#254785– CAPR-330 (Oak Creek Watershed) Appendix L
300-4010
LKH/JEB/mid
09/4/20, 10/7/20, 10/26/20

Community Assistance Planning Report No. 330

A RESTORATION PLAN FOR THE OAK CREEK WATERSHED

Appendix L

WATER QUALITY SIMULATION MODEL AND POLLUTANT LOADS FROM THE RWQMPU

RELATIONSHIP OF THE OAK CREEK WATERSHED RESTORATION PLAN TO THE REGIONAL WATER QUALITY MANAGEMENT PLAN

As noted previously in this report, the Oak Creek watershed restoration plan builds on the framework established under the 2007 SEWRPC regional water quality management plan update (RWQMPU) for the greater Milwaukee watersheds.[1] Chapter 2 of this watershed restoration plan summarizes 1) the recommendations of the RWQMPU as they relate to the Oak Creek watershed and 2) the status of implementation of those recommendations within the watershed. This appendix summarizes the water quality modeling analyses conducted under the RWQMPU and describes how the modeling results for the Oak Creek component of the recommended RWQMPU can be applied directly to estimate water quality improvements that would be expected from implementation of the recommended watershed restoration plan set forth in Chapter 6 of this report.

[1] *SEWRPC Planning Report No. 50,* A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, *December 2007 and* Amendment to the Regional Water Quality Management Plan for the Greater Milwaukee Watersheds, *May 2013*.

WATER QUALITY MODELING

Under the RWQMPU, a comprehensive, watershed-based, calibrated and validated U.S. Environmental Protection Agency (USEPA) HSPF continuous simulation model was developed to simulate pollutant loads and instream water quality conditions in the streams of the Oak Creek watershed.[2] This model has been used extensively across the country to develop water quality restoration plans through the Federal Clean Water Act Total Maximum Daily Load (TMDL) Program. The HSPF model is particularly suited to modeling water quality conditions in the Oak Creek watershed because it:

- Can be used on watersheds with both rural and urban land uses
- Can be used to simulate all of the constituents of interest for the RWQMPU
- Allows long-term continuous simulations to predict hydrologic and water quality variability
- Provides adequate temporal resolution to facilitate a direct comparison to water quality standards
- Simulates surface runoff and subsurface flows
- Simulates receiving stream water quality processes in addition to land surface loads

Under the RWQMPU, the HSPF model was applied to estimate pollutant loads and instream pollutant concentrations over a 10-year simulation period representing meteorological conditions from 1988 through 1997.[3] The HSPF model of the Oak Creek watershed was applied to represent then-existing year 2000 land use conditions and also planned year 2020 (baseline) land use conditions. Water quality conditions were simulated and evaluated at 10 assessment points along the Oak Creek mainstem and tributaries (see Map 5.1 in Chapter 5 of this report).

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[2] *U.S. Environmental Protection Agency, Environmental Research Laboratory,* Hydrological Simulation Program-Fortran, User's Manual for Release 12, *Athens Georgia, March 2001.*

[3] *This simulation period was selected because it was determined to be representative of the long-term precipitation statistics as measured at the National Weather Service Milwaukee Mitchell International Airport weather station for the 63-year period from 1940 through 2002.*

WATER QUALITY RESULTS OF THE RWQMPU MODELING ANALYSES

Under the RWQMPU, alternative plans were developed to represent different approaches to improving water quality under planned 2020 land use conditions through combinations of point pollution source controls and implementation of agricultural and urban best management practices and green infrastructure.

Four of the five pollutants identified for abatement under this watershed restoration plan—total suspended solids, total phosphorus, total nitrogen, and fecal coliform bacteria—were modeled under the RWQMPU along with several other pollutants.[4] The pertinent water quality indicators used to compare the plans are set forth in Table L.1. The RWQMPU alternative plans were evaluated as to their ability to cost-effectively meet a set of planning objectives related primarily to water quality management, land use development, and outdoor recreation and open space preservation.

The recommended RWQMPU plan was synthesized from the most effective components of the alternatives, and it consists of a combination of point source controls and urban and rural nonpoint source controls. The USEPA HSPF water quality model developed to represent recommended plan conditions explicitly accounted for the following rural and urban nonpoint source pollution control measures:

- Reducing soil erosion from cropland to the tolerable soil loss rate as determined by the U.S. Natural Resources Conservation Service
- Establishing riparian buffers with a minimum width of 75 feet on each side of streams
- Converting 10 percent of existing cropland to wetland or prairie conditions
- Expanding oversight of private onsite wastewater treatment systems
- Implementing nonagricultural (urban) performance standards established by the State of Wisconsin in Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code*

[4] *The fifth pollutant considered under this planning effort is chloride. Chloride loads and concentrations were not computed by the RWQMPU water quality model.*

- Establishing coordinated programs to detect and eliminate illicit discharges to storm sewer systems and to control urban-sourced pathogens that are harmful to human health

- Infiltrating residential roof drain runoff in rain gardens, or similar green infrastructure practices at 30 percent of the homes in the study area

These measures are also generally included in the recommended watershed restoration plan described in Chapter 6. Thus, the degree to which implementation of the watershed restoration plan described in the chapter would be expected to improve instream water quality can be inferred from the comprehensive water quality modeling results set forth in the report documenting the regional water quality management plan for the greater Milwaukee watersheds[5] and briefly summarized in the next paragraph.

Implementation of the recommended RWQMPU plan, and of the recommended watershed restoration plan which is set forth in Chapter 6 of this report and which adds detail to the RWQMPU recommendations, would be expected to result in significant reductions in instream mean and median concentrations of total suspended solids,[6] total phosphorus,[7] and total nitrogen[8] and in mean and geometric mean concentrations of fecal coliform bacteria. Relative to then-existing year 2000 conditions, implementation of the recommended plan would be expected to result in significant improvements in the levels of compliance with the geometric mean standard for fecal coliform bacteria, and generally more modest increases in the level of compliance with the single sample standard along the mainstem of Oak Creek and many tributaries.[9]

The load reductions required to achieve recommended RWQMPU conditions, and which have been adopted as reduction targets under this watershed restoration plan, are set forth in Tables 5.2, 5.4, 5.6, and 5.9 in Chapter 5 of this report.

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[5] *SEWRPC Planning Report No. 50,* op. cit. *and* Amendment to the Regional Water Quality Management Plan for the Greater Milwaukee Watersheds, *May 2013*.

[6] *See Table 5.5 in Chapter 5 of this report.*

[7] *See Table 5.3 in Chapter 5 of this report.*

[8] *See Table 5.10 in Chapter 5 of this report.*

[9] *See Tables 5.7 and 5.8 in Chapter 5 of this report.*

ADJUSTMENT OF MODELED LOADS TO DEVELOP POLLUTANT LOAD REDUCTION TARGETS

Numerical targets for some of the pollutants selected for reductions by this watershed restoration plan can be derived from the results of the RWQMPU model. These targets and the reductions in mean and median instream pollutant concentrations derived from the water quality simulation model used in the RWQMPU are presented and discussed in Chapter 5 of this report.

The RWQMPU made recommendations whose implementation would act to reduce contributions of phosphorus, TSS, fecal coliform bacteria, and total nitrogen. These recommendations were summarized, and the status of their implementation was reviewed in Chapter 2 of this report. The RWQMPU also included estimates of pollutant loads of these water quality constituents to the stream system that would occur under three sets of conditions.[10] These conditions include:

- Existing condition: Representing watershed conditions as of the year 2000

- Revised 2020 Baseline condition: The condition projected to occur in 2020 under planned 2020 land use conditions, assuming full implementation of the urban stormwater runoff performance standards set forth in Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code,* but without implementation of the recommendations of the RWQMPU

[10] *SEWRPC Planning Report No. 50,* op. cit. *and* Amendment to the Regional Water Quality Management Plan for the Greater Milwaukee Watersheds, *May 2013*.

- Recommended Plan condition: The condition projected to occur under planned 2020 land use conditions, assuming full implementation of both the urban stormwater runoff performance standards set forth in NR 151 and the recommendations of the RWQMPU[11]

These estimates were made using the calibrated and validated water quality simulation model described above.[12] The estimated pollutant loads associated with each of these three conditions are given in Tables L.2 through L.5. Maps L.1 though L.8 show comparisons of the estimated existing condition pollutant loads and per acre pollutant loads among the subwatersheds of the Oak Creek watershed.

It is important to note that for total phosphorus, TSS, fecal coliform bacteria, and total nitrogen the portion of the pollutant loads contributed by point sources is quite low under all three conditions described above. On a whole watershed basis, point sources are estimated to have contributed less than 1 percent of the total phosphorus load, less than 0. 1 percent of the TSS load, less than 1 percent of the fecal coliform bacteria load and less than 1 percent of the total nitrogen load under both the Existing (2000) condition and the Recommended Plan (2020) condition. Given that point sources are estimated to contribute these small percentages of the loads of these pollutants, the management objectives and targets for this watershed restoration plan should focus on nonpoint sources. The reductions in nonpoint source loads between the Existing (2000) condition and the Recommended Plan (2020) condition that are envisioned in the RWQMPU define targets to be met in order to improve water quality conditions in the Oak Creek watershed.

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[11] *The RWQMPU included pollutant load estimates for two additional conditions: A Revised 2020 Baseline condition with a five-year level of protection to control against sanitary sewer overflows (five-year LOP) and an Extreme Measures condition. In the Oak Creek watershed, the estimated pollutant loads under the Revised 2020 Baseline with a five-year LOP condition were identical to the estimated pollutant loads under the Revised 2020 Baseline condition. The Extreme Measures condition examined a level of nonpoint source controls in excess of the levels envisioned under the recommended plan and envisioned the virtual elimination of phosphorus from discharges of industrial noncontact cooling water. In the Oak Creek watershed at most locations, the degree of compliance with applicable water quality standards under the Extreme Measures condition, as estimated by the calibrated water quality simulation model, was similar to the degree of compliance under the Recommended Plan condition, although more significant improvements in compliance were indicated for fecal coliform bacteria.*

[12] *The calibrated and validated water quality model is described in more detail, and its results are presented and discussed in SEWRPC Planning Report No. 50, op. cit. The results presented here incorporate revisions made to Planning Report No. 50 in a May 2013 plan amendment that corrected errors in the calculation of mean and median concentrations of total phosphorus and total nitrogen at some water quality assessment locations.*

The RWQMPU targets were refined in two ways for the Oak Creek watershed restoration plan. First, the load estimates from the three conditions were used to estimate how much of the pollutant load reductions envisioned in the RWQMPU would result from implementation of the NR 151 stormwater runoff performance standards and how much would result from other elements of the recommended plan. Second, the load reductions were adjusted to account for changes in the application of NR 151 that have been made since the RWQMPU was completed.

The developed urban area performance standard for municipalities set forth in Section NR 151.13 requires that municipalities with Wisconsin Pollutant Discharge Elimination System (WPDES) stormwater discharge permits reduce the amount of TSS in stormwater runoff from areas of existing development that were in place as of October 1, 2004, to the maximum extent practicable, by 20 percent by March 10, 2008 and by 40 percent by October 1, 2013. In addition, other sections of NR 151 require that all construction sites that have one acre or more of land disturbance must achieve an 80 percent reduction in the sediment load generated by the site. With certain limited exceptions, those sites required under NR 151 to have construction erosion control permits must also have post-development stormwater management practices to reduce the TSS load from the site by 80 percent for new development, 40 percent for redevelopment, and 40 percent for infill development occurring prior to October 1, 2012. After October 1, 2012, infill development will be required to achieve an 80 percent reduction. An action by the State Legislature has changed the application of these performance standards. As a result of 2011 Wisconsin Act 32, the WDNR is prohibited from enforcing the 40 percent reduction in TSS load from areas of existing development.

The impact of this is that the load reductions from urban nonpoint sources as represented under the RWQMPU modeling need to be adjusted to account for the change in application of the developed urban area performance standard. This was done on a subwatershed basis using the existing 2000 land use and the planned land use (see Tables 3.8 through 3.11 in Chapter 3 of this report) to estimate the portions of urban lands within each subwatershed under the Recommended Plan (2020) condition that represent:

- Existing development that would have been subject to the 40 percent TSS reduction requirement

- New development that is subject to the 80 percent TSS reduction requirement, redevelopment that is subject to the 40 percent TSS reduction requirement, and infill development that is subject to a 40 percent TSS reduction requirement prior to October 1, 2012 and an 80 percent TSS reduction requirement after October 1, 2012

To adjust the urban nonpoint source load reductions for the changes in the application of NR 151, the portion of the NR 151-related load reductions that are attributable to existing development was estimated for each subwatershed. This portion of the pollutant load reduction was reduced by half. In order to maintain the recommended levels of water quality improvement envisioned under the RWQMPU, the amount of this reduction was added to the "other reductions" categories for urban nonpoint sources in the pollutant load reduction target tables given in Chapter 5 of this report.

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Appendix L

WATER QUALITY SIMULATION MODEL AND POLLUTANT LOADS FROM THE RWQMPU

TABLES

Table L.1
Water Quality Indicators Used to Compare Alternative Plans in the RWQMPU

Water Quality Parameter	Indicator
Fecal Coliform Bacterial over the Entire Year	Arithmetic mean concentration of fecal coliform bacteria Proportion of time fecal coliform bacteria concentration is equal to or below the single sample criterion Geometric mean concentration of fecal coliform bacteria Days per year geometric mean of fecal coliform bacteria concentration is equal to or below the geometric mean criterion
Fecal Coliform Bacteria from May to September[a]	Arithmetic mean concentration of fecal coliform bacteria Proportion of time fecal coliform bacteria concentration is equal to or below the single sample criterion Geometric mean concentration of fecal coliform bacteria Days per year geometric mean of fecal coliform bacteria concentration is equal to or below the geometric mean criterion
Total Phosphorus	Mean concentration of total phosphorus Median concentration of total phosphorus Proportion of time total phosphorus concentration is equal to or below the recommended planning standard
Total Suspended Solids	Mean concentration of total suspended solids Median concentration of total suspended solids

[a] *This time period represents the body contact recreation season when bacteria concentrations are of the greatest interest.*

Source: SEWRPC

#254797 – CAPR-330 - Table L.2 Phosphorus Pollutant Loads from the RWQMPU
300-4010
LKH/JEB/mid
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Table L.2
Average Annual Total Phosphorus Loads for the Oak Creek Watershed Taken from the RWQMPU

Subwatershed	Assessment Areas	Condition	Point Sources (pounds)			Nonpoint Sources (pounds)[a,b]			Total (pounds)
			Industrial Point Sources	SSOs	Subtotal	Urban	Rural[c]	Subtotal	
Upper Oak Creek	Oak Creek Headwaters, Upper Oak Creek	Existing (2000)	0	0	0	1,360	170	1,530	1,530
		Revised (2020) Baseline	0	0	0	1,270	120	1,390	1,390
		Recommended Plan (2020)	0	0	0	1,150	110	1,300	1,300
Middle Oak Creek	Middle Oak Creek, Oak Creek Drainage Ditches	Existing (2000)	0	0	0	1,310	980	2,290	2,290
		Revised (2020) Baseline	0	0	0	1,230	1,050	2,280	2,280
		Recommended Plan (2020)	0	0	0	1,160	970	2,130	2,130
Lower Oak Creek	Lower Oak Creek, Lower Oak Creek-Millpond, Grant Park Ravine	Existing (2000)	10	10	20	2,200	40	2,240	2,260
		Revised (2020) Baseline	10	10	20	1,830	20	1,850	1,870
		Recommended Plan (2020)	10	10	20	1,730	20	1,750	1,770
North Branch Oak Creek	Upper North Branch Oak Creek, Lower North Branch Oak Creek, College Avenue Tributary, Rawson Avenue Tributary, Drexel Avenue Tributary, Southland Creek	Existing (2000)	0	0	0	2,650	510	3,160	3,160
		Revised (2020) Baseline	0	0	0	2,370	520	2,890	2,890
		Recommended Plan (2020)	0	0	0	1,950	460	2,410	2,410
Mitchell Field Drainage Ditch	Lower Mitchell Field Drainage Ditch, Mitchell Field Drainage Ditch-Airport	Existing (2000)	<10	0	<10	980	410	1,390	1,390
		Revised (2020) Baseline	<10	0	<10	950	350	1,300	1,300
		Recommended Plan (2020)	<10	0	<10	730	260	990	990
	Watershed Total	Existing (2000)	10	10	20	8,500	2,110	10,610	10,630
		Revised (2020) Baseline	10	10	20	7,650	2,060	9,710	9,730
		Recommended Plan (2020)	10	10	20	6,760	1,820	8,580	8,600

[a] *Certain apparent anomalies in the relationship between urban and nonpoint source loads are due to the manner in which the loads were apportioned. In those cases, the loads in the nonpoint subtotal column generally exhibit the anticipated relationships between conditions.*

[b] *In certain limited cases, relatively minor anomalies in nonpoint source pollutant loads may occur among the three conditions for which the model results are presented in this table. Those anomalies might indicate a relatively slight increased load under the recommended plan condition relative to the revised 2020 baseline. In those cases, it may be assumed that no significant change in pollutant load occurs among those conditions. Since it was not always possible to explicitly represent certain components of the recommended plan condition in the water quality model, adjustments were made to model parameters that served as surrogates for the actual water pollution control measures being represented. In the sense that these modifications sometimes alter parameters established under the revised 2020 baseline model version, in limited cases, representation of a measure in the recommended plan model may have a side effect of introducing small, relatively insignificant anomalies in the comparative results.*

[c] *For reporting purposes, certain land uses such as forests and wetlands have been categorized as rural sources even though they may exist in a predominantly urban setting.*

Source: Brown and Caldwell, Tetra Tech, Inc., and SEWRPC

#254798 – CAPR-330 - Table L.3 TSS Loads from the RWQMPU
300-4010
LKH/JEB/mid
8/27/2020, 10/7/20, 10/26/20

Table L.3
Average Annual Total Suspended Solids Loads for the Oak Creek Watershed Taken from the RWQMPU

Subwatershed	Assessment Areas	Condition	Point Sources (pounds)			Nonpoint Sources (pounds)[a,b]			Total (pounds)
			Industrial Point Sources	SSOs	Subtotal	Urban	Rural[c]	Subtotal	
Upper Oak Creek	Oak Creek Headwaters, Upper Oak Creek	Existing (2000)	0	0	0	663,060	156,240	819,300	819,300
		Revised (2020) Baseline	0	0	0	513,460	10,710	524,170	524,170
		Recommended Plan (2020)	0	0	0	532,840	10,360	543,200	543,200
Middle Oak Creek	Middle Oak Creek, Oak Creek Drainage Ditches	Existing (2000)	0	0	0	685,780	387,670	1,073,450	1,073,450
		Revised (2020) Baseline	0	0	0	528,200	102,730	630,930	630,930
		Recommended Plan (2020)	0	0	0	545,020	102,060	647,080	647,080
Lower Oak Creek	Lower Oak Creek, Lower Oak Creek-Millpond, Grant Park Ravine	Existing (2000)	1,930	500	2,430	974,250	23,560	997,810	1,000,240
		Revised (2020) Baseline	1,930	500	2,430	689,780	3,970	693,750	696,180
		Recommended Plan (2020)	1,930	500	2,430	692,760	3,970	696,730	699,160
North Branch Oak Creek	Upper North Branch Oak Creek, Lower North Branch Oak Creek, College Avenue Tributary, Rawson Avenue Tributary, Drexel Avenue Tributary, Southland Creek	Existing (2000)	0	0	0	1,558,560	212,030	1,770,590	1,770,590
		Revised (2020) Baseline	0	0	0	1,169,670	50,010	1,219,680	1,219,680
		Recommended Plan (2020)	0	0	0	1,012,020	47,270	1,059,290	1,059,290
Mitchell Field Drainage Ditch	Lower Mitchell Field Drainage Ditch, Mitchell Field Drainage Ditch-Airport	Existing (2000)	<10	0	<10	532,620	108,810	641,430	641,430
		Revised (2020) Baseline	<10	0	<10	438,880	29,820	468,700	468,700
		Recommended Plan (2020)	<10	0	<10	364,090	23,660	387,750	387,750
	Watershed Total	Existing (2000)	1,930	500	2,430	4,414,270	888,310	5,302,580	5,305,010
		Revised (2020) Baseline	1,930	500	2,430	3,339,990	197,240	3,537,230	3,539,660
		Recommended Plan (2020)	1,930	500	2,430	3,146,730	187,320	3,334,050	3,336,480

[a] *Certain apparent anomalies in the relationship between urban and nonpoint source loads are due to the manner in which the loads were apportioned. In those cases, the loads in the nonpoint subtotal column generally exhibit the anticipated relationships between conditions.*

[b] *In certain limited cases, relatively minor anomalies in nonpoint source pollutant loads may occur among the three conditions for which the model results are presented in this table. Those anomalies might indicate a relatively slight increased load under the recommended plan condition relative to the revised 2020 baseline. In those cases, it may be assumed that no significant change in pollutant load occurs among those conditions. Since it was not always possible to explicitly represent certain components of the recommended plan condition in the water quality model, adjustments were made to model parameters that served as surrogates for the actual water pollution control measures being represented. In the sense that these modifications sometimes alter parameters established under the revised 2020 baseline model version, in limited cases, representation of a measure in the recommended plan model may have a side effect of introducing small, relatively insignificant anomalies in the comparative results.*

[c] *For reporting purposes, certain land uses such as forests and wetlands have been categorized as rural sources even though they may exist in a predominantly urban setting.*

Source: Brown and Caldwell; Tetra Tech, Inc., and SEWRPC

#254799 – CAPR-330 - Table L.4 Fecal Coliform Bacteria Loads from the RWQMPU
300-4010
LKH/JEB/mid
8/27/20 10/7/2020, 10/26/20

Table L.4
Average Annual Fecal Coliform Bacteria Loads for the Oak Creek Watershed Taken from the RWQMPU

Subwatershed	Assessment Areas	Condition	Point Sources (trillion cells)			Nonpoint Sources (trillion cells)[a,b]			Total (pounds)
			Industrial Point Sources	SSOs	Subtotal	Urban	Rural[c]	Subtotal	
Upper Oak Creek	Oak Creek Headwaters, Upper Oak Creek	Existing (2000)	0.00	0.00	0.00	354.83	7.39	362.22	362.22
		Revised (2020) Baseline	0.00	0.00	0.00	310.06	6.17	316.23	316.23
		Recommended Plan (2020)	0.00	0.00	0.00	201.08	4.16	205.24	205.24
Middle Oak Creek	Middle Oak Creek, Oak Creek Drainage Ditches	Existing (2000)	0.00	0.00	0.00	394.77	96.09	490.86	490.86
		Revised (2020) Baseline	0.00	0.00	0.00	357.33	100.90	458.23	458.23
		Recommended Plan (2020)	0.00	0.00	0.00	227.44	66.76	294.20	294.20
Lower Oak Creek	Lower Oak Creek, Lower Oak Creek-Millpond, Grant Park Ravine	Existing (2000)	0.00	9.55	9.55	612.67	0.33	613.00	622.55
		Revised (2020) Baseline	0.00	9.55	9.55	493.55	0.10	493.65	503.20
		Recommended Plan (2020)	0.00	9.55	9.55	315.86	0.10	315.96	325.51
North Branch Oak Creek	Upper North Branch Oak Creek, Lower North Branch Oak Creek, College Avenue Tributary, Rawson Avenue Tributary, Drexel Avenue Tributary, Southland Creek	Existing (2000)	0.00	0.00	0.00	735.48	39.60	775.08	775.08
		Revised (2020) Baseline	0.00	0.00	0.00	646.58	47.39	693.97	693.97
		Recommended Plan (2020)	0.00	0.00	0.00	359.89	30.36	390.25	390.25
Mitchell Field Drainage Ditch	Lower Mitchell Field Drainage Ditch, Mitchell Field Drainage Ditch-Airport	Existing (2000)	0.00	0.00	0.00	505.12	36.28	541.40	541.40
		Revised (2020) Baseline	0.00	0.00	0.00	524.29	28.76	553.05	553.05
		Recommended Plan (2020)	0.00	0.00	0.00	269.75	15.19	284.94	284.94
	Watershed Total	Existing (2000)	0.00	9.55	9.55	2,602.87	179.69	2,782.56	2,792.11
		Revised (2020) Baseline	0.00	9.55	9.55	2,331.81	183.32	2,515.13	2,524.68
		Recommended Plan (2020)	0.00	9.55	9.55	1,374.02	116.57	1,490.59	1,500.14

[a] *Certain apparent anomalies in the relationship between urban and nonpoint source loads are due to the manner in which the loads were apportioned. In those cases, the loads in the nonpoint subtotal column generally exhibit the anticipated relationships between conditions.*

[b] *In certain limited cases, relatively minor anomalies in nonpoint source pollutant loads may occur among the three conditions for which the model results are presented in this table. Those anomalies might indicate a relatively slight increased load under the recommended plan condition relative to the revised 2020 baseline. In those cases, it may be assumed that no significant change in pollutant load occurs among those conditions. Since it was not always possible to explicitly represent certain components of the recommended plan condition in the water quality model, adjustments were made to model parameters that served as surrogates for the actual water pollution control measures being represented. In the sense that these modifications sometimes alter parameters established under the revised 2020 baseline model version, in limited cases, representation of a measure in the recommended plan model may have a side effect of introducing small, relatively insignificant anomalies in the comparative results.*

[c] *For reporting purposes, certain land uses such as forests and wetlands have been categorized as rural sources even though they may exist in a predominantly urban setting.*

Source: Brown and Caldwell; Tetra Tech, Inc., and SEWRPC

#244865 – CAPR-330 - Table L.5 Total Nitrogen Pollutant Loads from the RWQMPU
300-4010
LKH/JEB/mid
8/27/20, 10/7/2020, 10/26/20

Table L.5
Average Annual Total Nitrogen Loads for the Oak Creek Watershed Taken from the RWQMPU

Subwatershed	Assessment Areas	Condition	Point Sources (pounds)			Nonpoint Sources (pounds)[a,b]			Total (pounds)
			Industrial Point Sources	SSOs	Subtotal	Urban	Rural[c]	Subtotal	
Upper Oak Creek	Oak Creek Headwaters, Upper Oak Creek	Existing (2000)	0	0	0	9,180	4,910	14,090	14,090
		Revised (2020) Baseline	0	0	0	9,000	1,140	10,140	10,140
		Recommended Plan (2020)	0	0	0	8,920	1,130	10,050	10,050
Middle Oak Creek	Middle Oak Creek, Oak Creek Drainage Ditches	Existing (2000)	0	0	0	9,240	13,810	23,050	23,050
		Revised (2020) Baseline	0	0	0	8,950	8,280	17,230	17,230
		Recommended Plan (2020)	0	0	0	8,920	8,290	17,210	17,210
Lower Oak Creek	Lower Oak Creek, Lower Oak Creek-Millpond, Grant Park Ravine	Existing (2000)	340	20	360	15,280	1,010	16,290	16,650
		Revised (2020) Baseline	340	20	360	13,320	380	13,700	14,060
		Recommended Plan (2020)	340	20	360	13,350	380	13,730	14,090
North Branch Oak Creek	Upper North Branch Oak Creek, Lower North Branch Oak Creek, College Avenue Tributary, Rawson Avenue Tributary, Drexel Avenue Tributary, Southland Creek	Existing (2000)	0	0	0	17,590	8,790	26,380	26,380
		Revised (2020) Baseline	0	0	0	16,500	4,490	20,990	20,990
		Recommended Plan (2020)	0	0	0	14,290	4,280	18,570	18,570
Mitchell Field Drainage Ditch	Lower Mitchell Field Drainage Ditch, Mitchell Field Drainage Ditch-Airport	Existing (2000)	<10	0	<10	9,360	7,580	16,940	16,940
		Revised (2020) Baseline	<10	0	<10	9,060	4,630	13,690	13,690
		Recommended Plan (2020)	<10	0	<10	7,340	3,740	11,080	11,080
	Watershed Total	Existing (2000)	340	20	360	60,650	36,100	96,750	97,110
		Revised (2020) Baseline	340	20	360	56,830	18,920	75,750	76,110
		Recommended Plan (2020)	340	20	360	52,820	17,820	70,640	71,000

[a] *Certain apparent anomalies in the relationship between urban and nonpoint source loads are due to the manner in which the loads were apportioned. In those cases, the loads in the nonpoint subtotal column generally exhibit the anticipated relationships between conditions.*

[b] *In certain limited cases, relatively minor anomalies in nonpoint source pollutant loads may occur among the three conditions for which the model results are presented in this table. Those anomalies might indicate a relatively slight increased load under the recommended plan condition relative to the revised 2020 baseline. In those cases, it may be assumed that no significant change in pollutant load occurs among those conditions. Since it was not always possible to explicitly represent certain components of the recommended plan condition in the water quality model, adjustments were made to model parameters that served as surrogates for the actual water pollution control measures being represented. In the sense that these modifications sometimes alter parameters established under the revised 2020 baseline model version, in limited cases, representation of a measure in the recommended plan model may have a side effect of introducing small, relatively insignificant anomalies in the comparative results.*

[c] *For reporting purposes, certain land uses such as forests and wetlands have been categorized as rural sources even though they may exist in a predominantly urban setting.*

Source: Brown and Caldwell; Tetra Tech, Inc., and SEWRPC

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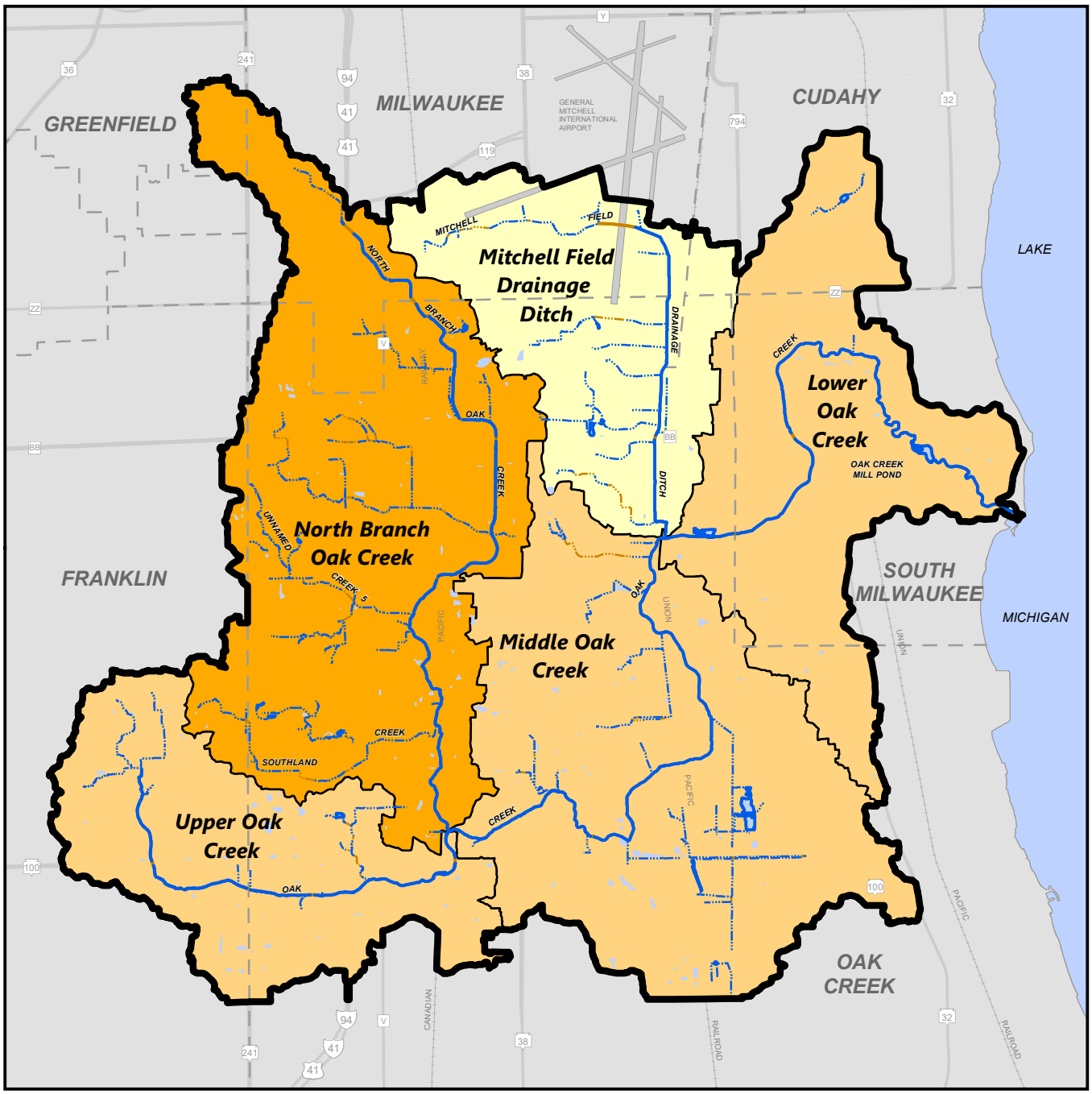
A RESTORATION PLAN FOR THE OAK CREEK WATERSHED

Appendix L

WATER QUALITY SIMULATION MODEL AND POLLUTANT LOADS FROM THE RWQMPU

MAPS

Map L.1
Estimated Average Annual Nonpoint Source Pollution Laods of Total Phosphorus in the Oak Creek Watershed



TOTAL PHOSPHORUS LOAD (lbs/yr) BY SUBWATERSHED

- 1,500 OR FEWER
- 1,501 - 3,000
- 3,001 - 4,500

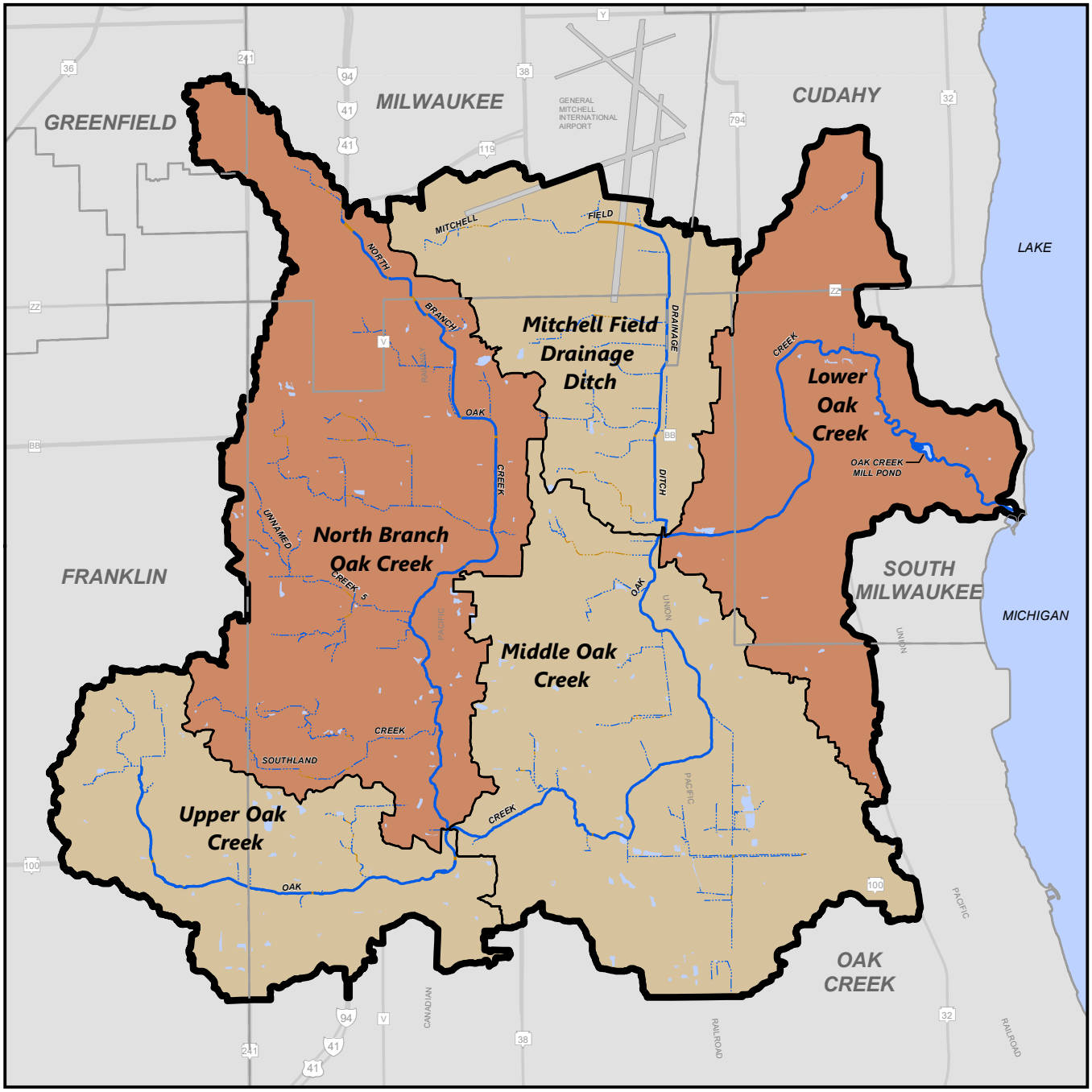
- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARIES
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.2
Estimated Average Annual Per Acre Nonpoint Source Pollution Loads of Total Phosphorus in the Oak Creek Watershed



TOTAL PHOSPHORUS UNIT AREA LOAD (lbs/acre/yr)

- 0.46 - 0.60
- 0.61 - 0.75

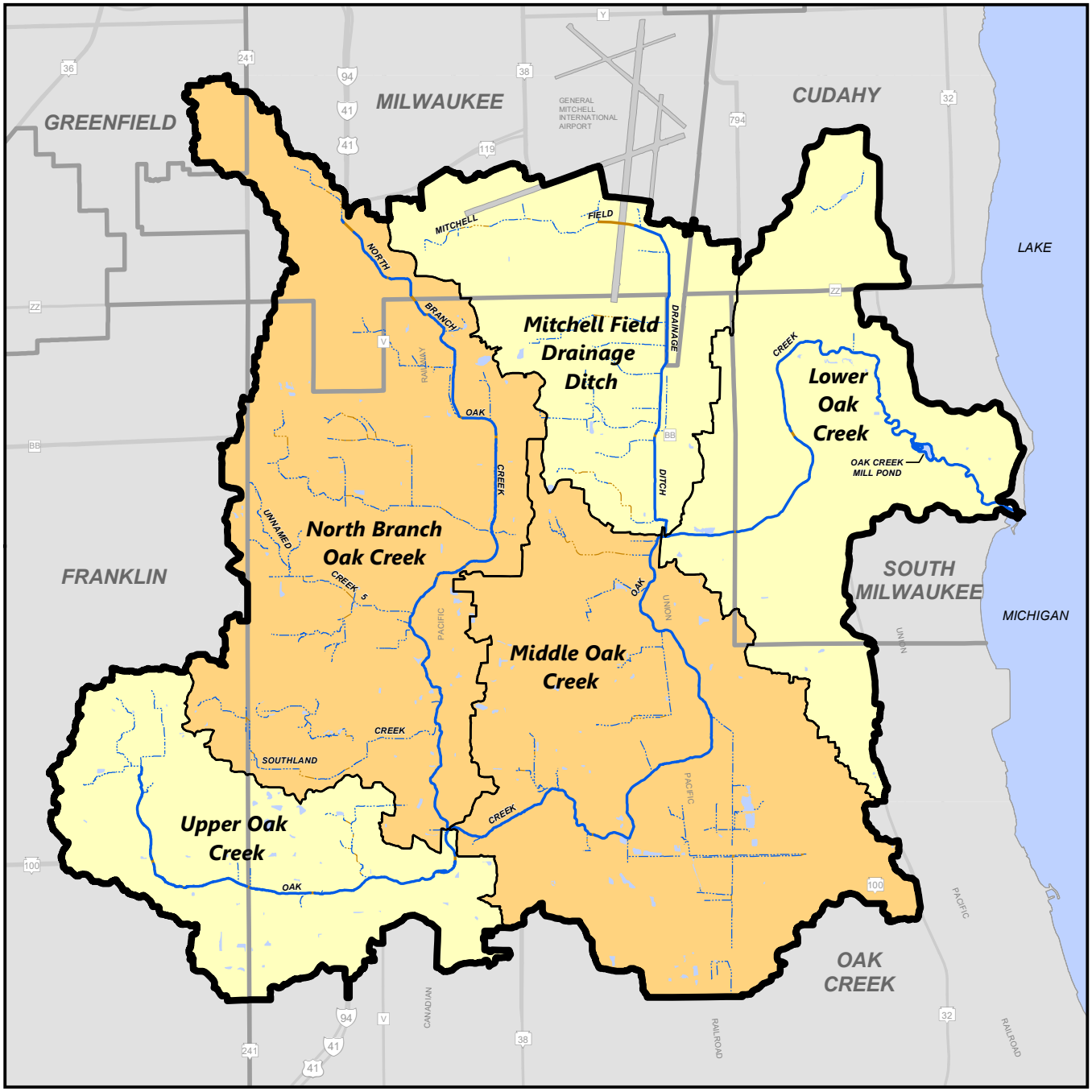
- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.3
Estimated Average Annual Nonpoint Source Pollution Loads of Total Suspended Solids in the Oak Creek Watershed



TOTAL SUSPENDED SOLIDS LOAD (lbs/yr) BY SUBWATERSHED

- 1,000,000 OR FEWER
- 1,000,001- 2,000,000

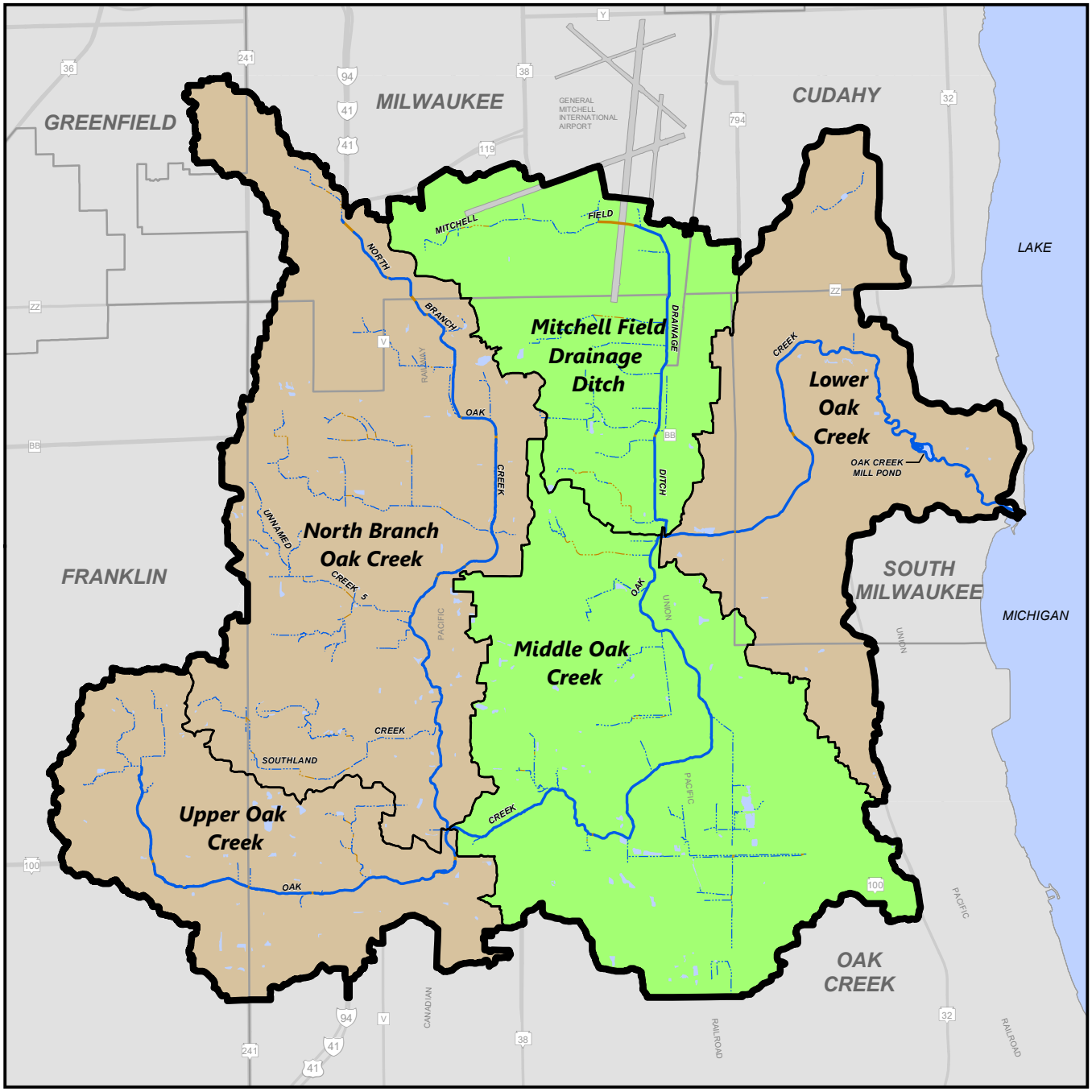
- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.4
Estimated Average Annual Per Acre Nonpoint Source Pollution Loads of Total Suspended Solids in the Oak Creek Watershed



TOTAL SUSPENDED SOLIDS UNIT AREA LOAD (lbs/acre/yr)

- 201 - 300
- 301 - 400

- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.5
Estimated Average Annual Nonpoint Source Pollution Loads of Fecal Coliform Bacteria in the Oak Creek Watershed

FECAL COLIFORM BACTERIA LOAD (trillion cells/yr) BY SUBWATERSHED

1,000 OR FEWER

OAK CREEK WATERSHED BOUNDARY

SUBWATERSHED BOUNDARY

PERENNIAL STREAM

PERENNIAL STREAM (ENCLOSED)

INTERMITTENT STREAM

INTERMITTENT STREAM (ENCLOSED)

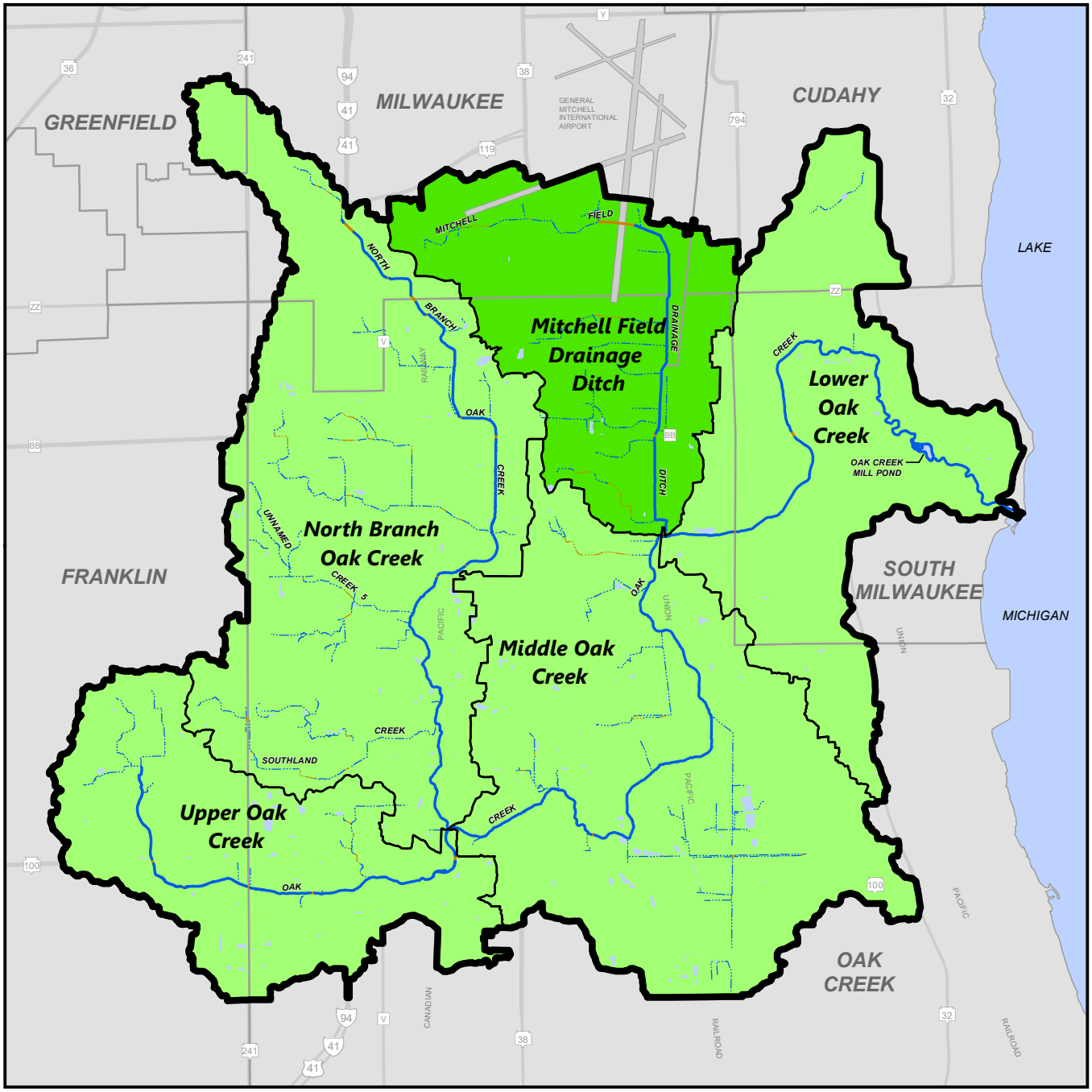
SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.6
Estimated Average Annual Per Acre Nonpoint Source Pollution Loads of Fecal Coliform Bacteria in the Oak Creek Watershed



TOTAL FECAL COLIFORM BACTERIA UNIT AREA LOAD
(trillion cells/acre/yr)

- 0.11 - 0.20
- 0.21 - 0.30

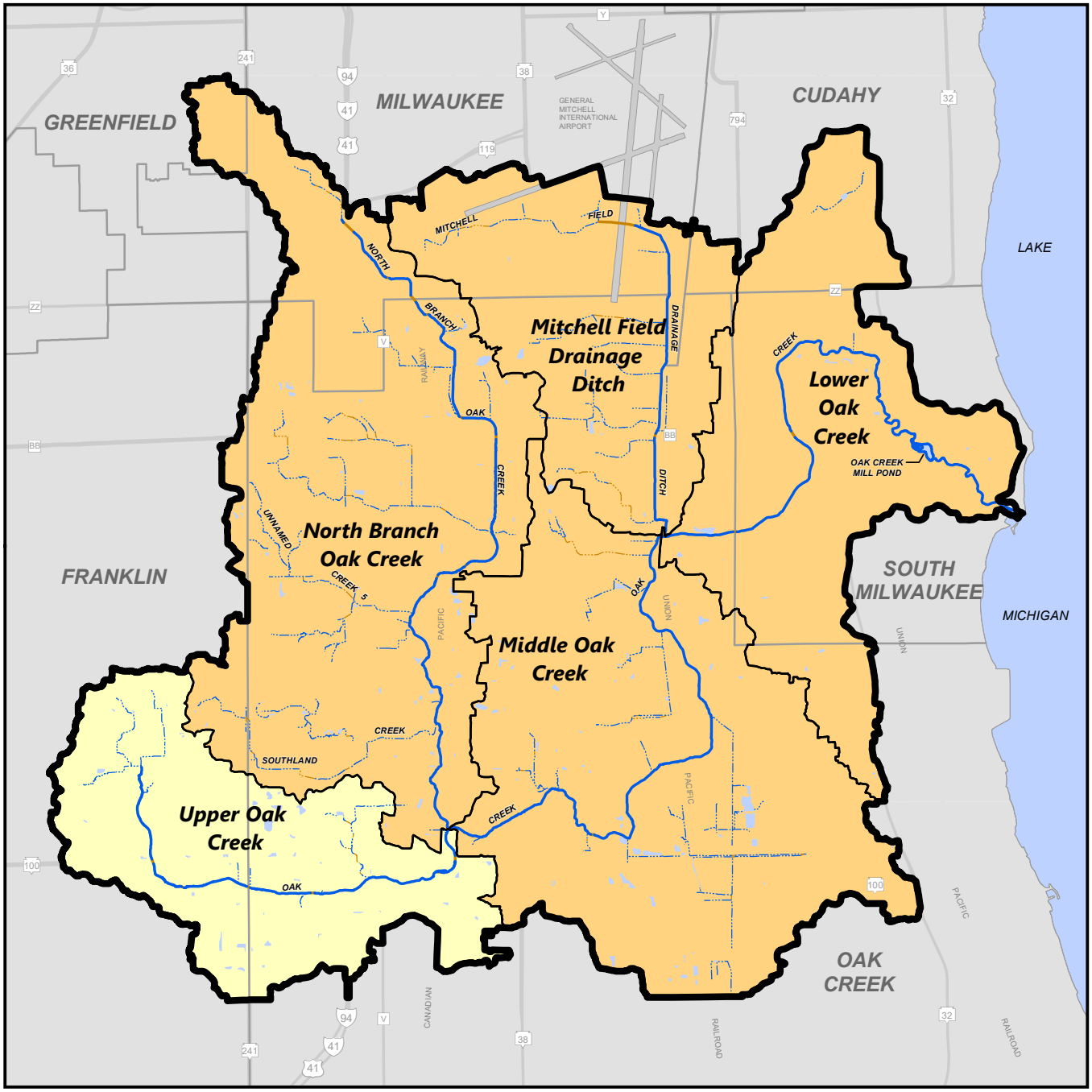
- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.7
Estimated Average Annual Nonpoint Source Pollution Loads of Total Nitrogen in the Oak Creek Watershed



NITROGEN LOAD (lbs/yr) BY SUBWATERSHED

- 15,000 OR FEWER
- 15,001 - 30,000

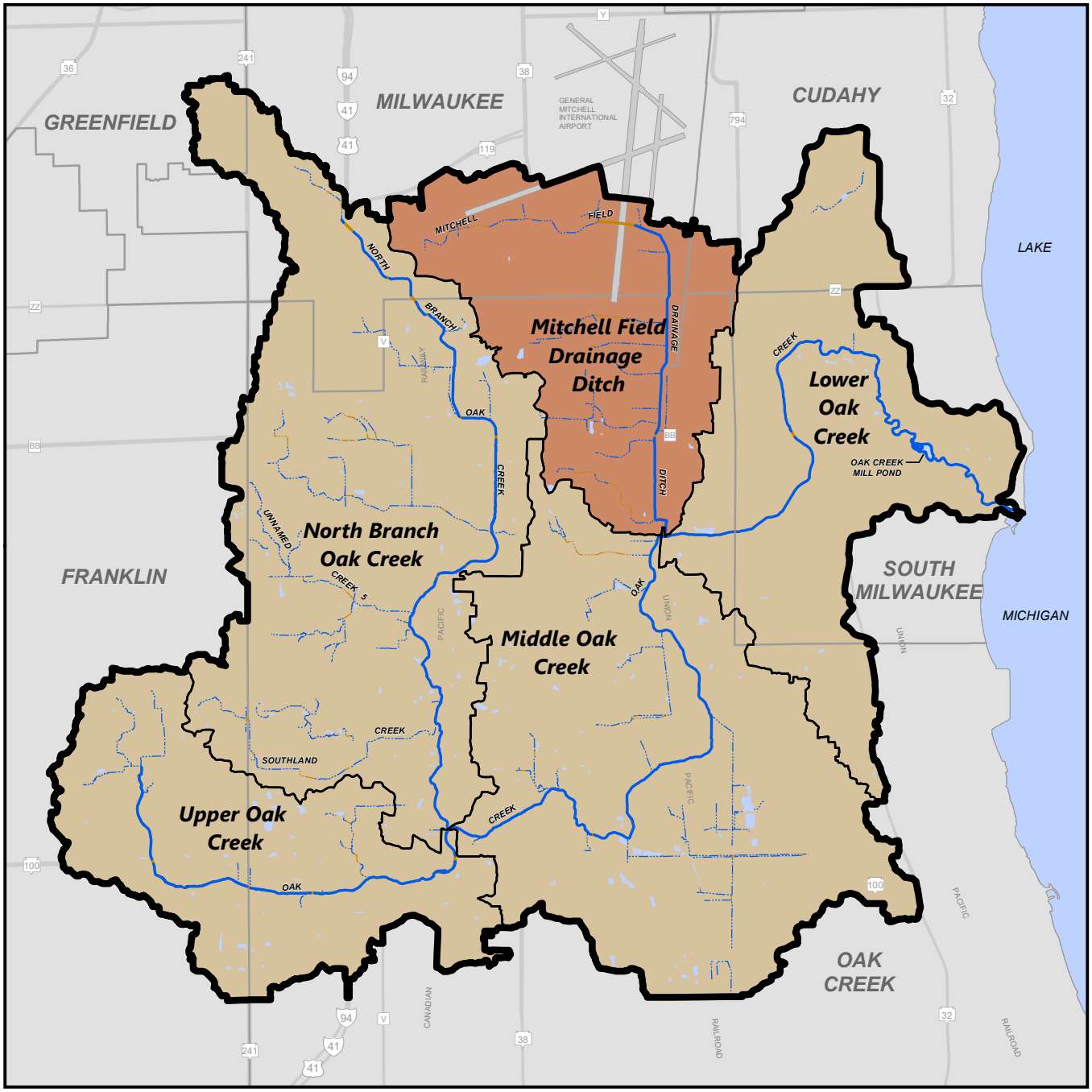
- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC

Map L.8
Estimated Average Annual Per Acre Nonpoint Source Pollution Loads of Total Nitrogen in the Oak Creek Watershed



TOTAL NITROGEN UNIT AREA LOAD (lbs/acre/yr)

- 4.51 - 6.00
- 6.01 - 7.50

- OAK CREEK WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY
- PERENNIAL STREAM
- PERENNIAL STREAM (ENCLOSED)
- INTERMITTENT STREAM
- INTERMITTENT STREAM (ENCLOSED)
- SURFACE WATER

N

0 0.25 0.5 1 Miles

Source: SEWRPC