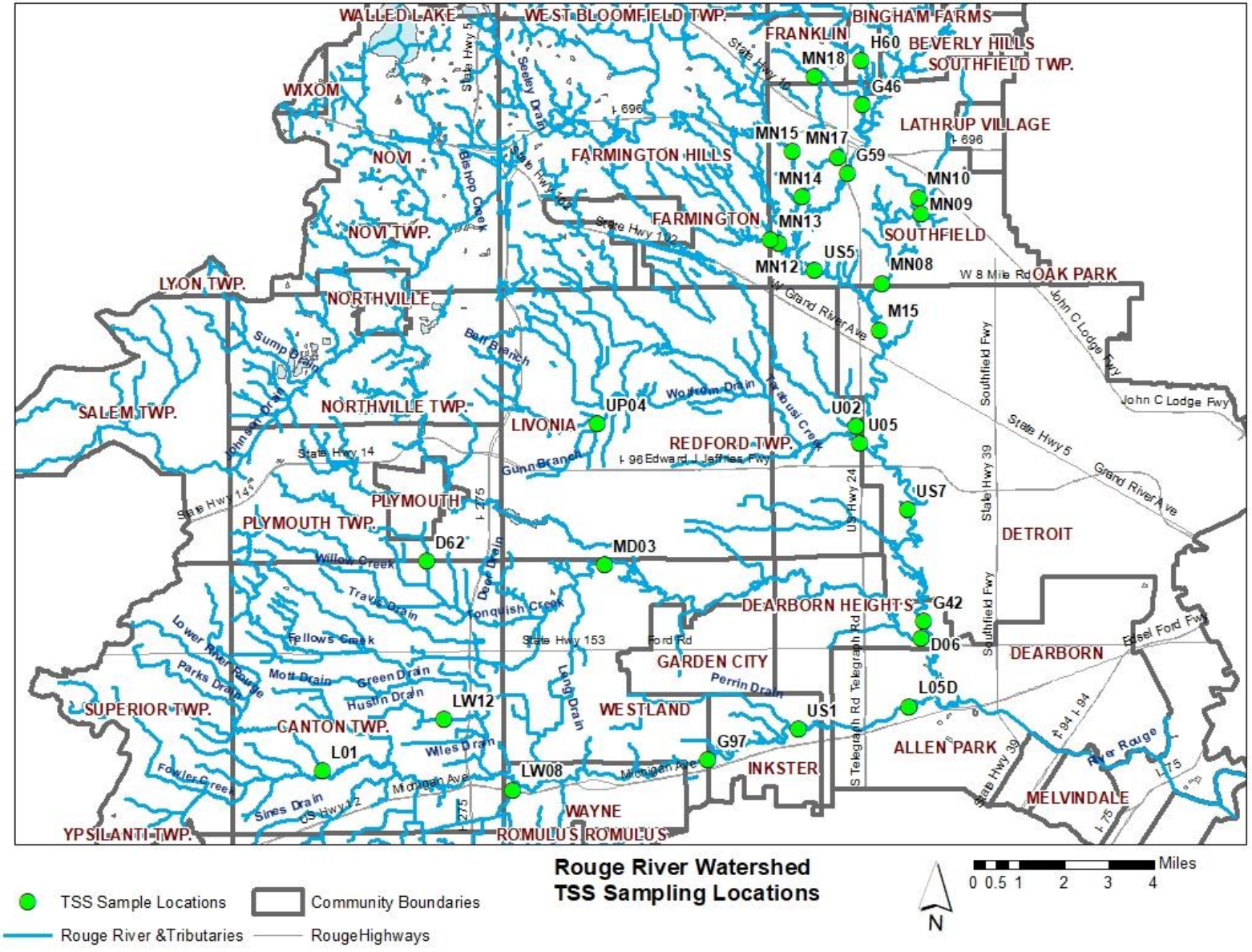

Figure 5. Total Suspended Solids Sampling Sites

Results

The 2022 sampling results are provided throughout this section and compared to the previous sampling results.

Dissolved Oxygen Results

During 2022, 97% of the dissolved oxygen values in Johnson Creek were above the water quality standard of 7.0 mg/L (Figure 6). DO concentrations intermittently fell below the water quality standard five times during the first week of August when the lowest concentration was 6.67 mg/l. Although the low DO events occurred in August, the DO concentrations were not correlated with stream temperature. Most (85%) of the exceedances occurred during the overnight hours when it was cooler which is unusual because cooler temperatures typically result in higher DO levels. This indicates that other factors are impacting the low DO values. Increased stormwater runoff likely helped DO levels rebound during early August as rain fell in the amounts of 0.07", 0.52", 1.1", 0.24" on August 3rd, 4th, 5th and 8th, respectively[3]. The percentage of DO exceedances in 2022 were comparable to those found in 2017 (ARC, 2018) and 1994-2001 (MDEQ, 2007b) (Table 3).

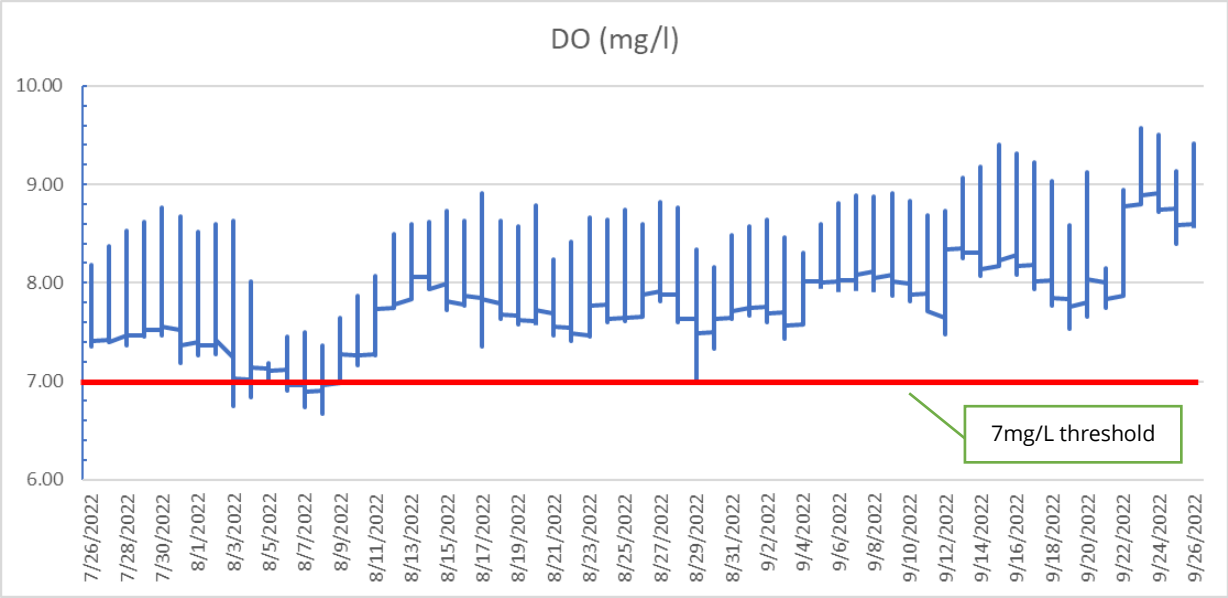

Figure 6. Johnson Creek Dissolved Oxygen Data – 2022

[3] Source: Daily rainfall data for Ann Arbor (USC00200230) from https://www.ncdc.noaa.gov/cdo-web/

Table 3. Current and Previous Johnson Creek Dissolved Oxygen Statistics

Year	Number of observations (n)	Min DO (mg/L)	Max DO (mg/L)	Mean DO (mg/L)	Portion of Measurements >7 mg/L
1994-2001	43,895	6.0		9.0	97%
2017	17,637	6.2	12.0	8.9	100%
2022	5,986	6.7	9.6	8.1	97%

1994-2001 maximum concentration not reported in the Johnson Creek TMDL.

E. coli Results for Priority Outfalls

The outfall *E. coli* results were grouped into Categories A, B and D for discussion in this report based on 2018 *E. coli* concentrations and resampling of the Category C outfalls. Category C outfalls were resampled in 2019, as required in the Collaborative IDEP Plan, and these outfalls were reassigned to Categories A, B and D, based on *E. coli* results.

For Category A outfalls, the 2018/2019 and 2022 geometric means were 20,316 and 3,199 MPN/100 mL, respectively (Table 4). This indicates an 84% reduction in *E. coli*, although a few outfalls still have elevated levels: 411 and U2008221 in Livonia, BH51 in Beverly Hills and PY8 in Plymouth.

Table 4. Category A Outfall Dry Weather E. coli Results

Outfall ID	Municipality	*E. coli* Result (MPN/100 mL)	
		2018/2019*	2022
fhc01	Farmington Hills	>24,196	no flow
411	Livonia	>24,196	7,701
U2008221	Livonia	>24,196	>24,196
PY8	Plymouth	>24,196	>24,196
WN21	Wayne	>24,196	no flow
BH51	Beverly Hills	>24,196	12,997
NV22	Northville	>24,196	1,918
NVO3	Northville	24,196	2,489
U2008223	Livonia	17,329	no flow
1619	Livonia	15,531	857
32	Birmingham	12,997	1,722
BH66	Beverly Hills	12,033	85
Geometric Mean for all Sites**		**20,316**	**3,199 (84% reduction)**

* The highest outfall sampling result from 2018 and 2019 is reported here.

** The upper detection limit was used for values above the detection limit.

For Category B outfalls, the 2018/2019 and 2022 geometric means were 7,323 and 693 MPN/100 mL, respectively (Table 5). This indicates an 91% reduction in *E. coli*, although two outfalls still have elevated levels: 2680 and 3582 in Livonia.

Table 5. Category B Outfall Dry Weather E. coli Results

Outfall ID	Municipality	*E. coli* Result (MPN/100 mL)	
		2018/2019*	2022
NV23	Northville	9,804	no flow
6038	Livonia	9,208	98
AH 5	Farmington	8,664	10
13002	Livonia	8,664	327
PY5	Plymouth	8,164	3,076
NO23	Novi	7,701	1,211
AH8	Farmington	7,270	63
M2008117	Livonia	7,270	3,076
U2008231	Livonia	7,270	496
U2008238	Livonia	6,131	no flow
NV57-1	Northville	6,131	789
3582	Livonia	5,475	9,804
2680	Livonia	5,172	19,863
Geometric Mean for all Sites		**7,323**	**693 (91% reduction)**

* The highest outfall sampling result from 2018 and 2019 is reported here.

For Category D outfalls, the 2018/2019 and 2022 geometric means were 214 and 339 MPN/100 mL, respectively (Table 6). This indicates a slight overall increase in *E. coli* which is primary due to higher concentrations at some outfalls, especially NO20 in Novi and OUT20SW001 and OUT05SW001 in Dearborn Heights.

Table 6. Category D Outfall Dry Weather E. coli Results

Outfall ID	Municipality	*E coli* Results (MPN/100 mL)	
		2018/2019*	2022
5626	Livonia	4,352	6,488
OUT05SE002	Dearborn Heights	3,448	3,255
SWOF-00355	Westland	3,255	<10
WN29	Wayne	3,076	2,489
OUT20SW001	Dearborn Heights	2,400	>24,196
M2008183	Livonia	2,064	52
6187	Livonia	1,935	1,050
WL1	Walled Lake	1,670	no flow
PY20	Plymouth	1,616	3,873
2129	Livonia	1,607	84

Outfall ID	Municipality	*E coli* Results (MPN/100 mL)	
		2018/2019*	2022
BH2	Beverly Hills	1,334	408
AH	Farmington	1,296	1,515
U2008220	Livonia	1,198	10
4456	Livonia	1,050	10
2905	Livonia	554	341
SWOF-00029	Westland	495	no flow
5765	Livonia	480	no flow
ink09	Inkster	479	no flow
SWOF-00055-1-N	Westland	288	no flow
WN65	Wayne	228	1,597
NO20	Novi	109	11,199
SWOF-00278	Westland	63	62
NO6	Novi	52	no flow
D03557	Troy	52	no flow
SF52	Southfield	41	no flow
SWOF-00434	Westland	41	226
SWOF-00033	Westland	20	110
4900	Livonia	10	233
SWOF-00500	Westland	10	594
fhc.54b	Farmington Hills	10	no flow
sf 38	Southfield	<10	no flow
sf44	Southfield	<10	175
SWOF-00215	Westland	<10	379
fhc.46d	Farmington Hills	<10	<10
D04367	Troy	<10	no flow
OUT05SW001	Dearborn Heights	no flow	>24196
BH17	Beverly Hills	no flow	1,785
PY27	Plymouth	no flow	594
U2008220B	Livonia	no flow	327
NV50	Northville	no flow	241
OUT10SW001	Dearborn Heights	no flow	74
SWOF-00272	Westland	no flow	52
48	Livonia	no flow	10
4136	Livonia	no flow	no flow
SF60	Southfield	no flow	no flow
SF61	Southfield	no flow	no flow
WL2	Walled Lake	no flow	no flow
AM	Farmington	no flow	no flow
fhc.36	Farmington Hills	no flow	no flow
fhc02	Farmington Hills	no flow	no flow
VF-5	Franklin	no flow	no flow

Outfall ID	Municipality	*E coli* Results (MPN/100 mL)	
		2018/2019*	2022
M2008200	Livonia	no flow	no flow
WL26	Walled Lake	no flow	no flow
WN13A	Wayne	no flow	no flow
SWOF-00276	Westland	no flow	no flow
SWOF-00508	Westland	no flow	no flow
BH90	Beverly Hills	no flow	no flow
14-11	Bloomfield Hills	no flow	no flow
OUT05SE004	Dearborn Heights	no flow	no flow
Geomean Mean for all Sites**		**214**	**339**

* The highest outfall sampling result from 2018 and 2019 is reported here.
**The lower and upper detection limits were used for values below or above the detection limits.

The outfalls with the 2022 *E. coli* still above 5,000 MPN/100 mL will be subject to further IDEP investigations (Table 7). Of note, an illicit connection upstream of outfall U2008221 was corrected after this data was collected in 2022. However, an additional pollutant source appears to be present at the outfall and further investigations are warranted.

Table 7. Outfalls requiring Additional IDEP Investigations

Outfall ID	Municipality	*E. coli* Result (MPN/100 mL)	
		2018/2019*	2022
411	Livonia	>24,196	7,701
U2008221	Livonia	>24,196	>24,196
PY8	Plymouth	>24,196	>24,196
2680	Livonia	5,172	19,863
5626	Livonia	4,352	6,488
BV51	Beverly Hills	3,076	12,997
OUT20SW001	Dearborn Heights	2,400	>24,196
3582	Livonia	2,382	9,804
NO20	Novi	109	11,199
OUT05SW001	Dearborn Heights	no flow	>24,196

* The highest outfall sampling result from 2018 and 2019 is reported here.

***E. coli* Results for Priority Areas**

For the instream sites in Wayne County, the 2015 and 2022 geometric means for all sites were 1,852 and 687 MPN/100 mL, respectively (Table 8). All sites had lower *E. coli*, except D62 Tonquish/Joy which had a moderately higher *E. coli* concentration in 2022. This is despite the nine illicit connections that were eliminated in Plymouth, as described in the Collaborative IDEP Plan Progress Reports (ARC, 2020c and ARC, 2022b).

For the drain outlets in Oakland County, the 2015 and 2022 geometric means for all sites were 3,084 and 5,590 MPN/100 mL, respectively (Table 9). There was a noticeable improvement at CH. Stevens 4 Drain which was likely due to the identification and correction of an upstream failing septic system. However, some sites (Austin, CH. Stevens 4, Flannery, Fracassi, Owens and US 16 drains) had higher *E. coli* concentration in 2022 than in 2015.

Table 8. Instream Dry Weather E. coli Results in Wayne County Priority Areas

Site	*E. coli* Result (MPN/100 mL)	
	2015	2022
D62 Tonquish/Joy	1,483	4,884
G200 Lower Rouge/Denton	1,314	529
G94 Sines Drain/Sheldon	1,046	556
L51 McKinstry Drain	4,884	201
U15 6 Mile/Farmington	2,187	529
Geometric Mean	**1,852**	**687**

Table 9. Drain Outlet Dry Weather E. coli Results in Oakland County Priority Areas

Site	*E. coli* Result (MPN/100 mL)	
	2015	2022
8 Mile Drain	1,940	1,030
Austin Drain	2,005	651,813
Bloomfield Highlands Drain	2,121	2,755
CH. Stevens 1 Drain	1,371	534
CH. Stevens 10 Drain	1,748	6
CH. Stevens 3 Drain	7,194	86,872
CH. Stevens 4 Drain	10,909	967
Devonshire Drain	1,181	574
Flannery Drain	1,765	68,800
Fracassi Drain	14,240	11,534
Owens Drain	7,095	252,666
US 16 Drain	2,269	16,264
Geometric Mean	**3,084**	**5,590**

TSS

The 2022 wet weather sampling took place over 3 days as shown in Table 10, and the resulting TSS concentrations are provided in Table 11. Concentrations ranged from <5 to 230 mg/l with a mean concentration of 65 mg/l. This compares to a mean concentration of 251 mg/l in 2017 (Table 12). Of the 28 sites sampled, six had values that exceeded the 120 mg/L threshold, and when compared to 2017 data, 25 sites had lower TSS levels in 2022 (Figure 7).

The Middle Branch had the lowest average TSS concentration. This may be indicative of the number of impoundments in this subwatershed which are likely trapping sediments.

Table 10. Rain Events associated with TSS Sampling

Date	Rainfall*	Weather Station	Sampling Sites
8/8/2022	0.41"	Dearborn (USC00202015)	L05D, M15, G42, US7, D06, U02, U05
8/29/2022	0.26"	Detroit Metro Airport (USW00094847)	LW12, L01, G97, US1, US1, D62
10/26/2022	0.27"	Livonia (US1MIWY0052)	MD03, UP04
10/26/2022	0.26"	Southfield (US1MIOK0069)	G46, G59, H60, MN08, MN09, MN10, MN12, MN13, MN14, MN15, MN17, MN18, US5

*Source: Daily rainfall data from https://www.ncdc.noaa.gov/cdo-web/

Table 11. 2017 and 2022 Wet Weather Total Suspended Solids Results

Sub-watershed	Site	TSS Concentrations (mg/l)		
		2017*	2022	2022 Average**
Lower Branch	LW12	580	21	119
	L01	290	46	
	G97	140	260	
	L05D	140	54	
	LW08	130	190	
	US1	150	140	
Main Branch	G46	360	13	49
	G59	550	17	
	H60	160	<10	
	MN08	130	25	
	MN09	350	22	
	MN10	200	17	
	MN12	570	<5	
	MN13	540	42	
	MN14	130	44	
	MN15	150	24	
	MN17	550	18	
	MN18	140	<5	
	US5	180	14	
	M15	180	170	
	G42	170	100	

Sub-watershed	Site	TSS Concentrations (mg/l)		
		2017*	2022	2022 Average**
	US7	130	170	
Middle Branch	D06	210	64	33
	MD03	190	22	
	D62	150	12	
Upper Branch	U02	130	110	103
	U05	240	180	
	UP04	180	20	

*Although multiple samples were collected at each site in 2017, only the highest TSS concentration at each site was considered in this report.
**The lower detection limit was used for values below the detection limit.

Table 12. Current and Previous Instream Total Suspended Solids Statistics

Year	Min TSS (mg/L)	Max TSS (mg/L)	Mean TSS (mg/L)	Portion < 120 mg/L
2017*	130	580	251	0%
2022	<5	260	65	82%

*Although multiple samples were collected at each site in 2017, only the highest TSS concentration at each site was considered in this report.

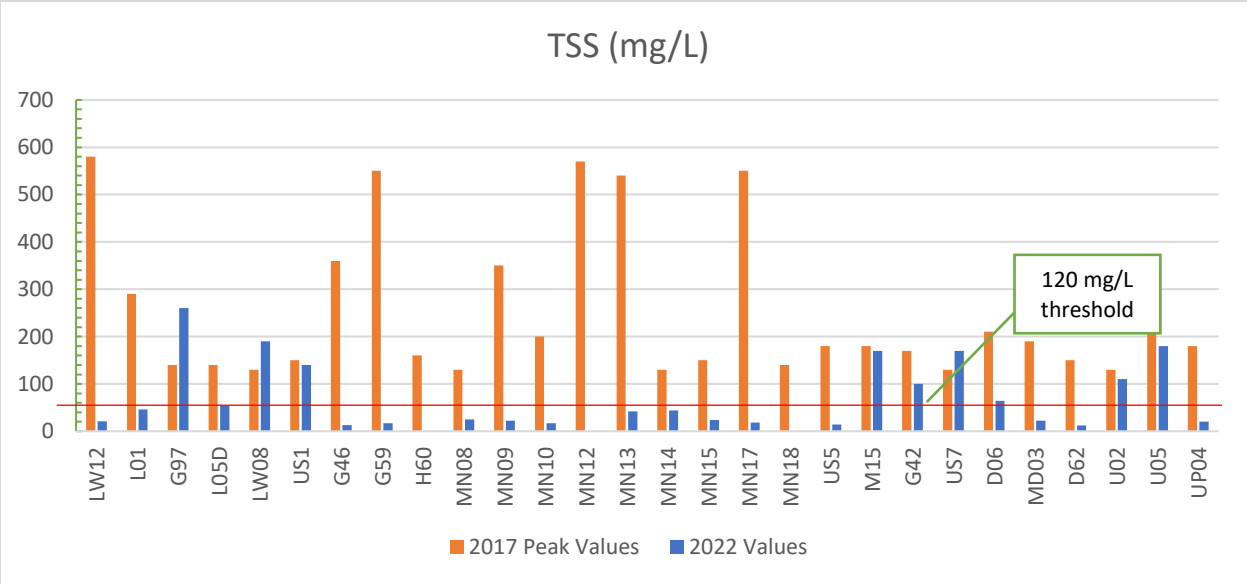

Figure 7. 2017 and 2022 Instream Wet Weather Total Suspended Solids Results

Conclusions

DO

During the past two monitoring events (2017 and 2022), dissolved oxygen levels in Johnson Creek at 7 Mile/Hines Dr were above the water quality standard 97% of the time. The five low DO events that occurred in 2022 were not correlated with stream temperature. Given that the State allows for 10% exceedance threshold for listing a stream on the impaired waters list (EGLE 2022, Chapter 3.5.1.1), this suggests that this stream segment may be eligible for delisting.

Priority Outfall *E. coli*

Overall, there was substantial reduction (88%) in the dry weather *E. coli* geometric means at the Category A and B outfalls. This is due to the illicit discharges that were discovered and corrected between 2017 and 2022 as described in the Collaborative IDEP Plan Progress Reports (ARC, 2020c and ARC, 2022b). A few examples are provided below:

- At BV66, a home's sanitary plumbing was rerouted to the sanitary sewer rather than the storm drain. In 2018 (before illicit connection discovery/correction), the *E. coli* concentration at the outlet was 12,033 MPN/100 mL and in 2022 it reduced to 85 MPN/100 mL.
- A similar situation occurred at NV03 where a home's plumbing was connected to an unmapped storm drain. In 2018 (before illicit connection discovery/correction), the *E. coli* concentration at the outlet was 24,196 MPN/100 mL and in 2022 it reduced to 2,489 MPN/100 mL.
- At NO23, an excessive amount of wildlife feces was cleaned out of the storm drain. In 2018 (before illicit connection discovery/cleaning), the *E. coli* concentration at the outlet was 7,701 MPN/100 mL and in 2022 it reduced to 1,211 MPN/100 mL.

Overall, there was no improvement in the dry weather *E. coli* geometric means at the Category D outfalls. However, the geometric means were low. Illicit discharge investigations were not required or conducted upstream of the Category D outfalls. Therefore, any reductions in individual *E. coli* concentrations is either due to implementation of the other BMPs included in the Collaborative TMDL Plan or a sign of the variability often seen in stormwater water quality data.

Ten outfalls (Table 8) need to be investigated to determine if illicit discharges are present. These investigations would include storm drain sampling to narrow down the suspicious discharge, storm drain inspections using closed circuit televising (CCTV) and dye testing, as needed.

Priority Area *E. coli*

With the instream *E. coli* still elevated on Tonquish Creek (D62), illicit discharges still may be present upstream. This data will be used to establish the next set of priority outfalls for screening as outlined in the Collaborative IDEP Plan. The moderate reductions seen in individual *E. coli* concentrations at

the other Wayne County instream sites are either due to implementation of the other BMPs included in the Collaborative TMDL Plan or a sign of the variability often seen in stormwater water quality data.

Correction of the failing septic system tributary to the CH Stevens 4 Drain likely resulted in the noticeably lower *E. coli* concentration found at the outlet in 2022. The moderate reductions seen in four other Oakland County Priority Areas (8 Mile, CH Stevens 1, CH Stevens 10 and Devonshire drains are either due to implementation of the other BMPs included in the Collaborative TMDL Plan or a sign of the variability often seen in stormwater water quality data. Lastly, six county drain outlets: Austin, CH. Stevens 4, Flannery, Fracassi, Owens and US 16 drains need further investigations in order locate potential illicit discharges.

TSS

For most sites sampled, the wet weather TSS levels decreased when compared to 2017 data. This is either an indicator of improvements in water quality or due to the variability of stormwater quality. Given that TSS concentrations were relatively low and not much different between the sites, it is not possible to pinpoint potential discrete sediment sources based on this data. More likely, the elevated TSS concentrations are the results of excessive stormwater runoff in the mostly urbanized watershed. Implementation of post-construction stormwater management ordinances should reduce runoff volumes and peak flows which in turn should reduce wet weather instream TSS concentrations.

Recommendations

Based on the results described in this report, ECT makes the following recommendations:

- The ARC should request that the State remove Johnson Creek from the impaired waters list for dissolved oxygen.
- The ARC and the permittees should continue to implement best management practices to reduce dry weather *E. coli* at outfalls with a focus on illicit discharge investigations.
- The ten outfalls listed in Table 7 should be included in the priority outfalls in the updated Rouge River Collaborative IDEP Plan. The ARC and the permittees should conduct investigations upstream of these outfalls to determine if illicit discharges are present.
- Oakland County should continue the illicit discharge investigations on the Austin, CH. Stevens 4, Flannery, Fracassi, Owens and US 16 drains.
- The permittees should continue to implement best management practices to reduce wet weather TSS concentrations. The focus should be on onsite post construction stormwater management, as required by ordinance, which should eventually reduce peak and the volume of stream flows.
- Dry weather *E. coli* and wet weather TSS monitoring should continue to track improvements in municipal stormwater management.

References

ARC, 2018. Alliance of Rouge Communities. *2017 Rouge River Ecosystem Monitoring and Assessment Report*. November 2018.

ARC, 2020a. Alliance of Rouge Communities. *Rouge River Collaborative TMDL Implementation Plan for Municipal Stormwater Permittees*. January 2020.

ARC, 2020b. Alliance of Rouge Communities. *Rouge River Collaborative Illicit Discharge Elimination Plan*. January 2020.

ARC, 2020c. Alliance of Rouge Communities. *Rouge River Collaborative Illicit Discharge Elimination Plan 2018 - 2019 Progress Report.* March 19, 2020.

ARC, 2022a. Alliance of Rouge Communities. *ARC TMDL Study Sampling Plan*. 2022

ARC, 2022b. Alliance of Rouge Communities. *Rouge River Collaborative Illicit Discharge Elimination Plan 2020 - 2021 Progress Report.* March 19, 2022.

MDEQ, 2019. Michigan Department of Environment, Great Lakes and Energy. *Michigan's Statewide E. coli Total Maximum Daily Load*. July 2019.

MDEQ, 2007a. Michigan Department of Environmental Quality. *Total Maximum Daily Load for Biota in the Rouge River Watershed including Bishop and Tonquish Creeks, Washtenaw, Wayne and Oakland Counties, Michigan*. August 2007.

MDEQ, 2007b. Michigan Department of Environmental Quality. *Total Maximum Daily Load for Dissolved Oxygen in Johnson Creek, Wayne and Washtenaw Counties, Michigan*. June 2007.

Appendix A TSS Locations Descriptions

Sub-watershed	Site ID	Latitude	Longitude	Intersection
Lower Branch	LW12	42.30094	-83.453644	West of Haggerty Rd
	L01	42.283485	-83.505433	South Beck Rd. & Lindenhurst Blvd. - northern stream crossing
	G97	42.29003	-83.339159	Michigan Ave. & Henry Ruff Rd
	L05D	42.308582	-83.252712	South Military St. & Morley Ave.
	LW08	42.278955	-83.42337	Michigan Ave. & Hannan Rd.
	US1	42.300629	-83.30055	John Daly St. & Lower Rouge Pkwy Dr.
Main Branch	G46	42.501224	-83.278604	12 Mile Rd. & Wildbrook Dr
	G59	42.479135	-83.284474	Civic Center Dr. & Telegraph Rd
	H60	42.515456	-83.279595	West 13 Mile Rd. & Bingham Rd.
	MN08	42.44408	-83.26876	Berg Rd. & West 8 Mile Rd.
	MN09	42.466608	-83.252509	Tamarack Trail & Hiawatha Trail
	MN10	42.471861	-83.253591	Tamarack Trail & West 10 Mile Rd.
	MN12	42.456262	-83.313634	Inkster Rd. & West 9 Mile Rd.
	MN13	42.457364	-83.317543	Inkster Rd. & Spring Valley Dr.
	MN14	42.471354	-83.303989	West 10Mile Rd. & Samoset Trail
	MN15	42.48582	-83.308736	West 11 Mile Rd.& Mel Bauman Blvd.
	MN17	42.484291	-83.288878	West 11 Mile Rd. & Franklin Rd.
	MN18	42.509759	-83.299754	West 13 Mile Rd. & Cheviot Hills Dr.
	US5	42.447867	-83.297672	Beech Rd. & Shiawassee St.
	M15	42.429135	-83.269132	West 7 Mile Rd. & Berg Rd.
	G42	42.336059	-83.247163	Ann Arbor Trail & Walter Cassidy Dr.
	US7	42.371776	-83.255556	Plymouth Rd. & Rouge Park Dr.
Middle Branch	D06	42.330724	-83.248019	Ford Rd. & Edward N Hines Dr.
	MD03	42.351892	-83.386037	Wayne Rd. & Joy Rd.
	D62	42.351646	-83.462714	Joy Rd. & Manton Ave.
Upper Branch	U02	42.398208	-83.278385	Graham Rd. & Telegraph Rd.
	U05	42.392683	-83.276665	Telegraph Rd. & River Circle
	UP04	42.396943	-83.39046	5 Mile Rd.& Ellen Dr