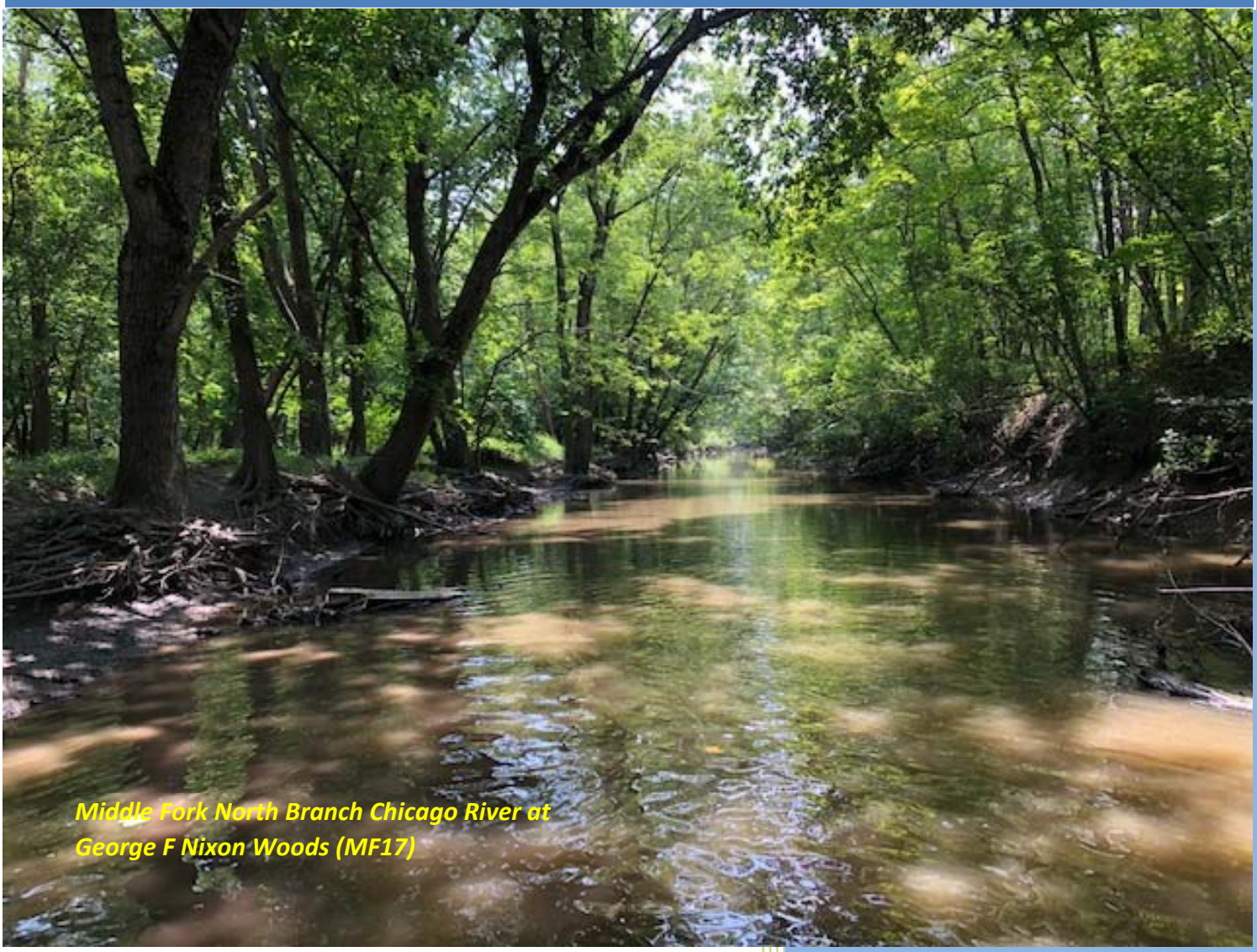
Midwest Biodiversity Institute

NORTH BRANCH CHICAGO RIVER WATERSHED WORKGROUP

Biological and Water Quality Assessment of the North Branch Chicago River: 2018-19



Middle Fork North Branch Chicago River at George F Nixon Woods (MF17)

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Biological and Water Quality Assessment of the North Branch Chicago River 2018-19

Cook County and Lake County, IL

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FOREWORD

What is a Biological and Water Quality Survey?

A biological and water quality survey, or "bioassessment", is an interdisciplinary monitoring effort coordinated on a waterbody specific or a watershed scale. This may involve a relatively simple survey that focuses on one or two small streams, one or two principle stressors and a handful of sampling sites or a much more complex effort including entire watersheds, multiple and overlapping stressors and tens of sites. The NBWW survey included the Skokie River, Middle and West Forks of the North Branch Chicago River, and the North Branch Chicago River. The principle focus of the NBWW bioassessment is on the status of the Illinois General Use for aquatic life and recreation.

Scope of the NBWW Biological and Water Quality Assessment

The Midwest Biodiversity Institute (MBI) was contracted by the North Branch Chicago River Watershed Workgroup (NBWW) to develop a biological and water quality monitoring and assessment plan for the North Branch Chicago River and tributaries in Cook and Lake Counties, IL. The plan was incorporated into at Quality Assurance Project Plan (QAPP; NBWW 2019) that was submitted to and approved by Illinois EPA. The spatial sampling design consisted of an intensive pollution survey and geometric allocation of sites. This design was employed to fulfill multiple purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical and biological stressors. Targeted sites were positioned upstream and downstream of major discharges, other sources of potential releases and contamination, and major tributaries to provide a "pollution profile" of the major streams and rivers. The major objectives include:

1. Determine the aquatic life status of each sampling location in quantitative terms, i.e., not only if a waterbody is impaired, but the spatial extent and severity of the impairment and the respective departures from established criteria;

2. Determine the proximate stressors that correspond to observed impairments for the purpose of targeting appropriate management actions to those stressors; and,

3. Screen for any potential issues with use attainability.

To meet these objectives data was collected with methods that provide high quality results and are in conformance with the practices of Illinois EPA (Illinois EPA 2010a,b; 2011a-g; 2014a,b) and Illinois DNR (2010a,b) and under a project QAPP approved by Illinois EPA (NBWW 2019).

EXECUTIVE SUMMARY

Aquatic Life Condition Assessment

The primary indicators of the status of the Illinois General Use for aquatic life are the Illinois fish and macroinvertebrate Indices of Biotic Integrity and generally following the guidance in the 2018 Integrated Report (Illinois EPA 2018) with certain exceptions. The status of aquatic life is reported here in the form of an attainment table (Table 1) and expressed as full, partial or non-support and based on the most limiting of either the fish or macroinvertebrate results. Non-support is further subdivided into non-support fair and non-support poor; a partial support category is added to clarify instances where only one of the two assemblages attain the General Use support fish or macroinvertebrate threshold. Of the 25 sites assessed for the General Use for aquatic life all were non-support poor.

Causes and Sources of Non-attainment

Newly derived IPS thresholds for water and sediment chemistry and physical habitat attributes (MBI 2020a) were available to better assess causes of impairment and their comparative severity. The approach for deriving these thresholds included a more refined stratification of biological effect threshold values for parameters that showed valid relationships with biological responses based on species and taxa level analyses and then correlated with the corresponding fish and macroinvertebrate IBI attainment thresholds and narrative ratings (MBI 2020a). This produced thresholds across four or five narrative categories of quality (excellent, good, fair, poor, and very poor). This replaces the formerly used binary (i.e., “pass/fail”) approach to evaluating exceedances of chemical and physical effect thresholds and criteria providing for a graded approach to the assignment of causes and sources of Illinois General Use biological impairments. The new IPS framework also offers the semblance of a tiered aquatic life use (TALU) stratification of goals and thresholds that has been incorporated into all IPS outputs to support local restoration and protection efforts by the respective watershed groups and stakeholders.

Causes and Sources were determined for each impaired site and included categorical or parameter level associations and their sources (if known). These were compared to the Illinois EPA derived causes involves using a lines of evidence approach where chemical and physical threshold exceedances within a causal category (or of a parameter) is logically related to a biological impairment, not just simply based on the coincidental exceedance of a criterion or other threshold (Illinois EPA 2018). With the recent availability of more comprehensive and regionally relevant analyses of stressors in the Northeast Illinois via the Integrated Prioritization System (NE Illinois IPS; MBI 2020a), assigning causes can be done at a better level of detail and reliability. This approach still involves using a lines of evidence approach where chemical and physical threshold exceedances generated by the NE Illinois IPS within a causal category (or for a parameter) is related to a biological impairment. This goes well beyond the association of a coincidental exceedance of a criterion or other effect threshold with a biological impairment.

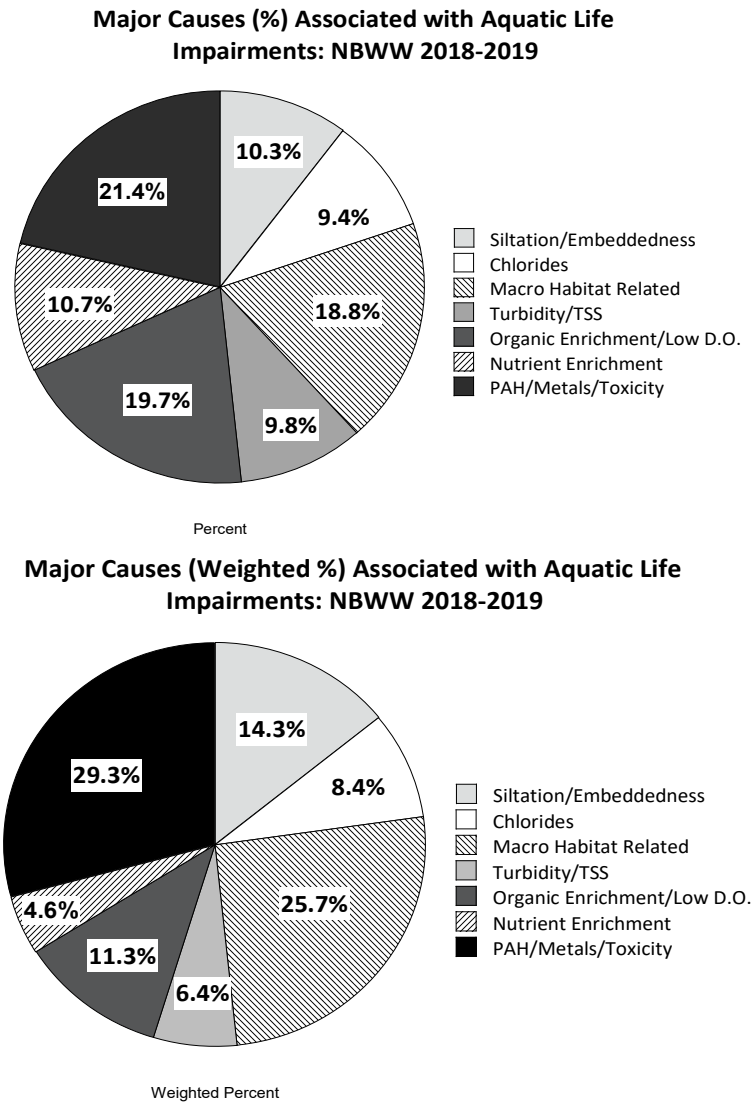

***Figure 1**. Categorical causes associated with aquatic life impairments in the NBWW survey area in 2018 and 2019 based on the number of observations (upper) and the weighted observations (lower), the latter based on the narrative rating of threshold exceedances (very poor = 5, poor = 3, and fair = 1).*

Knowing the relationships that are supported by prior empirical observations in previous studies as well as our own experiences boosts the confidence in casual assignments. This process varies somewhat from that of Illinois EPA in that additional effect thresholds were used to assign causes beyond those used by Illinois EPA.

Fourteen (14) causes across seven (7) major categories and four (4) source categories were identified for the North Branch Chicago River survey are in 2018 and 2019 (Figure 1). Of the 14 causes, three (3) were habitat related (QHEI score, channel modification, substrate quality) and eleven (11) were chemical (low dissolved oxygen [D.O.], Max D.O., 5-day biochemical oxygen demand [BOD_5], total suspended solids [TSS], organic enrichment, water column metals, sediment metals, polycyclic aromatic hydrocarbons [PAHs], nutrient enrichment, chlorides, turbidity, volatile suspended solids [VSS]). The proportion of causes was assessed based on the number of observations and weighted observations (Figure 1), the latter being based on the severity of the expression of the cause in chemical water column, sediment chemistry, or habitat measures. A higher weighting was assigned based on the narrative rating of an exceedance with 5 for very poor, 3 for poor and 1 for fair. PAH/Metals/Toxicity were the leading causes with a weighted frequency of 29.3%. More than six metals exceeded Illinois EPA guidelines or the IPS thresholds at numerous sites in the Skokie River and Middle Fork of the North Branch as well as at the North Branch mainstem site. PAHs were very poor at all but one site in the Skokie River and multiple PAHs exceeded IPS thresholds at every site. Macro Habitat Related issues were the next highest causes of impairment to aquatic life. Overall QHEI scores and channel modifications were the primary indicators used to

determine macro habitat related limitations. Only the sites of MF14 and MF19 did not possess a habitat limitation listed as a cause of aquatic life impairment. Four (4) sites in the Skokie River and one (1) site in the Middle Fork of the North Branch Chicago River were limited by very poor macro habitat related causes (Table 1). Poor Macro Habitat Related causal stressors were recorded at 21 of the 25 sites in the NBWW survey area. Legacy effects from channel modifications, urban encroachment on riparian corridors, and limited instream habitat were recorded 44 times (18.8%, 25.7% weighted). Siltation/Embeddedness of natural substrates was the most widely observed causal category (10.3%, 14.3% weighted), being identified at 24 sites (Table 1). Instances of the substrate category being listed in the poor and very poor categories caused the weighted frequency of impairment to be the second most influential stressor, and is still very prevalent throughout the survey area. Siltation/Embeddedness is closely related to the Macro Habitat Related category as it is included in the overall habitat evaluation score. Siltation and muck substrates were prevalent at nearly every site and are indicative of the legacy effects from urbanization and the alteration of land use from a wetland to the urban/residential majority observed during the 2018-2019 survey. Organic Enrichment/Low D.O. represented the most frequent (19.7%) of the causes with a weighted frequency of 11.3%. Low D.O. and elevated BOD_5 were also prevalent throughout each of the subwatersheds. Nutrient Enrichment (10.7%) can affect D.O. concentrations, diel D.O. swings and spurn the growth of nuisance algae. TKN values were the most frequent nutrient listed as a causal stressor, often listed in the fair category and throughout the survey area. The related Turbidity/TSS category (9.8%) possessed levels in the fair and poor categories in each subwatershed, but was primarily limiting in the Skokie River. The elevated levels of BOD_5 and low D.O. levels could be attributed to the high organic content in sediments and bacterial action that breaks down organic matter thus depleting D.O. levels. Chloride levels ranked lowest (9.4%), primarily poor to very poor levels in the West Fork of the North Branch, fair to poor in the Middle Fork of the North Branch, and fair in the Skokie River.

Habitat alteration, general nonpoint source (NPS) runoff, urban NPS runoff and flow modifications were listed as sources for 100% of the causes. No other causes were identified. The causes and sources were derived from the analyses described in the **SYNTHESIS** section (pp. 70) where the rationale for assigning causes and sources is detailed. These constitute the principal causes and sources that would need to be addressed to resolve the aquatic life impairments listed in Table 1. Illinois EPA (2018) listed causes at four (4) of the 17 mainstem sites which corresponded to some of the MBI causes including D.O., TSS, and siltation. The listing of a wider variety causes by MBI is due to the use of a wider array of effect thresholds, differences in the interpretation of impairments, and most of all to differences in the spatial survey design.

Synthesis of Results

The 2018 and 2019 results yielded poor and very poor results for both the macroinvertebrate and fish assemblages in each of the subwatersheds and the mainstem of the North Branch Chicago River. Urban runoff is the major contributor of pollution within the watershed including dissolved substances, heavy metals, and polycyclic aromatic hydrocarbons. It also plays a major

role in habitat alterations and heavy silt coverage that are also ubiquitous throughout the survey area. High diel D.O. swings and low D.O. concentrations can likely be attributed to the high organic matter content of the sediments as chlorophyll concentrations for both sestonic and benthic algal communities were mostly in the good or excellent IPS threshold ranges at all sites. Fish IBIs (fIBI) were primarily in the very poor to low poor range. The highest fIBI was found in the Skokie Lagoons (SR-7) and likely due to stocking efforts that included Walleye, Channel Catfish, Northern Pike, and various Sunfish species. The macroinvertebrate IBI (mIBI) scores were generally poor with a single site in the lower fair range. The Middle Fork site MF14 supported the highest percent of EPT taxa (43.6%) and attained the highest mIBI score (32.8). This site offered the highest quality habitat in the survey area (QHEI = 67.0). The AQLU attainment status for the NBWW survey area is consistently non-poor at each site.

Neither of the two major point sources (NSWRD Clavey Rd. and Deerfield WRFs) played a major role in the observed results with the exception of minor increases in some chemical constituents associated with municipal wastewater. No distinguishable signatures of excessive nutrient enrichment were apparent in the modified SNAP analysis even though the two WRFs heavily dominate the low flows of their receiving streams. Nor did wastewater effluents have any apparent beneficial effects as was observed in 2016 and 2018 with the entry of large volumes of treated wastewater discharges in the Upper Des Plaines River (MBI 2020b).

Perhaps the most important observation from the 2018-2019 bioassessment is that the overall habitat in each of the subwatersheds and in the mainstem North Branch Chicago River site is mostly poor. Heavy silt coverage and muck substrates coupled with the lingering effects of legacy channel and hydrological modifications reduce the habitat available for macroinvertebrates and fish and hamper the assimilation of pollution in general. Urban runoff contributes to toxic levels of PAHs and metals in sediments that are prevalent throughout the survey area. The biological results are associated with numerous exceedances of IPS thresholds with no sites meeting the Illinois EPA General Use designation for aquatic life.

Reinforcing these observations are the low and very low Restorability scores generated by the NE Illinois IPS (see Table 17, p. 72) which means that the challenges with restoring the streams of the NBWW study area to attaining the Illinois General Use for aquatic life are greater and dependent of restoration actions that address the most limiting chemical and physical factors as is demonstrated by the consistent repetition of very poor and poor causes of impairment related to urban land uses coupled with flow and habitat alterations.

***Table 1**. Aquatic life use attainment status in the 2018-19 study area with causes and sources of impairment listed for non-supporting sites determined by this study (see footnotes for fIBI and mIBI use support thresholds). fIBI, MIwb, and mIBI values are color coded in accordance with meeting five narrative classes (red = very poor; orange = poor; yellow = fair). See glossary of terms used next page.*

Site ID	River Mile	Drainage Area (sq. mi.)	Year	AQLU Status	fIBI[1]	mIBI[2]	QHEI[3]	2018 and 2019 Causes by Stressor Threshold Narrative Category			2018 and 2019 Sources	NE IL IPS Restorability Score (0-100)
								Very Poor[11]	Poor[11]	Fair[11]		
Skokie River												
SR1	21.1	2.7	2018	Non-Poor	8.0	18.4	33.5	Urban-WS;Dev-WS; Substr; Chan; WC Metals; PAH	Imperv-500m; TKN; QHEI;	Low DO; BOD; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	11.8
SR2	17.4	7.8	2018	Non-Poor	14.0	21.8	33.5	Urban-WS;Dev-WS; Substr; PAH	QHEI; Chan;	Imperv-500m;TP; TKN; BOD; Nitrate;	Urban, NPS, Altered Flow, Habitat Mod.	16.7
SR3	14.8	11.5	2018	Non-Poor	14.0	28.6	40.5	Urban-WS;Dev-WS; Substr; PAH	Imperv-500m; BOD; QHEI; Chan; TSS;	Low DO; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	21.1
SR4	11.3	15.0	2018	Non-Poor	12.5	22.9	47.0	Chan; PAH	Imperv-500m;Urban-WS;Dev-WS; QHEI; TSS;	Low DO; BOD; Substr; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	24.5
SR5	8.0	20.6	2018	Non-Poor	16.5	22.4	45.5	Urban-WS;Dev-WS; PAH	QHEI; Substr; Chan; TSS;	Imperv-500m; TKN; BOD; Chloride; VSS;	Urban, NPS, Altered Flow, Habitat Mod.	19.5
SR6	7.4	21.5	2018	Non-Poor	15.5	21.6	36.3	Urban-WS;Dev-WS; PAH	BOD; QHEI; Substr; Chan; TSS;	Imperv-500m; Low DO; TKN; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	19.2
SR7	3.0	23.7	2018	Non-Poor	20.5	N/A	32.5	Urban-WS;Dev-WS; Chan;	QHEI; Substr; TSS;	Imperv-500m;Imperv-30;Imperv-30C; Low DO; BOD; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	22.4
SR18	0.5	30.9	2018	Non-Poor	16.0	28.2	38.5	Urban-WS;Dev-WS; Substr; Chan; PAH	QHEI;	Imperv-500m; Low DO; BOD; Chloride; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	25.1
Middle Fork N. Branch												
MF8	21.1	5.8	2019	Non-Poor	14.0	29.6	34.0	Substr; PAH	Urban-WS;Dev-WS; Low DO; QHEI; Chan; Chloride; WC Metals;	Imperv-500m; Conduct;	Urban, NPS, Altered Flow, Habitat Mod.	16.4
MF9	18.9	8.9	2019	Non-Poor	17.0	21.9	28.0	Low DO; PAH	Urban-WS; QHEI; Substr; Chan; Chloride;	Imperv-500m;Dev-WS; TKN; Max DO; Conduct;	Urban, NPS, Altered Flow, Habitat Mod.	24.6
MF10	16.7	11.9	2019	Non-Poor	16.0	23.9	43.0	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Substr; Chan; Chloride;	Imperv-500m; TKN; Max DO; Conduct;	Urban, NPS, Altered Flow, Habitat Mod.	25.7
MF11	14.1	16.1	2019	Non-Poor	17.0	18.8	45.5	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Substr; Chan; Chloride;	Imperv-500m; TKN; Max DO; Conduct;	Urban, NPS, Altered Flow, Habitat Mod.	24.4
MF12	10.8	19.2	2019	Non-Poor	15.0	23.7	41.5	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Substr; Chan; Chloride;	Imperv-500m; TKN; Max DO; Conduct; TSS;	Urban, NPS, Altered Flow, Habitat Mod.	20.8
MF13	8.6	21.0	2019	Non-Poor	14.0	25.6	54.5	Substr; PAH	Urban-WS;Dev-WS; Chan; TSS;	Imperv-500m; Low DO; TKN; QHEI; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	27.7
MF14	6.0	22.5	2019	Non-Poor	14.0	32.8	67.0	PAH	Urban-WS;Dev-WS; Chloride;	Imperv-500m; Low DO; TKN; Max DO; QHEI; Substr; Conduct; TSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	37.5
MF15	4.0	24.3	2019	Non-Poor	15.0	29.9	59.0	PAH	Urban-WS;Dev-WS; Substr; Chloride; TSS;	Imperv-500m; BOD; Max DO; QHEI; Chan; Conduct; WC Metals;	Urban, NPS, Altered Flow, Habitat Mod.	25.9
MF16	3.0	56.1	2018	Non-Poor	15.0	21.7	44.0	Substr; PAH	Urban-WS;Dev-WS; QHEI; Chan; VSS;	Imperv-500m; TKN; BOD; Nitrate; Chloride; TSS;	Urban, NPS, Altered Flow, Habitat Mod.	28.2
MF17	1.8	57.3	2018	Non-Poor	14.0	28.0	45.0	Chan; PAH	Urban-WS;Dev-WS; QHEI; Substr;	Imperv-500m; Low DO; TKN; BOD; TSS; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	26.2
West Fork N. Branch												
WF20	12.5	3.9	2019	Non-Poor	16.0	22.2	30.5	Substr; PAH	Urban-WS;Dev-WS; Low DO; QHEI; Chan; Chloride;	Imperv-500m; TKN; BOD; Conduct; TSS;	Urban, NPS, Altered Flow, Habitat Mod.	14.8
WF21	10.4	7.0	2019	Non-Poor	9.0	20.5	40.5	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Chan;	Imperv-500m; TKN; BOD; Max DO; Substr; Chloride;	Urban, NPS, Altered Flow, Habitat Mod.	19.4
WF22	9.2	9.4	2019	Non-Poor	12.0	18.1	46.0	Urban-WS;Dev-WS; WC Metals; PAH	Low DO; QHEI; Substr; Chan; Chloride;	Imperv-500m;Imperv-30;Imperv-30C;TP; TKN; BOD; Conduct;	Urban, NPS, Altered Flow, Habitat Mod.	11.3
WF23	4.9	17.9	2019	Non-Poor	13.0	28.7	38.5	Urban-WS;Dev-WS; Substr; Chloride; PAH	Imperv-500m;Imperv-30;Imperv-30C; Low DO; QHEI; Chan;	TP; TKN; Max DO; Conduct;	Urban, NPS, Altered Flow, Habitat Mod.	18.3
WF24	2.9	24.5	2019	Non-Poor	4.0	23.1	53.5	Urban-WS;Dev-WS; Chloride; PAH	Imperv-500m; TKN; Conduct;	Imperv-30;Imperv-30C;TP; Low DO; Max DO; QHEI; Substr; Chan; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	19.6
WF25	1.3	28.0	2019	Non-Poor	12.0	22.8	45.5	Urban-WS;Dev-WS; Chloride; PAH	Imperv-500m; Low DO; QHEI; Substr; Chan; Conduct;	TP; TKN; Max DO;	Urban, NPS, Altered Flow, Habitat Mod.	20.8
North Branch												
MF19	18.6	93.4	2018	Non-Poor	12.0	19.5	49.0	Urban-WS;Dev-WS; PAH	Imperv-30;Imperv-30C;	Imperv-500m; Low DO; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	30.2

[1] fIBI: full support >41; nonsupport-fair >20<41; nonsupport-poor <20; [2] mIBI: full support >41.8; nonsupport-fair >20.9<41.8; nonsupport-poor <20.9; [3] From Table 6 - IPS thresholds for habitat attributes; [4] IPS derived primary, secondary, and tertiary causes assigned by weighting the stressor rank *FIT factor - primary causes rank >8-10, secondary causes rank >6-8, tertiary causes rank >4-6.

Glossary of terms used in Table 1					
Acronym	Description	Acronym	Description	Acronym	Description
Urban-WS	Urban land use HUC12	Substr	Substrate condition from QHEI	VSS	Volatile suspended solids
Dev-WS	Developed land HUC12	NPS	Nonpoint source	Conduct	Specific conductivity
Imperv-30	Impervious surface 30 meter buffer	Mod.	Modification	TKN	Total Kjeldahl nitrogen
Imperv-30C	Imprevious surface 30 m buffer clipped	PAH	Polycyclic aromatic hydrocarbons	TP	Total phosphorus
Imperv-500	Impervious surface 500 meter buffer	WC Metals	Metals concentration in water column	BOD	Biochemical oxygen demand
QHEI	Qualitative Habitat Evaluation Index (QHEI)	DO	Dissolved oxygen	Max.	Maximum
Chan	Channel condition from QHEI	TSS	Total suspended solids		

Recreational Use Assessment

Levels of fecal bacteria in the form of *Escherichia coli* (*E. coli*) cfu[2]/100 mL were used to assess the status of recreation in and on the water. The Illinois EPA General Use criteria are expressed as counts of fecal coliform bacteria, which were not measured here, hence the U.S. EPA national criteria for *E. coli* were used instead. The U.S. EPA *E. coli* criteria are expressed in terms of a 90-day geometric mean and a statistical threshold value (STV) which is the 90th percentile of the data distribution that is not be exceeded by more than 10% of the samples. Given the small sample size limitations, mean values were used as an approximation of the 90-day geometric mean and maximum values as the STV. The U.S. EPA recommended 90-day geometric mean criteria value is 126 cfu/100 ml and the STV criteria value is 410 cfu/100 ml (U.S. EPA 2012).

E. coli results for the North Branch Chicago River and tributaries are available from all 25 locations in each of the 2018 and 2019 sampling years. The frequency of exceedances of the U.S. EPA recommended geometric mean and STV criteria was very high in the NBWW survey area. Among the 25 sites sampled for *E. coli* in 2018 all exceeded the geometric mean and twenty-four (24) exceeded the maximum STV (Table 2). The 25 sites were re-sampled in 2019, and among the sites twenty-one exceeded the geometric mean and twenty-one (21) exceeded the maximum STV. Twenty (20) exceeded for both geometric mean and maximum STV in 2019 (Table 2). There is no discernable longitudinal pattern in *E. coli* exceedances. The only sites to not exceed the geometric mean and maximum STV are SR7 (RM 3.0 in the Skokie River) and MF16 (RM 3.0 in the Middle Fork North Branch Chicago River) during the 2019 sampling year (Table 2). The only non-exceedance during the 2018 sampling year was the maximum STV at MF8 (RM 21.1 of the Middle Fork North Branch Chicago River) and only five sites not exceeding in both the geometric mean and maximum STV in 2019 (Table 2). The Skokie Lagoons appear to aid in the reduction of *E. coli* in the Skokie River with declines occurring at SR7 (RM 3.0) during both 2018 and 2019 (Table 2). The confluence of the Skokie River with the Middle Fork North Branch appears to also reduce *E. coli* colonies at MF16. Fewer exceedances of the geometric mean and maximum STV occurred in 2019 when elevated flows were recorded due to higher volumes of precipitation. The increased flows in 2019 diluted the *E. coli* colonies throughout the North Branch Chicago River watershed.

***Table 2**. E.coli values (cfu/100 ml) for samples collected in the North Branch Chicago River study area during May-October 2018 and 2019. Yellow shaded cells exceed the recommended U.S. EPA (2012) 90-day geometric mean (126 cfu/100 ml); red shaded cells exceed the maximum statistical threshold value (STV; 410 cfu/100ml). Grey shading is a histogram of the relative values at each site.*

Site ID	River Mile	Drainage Area (sq. mi.)	Samples	Minimum	Mean	Maximum
Skokie River: 2018						
SR1	21.1	2.7	6	73	620	24200
SR2	17.4	7.8	6	404	1058	19900
SR3	14.8	11.5	5	119	1009	14100
SR4	11.3	15	5	687	1709	13000
SR5	8	20.6	5	344	1719	15500
SR6	7.4	21.5	5	272	2191	12000
SR7	3	23.7	5	34	498	2380
SR18	0.5	30.9	6	345	1017	2910
Skokie River: 2019						
SR1	21.1	2.7	4	10	189	1050
SR2	17.4	7.8	4	74	142	365
SR3	14.8	11.5	5	142	223	579
SR4	11.3	15	4	683	1145	1990
SR5	8	20.6	4	517	814	2420
SR6	7.4	21.5	3	770	1127	1550
SR7	3	23.7	4	31	79	345
SR18	0.5	30.9	5	79	219	461
Middle Fork North Branch Chicago River: 2018						
MF8	21.1	5.81	3	148	252	377
MF9	18.9	8.91	3	270	459	617
MF10	16.7	11.9	3	296	696	1220
MF11	14.1	16.11	3	338	929	2280
MF12	10.8	19.23	3	270	919	3080
MF13	8.6	20.96	3	218	878	3870
MF14	6	22.48	3	148	900	4610
MF15	4	24.29	3	296	1417	6870
MF16	3	56.1	5	203	560	2990
MF17	1.8	57.3	5	345	1137	3870
Middle Fork North Branch Chicago River: 2019						
MF8	21.1	5.81	7	10	109	1300
MF9	18.9	8.91	6	26	166	1730
MF10	16.7	11.9	6	10	102	2420
MF11	14.1	16.11	6	36	251	2420
MF12	10.8	19.23	6	66	320	2420
MF13	8.6	20.96	5	48	169	2420
MF14	6	22.48	6	96	270	2420
MF15	4	24.29	6	156	599	2420
MF16	3	56.1	4	36	121	261
MF17	1.8	57.3	4	64	132	253

***Table 2**. (continued)*

Site ID	River Mile	Drainage Area (sq. mi.)	Samples	Minimum	Mean	Maximum
West Fork North Branch Chicago River: 2018						
WF20	12.5	3.87	3	298	487	1050
WF21	10.4	7.02	3	504	609	808
WF22	9.2	9.41	3	570	786	1480
WF23	4.9	17.86	3	907	1179	1350
WF24	2.9	24.52	3	446	780	1140
WF25	1.3	27.97	3	662	1023	1470
West Fork North Branch Chicago River: 2019						
WF20	12.5	3.87	6	56	239	1730
WF21	10.4	7.02	7	36	270	2420
WF22	9.2	9.41	7	51	317	3650
WF23	4.9	17.86	7	72	334	6490
WF24	2.9	24.52	6	91	290	2280
WF25	1.3	27.97	6	249	773	3870
North Branch Chicago River: 2018						
MF19	18.6	93.4	6	538	943	2010
North Branch Chicago River: 2019						
MF19	18.6	93.4	4	148	397	2100

Biological and Water Quality Assessment of the North Branch Chicago River Watershed: 2018-2019

STUDY AREA DESCRIPTION

Lake and Cook Counties are densely populated with 5.8 million residents comprising 46% of the Illinois population, according to the 2014 U.S. Census. The North Branch Chicago River watershed consists of 25 municipalities and 10 townships (Lake Co. SMC 2020). The North Branch Chicago River originates in Glenview, IL where the West Fork and Middle Fork of the North Branch Chicago River converge. The watershed drains 112 square miles of Cook and Lake Counties via the Skokie River and West and Middle Forks of the North Branch Chicago River. The NBWW study area included the North Branch Chicago River, the West Fork of the North Branch Chicago River, the Middle Fork of the North Branch Chicago River and the Skokie River. The Middle Fork of the North Branch Chicago River (63.3 $mi.^2$) has the largest watershed in the NBWW, which includes the Skokie River. The Skokie River (31.1 $mi.^2$) has the second largest watershed, and flows a distance of 17 miles beginning in Gurnee, IL to its confluence with the Middle Fork North Branch Chicago River in the Cook County Forest Preserve Watersmeet Woods. The West Fork of the North Branch Chicago River (28.7 $mi.^2$) has the smallest drainage area and flows the shortest distance (14 mi) from its headwaters near Mettawa, IL to its confluence with the North Branch mainstem near Morton Grove, IL (Lake Co. SMC 2020).

General Landscape Setting

The North Branch Chicago River watershed lies entirely within the level III ecoregion Central Corn Belt Plains. The NBWW study area is primarily located in the level IV subregion of Valparaiso-Wheaton Morainal Complex with the exception of site MF19 which is located in the Chicago Lake Plain subregion Table 3). The Valparaiso-Wheaton Morainal Complex is characterized by its hilly, hummocky rolling area containing moraines, kames, eskers and outwash plains with numerous small lakes and marshes. Soils are largely derived from thick late-Wisconsin glacial drift and thin loess deposits where they occur. Prior to modern development the subregion possessed natural oak-hickory forests and bluestem prairie on dry, well-drained moraines. In poorly drained uplands swamp white oak forests were common and cattails, common reed and bulrushes were dominant in marshes. Prairies dominated the subregion, but through fire suppression their removal allowed for increased forest density. Land use is primarily residential (36.3%) followed by public/private open space (29.1%), transportation/utilities (16.3%) retail/commercial (5.3%), governmental/institutional (4.5%), industrial (3.8%), water (2.8%), office parks (1.1%), and agriculture (0.8%) (Lake County SMC 2020).

Table 3. *Level IV subregions in the 2018-2019 North Branch Chicago River watershed study area and their key attributes (from Woods et al. 1995).*

Level IV Subregion	Physiography	Geology	Soils	Potential Natural Vegetation	Land Use/Land Cover
Chicago Lake Plain (54b)	Nearly level to flat, paleo-lake plain containing beach ridges, swales, sand dunes, paleo-spits, paleo-sand bars, bluffs, and both morainal and bedrock ridges	Quaternary lacustrine sediments, beach deposits, outwash deposits, and glacial till	Mollisols (Endoaquolls, Argiaquolls), Entisols (Udipsamments); Also Histosols (Medisaprists)	A mosaic of bluestem prairie and oak–hickory forest.	Mostly urbanized
Valparaiso-Wheaton Morainal Complex (54f)	Glaciated, hilly, hummocky to rolling area containing moraines, kames, eskers, rolling till plains, outwash plains, kettle holes, and ravines. Small lakes and marshes are common.	Wisconsinan-age glacial till and Quaternary lake deposits, thin loess (< 20”) and alluvium. Ordovician and Silurian dolomite, limestone and shale	Alfisols (Epiaqualfs, Hapludalfs), Mollisols (Endoaquolls, Argiudolls), Inceptisols (Eutrudepts)	A mosaic of oak–hickory forest and bluestem prairie. Dry prairie and dry upland forest on dry soils. In marshes: cattails, bulrushes and common reed.	Mostly growing urban and suburban developments, but wooded areas, wetlands, and pastureland are common

Major Point Sources

Significant point sources of pollution were inventoried as part of the North Branch Chicago River Watershed bioassessment to understand the extent of their potential impact and for developing the intensive pollution survey monitoring design. The NBWW 2018-19 survey area includes two major discharges, the Deerfield Water Reclamation Facility (WRF) that discharges into the West Fork of the North Branch Chicago River at river mile 10.0, and the Clavey Road WRF that discharges into the Skokie River at river mile 1.0 just downstream for the Skokie Lagoons dam (Table 4). The Clavey Road WRF treats 17.8 MGD with any inflow in excess of the design flow being diverted into retention basins until flows reach 28 MGD; the stored sewage is then treated by the plant (CSWEA 2010). The Dundee Road lift station is located further upstream just upstream from the Skokie Lagoons, but it has not been active for several years. The Deerfield WRF treats 2-3 million gallons of wastewater per day (MGD) while serving the Villages of Deerfield and Bannockburn, as well as portions of Highland Park (Village of Deerfield 2020). Advanced treatment is conducted at both WRFs. The Village of Glenview, which is served by the Metropolitan Water Reclamation District of Great Chicago (MWRD), has a lift station overflow that impacts the lower West Fork. These sources are depicted in the graphs of the key water quality parameters, habitat, and biological indicators in all three branches throughout the report.

***Table 4**. Major wastewater treatment facilities that discharge directly (river miles are indicated) to 2018-2019 survey area streams (NSWRD– North Shore Water Reclamation District; WRF - Water Reclamation Facility). Treatment levels and nutrient information from U.S. EPA Discharge Monitoring Report (DMR) Pollutant Loading Tool.*

Facility	Receiving Water Body	River Mile	Latitude	Longitude	Avg. Flow 2018 (MGD)[1]	Avg. Flow 2019 (MGD)[1]	Design Avg. Flow (MGD)[2]	Treat-ment Type[3]	Nutrient Removal[4]
NSWRD Clavey Rd. WRF	Skokie River	1.0	42.10188	-87.75883	12.9	17.0	17.8	AWT	B
Deerfield WRF	West Fork North Branch Chicago R.	7.6	42.15944	-87.85472	2.3	2.9	3.5	AWT	M

[1] Effluent quality reported to MBI by DRWW and individual POTWs; [2] Design average flow from NPDES fact sheet; [3] AWT – Advanced Wastewater Treatment – generally 10-20 mg/L CBOD5, 1.5-3.0 NH3-N; 12-24 mg/L TSS; Secondary – generally 30 mg/L CBOD5/TSS, and no NH3-N removal; [4] B – biological phosphorus removal; M – nutrient (N and P) monitoring only; P – 1.0 mg/L limitation.

NPDES Permit Special Conditions

The two major permitted WWTPs in the NBWW study area are subject to Special Conditions related to the discharge of nutrients. The first special condition states:

"The Permittee shall, within eighteen (18) months of the permit effective date, prepare and submit to the Agency a feasibility study that identifies the method, timeframe, and costs of reducing phosphorus levels in its discharge to a level meeting a potential future effluent standard of 0.5 and 0.1 mg/L. The study shall evaluate the costs of the application of these limits on a monthly, seasonal, and annual average basis."

Special condition 23 (using the Clavey Rd. WRF NPDES permit as an example) states:

"The Agency has determined that the Permitee's treatment plant effluent is located upstream of a waterbody or stream segment that has been determined to have a phosphorus related impairment. This determination was made upon reviewing available information concerning the characteristics of the relevant waterbody/segment and the relevant facility (such as quantity of discharge flow and nutrient load relative to the stream flow).

A phosphorus related impairment means that the downstream waterbody or segment is listed by the Agency as impaired due to dissolved oxygen and/or offensive condition (algae and/or other aquatic plant growth) impairments that is related to excessive phosphorus levels.

The permittee shall develop, or be part of a watershed group that develops, a Nutrient Assessment Reduction Plan (NARP) that will meet the following requirements:

A. The NARP shall be developed and submitted to the Agency by December 31, 2024. This can be accomplished by the Permittee, by participation in an existing watershed group, or by creating a new group. The NARP shall be supported by data and sound scientific rationale.

B. The permittee shall cooperate with and work with other stakeholders in the watershed to determine the most cost-effective means to address the phosphorus related impairment. If other stakeholders in the watershed will not cooperate in developing the NARP, the permittee shall develop its own NARP for submittal to the Agency to comply with this condition.

C. In determining target levels of various parameters necessary to address the phosphorus related impairment, the NARP shall either utilize the recommendations of the Nutrient Science Advisory Committee or develop its own watershed-specific target levels.

D. The NARP shall identify phosphorus input reductions by point source discharges and non-point source discharges in addition to other measures necessary to remove phosphorus related impairments in the watershed. The NARP may determine, based on an assessment of relevant data, that the watershed does not have an impairment related to phosphorus, in which case phosphorus input reductions or other measures would not be necessary. Alternatively, the NARP could determine that phosphorus input reductions from point sources are not necessary, or that phosphorus input reductions from both point and nonpoint sources are necessary, or that phosphorus input reductions are not necessary and that other measures, besides phosphorus input reductions, are not necessary.

E. The NARP shall include a schedule for the implementation of the phosphorus input reductions by point sources, non-point sources and any other measures necessary to remove phosphorus related impairments. The NARP schedule shall be implemented as soon as possible and shall identify specific timelines applicable to the Permittee.

F. The NARP can include provisions for water quality trading to address the phosphorus related impairments in the watershed. Phosphorus/Nutrient trading cannot result in violations of water quality standards or applicable antidegradation requirements.

G. The Permittee shall request modification of the permit within 90 days after the NARP has been completed to include necessary phosphorus input reductions identified within the NARP. The Agency will modify the NPDES permit if necessary.

H. If the permittee does not develop or assist in developing the NARP, and such a NARP is developed for the watershed, the Permittee will become subject to effluent limitations necessary to address the phosphorus related impairments. The Agency shall calculate these effluent limits by using the NARP and any applicable data. If no NARP has been developed, the effluent limits shall be determined for the Permittee on a case-by-case basis, so as to ensure that the Permittee's discharge will not cause or contribute to violations of the dissolved oxygen or narrative water quality standards."

In addition all of the WWTPs that are members of the NBWW are subject to Special Condition 24 in their respective NPDES permits as follows:

"The Permittee shall participate in the North Branch Chicago River Watershed Workgroup (NBWW). The Permittee shall work with other watershed members of the NBWW to determine the most cost effective means to remove dissolved oxygen (DO) and offensive condition impairments in the North Branch Chicago River Watershed to the extent feasible."

A. The NBWW will conduct the following activities in accordance with the Plan during the term of this permit:

1. Develop and Integrated Prioritization System (IPS) and supporting tools consisting of in-depth analysis of all chemical, physical and biological data collected in past watershed assessments to develop a library of data analysis tools and prioritization mechanisms related to future impairment restoration activities.

2. Develop a Nutrient Assessment Reduction Plan (NARP) sequenced as follows:

a. Develop a preliminary NARP Workplan to be utilized to plan and budget the multiyear development and completion of a NBWW NARP. The preliminary NARP Workplan shall be completed by December 31, 2021.
b. Develop NBWW NARP in accordance with the requirements in Special Condition 24.

3. Continue comprehensive water quality monitoring program consisting of bioassessment monitoring, flow monitoring, and water column and sediment chemistry sampling and analysis; modify these programs as necessary to meet NARP objectives.

B. The Permittee shall submit an annual progress report on the activities identified in (A) above, which includes the monitoring data from the previous year, to the Agency by March 31st of each year. The Permittee may work cooperatively with the NBWW to prepare a single annual progress report that is common among NBWW members.

C. In its application for renewal of this permit, the Permittee shall consider and incorporate recommended NBWW activities listed in any annual progress report or Nutrient Assessment Reduction Plan that the Permittee will implement during the next permit term."

Nutrient Assessment Reduction Plan (NARP)

The State of Illinois developed the Illinois Nutrient Loss Reduction Strategy (NLRS; State of Illinois 2018) to deal with the enrichment of Illinois surface waters by primary nutrients (N and P). As part of the NLRS Illinois EPA developed a process termed the Nutrient Assessment Reduction Plan (NARP) which is to be developed for major wastewater treatment facilities by December 31, 2023. The two major WWTPs that are members of the NBWW have recently initiated planning for meeting the NARP requirements as specific in their NPDES permits.

Depending on the findings of the NBWW NARP process, additional controls on discharges of N and P could be forthcoming.

Nonpoint Sources

Nonpoint sources in the NBWW study area primarily include urban sources of varying intensities that range from light suburban to heavy urban and industrial. Hydromodification of stream and river flows, and habitat modifications occur throughout the survey area with the latter primarily in the form of channelization and riparian encroachment by urban and suburban development. A dam located upstream of Willow Rd on the lower Skokie River that creates the Skokie Lagoons impounds 4 miles of the river.

Spatial Survey Design

The spatial monitoring design employed a combined geometric (stratified-random) and targeted-intensive pollution surveys that evaluates pollution from all sources and in keeping with its definition in the CWA. This design was employed primarily to determine the status of aquatic life and recreational use attainment at the same scale at which pollution sources are being managed and regulated within NE Illinois watersheds. Given that there are hundreds of point sources, numerous stormwater structures, varying degrees of urban and suburban development, legacy pollutants, and habitat and hydrologic alterations, an intensive pollution survey design is needed to capture and characterize the numerous and overlapping pollution gradients that result from these sources. This requires more sites than a condition survey which relies on a comparatively greater extrapolation of data from fewer sampled sites to many more unsampled sites and reaches. This design can result in overlooking local impairments that can evade less spatially intensive condition assessments. The pollution survey design is intended to make quantitative indicators and tools available to guide and support restoration and protection efforts undertaken by NBWW, other watershed groups, and their respective stakeholders. The data and assessments provided by these periodic watershed assessments and by the Northeastern Illinois Integrated Prioritization System (IPS) framework (MBI 2020), that provides supporting analyses and information on a regional basis to support the restoration of impaired streams and rivers and the protection of high quality sites, reaches, and watersheds from further degradation.

A tiered design was adopted by the NBWW that monitors water chemistry more frequently and comprehensively the watershed. This consists of sampling 25 sites located throughout the three North Branch Chicago River main tributaries (Figure 2). All sites were sampled for biological assemblages and habitat, sediment chemistry, water chemistry via grab samples and Datasondes were set at 7 sites (continuous data for D.O., temperature, conductance, and pH) and benthic chlorophyll was collected in conjunction with the retrieval of the Datasondes. Each site was assigned a unique NBWW numeric site code, a river mile and UTM coordinates (Table 5).

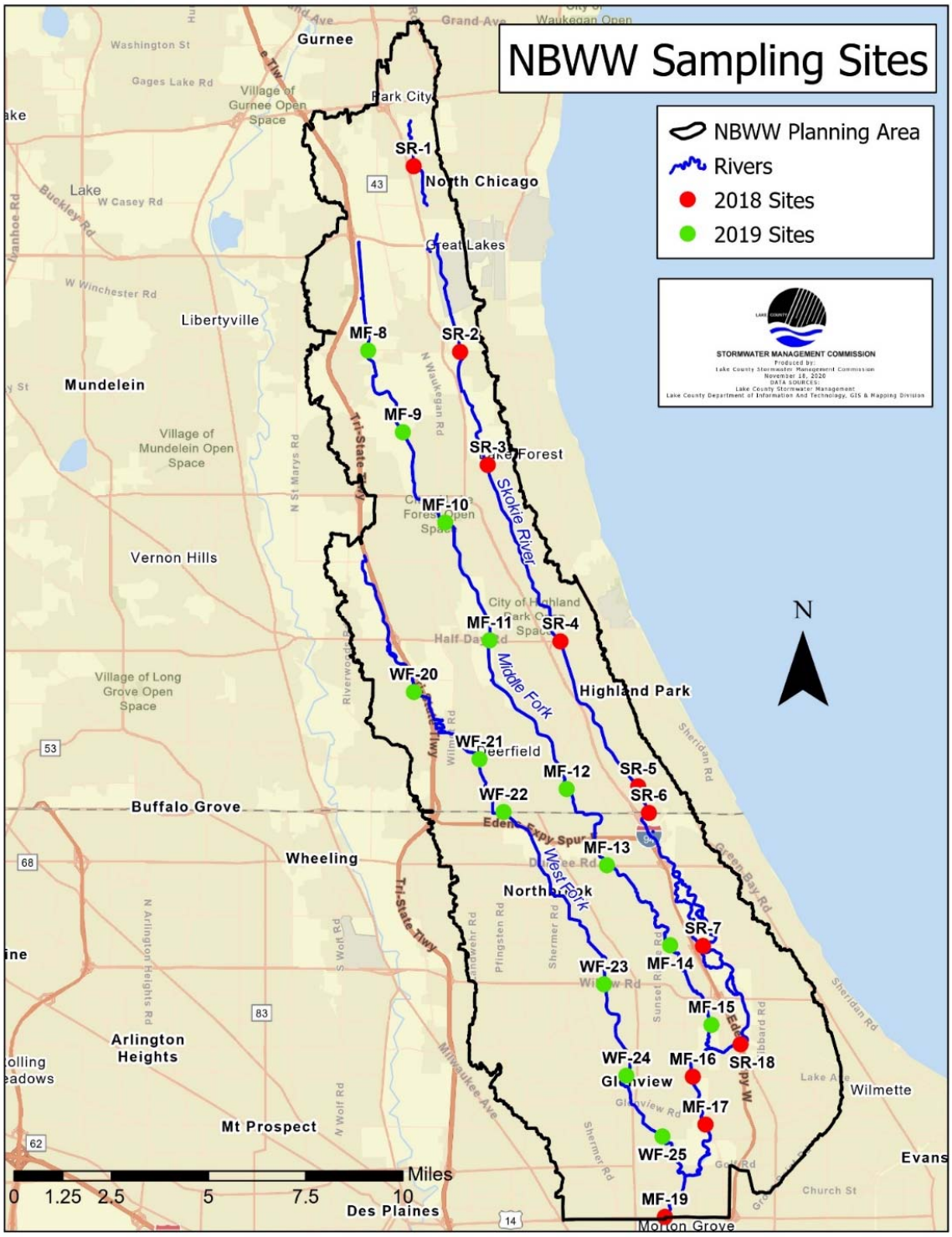

***Figure 2**. Location of biological, chemical and habitat sampling sites in the NBWW survey area in 2018 (red symbols) and 2019 (green symbols). Site codes correspond to the sites listed in Table 5.*

***Table 5**. Locations of sampling sites in the NBWW survey area in 2018-19 showing the site ID, river, river mile and what sampling was performed at each site (F - Fish; MH - multihabitat macroinvertebrate; QHEI - Qualitative Habitat Evaluation Index; Datasonde; Benthic Chlorophyll a, and water chemistry in accordance with Tier 1-3 designation).*

NBWW Site ID	River_Stream Name	Drainage Area (mi.^{2})	RIVER MILE	YEAR	Latitude	Longitude	Geographic Location	Biota	Habitat	DataSonde/ Benthic Chla	Water Chemistry		
											Tier 1	Tier 2	Tier 3
Skokie River													
SR1	Skokie River	2.78	21.1	2018	42.33089	-87.88161	adj. Gillett Plant	MH, F	QHEI	X	1		3
SR2	Skokie River	7.87	17.4	2018	42.27941	-87.86409	ust. IL 176	MH, F	QHEI			2	3
SR3	Skokie River	11.56	14.8	2018	42.24616	-87.85333	dst. Deerpath Rd.	MH, F	QHEI	X		2	3
SR4	Skokie River	15.07	11.3	2018	42.20196	-87.82955	ust. Half Day Rd.	MH, F	QHEI			2	3
SR5	Skokie River	20.67	8.0	2018	42.16077	-87.79907	ust. Clavey Rd.	MH, F	QHEI	X		2	3
SR6	Skokie River	21.51	7.4	2018	42.15269	-87.79392	Ust. Lake Cook Rd.	MH, F	QHEI			2	3
SR7	Skokie River	23.73	3.0	2018	42.11398	-87.77361	Skokie Lagoon	F	QHEI	X		2	3
SR18	Skokie River	30.90	0.5	2018	42.08834	-87.76299	dst. I-94	MH, F	QHEI	X	1		3
Middle Fork North Branch Chicago River													
MF08	Middle Fork North Branch Chicago River	5.80	21.1	2019	42.28013	-87.89854	Ust. Rockland Rd.	MH, F	QHEI		1		3
MF09	Middle Fork North Branch Chicago River	8.90	18.9	2019	42.25635	-87.88459	Dst. foot bridge	MH, F	QHEI			2	3
MF10	Middle Fork North Branch Chicago River	11.90	16.7	2019	42.23196	-87.86841	Dst. Westleigh St.	MH, F	QHEI	X		2	3
MF11	Middle Fork North Branch Chicago River	16.10	14.1	2019	42.19861	-87.85362	Dst. IL22	MH, F	QHEI			2	3
MF12	Middle Fork North Branch Chicago River	19.20	10.8	2019	42.15927	-87.8247	Ust. Carriage Way	MH, F	QHEI	X		2	3
MF13	Middle Fork North Branch Chicago River	20.90	8.6	2019	42.13879	-87.81029	Ust. IL68	MH, F	QHEI			2	3
MF14	Middle Fork North Branch Chicago River	22.40	6.0	2019	42.11541	-87.78472	Dst. Sunset Dr.	MH, F	QHEI	X		2	3
MF15	Middle Fork North Branch Chicago River	24.20	4.0	2019	42.09294	-87.77116	Dst. Winnetka Ave.	MH, F	QHEI	X	1		3
MF16	Middle Fork North Branch Chicago River	56.15	3.0	2018	42.08152	-87.7786	ust. E. Lake Rd.	MH, F	QHEI			2	3
MF17	Middle Fork North Branch Chicago River	57.31	1.8	2018	42.06667	-87.7731	dst. Glenview Rd.	MH, F	QHEI	X		2	3
West Fork North Branch Chicago River													
WF20	West Fork North Branch Chicago River	3.80	12.5	2019	42.18624	-87.88178	Adj. Saundrers Rd.	MH, F	QHEI		1		3
WF21	West Fork North Branch Chicago River	7.00	10.4	2019	42.16572	-87.85696	Dst. Deerfield Rd.	MH, F	QHEI	X		2	3
WF22	West Fork North Branch Chicago River	9.40	9.2	2019	42.15161	-87.84602	Dst. Lake-Cook Rd.	MH, F	QHEI		1		3
WF23	West Fork North Branch Chicago River	17.80	4.9	2019	42.10279	-87.80994	Dst. Willow Rd.	MH, F	QHEI	X		2	3
WF24	West Fork North Branch Chicago River	24.50	2.9	2019	42.07891	-87.80765	Dst. Lake Ave.	MH, F	QHEI			2	3
WF25	West Fork North Branch Chicago River	27.90	1.3	2019	42.06345	-87.78887	Ust. walking bridge	MH, F	QHEI	X	1		3
North Branch Chicago River													
MF19	North Branch Chicago River	93.41	18.6	2018	42.04128	-87.78799	ust. Dempster St.	MH, F	QHEI	X	1		3
								25	25	14			

METHODS

All methods followed Illinois EPA and DNR procedures, except as modified to meet the needs of the NBWW, but with the goal of providing comparable data to evaluate aquatic life and recreational use attainment. This includes fish, macroinvertebrates, habitat, bacteria, chemical parameters (water and sediment), continuous data for select parameters, and benthic and sestonic chlorophyll a. Recreational use attainment was evaluated with *Escherichia coli* and using the U.S. EPA national criteria since none were available from Illinois EPA.

Chemical/Physical Water Quality

Water Sampling

The specific methods of data collection followed Illinois EPA (2012a) and chemical laboratory analyses were provided by the North Shore Water Reclamation District laboratory. The chemical/physical parameter categories (demand, nutrients, metals, and organics) and the frequency of sample collection are summarized in the Monitoring Strategy for the North Branch Chicago River (2018). NBWW assigned tiers to the 25 sampling sites as follows:

- **Tier 1**: Eight (8) sites, three (3) in the West Fork North Branch Chicago River, three (3) in the Middle Fork North Branch Chicago River, and two (2) in the Skokie River, were sampled four times for demand, nutrient, and bacteria parameters, and once annually for metals and organics.
- **Tier 2**: Seventeen (17) sites divided into each of the three subwatersheds are monitored four times for the majority of the demand parameters, all nutrients, and bacteria parameters.
- **Tier 3**: Two additional monitoring events for demand, nutrients, and bacteria parameters at bioassessment sites during the bioassessment seasonal index period.

While NBWW collects water samples in February along with more frequently collected samples during the May-October seasonal index period, only the latter period data is included as it coincides with the bioassessment seasonal index period of mid-June to mid-October.

Sediment Sampling

Surficial sediments were sampled for bulk chemical analysis once at all 25 locations in early October following Illinois EPA methods (Illinois EPA 2011b). Eleven (11) samples were collected in the Skokie River in 2018 and 14 samples were collected in the Middle and West Forks of the North Branch Chicago River in 2019 and analyzed by Eurofins/Test America.

Nutrient Effect Assessment Procedure

A new methodology to assess the effects of nutrient enrichment was used in the NBWW bioassessment for 2018-19 (MBI 2019). Modeled after the Stream Nutrient Assessment Procedure (SNAP) developed by Ohio EPA (2015b), it includes the width of the diel variation in continuously measured D.O., the biomass of chlorophyll a in benthic algae analyzed by the

University of Washington Marine Sciences Laboratory, sestonic chlorophyll a, and the concentration of total phosphorus and dissolved inorganic nitrogen (nitrate + nitrite-N). Other potentially related parameters such as volatile suspend solids (VSS), turbidity, and total Kjeldahl nitrogen (TKN) were included when they were collected at the 14 Datasonde and benthic chlorophyll a locations (Table 5). Datasondes were deployed for consecutive 5-7 day periods during times of low stream flow and elevated summer ambient temperatures (YSI 2012 2017). The number of phosphorus sensitive species derived from the NE Illinois IPS stressor analyses and a Nutrient Ranking Index that was also developed with IPS outputs were also used in this analysis (Appendix E).

Together these results were used to determine five degrees of nutrient enrichment (none, low, moderate, high, and severe). A summary of the number of water and sediment parameters and samples collected in 2018 and 2019 are found in Table 6. The parameters analyzed and frequencies of collection varied by NBWW tier assignment as was previously described.

Table 6*. Summary of the number of water chemistry parameters and samples collected by parameter category for water column (left) and surficial sediment (right).*

Parameters Category	Water		Sediment	
	Parameters	Samples	Parameters	Samples
All	112	3573	109	2,886
E. Coli	1	140	0	0
Field pH & Temp.	2	268	0	0
Demand[1]	2	274	0	0
Nutrients[2]	6	630	2	52
Ionic Strength[3]	3	284	0	0
Suspended Materials[4]	2	216	0	0
Metals	14	247	20	520
Organic Compounds	83	1,514	87	2,314

1 Includes dissolved oxygen and turbidity
2 Includes total ammonia, total phosphorus, total nitrate, TKN, benthic chlorophyll a, sestonic chlorophyll a
3 Includes total chloride, and conductivity
4 Includes total suspended solids and volatile suspended solids

Biological Assemblage Methods

Biological assemblages in the 2018-19 NBWW study area included fish and macroinvertebrates at 25 instream locations. Biological and habitat sampling adhered to a summer-early fall index period of June 16-October 15 for fish and July 1-September 30 for macroinvertebrates. All sites were sampled for fish twice, excepting in 2019 when recurring high flow events precluded a second pass, while macroinvertebrates were sampled once with a 10% resample. A habitat evaluation was performed at all fish sites using the QHEI (Ohio EPA 2006) and a site description accompanied the Illinois EPA multihabitat macroinvertebrate sample. All sampling occurred during periods of summer-fall base flows; periods of high flows and runoff were avoided.

Fish Assemblage Methods

Fish were collected once at each site with pulsed D.C. electrofishing units including a Wisconsin AbP-3 battery powered backpack, a 2500 Watt generator controlled by a Smith-Root 2.5 GPP pulse box, or a 5000 Watt generator controlled by a Smith-Root 5.0 GPP pulse box. Deference was given to the most effective method based on the prevailing site and water characteristics. The upper boundary for using the battery-powered backpack electrofishing unit was two times the depth and five times the width of the net ring (anode). Wider and deeper sites were sampled with the 2500 Watt generator and Smith-Root 2.5 GPP pulse box unit as either a bank set longline or floated on a roller barge. The primary net ring served as the anode and a woven steel cable cathode trailed from the backpack unit, the longline or the roller barge. A long-handled dip net was used to assist in the collection of stunned fish. The 5000 Watt generator and Smith-Root 5.0 GPP pulse box were mounted to an inflatable 16 foot Wing raft with an electrode array, which was used at site SR7 in the Skokie Lagoons. Woven steel droppers extended out in front of the raft on a telescoping boom served as the anode and steel dishwasher hoses extending off the side of the frame served as the cathodes. A two or three person crew consisting of a fish crew leader and one or two field technicians conducted the sampling under summer base flow conditions. Sampling effort was standardized by distance and included a 150-200 meter reach for all wadeable sites and a 500 meter reach for raft sites.

Captured fish were placed in a live well for later processing. Water was regularly replaced and/or aerated to maintain adequate oxygen levels to minimize fish mortality. Samples from each site were processed by enumerating weights by species and by life stage (young-of-the-year, juvenile, and adult) on a field data sheet. The incidence of external anomalies was recorded following the procedures outlined by Ohio EPA (1996, 2015a) and refinements made by Sanders et al. (1999). Fish were released back into the stream after they were identified to species, examined for any external anomalies and weighed either individually or in batches. Larval fish were not included in the sample and fish measuring less than 25 mm in length were generally excluded as a matter of practice (excepting adults of small species). All sites were marked with GPS coordinates (beginning, middle and end of the sampling reach) and site data was recorded on a standard field form.

Any fish collected that were not identifiable were required to be vouchered for identification in the laboratory. Vouchered specimens were preserved in borax buffered 10% formalin solution and labeled by site, date, and geographic identifier (e.g. river mild and/or site number). Regional ichthyology keys were used including the Fishes of Illinois (Smith, 1979) and updates available through the Illinois Natural History Survey (INHS). Identification was made to species level at a minimum. Scientific nomenclature followed Page et al. (2012). Vouchers were deposited at Midwest Biodiversity Institute in Hilliard, OH. The data were used to calculate the Illinois Fish Index of Biotic Integrity (fIBI; Smogor 2000, 2005) as the primary assessment of fish assemblage quality.

Macroinvertebrate Methods

Macroinvertebrate methods followed the Illinois EPA multi-habitat method (Illinois EPA 2011 c,d) at all sites (Appendix Table A-1). The Illinois EPA multi-habitat method requires the

selection of a sampling reach that is representative of the instream and riparian habitat conditions of the assessment reach. Sampling requirements included flow conditions characteristic of typical summer base flows, absence of highly influential tributary streams, the presence of one riffle/pool sequence or run/bend meander or alternate point-bar sequence, if present, and a length of 300 feet. Collection methods included using a D-frame dip-net to sample all bottom- and bank-zone habitat types within a site. All sites were marked with GPS coordinates (beginning and end of sampling reach) and site data was recorded on a standard field form.

Multi-habitat macroinvertebrate samples were field preserved in borax buffered 10% formalin solution. Once samples were delivered to the lab in Hilliard, Ohio the samples were transferred to 70% ethyl alcohol. Laboratory procedures followed the Illinois EPA (2011e) methodology which requires the field sample to be subsampled into a 300-organism count following the pre-pick of large and/or rare taxa. Taxonomic resolution was at the lowest practicable taxonomic level for the common macroinvertebrate assemblage groups (mayflies, stoneflies, midges, and crustaceans), which goes beyond the genus level requirement by Illinois EPA (2011g). Calculation of the Macroinvertebrate IBI (mIBI) adhered to the Illinois EPA methods by using genus as the benchmark level of taxonomic resolution.

Habitat Assessment Methods

The QHEI (Rankin 1989, 1995; Ohio EPA 2006) was the principle aquatic habitat assessment method used at each site. Assessments were completed as a part of the fish assemblage sampling by the fish crew leader who is trained and experienced in using the QHEI. The QHEI measures six categories of important attributes to the aquatic biota with a scoring range of 0-100. QHEI scores of 55 in headwaters and 60 in larger streams are generally regarded as sufficient to support the General Use for aquatic life. Scores below 45 indicate substantial deficiencies in the habitat that can preclude attainment of General Use. A QHEI matrix (Rankin 1995) showing the occurrence of good and modified attributes was also examined to evaluate the overall capacity of the stream habitat to support the General Use at each site.

Data Management

All data was managed by MBI in internal databases that permit ready access and analysis. Biological and habitat data is stored in a routine based on the Ohio ECOS format that MBI uses for all biological data management tasks. Biological data analysis included the calculation of Illinois fish and macroinvertebrate IBIs for determining General Use aquatic life status and the accompanying data attributes to enhance the diagnosis of impairments. Habitat data was analyzed using the QHEI and also via a QHEI attributes matrix to aid in assessing habitat related impairments. Summaries of species/taxa relative abundance and QHEI metrics at each site and by sampling date are provided in Appendices B-D.

Determining Use Attainability

Illinois EPA offers a single aquatic life use designation that applies to all rivers and streams through the General Use provision of the Illinois WQS. An assessment of aquatic life use attainability was not conducted as the General Use designation was presumed for all rivers and streams in the 2018-2019 study area. The data collected is adequate to determine if habitat is a limiting factor in any instances of non-support.

Determining Use Attainment

The determination of the attainment status of the Illinois General Use for aquatic life generally followed the guidance in the Illinois EPA 2018 Integrated Report (Illinois EPA 2018). The General Use for aquatic life is applicable to all streams in the NBWW 2018-2019 study area. Attainment of the fIBI and mIBI thresholds were expressed as fully supporting excellent, fully supporting good, partially supporting, non-supporting fair, non-supporting poor, and non-supporting very poor with the most limiting result of either the fish or macroinvertebrates determining the narrative assignment of fair, poor or very poor. Narrative ratings were assigned based on the Integrated Prioritization System (NE Illinois IPS; MBI 2020a). The addition of a partial support category goes beyond the current Illinois EPA structure and was done to highlight where one assemblage attained their respective fIBI or mIBI biocriterion.

Determining Causal Associations

Using the results, conclusions, and recommendations of this assessment requires an understanding of the methodology used to determine biological status and assigning associated causes and sources of impairment utilizing the accompanying chemical/physical data and source information (e.g., point source loadings, land use). New in 2018 was the availability of outputs from the Northeastern Illinois Integrated Prioritization System (NE Illinois IPS; MBI 2020a). These outputs included regionally derived stressor thresholds for more than 70 chemical and habitat variables, Restorability rankings for impaired sites, and Susceptibility and Threat rankings for sites that attained the Illinois General Use biological criteria.

Causal Diagnosis

Describing the causes and sources associated with observed biological impairments relies on an interpretation of multiple lines of evidence including water chemistry data, sediment chemistry data, habitat data, effluent data, land use data, and biological response signatures (Yoder and Rankin 1995; Yoder and DeShon 2003). Thus the assignment of associated causes and sources of biological impairment in this report represents the association of impairments (based on response indicators) with stressor and exposure indicators using linkages to the bioassessment data based on previous experiences with analogous situations and impact types. This was done by relating exceedances of chemical thresholds such as chronic and acute water quality criteria and relevant biological effects thresholds for water and sediment chemistry from the NE Illinois IPS tool and dashboard to further refine the relative importance of categorical and/or

parameter specific causes. The reliability of the identification of associated causes and sources is increased where other such prior associations have been observed. This process relies on multiple lines of evidence concerning the biological response which is the ultimate measure of success in water quality management. The NE Illinois IPS derived exceedance thresholds for chemical and habitat parameters used in the causal analyses were also used in the tabular and graphical presentation of the chemical water and sediment results. When combined with the Restorability and Susceptibility/Threat rankings this improved the certainty of the assignment of causes and sources to an observed biological impairment.

Hierarchy of Water Indicators

A carefully conceived ambient monitoring approach, using cost-effective indicators comprised of ecological, chemical, and toxicological measures, can ensure that all relevant pollution sources are judged objectively on the basis of environmental results. A tiered approach that links the results of administrative actions with true environmental measures was employed in the analyses. The integrated approach is outlined in Figure 3 and includes a hierarchical continuum from administrative to true environmental indicators. The six "levels" of indicators include:

- Level 1 - actions taken by regulatory agencies (permitting, enforcement, grants);
- Level 2 - responses by the regulated entity (treatment works, pollution prevention);
- Level 3 - changes in discharged quantities (pollutant loadings);
- Level 4 - changes in ambient conditions (chemical/physical water quality, habitat);
- Level 5 - changes in uptake and/or assimilation (tissue contamination, biomarkers, assimilative capacity); and,
- Level 6 - changes in health, ecology, or other effects (ecological condition, human and wildlife health).

In this process the results of administrative activities (Levels 1 and 2) are linked to water quality (Levels 3, 4, and 5) which translates to a response (Level 6). An example is the aggregate effect of billions of dollars spent on water pollution control in the U.S. since the early 1970s that have been determined with quantifiable measures of environmental condition. In this case the hierarchy was applied to a specific stream reach that is impacted by multiple point and nonpoint sources. The administrative steps taken by Illinois EPA to issue NPDES permits (Level 1) and the steps taken by the permit holders (Level 2) are easily described and quantified. Quantifying changes in the loadings of pollutants (Level 3) can be affected by the quality and completeness of the effluent monitoring which includes the capture of stressors that actually affect the receiving streams. Likewise, documenting changes in ambient conditions (Level 4) can also be affected by the quality and completeness of the chemical/physical monitoring that not only includes the parameters but also the spatial design in relation to sources of pollution.

This in turn informs about how pollution sources tax the assimilative capacity (Level 5) of a receiving stream. The end result of all the above is portrayed by the response in the biological indicators which is expressed as attainment or non-attainment of the Illinois General Use

aquatic life thresholds for the fish and macroinvertebrate IBIs (Illinois EPA 2016). Symptoms expressed by the biota beyond the index scores can be useful in aiding the causal diagnosis as a feedback loop in the hierarchy of indicators process.

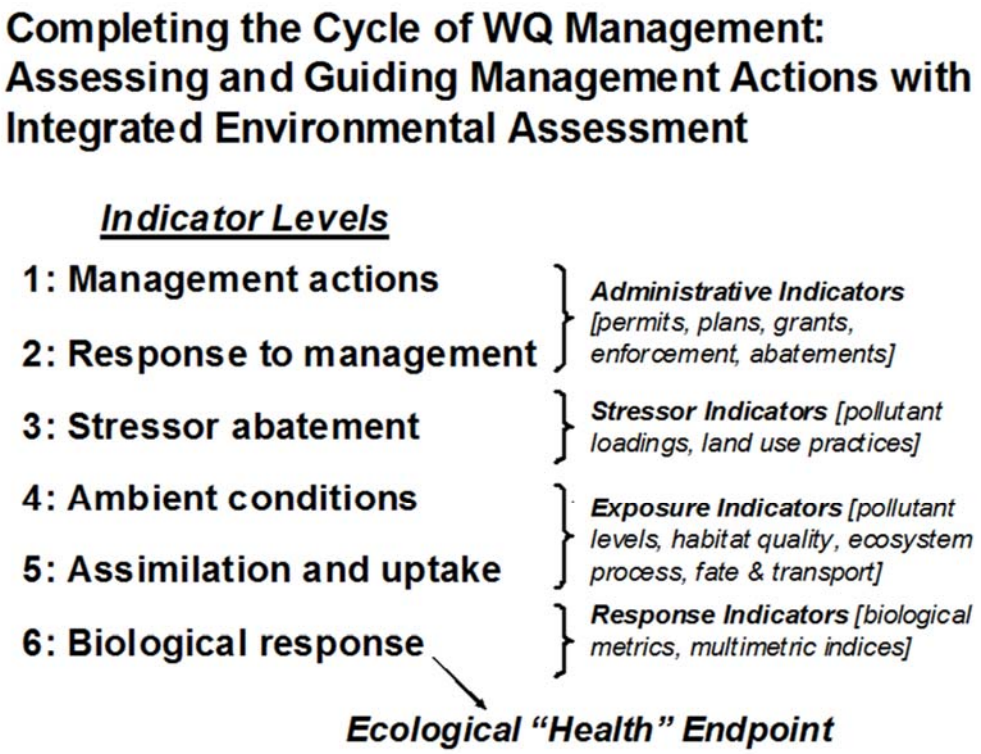

***Figure 3**. The hierarchy of administrative and environmental indicators which can be used to support monitoring and assessment, reporting, and an evaluation of the effectiveness of pollution controls on a receiving stream. This is patterned after a model developed by U.S. EPA (1995a,b) and enhanced by Karr and Yoder (2004).*

Superimposed on this hierarchy is the concept of stressor, exposure, and response indicators.

- Stressor indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications.
- Exposure indicators are those which measure the effects of stressors and can include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent.
- Response indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices which comprise the Illinois EPA biological endpoints.

This classification of indicators represents the essential technical elements for the pollution survey design that was employed in the North Branch bioassessments by using each indicator within its most appropriate role for each (Yoder and Rankin 1998).

Causal Associations

Describing the causes and sources associated with biological impairments in the study area involved the interpretation of multiple lines of evidence that included water chemistry, sediment chemistry, habitat, and effluent data, a general knowledge about upstream land uses, and biological response signatures within the biological data itself. The assignment of causes and sources of biological impairment result from the association of the impairment with exceedances of water quality criteria or other response-based thresholds and the proximity to sources of pollution. This process was strengthened by the availability of regionally derived stressor effect thresholds from the NE Illinois IPS (MBI 2020a) that classified stressor levels into excellent, good, fair, poor, and very poor categories.

RESULTS – CHEMICAL/PHYSICAL WATER QUALITY

Chemical/physical water quality in the NBWW study area was characterized by grab sample data collected from the water column three times at each Tier 1-2 sites with an additional two collections at Tier 3 sites during summer-fall base flows. Sediment chemistry was determined from samples collected at all 25 Tier 1-3 sites in October 2018 and 2019. Commonly detected chemical parameters were compared either to the criteria in the Illinois WQS, Illinois EPA non-standard benchmarks, reference benchmarks, and most commonly to biologically derived thresholds from the newly available NE Illinois IPS tool and dashboard (MBI 2020a). As such, the chemical/physical data herein serves as an indicator of the degree of exposure and stress in support of using the biological data to assess the attainment of designated aquatic life uses and to assist in assigning associated causes and sources. Parameter groupings included field, demand, ionic strength, nutrients, heavy metals, and organic compounds. Bacteria data were collected by grab samples and were used primarily to determine the status of recreational uses in accordance with U.S. EPA National Water Quality Criteria (U.S. EPA 2012).

Flow Regime

The flow regime for the NBWW study area during the period of January 1 – December 31 for both years of NBWW monitoring during 2018 and 2019 is depicted in Figure 4 based on the gages operated by the U.S. Geological Survey on the West Fork North Branch Chicago River at Northbrook, IL (USGS 05535500), on the Middle Fork North Branch Chicago River at Deerfield, IL (USGS 05534500), on the Skokie River at Highland Park, IL (USGS 05535070) and on the N Br Chicago River at Niles, IL (USGS 05536000). Flows in 2018 were lower during the August and September months compared to 2019 when recurrent elevated flows occurred. Low flows were observed during the latter part of July into August during the 2018 sampling year, falling below the 90% duration value in the Middle Fork North Branch Chicago River, Skokie River, and the West Fork North Branch Chicago River (Figure 4). Higher flows in September 2018 and 2019 exceeded the flood stage in the Skokie River and Middle Fork North Branch Chicago River. These elevated flows and high flows in June and July prevented a second fish pass in 2019 at all sites and at MF19 in 2018. Flows were sufficiently “normal” in mid-July and August.

Point Source Effluent Quality

Point source discharges of treated wastewater are a major contribution of pollutant loadings in the West Fork North Branch Chicago River and the Skokie River with design average flows of 17.8 MGD and 3.0 MGD (27.5 cubic feet/second and 4.6 cubic feet/second) contributed by the Clavey Rd. WRF and the Deerfield WRF, respectively (Table 3). The 2018 discharge for the Clavey Rd. WRF averaged 12.9 MGD (19.96 cfs) and the Deerfield WRF averaged 2.3 MGD (3.55 cfs). These totals are 33.6 times the $Q_{7,10}$ flow of 0.7 cfs for the Skokie River at Highland Park, IL and 10.7 times the $Q_{7,10}$ flow of 2.2 cfs of the West Fork North Branch Chicago River at Northbrook, IL. The 2019 average discharges averaged 17.0 MGD (26.3 cfs) for the Clavey Rd. WRF and 2.9 MGD (4.48 cfs) for the Deerfield WRF. These are 44 times the Q710 flow of 0.7 cfs for the Skokie River at Highland Park, IL and 14 times the $Q_{7,10}$ flow of 2.2 cfs of the West Fork North Branch Chicago River at Northbrook, IL. As a result of these discharges, the Skokie River and the West Fork North Branch Chicago River are "effluent dominated" where the total flow consists primarily of treated wastewater (Onnis-Hayden et al. 2006). The Deerfield WRF and Clavey Rd. WRF are the only two WWTPs in the NBWW survey area and provide the major portion of the low flows of their respective receiving streams. Summaries of the 2018 and 2019 effluent flow and loads from each facility appear in Table 3 and Figure 5.

North Shore Water Reclamation District (NSWRD) Clavey Road WRF

The North Shore Water Reclamation District (NSWRD) Clavey Rd. WRF discharged an annual flow of 12.9 MGD in 2018 and 17.0 MGD in 2019 (NPDES Permit No. IL0030171; Table 3). The Clavey Rd. WRF discharges to the Skokie River downstream of the Skokie Lagoons, upstream of the confluence with the Middle Fork North Branch Chicago River. The design average flow (DAF) for the facility is 17.8 MGD and the design maximum flow (DMF) is 28 MGD. Treatment consists of screening, grit removal, floating and settled solids removal, sedimentation filtration, sludge handling, biological nutrient and ammonia removal, and ultraviolet disinfection. In terms of effluent, in 2018 the Clavey Rd. WRF discharged $CBOD_5$ (118.1 lbs./day), TSS (139.3 lbs./day), NH_3-N (5.7 lbs./day), NO_3-N (2082.5 lbs./day), and P (69.1 lbs./day). In 2019 $CBOD_5$ (138.5 lbs./day), TSS (232.9 lbs./day), NH_3-N (7.4 lbs./day), NO_3-N (1852.6 lbs./day), and P (204.3 lbs./day) were discharged into the Skokie River.

Village of Deerfield WRF

The Village of Deerfield Water Reclamation Facility (NPDES Permit No. IL0028347) discharged an annual flow of 2.3 MGD in 2018 and 2.9 MGD in 2019. The Deerfield WRF discharges into the West Fork North Branch Chicago River 0.4 miles upstream of the Lake and Cook Counties boundary line. The design average flow (DAF) for the facility is 3.5 MGD and the design maximum flow (DMF) is 9.2 MGD. Treatment consists of screens, comminutor, aerated grit tank, primary clarifiers, trickling filters, activated sludge, final clarifiers and UV disinfection.

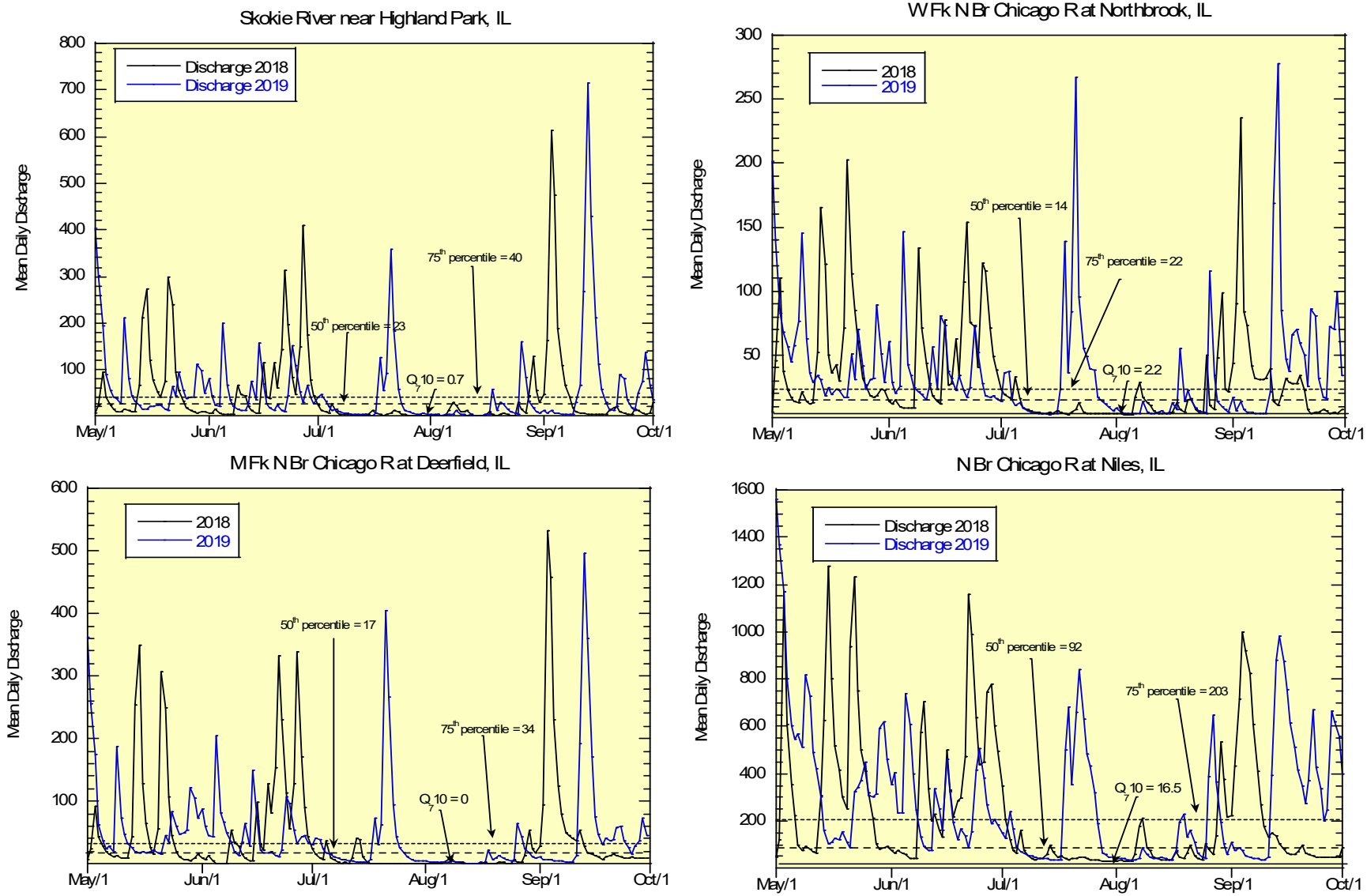

***Figure 4**. Daily flow measured at the USGS gages on the Skokie River (USGS 05535070, upper left) near Highland Park, the West Fork North Branch Chicago River (USGS 05535500, upper right) near Northbrook, the Middle Fork North Branch Chicago River (USGS 05534500, lower left) at Deerfield, and the North Branch Chicago River at Niles (USGS 05536000, lower right) for the years of 2018 and 2019. The horizontal lines are the 75thpercentile, 50thpercentile, and the seven-day, ten year (Q7,10) critical low flows.*

***Figure 5**. Proportions of effluent flow (MGD) and pollutant loadings (lbs./day) discharged by two major WWTPs to the NBWW survey area in 2018 and 2019. Proportions and loadings are based on the annual averages of each parameter. Discharges are listed in the inset table (bottom right).*

Facility	Flow (MGD)	$CBOD_5$ (lbs/day)	TSS (lbs/day)	NH_3-N (lbs/day)	NO3 - N (lbs/day)	Total P (lbs/day)
2019						
Clavey Rd. WRF	17.0	138.5	232.9	7.4	1,852.6	204.3
Deerfield WRF	2.9	55.1	121.4	2.6	193.4	32.0
2018						
Clavey Rd. WRF	12.9	118.1	139.3	5.7	2,082.5	69.1
Deerfield WRF	2.3	64.7	114.9	3.8	265.6	42.5

Water Column Chemistry

The water column chemistry results were analyzed for spatial (longitudinal) patterns resulting from the pollution survey design in the North Branch Chicago River and its tributaries. The results were screened for exceedances of Illinois WQS, Illinois non-standard benchmarks, regional reference benchmarks, and most commonly for exceedances of the tiered biological effect thresholds derived from the NE Illinois IPS (Appendix A; Tables 7 and 8). Exceedances of these benchmarks and thresholds are indicated on the plots and tables of the 2018-2019 chemical results.

Exceedances of Biological Effect and Reference Thresholds

The principal purpose of chemical sampling in a bioassessment is to provide data that supports the interpretation and the assignment of associated causes of biological impairments. Chemical exceedances of biological effect thresholds is essential to that process and has previously included the Illinois water quality criteria, regional reference benchmarks, and national and regional biological effects compendia. Some consist of correlations between concentrations of substances that correspond to biological quality gradients across wide geographical areas while others are toxicological endpoints derived from laboratory studies. Two regional studies that have been used include correlative effects levels of different chemicals by the DuPage River Salt Creek Workgroup (DRSCW; Miltner et al. 2010) in northeastern Illinois and the Metropolitan Sewer District of Greater Cincinnati (MSDGC; MBI2015) in southwest Ohio. NOAA Screening Quick Reference Tables (SQRT; Buchman 2008) were also used especially for chemicals that are not included in the Illinois WQS.

The NE Illinois IPS (MBI 2020a) thresholds for water column chemical parameters that are applicable to assessing the results in the NBWW study area appear in Table 7. Sediment chemical thresholds are provided in Table 8 and were also evaluated against threshold and probable effect levels (TEL and PEL) established by MacDonald et al. (2000) and elevation levels by Illinois EPA (Short 1998). NE Illinois IPS thresholds derived for water column chemicals, sediment chemistry, and habitat and land use variables also appear in Appendix A. The severity of exceedances of these values offered by the multiple narrative classes (i.e., excellent, good, fair, poor, and very poor) were used to support the assignment of causes of biological impairment provided that there was a logical linkage of an exceedance with a biological impairment. The chemical results are also displayed graphically for selected parameters and in tables of exceedances of the IPS and other relevant effect thresholds for selected parameter groups for both water column and sediment chemistry results. With the exception of D.O. there were no exceedances of the parameters that have Illinois EPA water quality criteria.

Demand and Nutrient Related Parameters

Demand and nutrient parameters consist of those related to the discharges of treated and untreated sewage, organic enrichment from point and nonpoint sources, nutrient parameters and their effects, and physical parameters such as total suspended solids and temperature.

Table 7. *Biological effect thresholds derived from Northeast Illinois streams and rivers for selected water column parameters as part of the NE Illinois IPS model and used to assess chemical sample results from the NBWW study area. The most limiting of the fish or macroinvertebrate assemblages for each parameter are indicated along with thresholds for excellent, good, fair, poor, and very poor biological condition. The goodness of fit score (FIT) and reference site values are also provided.*

Parameter Code	Variable Name	Units	Parameter Group	Limiting Assemblage	FIT Score	Sample N	Thresholds by Narrative Condition Category					Reference Site Values (Median-2X IQR)	Reference Site N
							Excellent	Good	Fair	Poor	Very Poor		
P665	Total Phosphorus	mg/L	Nutrients	Fish	0.04	1464	≤0.106	>0.106	>0.277	>1.002	>1.726	0.088 (0.062-0.115)	35
P94	Conductivity	µS/cm	Ionic	Fish	0.05	1464	≤739	≥739	>1038	>1208	>1378	922 (705-1158)	40
P70300	Total Dissolved Solids	mg/L	Ionic	Fish	0.10	1464	≤453.8	>453.8	>558.0	>651.2	>744.5	614 (512-664)	28
DO_MIN	Minimum DO	mg/L	Demand	Macros	0.10	985	>8.0	≥6.5	>5.47	<4.44	<3.4	8.6 (6.5-9.6)	29
P1092	Zinc, Total	µg/L	Metal_Tox	Fish	0.13	1464	≤7.47	>7.47	>9.78	>11.00	>12.22	2.0 (2.0-7.0)	23
P625	Total Kjeldahl Nitrogen	mg/L	Demand	Macros	0.14	985	≤1.07	>1.07	>1.12	>1.63	>2.14	0.74 (0.30-0.99)	30
P940	Chloride, Total	mg/L	Ionic	Fish	0.17	1464	≤40.00	>40.00	>120.0	>184.9	>249.8	154 (80.3-171.3)	33
P310	BOD (5-Day)	mg/L	Demand	Macros	0.21	985	≤1.30	>1.30	>2.35	>3.45	>4.54	2 (2.0-2.2)	27
P610	Total Ammonia	mg/L	Nutrients	Macros	0.28	985	≤0.084	>0.084	>0.100	>0.190	>0.280	0.1 (0.10-0.10)	34
P630	Nitrate-N	mg/L	Nutrients	Fish	0.29	1464	≤3.767	>3.767	>5.045	>7.344	>9.643	0.39 (0.29-0.97)	32
P929	Sodium, Total	mg/L	Ionic	Fish	0.29	1464	≤16275	>16275	>45000	>79056	>113112	14200 (10375-22500	21
P530	Total Suspended Solids	mg/L	Demand	Fish	0.32	1464	≤17.50	>17.50	>31.60	>35.15	>38.69	9.2 (5.4-20.3)	33
P1027	Cadmium, Total	µg/L	Metal_Tox	Fish	0.93	1464	≤0.937	>0.937	>0.974	>0.983	>0.991	<MDL (0.17)	23
DO_MAX	Maximum DO	mg/L	Demand	Macros	0.94	985	≤10.36	≥10.36	>12.21	>14.24	>16.28	8.74 (8.21-9.45)	29
P1042	Copper, Total	µg/L	Metal_Tox	Fish	1.75	1464	--	≤4.480	>4.480	>4.969	>5.458	2.00 (1.96-4.15)	22
P1051	Lead, Total	µg/L	Metal_Tox	Macros	2.11	985	≤2.851	>2.851	>3.335	>3.884	>4.434	0.24 (0.20-0.57)	23
P82078	Turbidity	NTU	Demand	Macros	2.61	985	--	≤19.3	>19.3	>25.9	>32.5	11.0 (4.5-24.5)	7
P1055	Manganese, Total	µg/L	Metal_Tox	Macros	2.74	985	≤53.71	>53.71	>77.03	>107.1	>137.2	32.0 (24.1-38.2)	23
P549	Volatile Suspended Solids	mg/L	Demand	Fish	2.81	1464	≤5.000	>5.000	>7.769	>9.825	>11.88	6.0 (4.8-7.4)	5
P1067	Nickel, Total	µg/L	Metal_Tox	Macros	3.26	985	--	≤3.470	>3.470	>9.585	>15.70	5 (1.5-21)	14
P945	Sulfate, Total	mg/L	Ionic	Macros	6.49	985	≤58.27	>58.27	>73.10	>83.45	>93.81	74.6 (61.8-81.8)	4
P1002	Arsenic	µg/L	Metal_Tox	Macros	9.19	985	--	≤3.616	>3.455	>5.029	>6.603	Insufficient Data	
P937	Potassium, Total	mg/L	Ionic	Macros	10.13	985	≤3158	>3158	>6300	>7718	>9129	2400 (1574-2817)	21
P1007	Barium, Total	µg/L	Metal_Tox	Fish	4.77	1464	≤74.1	>74.09	>84.88	>101.8	>118.6	56.3 (44.3-64.7)	21
P1034	Chromium, Total	µg/L	Metal_Tox	Fish	10.17	1464	≤1.398	>1.398	>1.540	>2.682	>3.824	1.73 (1.30-2.00)	6
P1082	Strontium	µg/L	Metal_Tox	Fish	2.69	1464	≤169.1	>169.1	>190.8	>280.4	>370.1	150 (135-181)	21
P1105	Aluminum, Total	µg/L	Metal_Tox	Fish	4.54	1464	≤310.0	>310.0	>393.3	>560.2	>727.0	200 (128-449)	21
P916	Calcium, Total	mg/L	Ionic	Fish	Unimodal	1464	≤84425	>84425	>86067	>86313	>86559	54,000 (80-74,250)	21
P299	Mean Dissolved Oxygen	mg/L	Demand	Macros	0.21	985	≥9.42	<9.42	<9.25	<6.11	<3.05	8.6 (7.9-9.0)	40
P615	Nitrite-N	mg/L	Nutrients	Macros	0.41	985	≤0.014	>0.014	>0.040	>0.068	>0.096	0.01 (0.01-0.01)	27
P720	Cyanide, Total	µg/L	Metal_Tox	Macros	5.17	985	≤8	>8	>10	>10	>10	3 (2-10)	6

***Table 8**. Biological effect thresholds derived from Northeast Illinois streams and rivers for selected sediment chemical parameters as part of NE Illinois IPS model and used to assess chemical sample results from the NBWW study area. The most limiting of the fish or macroinvertebrate assemblages for each parameter are indicated along with thresholds for excellent, good, fair, poor, and very poor biological condition. The goodness of fit score (FIT) and reference site values are also provided.*

Parameter Code	Variable Name	Units	Parameter Group	Limiting Assemblage	FIT Score	Sample N	Thresholds by Narrative Condition Category					Reference Site Values Median (IQR)
							Excellent	Good	Fair	Poor	Very Poor	
P1093	Zinc	mg/kg	Metal_Tox	Macros	2.22	985	≤75.00	>75.00	>100.0	>133.9	>167.8	Insufficient Data
P34524	Benzo(g,h,i)perylene	µg/kg	PAH	Macros	2.32	985	--	< 335.0	>335.0	>792.1	>1249	
P34406	Indeno(1,2,3-cd)pyrene	µg/kg	PAH	Macros	2.41	985	--	< 260.5	>260.5	>623.3	>986.2	
P1043	Copper	mg/kg	Metal_Tox	Macros	2.42	985	≤19.00	>19.00	>29.78	>40.45	>51.12	
P34233	Benzo(b)fluoranthene	µg/kg	PAH	Macros	2.51	985	--	<520.8	>520.8	>1437	>2354	
P1068	Nickel	mg/kg	Metal_Tox	Macros	2.67	985	--	<19.50	>19.50	>22.52	>25.53	
P34250	Benzo(a)pyrene	µg/kg	PAH	Macros	2.85	985	--	<230.0	>230.0	>798.3	>1367	
P34472	Pyrene	µg/kg	PAH	Macros	2.85	985	--	< 393.0	>393.0	>1570	>2747	
P1052	Lead	mg/kg	Metal_Tox	Macros	3.01	985	≤15.50	>15.50	>24.80	>33.04	>41.27	
P34529	Benzo[a]anthracene	µg/kg	PAH	Macros	3.48	985	--	< 239.0	>239.0	>699.4	>1160	
P34323	Chrysene	µg/kg	PAH	Macros	3.51	985	--	<266.0	>266.0	>958.3	>1651	
P34379	Fluoranthene	µg/kg	PAH	Macros	3.91	985	--	<774.0	>774.0	>2432	>4091	
P1083	Strontium	mg/kg	Metal_Tox	Macros	4.44	985	--	<81.80	>81.80	>106.8	>131.9	
P34559	Dibenz(a,h)anthracene	µg/kg	PAH	Macros	4.57	985	--	< 101.0	>101.0	>167.3	>233.7	
P34223	Anthracene	µg/kg	PAH	Macros	5.10	985	--	<78.00	>78.00	>119.9	>161.8	
P34464	Phenanthrene	µg/kg	PAH	Macros	5.10	985	--	< 243.5	>243.5	>803.3	>1363	
P1003	Arsenic	mg/kg	Metal_Tox	Macros	6.21	985	--	≤8.65	>8.65	>15.82	>23.67	
P1029	Chromium	mg/kg	Metal_Tox	Macros	6.29	985	≤20.53	>20.53	>23.30	>26.22	>29.15	
P1053	Manganese	mg/kg	Metal_Tox	Macros	7.08	985	≤841.0	>841.0	>845.5	>996.8	>1148	
P1078	Silver	mg/kg	Metal_Tox	Macros	7.11	985	--	<0.483	>0.483	>1.261	>2.039	
P1108	Aluminum	mg/kg	Metal_Tox	Macros	8.26	985	--	<6480	>6480	>8272	>10064	
P1008	Barium	mg/kg	Metal_Tox	Macros	8.88	985	--	≤141.0	>132.0	>150.3	>168.7	
P1028	Cadmium	mg/kg	Metal_Tox	Macros	11.00	985	--	≤0.933	>0.745	>1.354	>1.963	
P1013	Beryllium	mg/kg	Metal_Tox	Macros	ND[a]	985	--	≤0.411	>0.411	>0.496	>0.581	
P1103	Tin	mg/kg	Metal_Tox	Macros	ND	985	--	<8.86	>11.00	>16.73	>24.60	
P34203	Acenaphthylene	µg/kg	PAH	Macros	ND	985	--	<86.38	>86.38	>103.6	>120.9	
P34208	Acenaphthene	µg/kg	PAH	Macros	ND	985	--	<84.25	>84.25	>104.8	>125.3	
P34262	Delta-BHC	µg/kg	PAH	Macros	ND	985	--	<2.098	>2.098	>6.19	>10.28	
P34384	Fluorene	µg/kg	PAH	Macros	ND	985	--	<84.25	>84.25	>104.8	>125.3	
P34445	Naphthalene	µg/kg	PAH	Macros	ND	985	--	< 86.38	>86.38	>103.6	>120.9	

[a] - Not determined (ND) due to a high number of non-detects

Dissolved Oxygen (D.O.)

Exceedances of dissolved oxygen (D.O.) were assessed with continuous data obtained from Datasonde deployments during August. Short-term deployments of Datasonde continuous recorders in mid-August 2018 and 2019 recorded exceedances of parts of the Illinois EPA D.O. criteria (Figure 6). All of the deployments were made after August 1 hence the minimum was evaluated against the 3.5 mg/L criterion and the 6 mg/L 7-day average criterion. Exceedances of the 3.5 mg/L minimum criterion occurred at five (5) sites and were most pronounced in the West Fork of the North Branch at WF21 (RM 10.4) where half of the values were below 3.5 mg/L (Figure 6). Exceedances of the minimum also occurred in the Skokie River at SR1 (RM 21.1) and in the Skokie Lagoons (SR7, RM 3.0), in the Middle Fork of the North Branch at MF10 (RM 16.7), and in the West Fork of the North Branch downstream of the Clavey Rd. WRF (WF23, RM 4.9; Figure 6). Median values were used to assess exceedances of the 6.0 mg/L average criterion which occurred at all except for three (3) sites. Of these the median value of 3.5 mg/L at WF21 was the largest exceedance of the average criterion. Only three sites MF10, SR7, and WF23 had diel fluctuations at or more than 6.5 mg/L. This further evaluated as symptom of excessive nutrient enrichment in the modified SNAP assessment.

Skokie River

Ammonia-Nitrogen (N)

Most ammonia-N concentrations in 2018 were either just above or below the NE Illinois IPS good threshold of 0.15 mg/L at all sites with no values that exceeded the fair threshold (Figure 7). Values ranged from excellent to fair with fair values located at SR2, SR3 and SR7 in the Skokie Lagoons, and downstream of the Skokie Lagoons (SR18; Figure 7). The 2019 ammonia concentration levels were observed at higher levels throughout the Skokie River (Figure 7). Concentration levels were generally fair except for SR6, downstream of the Clavey Rd. WRF, exceeding the fair threshold of <0.19 mg/L (Figure 7). Increased precipitation during 2019 triggered higher ammonia concentrations throughout the Skokie River indicates that the sources are likely non-point sources. Ammonia concentration levels did not exceed Illinois WQS criteria during either survey.

Total Phosphorus

Median concentrations of total phosphorus (P) in 2018 were consistently low and in the excellent range except for the lowermost site on the Skokie River (SR18). The median concentration exceeded the excellent threshold, but was within the good range (Figure 8). 0.106 mg/L threshold at all sites (Figure 8). The Clavey Rd. WRF had a minimal, yet measurable influence on TP concentrations in the Skokie River. The role of TP (and other indicators) as a contributor to overall nutrient enrichment effects was evaluated as part of the modified SNAP procedure (Ohio EPA 2015b) discussed later. Median concentrations of TP in 2019 were consistently excellent in the Skokie River below the 0.106 mg/L threshold at all sites (Figure 8).

Total Nitrate-N (NO_3-N)

Median nitrate levels in 2018 were consistently low and ranged from good to excellent at all

sites in the Skokie River (Figure 9). All sites were well within the excellent threshold of 3.767 mg/L except SR18 downstream of the Skokie Lagoons which did not exceed the narrative good rating (Figure 9). In 2019 the Skokie River nitrate concentrations were generally excellent except the site downstream of the Skokie Lagoons which exceeded 5.050 mg/L and rated fair. Median concentrations of nitrate-N increased downstream of the Clavey Rd. WRF at the MF19 location below the outfall downstream from the Skokie Lagoons dam. The role of total nitrate-N and other indicators as a contributor to overall nutrient enrichment effects was considered as part of the modified SNAP procedure (Ohio EPA, 2015b).

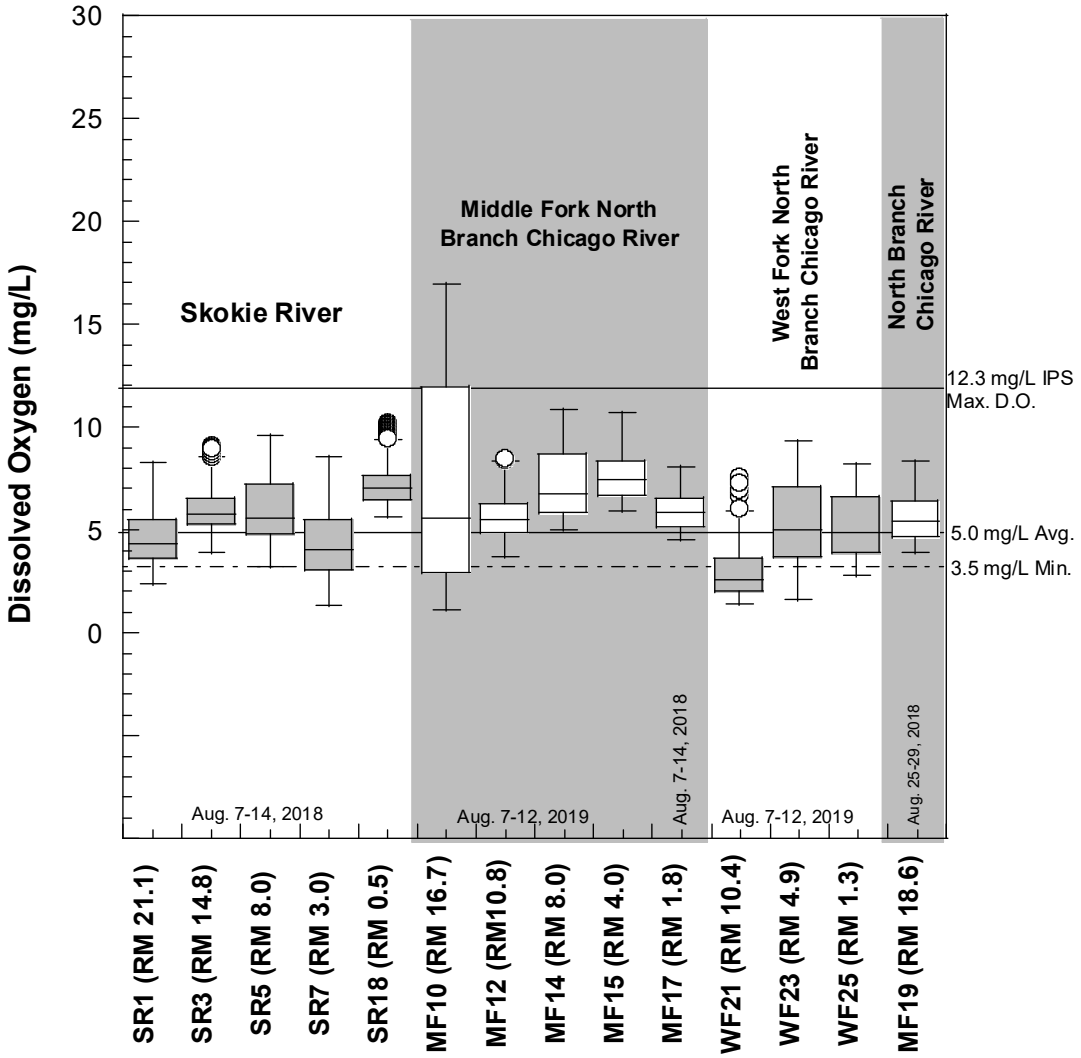

***Figure 6**. Dissolved oxygen (D.O.) concentrations (mg/L) measured continuously by Datasondes deployed for 5-7 day periods during August 7-14, 2018 and August 7-12, 2019 at 14 locations. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The Illinois EPA August-February minimum (3.5 mg/L) and the 7-day average D.O. criteria are shown by solid and dashed lines.*

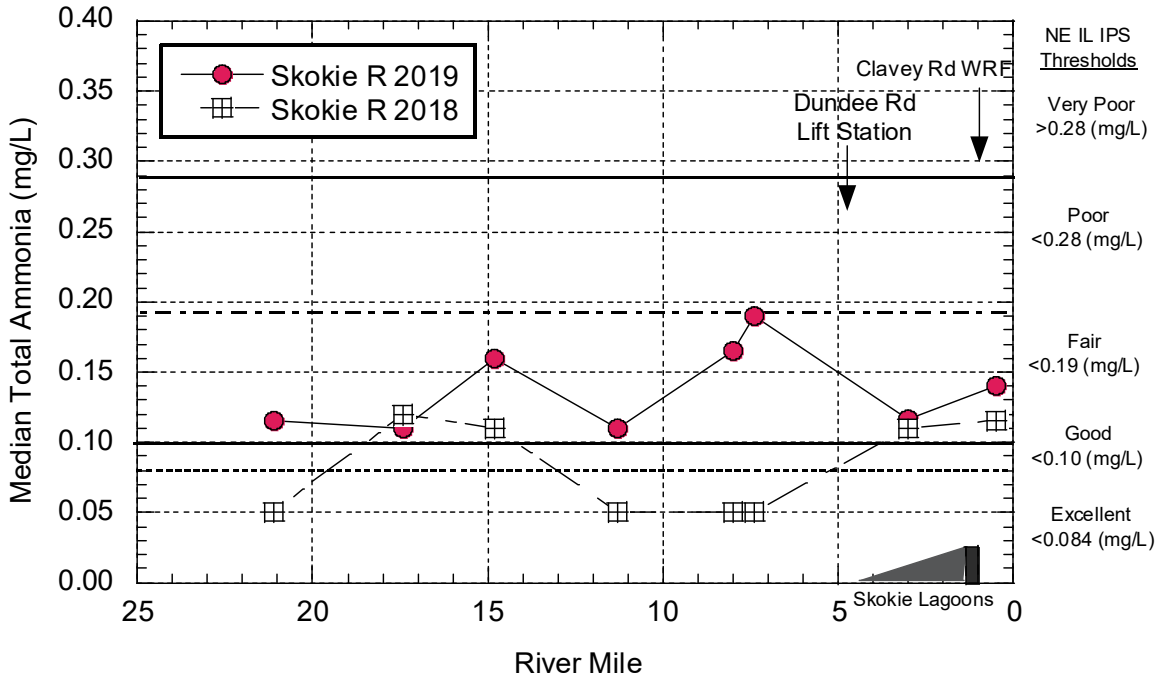

***Figure 7**. Concentrations of median ammonia-N in the Skokie River during May-October 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

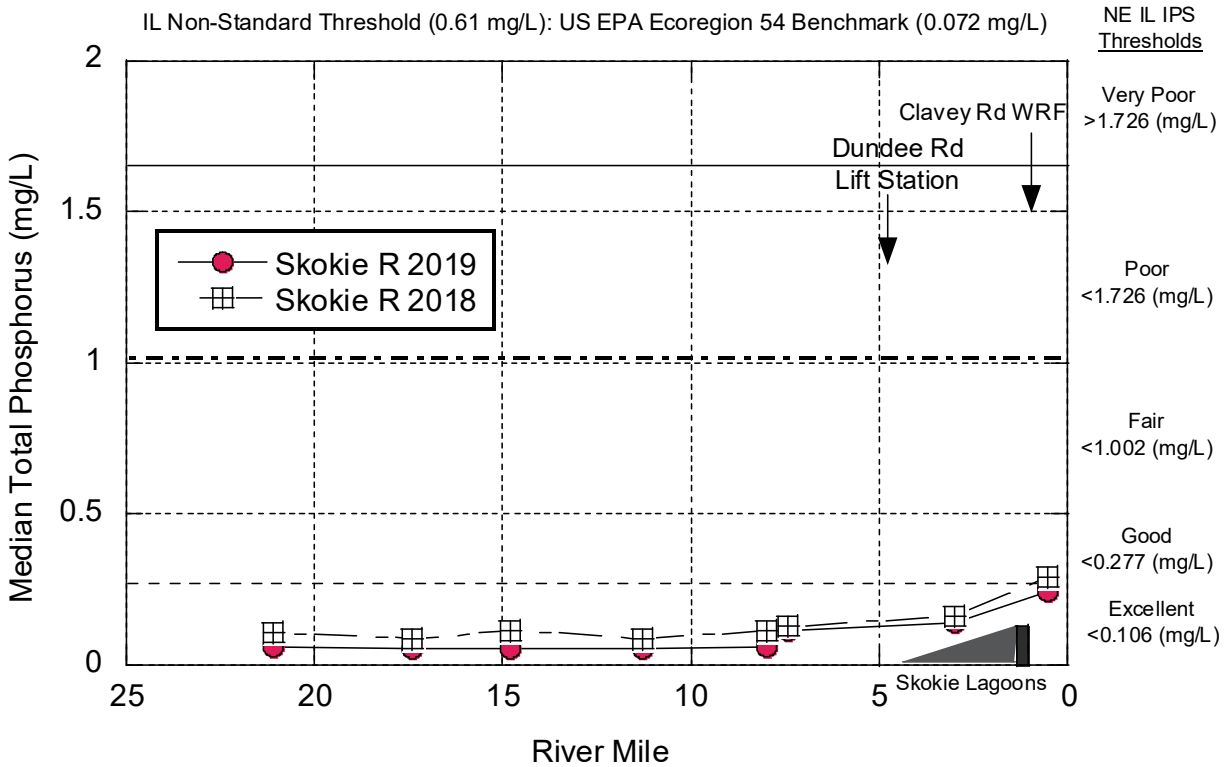

***Figure 8**. Concentrations of median total phosphorus in the Skokie River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

Total Kjeldahl Nitrogen (TKN)

Median total organic nitrogen measured by Total Kjeldahl Nitrogen (TKN), an indicator of the living or recently dead fraction of sestonic algae, is an informative indicator of organic and nutrient enrichment. While TKN is not a direct effect parameter, it is indicative of the effects of organic enrichment by nitrogenous biomass the latter primarily resulting from increased algal biomass. The median TKN concentrations in 2018 were generally excellent, but ranged from excellent to poor (Figure 10). The Skokie River at SR4 (RM 11.3) was the only poor value observed in the 2018 sampling year. The 2018 results roughly follow ammonia concentrations, while the 2019 TKN concentrations roughly follow nitrate concentrations. The 2019 median TKN concentrations ranged from excellent to poor (Figure 10). TKN concentrations increased downstream from the Clavey Rd. WRF to poor values in the lower section of the Skokie River in the Skokie Lagoons and at SR18 (RM 0.5) in 2019 (Figure 10).

Total Suspended Solids (TSS)

Total suspended solids can indicate inorganic suspended sediment and/or organic matter in the form of sestonic algae. The median TSS values were generally poor to very poor in the Skokie River (Figure 11). The Skokie Lagoons impoundment apparently promoted to settling of suspended solids resulting in reduced TSS at SR18 (Figure 11). Median TSS values in 2019 were about one-third of the levels in 2018 with values generally ranging from excellent to good (Figure 11). Because TSS and Turbidity can also reflect the effects of nutrient enrichment they are included in the modified SNAP procedure.

West Fork North Branch Chicago River

Ammonia-Nitrogen (N)

Ammonia concentration levels in 2018 ranged from fair to excellent (Figure 12). The longitudinal plot shows that the Deerfield WRF increased ammonia concentrations in the West Fork, but not above the 0.10 mg/L IPS threshold. Two values on the lower West Fork rated fair are downstream of the Village of Glenview 1800 E Lake Ave lift station. The 2019 ammonia concentration levels were higher than 2018 values, rating from poor to good. The Deerfield WRF had a greater influence on ammonia concentrations. Downstream of the WWTP exceeded the 0.19 mg/L IPS threshold and rated poor (Figure 12). The highest median value occurred immediately downstream of the Village of Glenview lift station. There were no ammonia values in the West Fork of the North Branch Chicago River that exceeded the Illinois WQS criteria.

Total Phosphorus

Median concentrations of phosphorus (P) in 2018 were consistently low rating good to excellent (Figure 13). The highest value exceeded the 0.106 mg/L IPS threshold at WF24 yet remained in the lower good range. Median concentrations of P in 2019 were consistently low at all sites except downstream of the Deerfield WRF (Figure 13). The highest value was observed at WF23 which exceeded the 1.020 mg/L IPS threshold for a rating of fair. A sharp decline in P concentration levels occurred from WF23 to WF24 with values decreasing to good and excellent values.

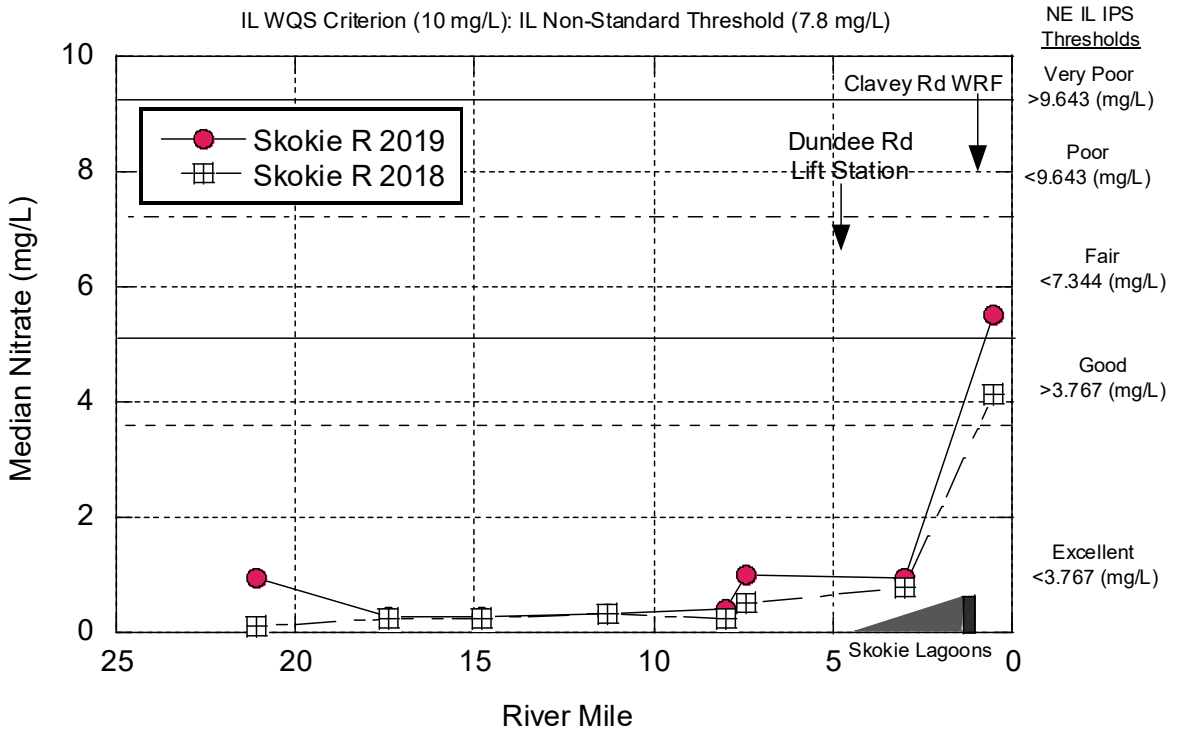

***Figure 9**. Concentrations of median total Nitrate-N in the Skokie River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

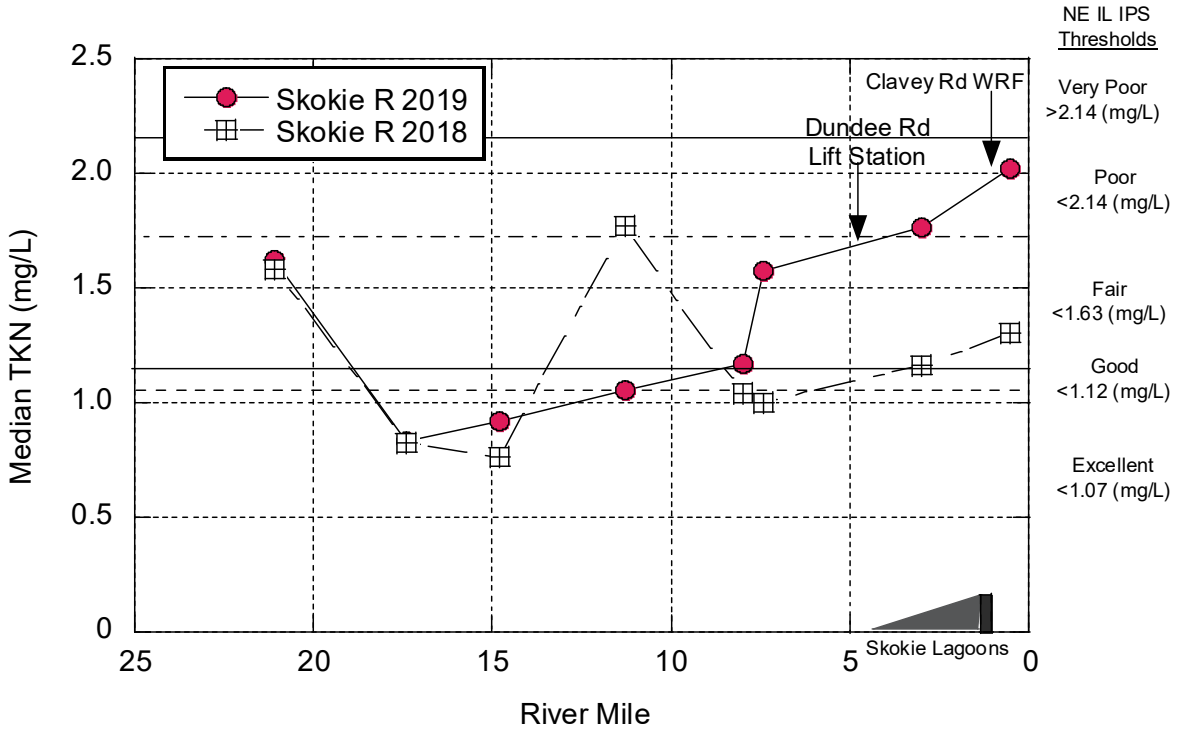

***Figure 10**. Concentrations of median total Kjeldahl nitrogen (TKN) in the Skokie River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

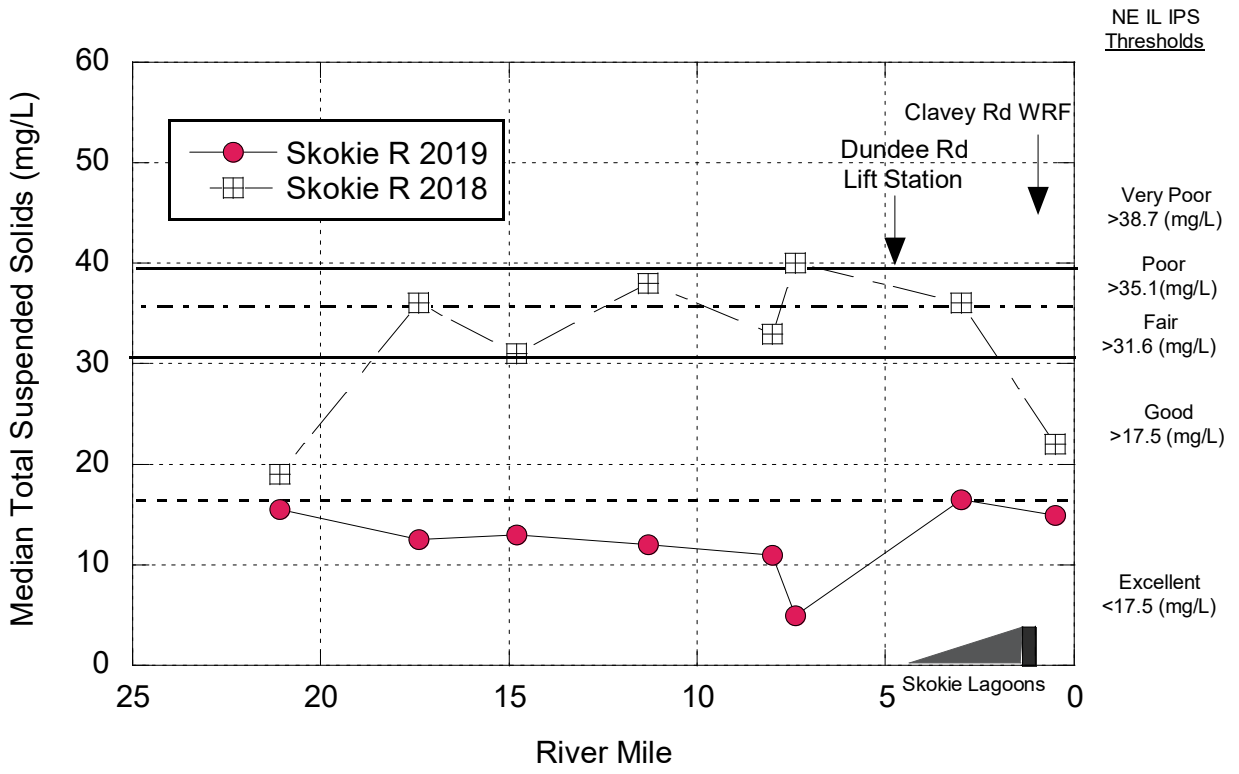

***Figure 11**. Concentrations of median total suspended solids in the Skokie River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

Only the 2019 WF23 value exceeded the 0.61 mg/L Illinois non-standard threshold, but all values exceeded the US EPA ecoregion 54 benchmark of 0.072 mg/L (Figure 13). The Deerfield WRF has a noticeable influence on P concentrations in the West Fork with significantly greater inputs observed in 2019.

Total Nitrate-N (NO_3-N)

Median nitrate values in 2018 were excellent at West Fork sites and well within the Illinois WQS criterion of 10 mg/L (Figure 14). The highest value observed at WF22 downstream of the Deerfield WRF did not exceed the 3.767 mg/L excellent IPS threshold. Median values in 2019 ranged from fair to excellent and below the Illinois nonstandard of 7.8 mg/L. The highest value which exceeded the 5.020 mg/L good IPS threshold downstream from the Deerfield WRF. Concentrations of nitrate then fell sharply at WF24 to the excellent range.

Total Kjeldahl Nitrogen (TKN)

Median TKN concentrations ranged from fair to excellent in 2018 (Figure 15). The sites downstream of the Deerfield WRF and the Village of Glenview lift station possessed the highest observed TKN concentrations and were the lone two fair values. Median TKN concentrations in 2019 ranged from good to poor and varied longitudinally. The highest concentration was observed downstream of the Village of Glenview lift station and most closely followed the longitudinal ammonia concentration pattern.

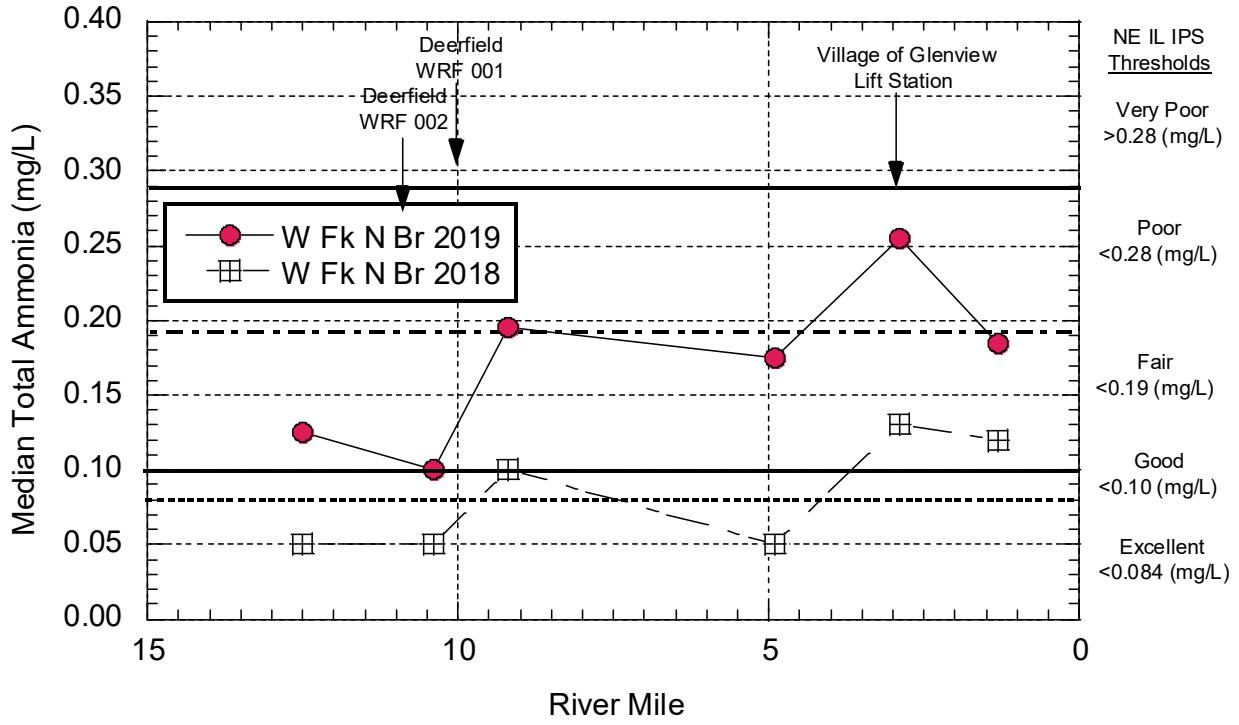

Figure 12. *Concentrations of median total ammonia-N in the West Fork North Branch Chicago River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

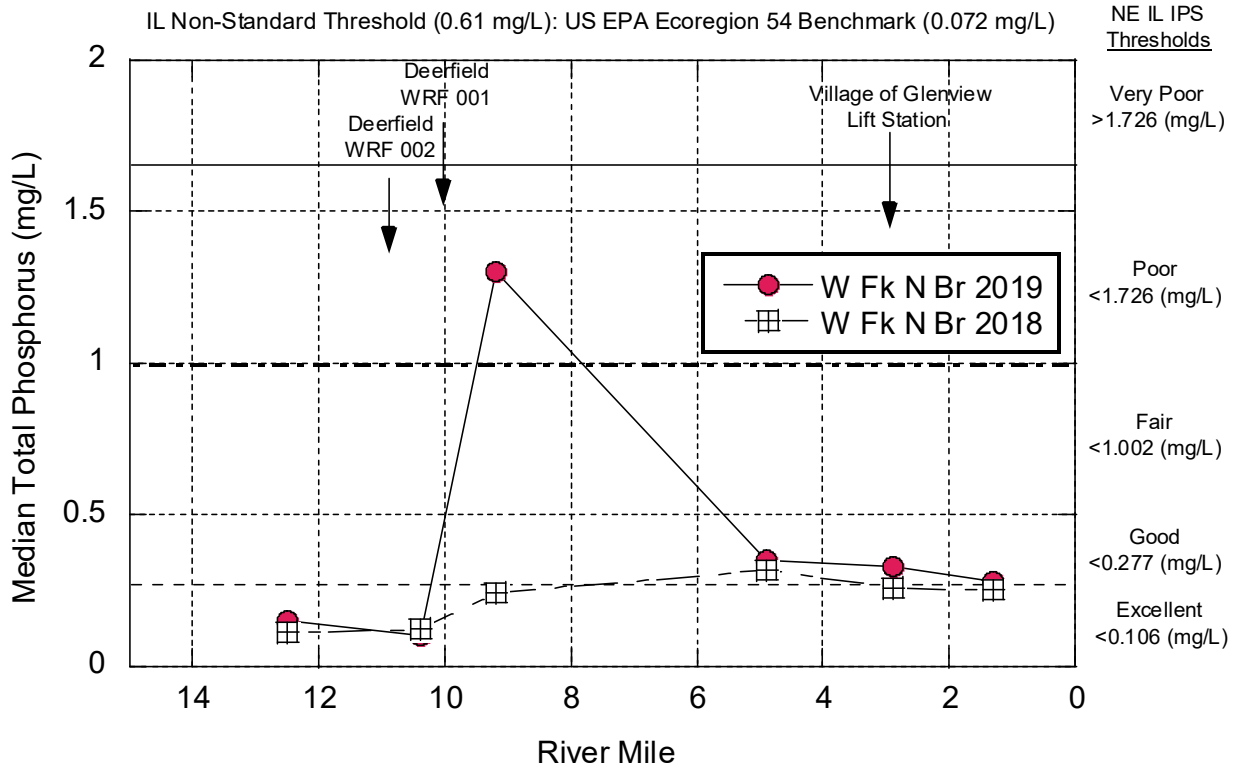

Figure 13*. Concentrations of median total phosphorus in the West Fork North Branch Chicago River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

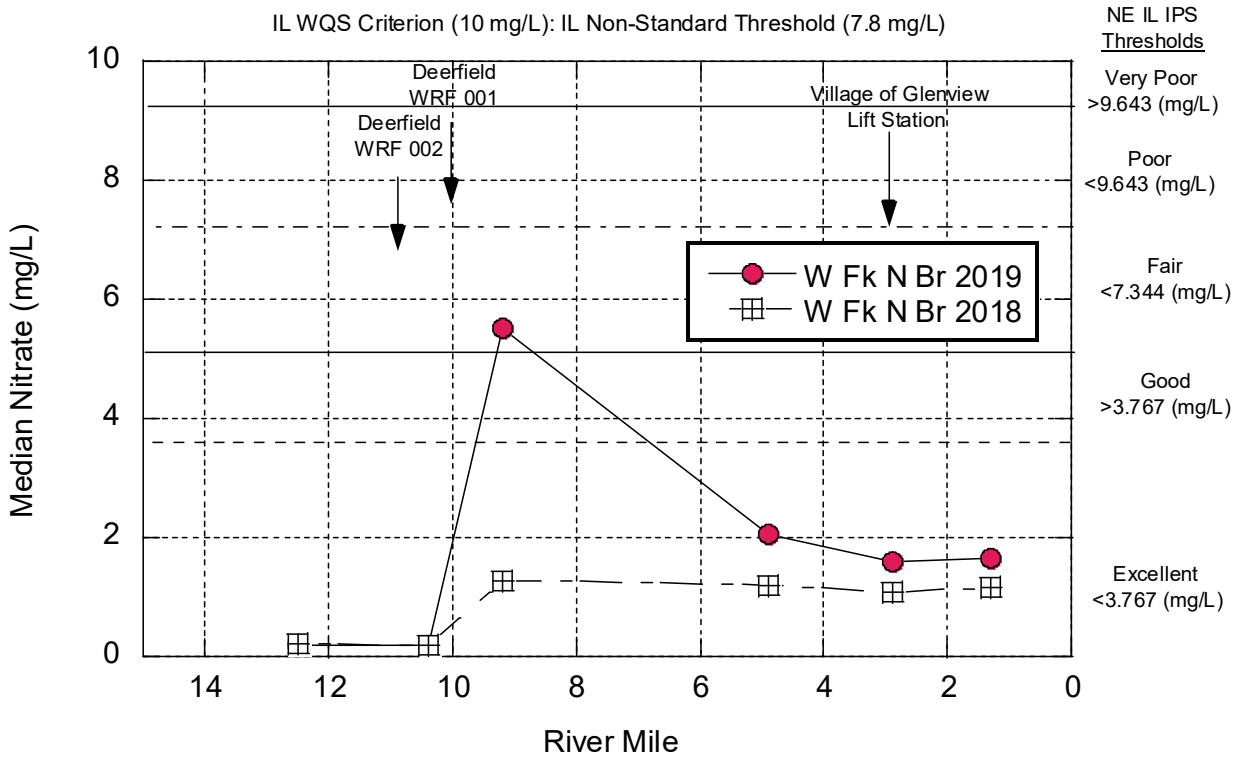

***Figure 12**. Concentrations of median nitrate-N in the West Fork North Branch Chicago River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

Total Suspended Solids

The median TSS values were generally good in 2018 in the West Fork (Figure 16). The highest values were observed downstream of the Village of Glenview lift station and downstream of the Deerfield WRF. Concentrations of TSS in 2019 range from poor to excellent (Figure 16). The highest observed value was recorded at the most upstream site (WF20), declining to excellent upstream of the Deerfield WRF. TSS inputs from the WWTP increased concentrations to just above the 17.5 mg/L IPS threshold for excellent levels

Middle Fork North Branch Chicago River & North Branch Chicago River

Ammonia-Nitrogen (N)

Median concentrations of ammonia in 2018 did not exceed 0.05 mg/L and were excellent at all sites (Figure 17). The North Branch Chicago River site (MF19) had median ammonia concentrations that exceeded 0.10 mg/L and within the range of the fair IPS threshold. Median concentrations in 2019 ranged from excellent to fair in the Middle Fork Chicago River. The longitudinal plot indicates point source influence from the Deerfield WRF excess flow outfall 004 input in 2019. The Skokie River impacted ammonia concentration levels in the lower Middle Fork in 2019, inputting discernable amounts which decreased the rating of MF18 to fair and MF17 to good. This impacted ammonia concentrations in the North Branch, causing elevated levels compared to the upper Middle Fork.

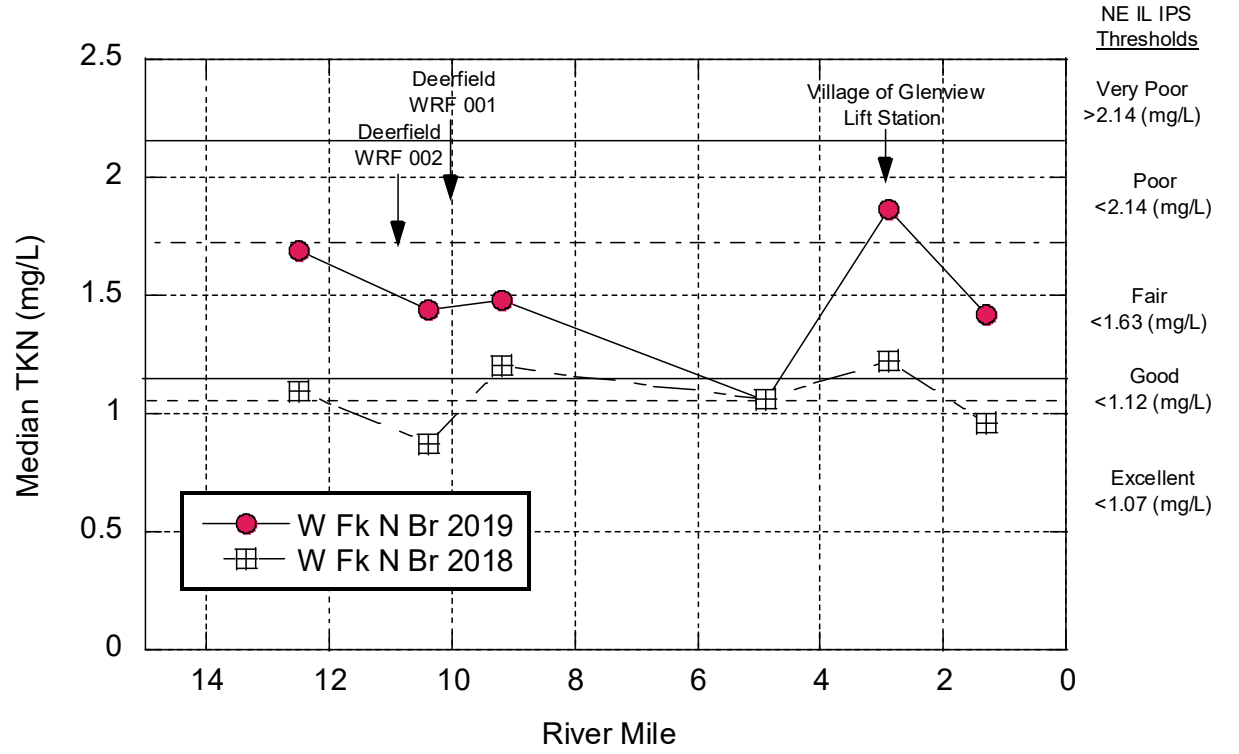

***Figure 13**. Concentrations of median total Kjeldahl nitrogen (TKN) in the West Fork North Branch Chicago River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

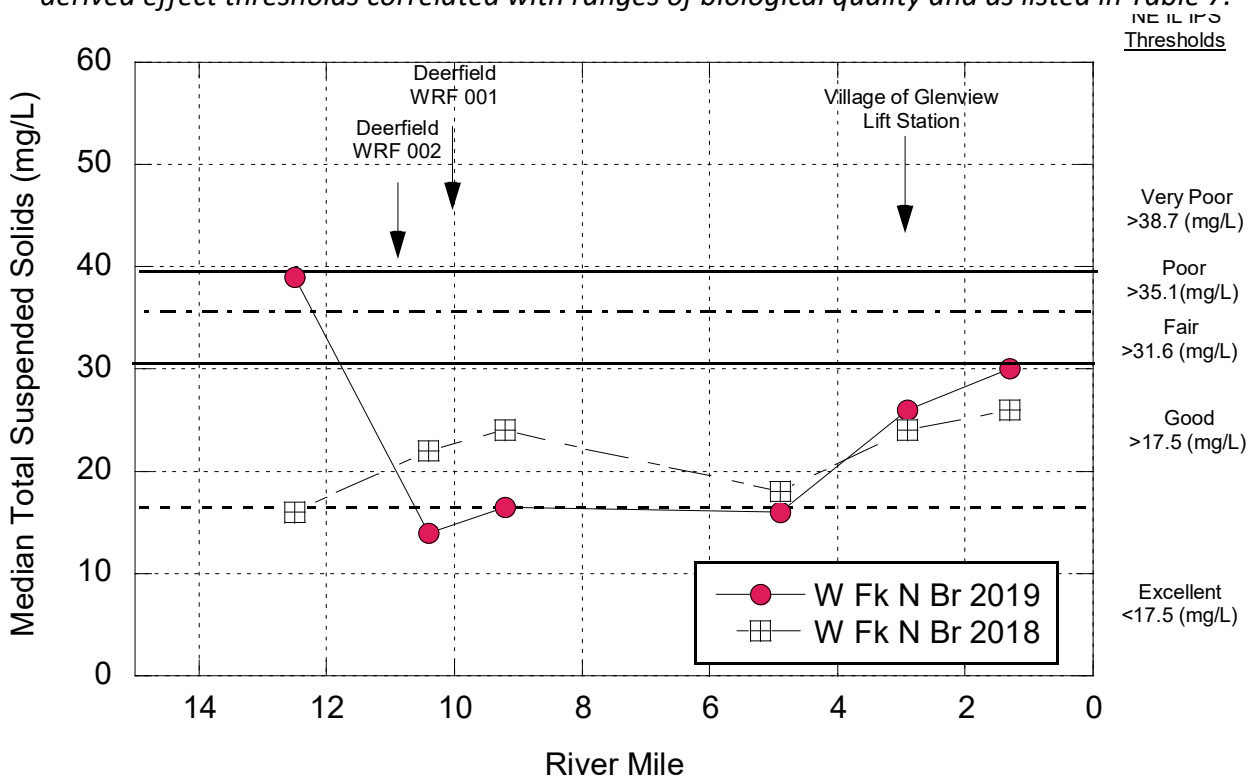

***Figure 14**. Concentrations of median total suspended solids in the West Fork North Branch Chicago River during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

The North Branch site exceeded the 0.10 mg/L fair IPS threshold. None of the exceedances were excessive, but were the only detections in the Middle Fork and North Branch.

Total Phosphorus

Median phosphorus concentrations in the Middle Fork Chicago River were excellent at all sites in 2018 (Figure 18). Highest values are observed downstream of the confluence with the Skokie River. Upstream from the Skokie River confluence values were consistently below 0.20 mg/L. The North Branch Chicago River concentration of total phosphorus remained within the excellent threshold. Median 2019 phosphorus concentrations ranged from good to excellent in the Middle Fork Chicago River (Figure 18). The lone value to exceed 0.106 mg/L is downstream of the confluence with the Skokie River. The North Branch Chicago River site phosphorus concentration levels remained excellent in 2019. No value exceeded the Illinois non-standard threshold of 0.61 mg/L, but all values exceeded the U.S. EPA Ecoregion 54 benchmark of 0.072 mg/L.

Total Nitrate-N (NO_3-N)

Nitrate concentration levels in the Middle Fork North Branch Chicago River are generally excellent on 2018 with the exception of downstream of the confluence with the Skokie River. Nitrate concentrations increased markedly and exceed the 3.767 mg/L IPS good threshold. The Middle Fork site MF 17 had the highest nitrate concentrations at the high end of the good range. The North Branch Chicago River site possessed excellent nitrate concentrations in 2018 (Figure 19). The Middle Fork North Branch Chicago River generally recorded excellent levels. Concentrations ranged from excellent to fair with the fair values downstream of the confluence with the Skokie River. The fair values caused by elevated nitrate levels in the Skokie River influenced the North Branch site. While the concentration of nitrates at MF19 are within the good range, they are considerably higher due to the Skokie River. No values exceeded the Illinois WQS criterion or the Illinois non-standard threshold.

Total Kjeldahl Nitrogen (TKN)

Median TKN concentrations in 2018 ranged from excellent to fair (Figure 20). Upstream of the confluence with the Skokie River median TKN concentrations were good to excellent. Downstream of the confluence TKN levels rose above the 1.12 mg/L good IPS threshold to the upper fair range at the lower two sites. The North Branch site appears unaffected by the influence by the Skokie River as TKN median concentration did not exceed the excellent threshold. Median TKN concentrations ranged widely in 2019 (Figure 20). Excellent, good, fair and poor median values were observed, increasing longitudinally to poor value at MF13 (RM 8.6) before declining to below the excellent threshold at MF15 (RM 4.0; Figure 20). The median TKN value in the North Branch exceeded the 1.12 mg/L threshold for good values to the low fair range. TKN median values roughly track nitrate concentrations in the Middle Fork North Branch Chicago River.

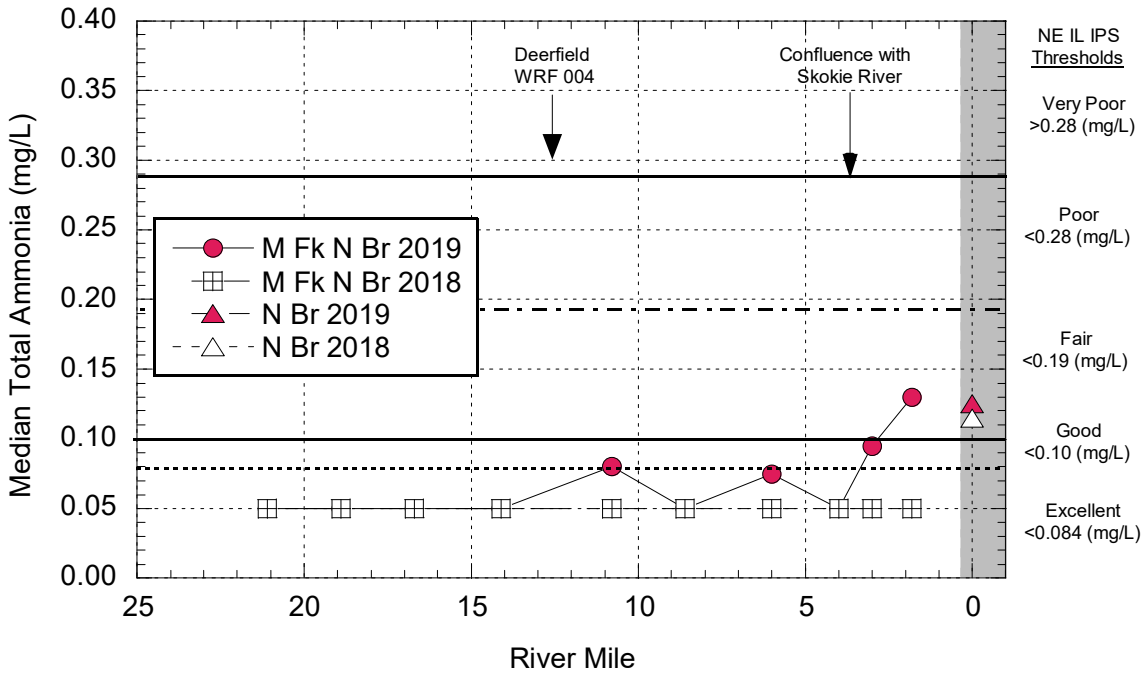

Figure 17. *Concentrations of median ammonia-N in the Middle Fork North Branch Chicago River and the North Branch Chicago River mainstem during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

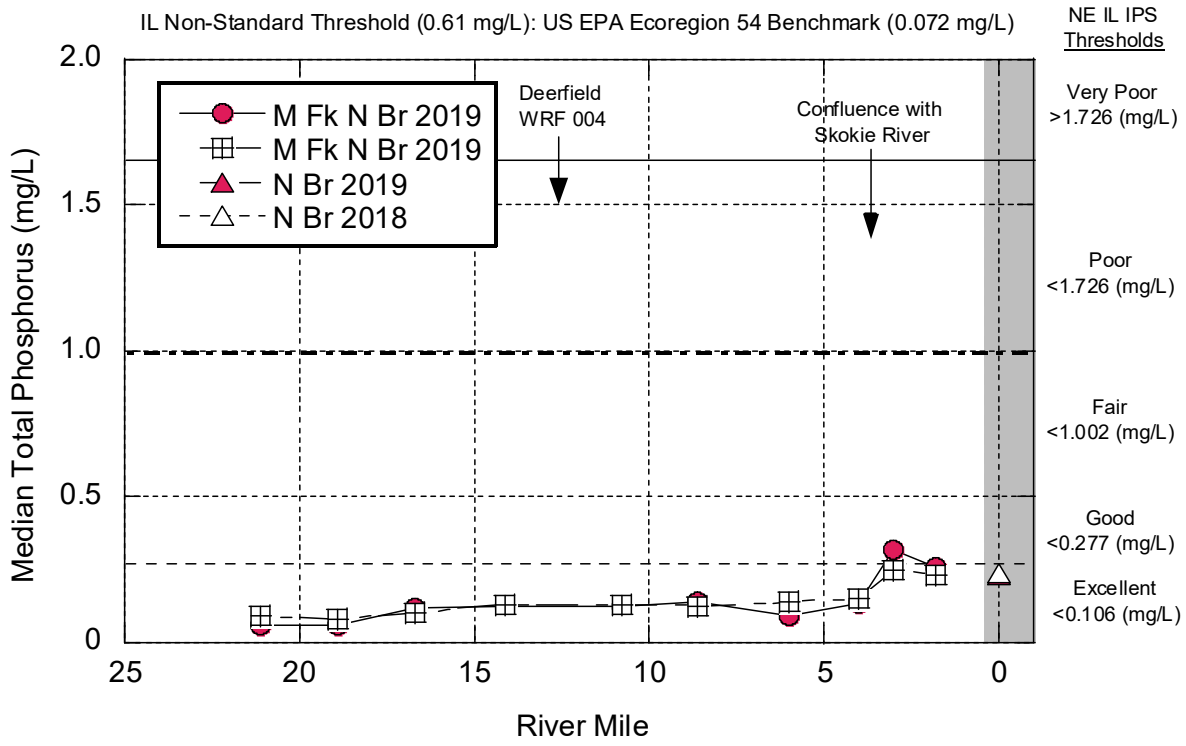

Figure 18. *Concentrations of median total phosphorus in the Middle Fork North Branch Chicago River and the North Branch Chicago River mainstem during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

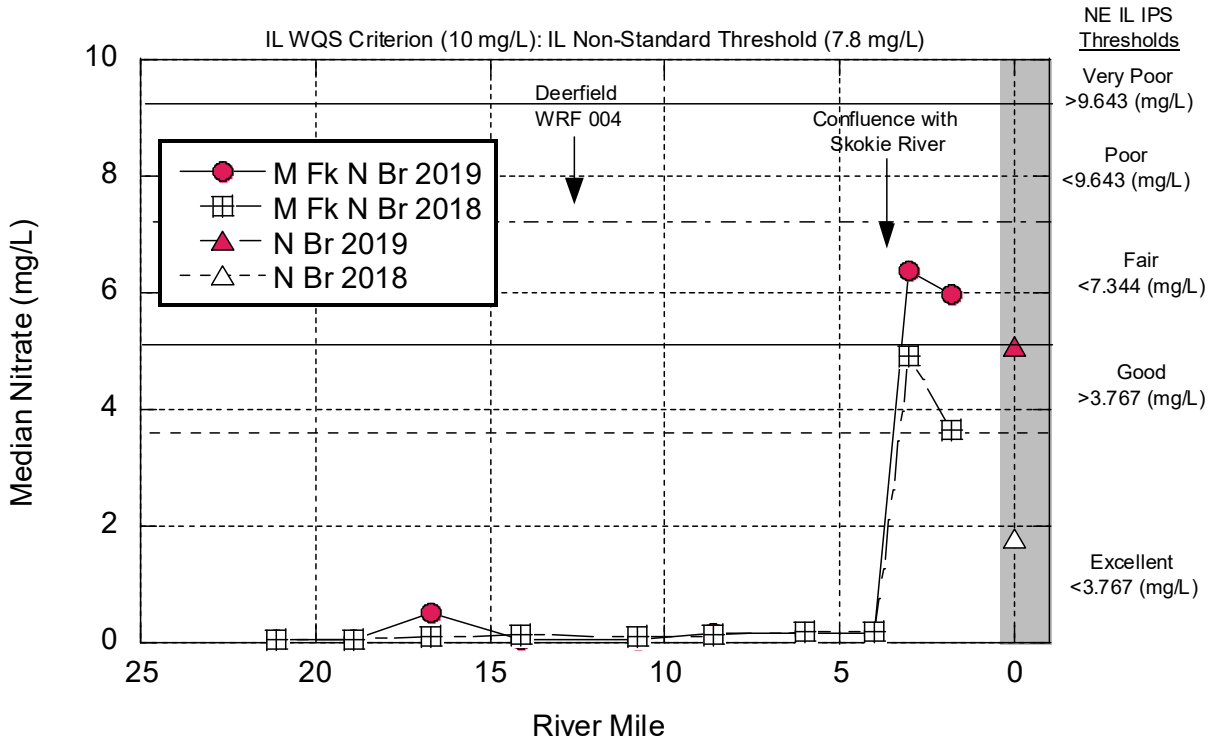

Figure 15. *Concentrations of median nitrate-N in the Middle Fork North Branch Chicago River and the North Branch Chicago River mainstem during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

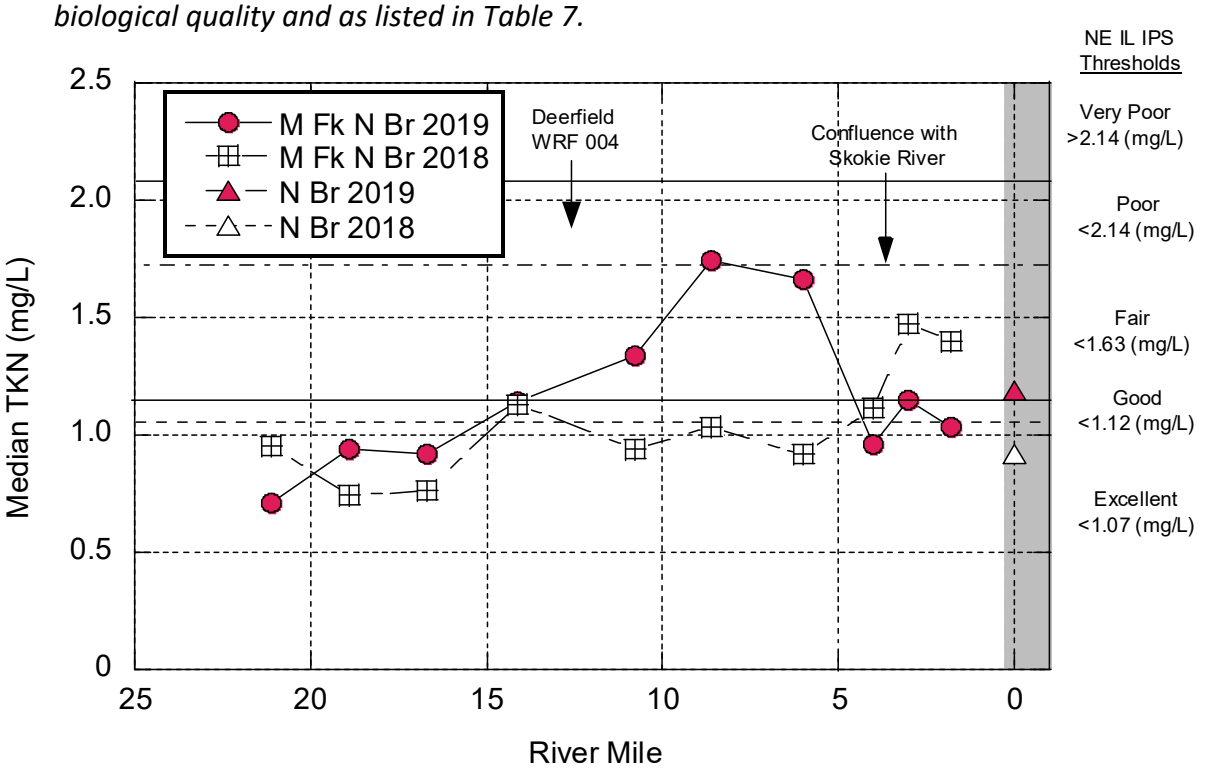

Figure 16*. Concentrations of median total Kjeldahl nitrogen in the Middle Fork North Branch Chicago River and the North Branch Chicago River mainstem during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

Total Suspended Solids (TSS)

The median TSS values were generally good in 2018 in the upper Middle Fork with fair values observed in the downstream sites that were 300% higher (Figure 21). The North Branch median TSS was recorded in the lower good range, just above the 17.5 mg/L excellent threshold. Median TSS values ranged from excellent to good and were longitudinally more variable in 2019 (Figure 21). The North Branch Chicago River median value was within the upper limits of the excellent threshold. During each of the survey years the site below the confluence with the Skokie River observed an increase in TSS in the Middle Fork. The 2018 values at the five (5) lower mainstem sites were in the fair range and higher than the 2019 results.

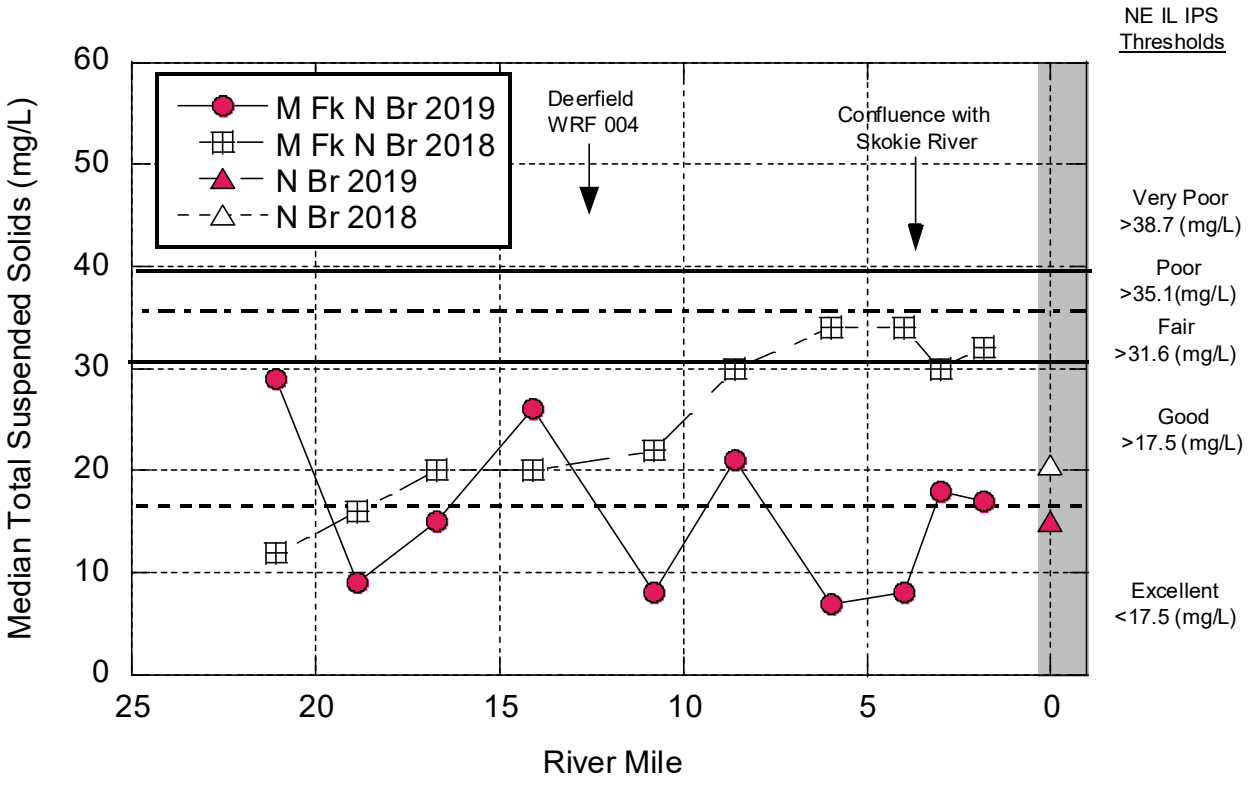

Figure 17. *Concentrations of median total suspended solids in the Middle Fork North Branch Chicago River and the North Branch Chicago River mainstem during May-October in 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

Nutrient Effects Assessment

The impact of nutrients on aquatic life has been well documented (e.g., Allan 2004), but serious attempts to derive nutrient criteria in terms of their form and application are only recently emerging. Because of the widely varying efforts to develop nutrient criteria by the States, conflicting U.S. EPA oversight, and the potential cost of additional nutrient controls, the impact of nutrients on aquatic life has been controversial (Evans-White et al. 2014). Unlike toxicants, the influence of nutrients on aquatic life is indirect and primarily via their influence on algal

photosynthesis and respiration, the resulting increased magnitude of diel D.O. swings, by the biochemical oxygen demand exerted by algal decomposition, and cascading effects therefrom. Nutrients can also affect food sources for macroinvertebrates and fish and the response of aquatic life to elevated nutrients is co-influenced by habitat (e.g., substrate composition), stream flow (e.g., scouring and dilution), temperature, and exposure of the water column to sunlight. Illinois is the leading state in terms of nitrogen (16.8%) and phosphorus (12.9%) loadings exported via the Illinois and Upper Mississippi Rivers towards the Gulf of Mexico where an anoxic zone has developed (U.S. EPA 2008). In Illinois, as in neighboring Midwestern states that drain to the Mississippi River, efforts are underway to develop and modernize nutrient water quality criteria (NSAC 2018). However, nutrient export is not the only concern – local and river reach scale impacts are also important and the focus of this evaluation is on such effects in the NBWW streams and rivers given the localized emphasis of the biological and water quality assessment.

The combined effects of nutrient enrichment were assessed to supplement the preceding descriptions of concentrations of each of the key nutrient related parameters. A multi-parameter approach modified from the Ohio SNAP method (Ohio EPA 2015a), and as described in the Methods section, was employed in a manner similar to its first use in the DRWW Years 1 and 2 study areas of the upper Des Plaines River watershed in 2017 (MBI 2018) and 2018 (MBI 2020b). The findings of the Illinois Nutrient Science Advisory Committee (NSAC 2018) were also used. A relatively new addition to the assessment of nutrient impacts is a Nutrient Ranking Index (NRI) that is part of the NE Illinois IPS outputs (MBI 2020a; Appendix E). The NRI consists of a summed ranking of each of the individual nutrient or nutrient-related stressor parameters with each weighted based on a tightness of fit coefficient (FIT). At this point it is a standalone indicator that can be compared to the modified SNAP outcome, but its application in watershed assessments is new and potentially subject to change as more is learned via future assessments.

The results are detailed in a matrix that shows the fish and macroinvertebrate IBIs, the QHEI score, total P, nitrate-N, TKN, the maximum and minimum D.O. (based on Datasondes), the width of the diel D.O. swing, benthic chlorophyll a (as biomass), and an overall rating of the degree of nutrient enrichment based on the frequency and magnitude of exceedances of thresholds for the aforementioned indicators and parameters (Table 9). The overall degree of nutrient enrichment effects are represented by five narrative ratings of Enrichment Status that results from the degree to which each of the available nutrient parameters and SNAP indicators exceeded their respective thresholds, the minimum and maximum D.O., the width of the diel D.O. swing, benthic chlorophyll a, and sestonic chlorophyll a biomass. The Highly Enriched and Enriched narratives are assigned where the indicators are exceeded in terms of the number and magnitude of exceedances and that are associated with a biological impairment. The Possibly Nutrients narrative is where there are either an insufficient number and/or magnitude of exceedances to warrant an Enriched status (see Rationale for Enrichment Status column in Table 9) thus it serves as an indication where a threat for excessive nutrient enrichment effects exist. The two Not Nutrients narratives rule out nutrient effects as a cause of impairment and are also assigned to sites with full attainment of the General Use biocriteria regardless of

***Table 9**. Results of applying an interim modified Stream Nutrient Assessment Procedure (SNAP) to 25 sites in the 2018-19 NBWW study area. Descriptions of how the results reflect the degree of nutrient enrichment and resulting assignment of enrichment status are provided at the bottom of the matrix along with the source(s) of the thresholds for each parameter. Biological sampling sites that lacked sufficient continuous D.O., chemical, and chlorophyll a data are included for comparison purposes and assessed with the available data.*

Site ID	River Mile	Drain-age Area ($mi.^2$)	Year	QHEI	AQL Attainment Status	TP (mg/L)	Nitrate (mg/L)	Max D.O. (mg/L)	Min D.O. (mg/L)	D.O. Swing (mg/L)	D.O. Swing Narrative	Benthic Chloro-phyll a (mg/m^3)	Benthic Chloro-phyll a Narrative	VSS (mg/L)	TKN (mg/L)	Sestonic Chloro-phyll a (mg/L)	Enrichment Status	Rationale for Enrichment Status
SR1	21.1	2.7	2018	33.5	NON-Poor	0.107	0.12	8.31	2.38	5.05	High	23.3	Very Low	2.5	1.58	4.2	Enriched	Min. D.O.; D.O. swing; TKN
SR2	17.4	7.8	2019	33.5	NON-Poor	0.086	0.26							9.0	0.82	3.1	Not Nutrients	VSS
SR3	14.8	11.5	2019	40.5	NON-Poor	0.110	0.25	9.09	3.91	5.07	High	31.7	Very Low	2.5	0.76	3.0	Possible Nutrients	Min. D.O.; D.O. swing
SR4	11.3	15.0	2019	47.0	NON-Poor	0.086	0.33							7.0	1.77	2.2	Possible Nutrients	TKN
SR5	8.0	20.6	2019	45.5	NON-Poor	0.110	0.26	9.62	3.25	5.77	High	44.3	Low	6.0	1.04	3.4	Possible Nutrients	Min. D.O.; D.O. swing
SR6	7.4	21.5	2019	36.3	NON-Poor	0.127	0.53							8.0	1.00	3.8	Not Nutrients	VSS
SR7	3.0	23.7	2019	32.5	(NON-Poor)	0.160	0.78	8.54	1.33	6.47	High	43.3	Low	5.0	1.16	25.0	Enriched	Min. D.O.; D.O. swing;TKN; Ses.Chloro.
SR18	0.5	30.9	2019	38.5	NON-Poor	0.290	4.13	10.24	5.64	3.99	Low	47.4	Low	6.5	1.31	14.0	Enriched	TP; TKN; Ses.Chloro.
MF8	21.1	5.8	2019	34.0	NON-Poor	0.060	0.05							1.5	0.71	5.6	Not Nutrients	Ses.Chloro.
MF9	18.9	8.9	2018	28.0	NON-Poor	0.060	0.05							1.5	0.94	3.7	Not Nutrients	none
MF10	16.7	11.9	2018	43.0	NON-Poor	0.115	0.10	16.93	1.12	15.25	Wide	20.6	Very Low	2.8	0.92	4.5	Highly Enriched	Max. D.O.,Min. D.O.; D.O. swing
MF11	14.1	16.1	2019	45.5	NON-Poor	0.120	0.12							1.8	1.14	4.3	Not Nutrients	none
MF12	10.8	19.2	2019	41.5	NON-Poor	0.125	0.11	8.5	3.72	3.64	Low	31.1	Very Low	1.5	1.34	1.1	Possible Nutrients	Min. D.O.; TKN
MF13	8.6	21.0	2019	54.5	NON-Poor	0.140	0.14							1.5	1.74	1.2	Possible Nutrients	TKN
MF14	6.0	22.5	2019	67.0	NON-Poor	0.090	0.17	10.86	5.02	5.24	High	27.9	Very Low	1.5	1.66	1.4	Possible Nutrients	D.O. swing; TKN
MF15	4.0	24.3	2019	59.0	NON-Poor	0.135	0.17	10.74	5.94	4.20	Moderate	31.3	Very Low	1.5	0.96	2.8	Possible Nutrients	D.O. swing
MF16	3.0	56.1	2019	44.0	NON-Poor	0.249	4.92							7.0	1.47	8.5	Possible Nutrients	TKN; Ses.Chloro.
MF17	1.8	57.3	2018	45.0	NON-Poor	0.233	3.63	8.1	4.52	2.58	Low	28.6	Very Low	6.0	1.40	3.2	Possible Nutrients	Min. D.O.; TKN
WF20	12.5	3.9	2018	30.5	NON-Poor	0.150	0.17							5.5	1.69	5.0	Possible Nutrients	TKN; Ses.Chloro.
WF21	10.4	7.0	2018	40.5	NON-Poor	0.100	0.19	7.62	1.44	5.77	High	41.3	Low	5.0	1.44	4.4	Enriched	Min. D.O.; D.O. swing; TKN
WF22	9.2	9.4	2018	46.0	NON-Poor	1.300	5.50							4.5	1.48	8.8	Possible Nutrients	TP; TKN; Ses.Chloro.
WF23	4.9	17.9	2018	38.5	NON-Poor	0.350	2.05	9.36	1.62	6.67	Wide	58.0	Low	3.8	1.06	4.4	Highly Enriched	Min. D.O.; D.O. swing
WF24	2.9	24.5	2018	53.5	NON-Poor	0.330	1.60							4.0	1.87	0.9	Possible Nutrients	TKN
WF25	1.3	28.0	2018	45.5	NON-Poor	0.280	1.64	8.21	2.77	5.16	High	30.3	Very Low	3.5	1.42	1.1	Enriched	Min. D.O.; D.O. swing; TKN
MF19	18.6	93.4	2018	49.0	NON-Poor	0.235	1.77	8.34	3.89	2.93	Low	7.5	Very Low	5.0	0.92	2.8	Not Nutrients	Min. D.O.
Condition Category Thresholds	Excellent		>84.5	FULL	≤0.106	≤3.77	<10.36	>6.9	<2.0	Normal	<35	Very Low	<5.0	<1.07	<2.5	Not Nutrients	All Excellent
	Good		>75.9	FULL	> 0.106-0.277	>3.77-5.05	>10.36-12.2	6-6.9	2.0-4.0	Low	35-79	Low	5.0-7.77	1.07-1.12	>2.5-5.1	Not Nutrients	Good, 1 exceed Fair
	Fair		<75.9	PARTIAL	>0.277-1.02	>5.05-7.34	>12.2-14.2	4.0-5.9	4.0-5.0	Moderate	79-150	Moderate	7.77-9.83	1.12-1.63	>5.1-13.8	Possible Nutrients	2-3 exceed Fair
	Poor		<50.1	NON-Fair	>1.02-1.726	>7.34-9.64	>14.2-16.3	2.0-3.9	5.0-6.5	High	150-320	High	9.83-11.88	1.63-2.14	>13.8-28.9	Enriched	2-3 exceed Poor
	Very Poor		<25	NON-Poor	≥1.726	≥9.64	≥16.3	<2.0	>6.5	Wide	>320	Very High	>11.88	>2.14	>28.9	Highly Enriched	2-3 exceed V. Poor
Source	IPS		IPS	IPS	IPS	IPS	IPS	IPS	MBI/SNAP	MBI/SNAP	MBI/SNAP/NSAC	MBI/SNAP	IPS	IPS	MBI;NSAC	MBI/SNAP	

IPS - NE Illinois Integrated Prioritization System (IPS; MBI 2020a); SNAP - Stream Nutrient Assessment Procedure (SNAP: Ohio EPA 2015); NSAC - Illinois Nutrient Science Advisory Committee (NSAC 2018)

nutrient parameter exceedances. The evaluations based on incomplete data should be regarded as preliminary. Fourteen (14) of the 25 sites had the full array of SNAP indicators due to limitations with the number of Datasondes that could be deployed. The overall results at all 25 sites using whatever data was available indicated enriched or highly enriched conditions at seven (7) locations (Table 9) each of which had the full suite of SNAP parameters. In each case there was a wide diel D.O. swing, a high maximum D.O., and a low minimum D.O. TKN values were elevated at five (5) sites and sestonic chlorophyll a was elevated at two sites. All sites had very low benthic chlorophyll a values. Possible enrichment was indicated for 12 locations of which half had the full suite of SNAP indicators with a mix of wide diel D.O. swings, low minimum D.O., elevated TKN, and elevated sestonic chlorophyll a listed as the rationale for the assigned enrichment status. Six (6) sites had no serious evidence of nutrient enrichment, but only one of these sites had the full array of SNAP parameters. Habitat was generally poor throughout the study area and at all of the enriched sites.

There were no obvious patterns between the three major branches as all had enriched sites with the highly enriched sites on the Middle Fork (MF10) and the West Fork (WF23). In some cases it was difficult to determine the definitive cause of the low minimum D.O. values, but these could have been the result of excessive organic enrichment in addition to nutrients. The *E. coli* results (see Table 2) suggest excessive organic enrichment throughout much of the Skokie River in particular. Levels of primary nutrients were comparatively low at most sites with only one nitrate-N exceedances of the excellent threshold with a value of 4.13 mg/L (Good) at SR18. Total phosphorus was elevated into the Fair range at four (4) locations and the Poor range at a single location (WF22).

Temperature

Temperature is a controlling factor for aquatic life, hence it is important to document the thermal regime and note any apparent alterations. This was done continuously during the short-term deployment of Datasondes in August 2018 and 2019. Based on continuous data collected during the Datasonde deployments in mid-late August 2018 in the Skokie River, lower Middle Fork and North Branch mainstem and mid-August 2019 in the West Fork and upper Middle Fork, there were no temperature values that exceeded the Illinois temperature standards and were not of concern in being harmful to aquatic life. Typically the potential for adverse thermal effects are evaluated based on the warmest period of the year and against temperature criteria that are intended to protect aquatic life. The Illinois EPA summer maximum criterion of 32.2°C (90°F) is at the extreme upper maximum for the most sensitive riverine fish species and is shown to be met at all times by the continuous data (Figure 21). The data collected also met the more modernized Ohio temperature criteria that are river specific with a maximum and average criteria of 31.7°C (89.0°F) and 29.4°C (85.0°F). The maximum of 29.2°C at the uppermost site in the Middle Fork North Branch, MF10, was the highest value measured in 2019 and was below the Ohio maximum criterion. The maximum temperature value measured in 2018 was 29.2°C at the uppermost site on the Skokie River, which was also below the Ohio maximum criterion. Otherwise, there is no reason to believe that temperatures are a widely limiting factor to the biota.

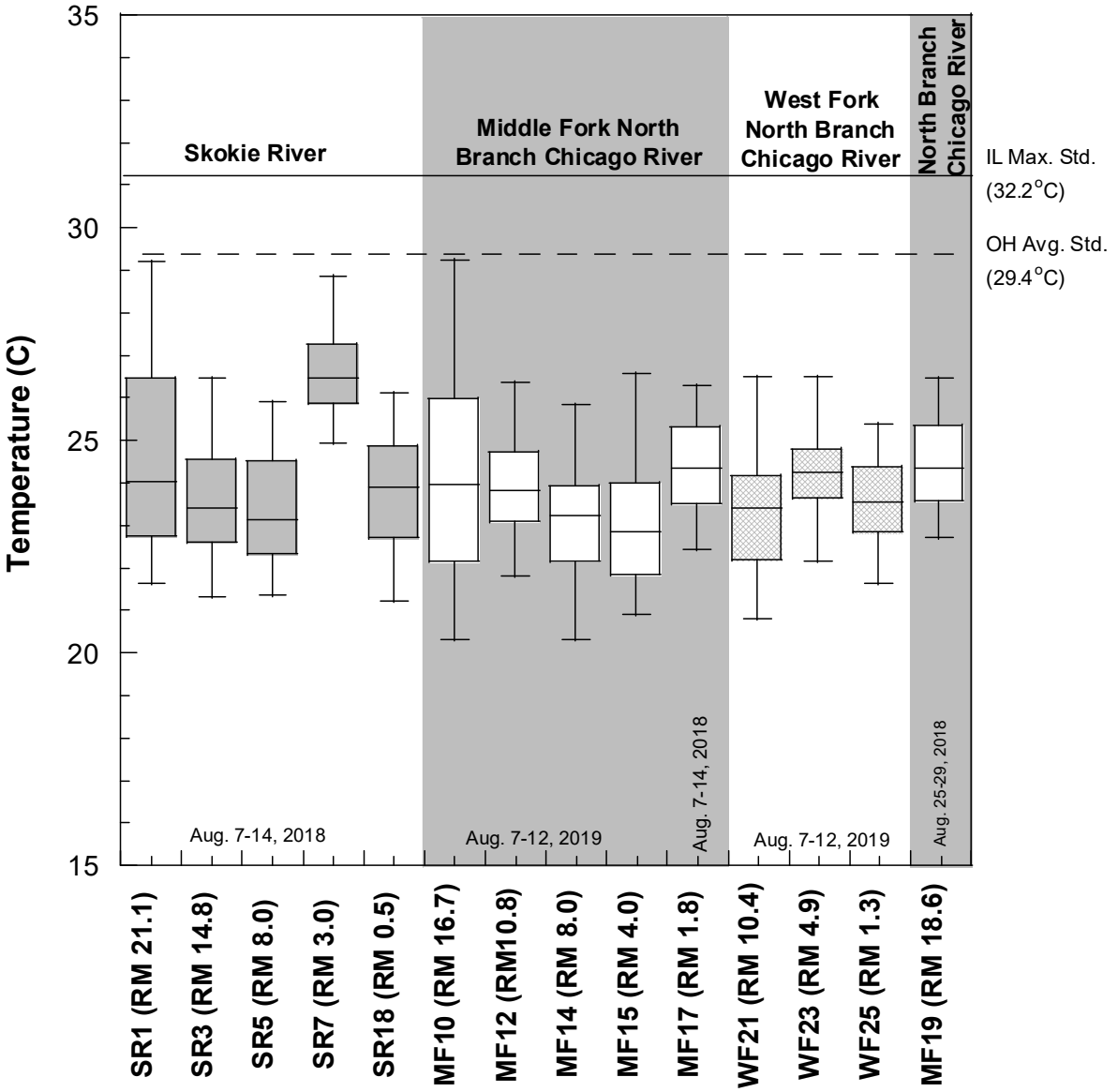

Figure 18*. Temperature (°C) measured continuously by Datasondes deployed for 5-7 day periods during mid-August at 14 locations in the 2018-19 study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The Illinois EPA maximum (32.2°C) and the Ohio EPA mainstem rivers average (29.4°C) criteria are shown by solid and dashed lines.*

Ionic Strength Parameters

Ionic strength parameters are generally in the form of dissolved solutes that can be delivered to rivers and streams in runoff events and point source effluents and some are associated with urban runoff specifically. These include parameters measured in the water column and commonly include conductivity, total dissolved solids, and ions such as chlorides and sulfate.

Typically, our analyses have been geared to “urban parameters” which includes certain common heavy metals such a lead, zinc, and copper, and while these were analyzed only one time in August 2018 and 2019 by NBWW the results are presented herein.

Chlorides

In temperate climates such as northern Illinois, chlorides are an emerging problem because they accumulate in soils and shallow groundwater and have been documented to reach concentrations that can threaten and impair aquatic life. Of particular concern in urban areas with high road density is the concentration of chlorides from winter road salt applications and point source loadings from water treatment blowdown. Kelly et al. (2012) identified a steadily increasing trend in chloride levels in the Illinois River at Peoria where the median increased from 20 mg/L in 1947 to nearly 100 mg/L in 2004 with high values in the 1940s of <40 mg/L rising to >300 mg/L by 2003. Chlorides do not exhibit a simple runoff and export mode of effect, but rather accumulate in near surface groundwater (Kelly 2008), soils, and land surfaces adjacent to streams. Seasonal studies have shown that elevated summer concentrations are correlated with higher and acute concentrations during late winter and spring periods (Kaushal et al. 2005). Research in New England (Kaushal et al. 2005) and Minnesota (Novotny et al. 2008) show that chlorides can accumulate in watersheds and that there is a strong association between high winter and elevated summer concentrations. Novotny et al. (2008) identified that 78% of the road salt applied in a Minnesota watershed accumulated in a given year and contributed to an increase in summer chloride concentrations.

Skokie River

Median total chloride concentrations (mg/L) in 2018 ranged from poor in the upper section to good at the most downstream site (Figure 23). The 2019 median chloride concentration levels were generally higher than in 2018, and ranged from very poor in the upper section to good at the most downstream site. There is a longitudinal pattern of decline in median chloride concentrations in both 2018 and 2019, indicating the principal source(s) of chlorides are in the upper Skokie River.

West Fork North Branch Chicago River

Median concentration levels of chloride in 2018 ranged from good to fair, increasing from upstream to downstream (Figure 24). Downstream sites contained median values in the low fair range and upstream values were observed in the high, good range. The Deerfield WRF increases chloride concentrations slightly, but not significantly enough to exceed the 120 mg/L IPS threshold. Median chloride concentrations in 2019 were higher than the previous year, ranging from fair to very poor, but followed a similar longitudinal pattern. Lower concentrations were observed in the upper section of the river and increasing to the poor range in the lower section with no clear sources being apparent.

Middle Fork North Branch and North Branch Mainstem

Median total chloride concentration levels ranged from very poor to fair in 2018 (Figure 25).

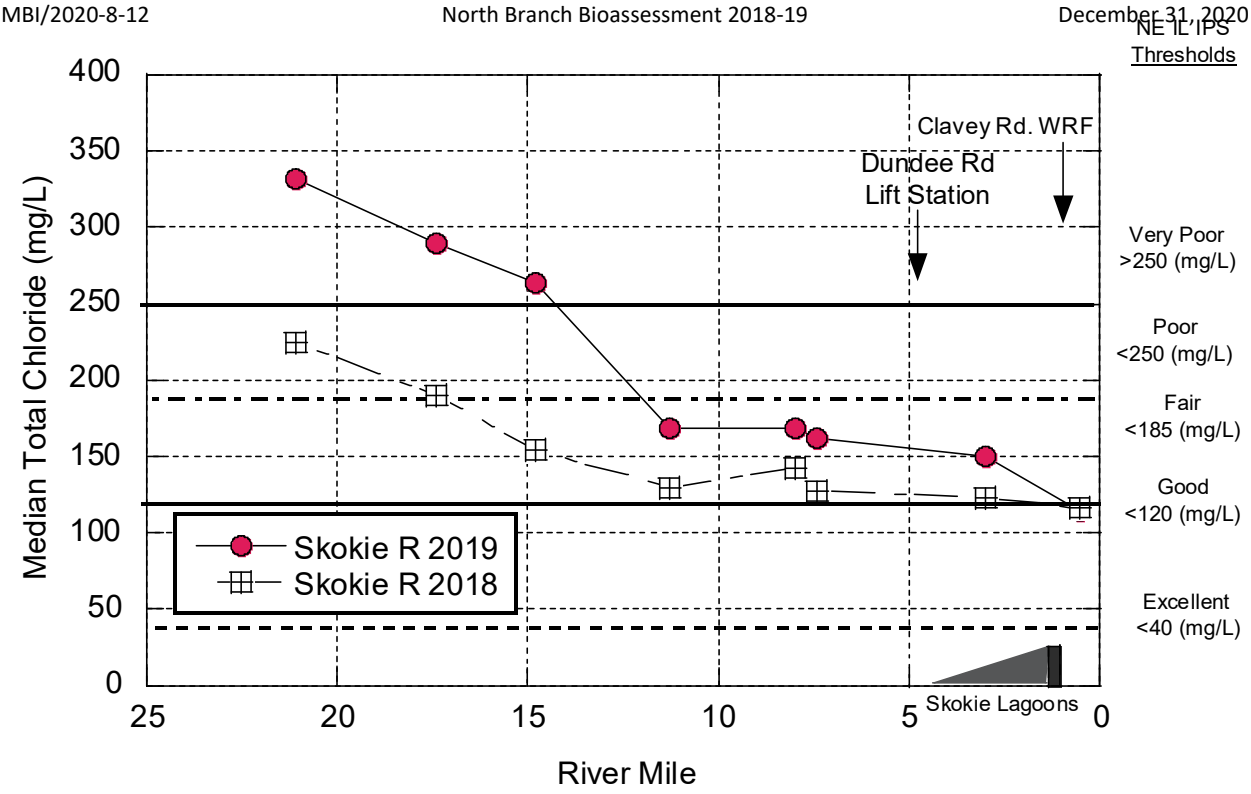

***Figure 19**. Concentrations (mg/L) of median chloride in the Skokie River during May-October 2018-2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

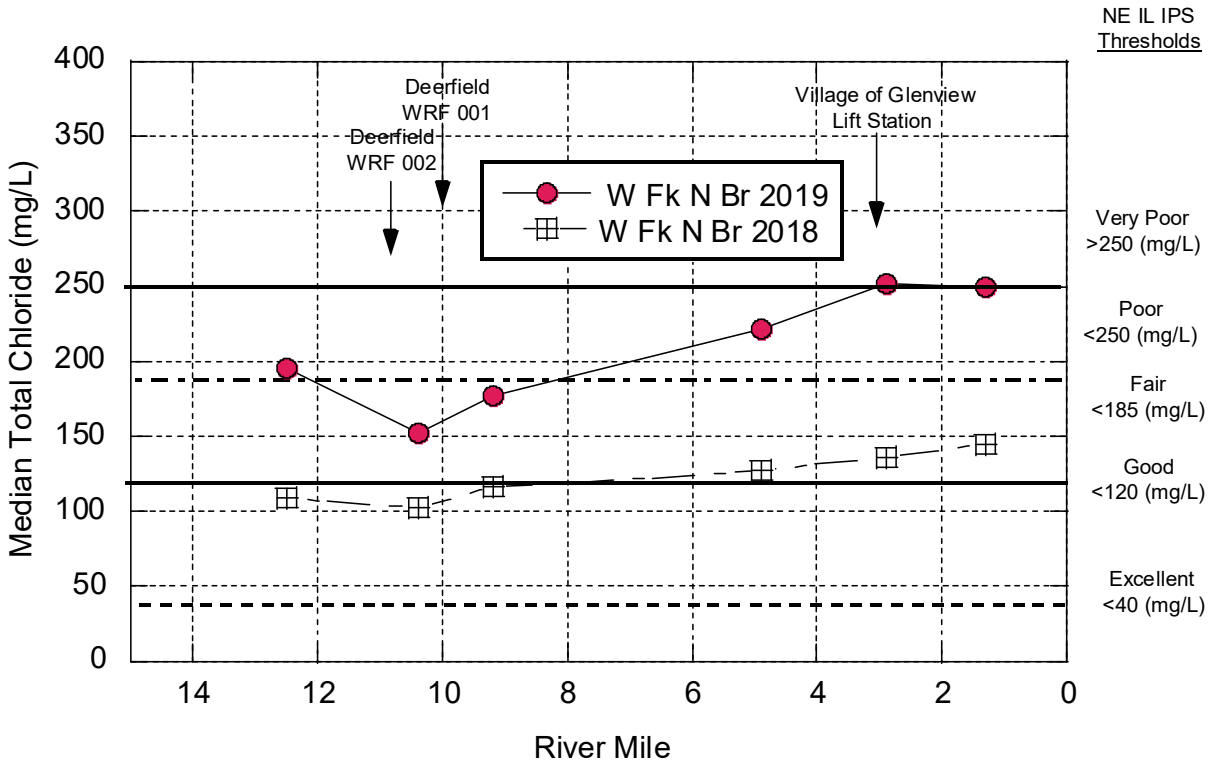

***Figure 20**. Concentrations (mg/L) of median chloride in the West Fork during May-October 2018-2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

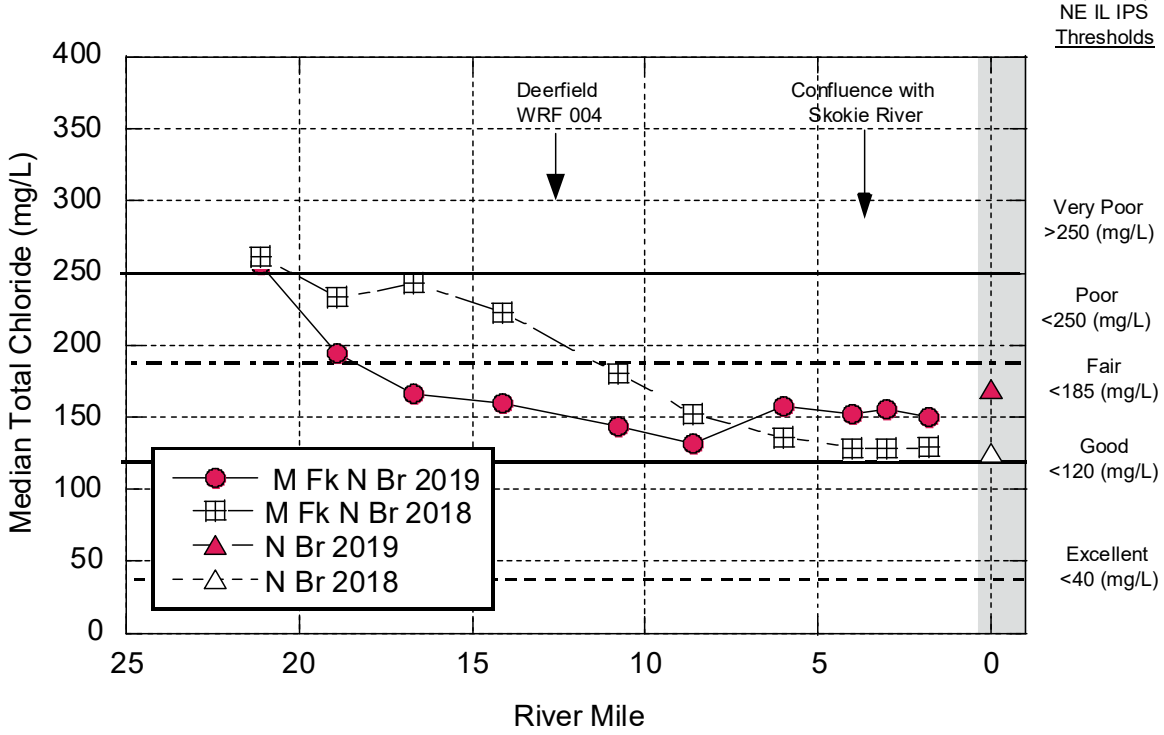

Figure 21. *Concentrations (mg/L) of median chloride in the Middle Fork of the North Branch River during May-October 2018-2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

The longitudinal pattern generally shows decreasing concentrations of chlorides in a downstream direction. The median chloride concentrations in 2019 have the same threshold range and generally follow the same longitudinal pattern of decreasing levels downstream. The North Branch Chicago River site in both 2018 and 2019 exceeded the 120 mg/L threshold and rated fair. The Deerfield excess overflow discharge 004 and the confluence with the Skokie River do not appear to have an appreciable influence on chloride concentrations in the lower Middle Fork or the North Branch Chicago River mainstem. Chloride source(s) appear to be located in the upper section of the Middle Fork.

Conductivity

Dissolved materials are also measured by specific conductance or conductivity which is depicted in Figure 26 for the short-term continuous data. Values were the highest at the upstream site (SR1) in the Skokie River where the median exceeded the very poor IPS threshold. Values declined steadily downstream with most readings within the IPS good range at SR7. Median values were similar at SR 18, but with greater variability in individual readings. All median values were within the good range in the Middle Fork and at the single North Branch site, but were elevated into the fair range at the two downstream most West Fork sites with individual values exceeding poor and very poor values. These results suggest a major sources of dissolved materials in the headwaters of the Skokie River.

Median specific conductance in the 2018 grab samples was generally lower than values observed in 2019 in the Skokie River (Figure 27) and West Fork (Figure 28), but similar in the Middle Fork (Figure 29).

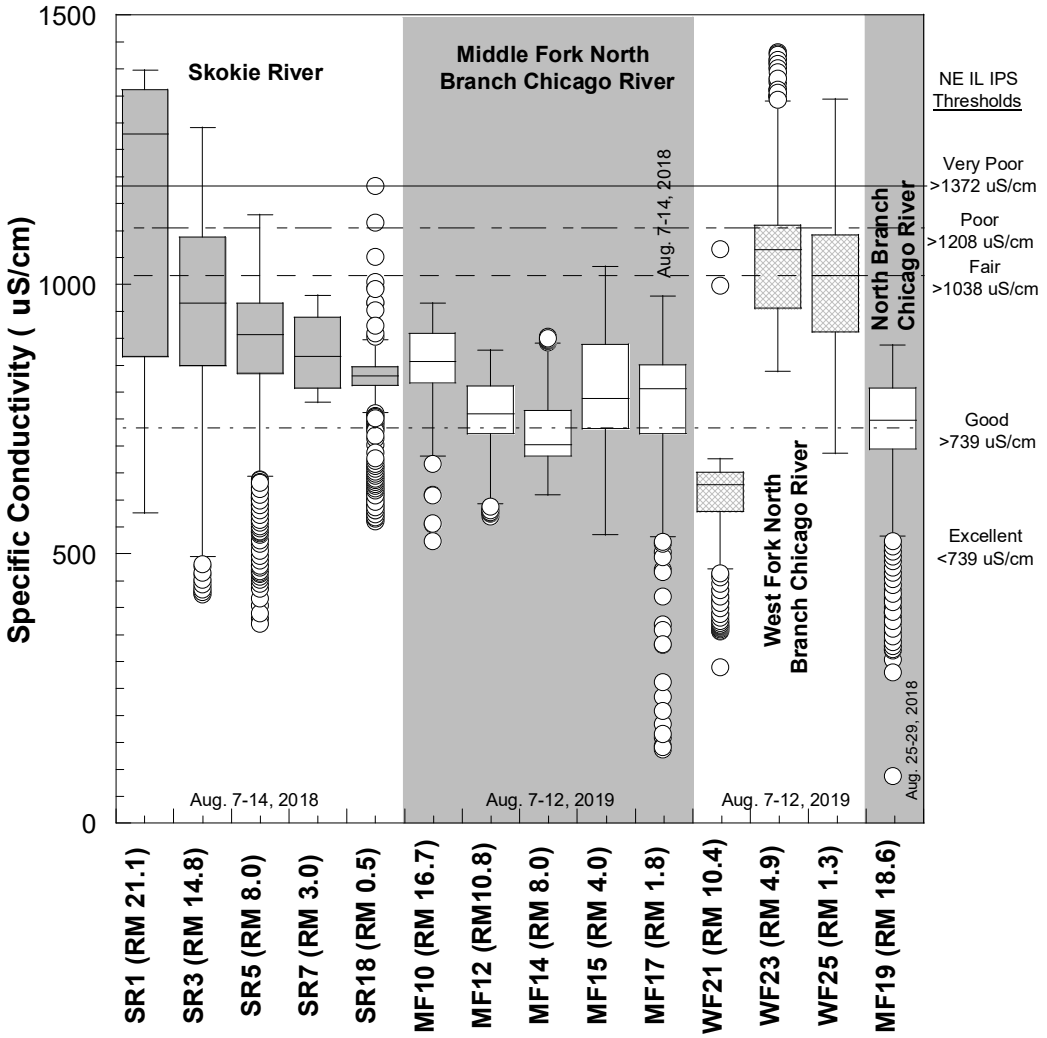

***Figure 22**. Specific conductance (µS/cm) measured continuously by Datasondes deployed for 5-7 day periods during mid-August at 13 locations in the 2018 and 2019 study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The IPS thresholds for five narrative ratings are shown by solid and dashed lines.*

Conductivity values mirrored chloride concentrations at all sites in 2018 and 2019. The general pattern in the Skokie River was a gradual decrease from upstream to downstream in both 2018 and 2019 (Figure 26) the same as was depicted by the continuous results in 2018. The 2018 values ranged from good to excellent while 2019 values were higher, ranging from very poor to good. The West Fork 2018 values ranged from good to excellent, with a modest increase from upstream to downstream in median conductivity levels. The 2019 values ranged from poor to good, also increasing from upstream to downstream in a near identical pattern to 2018 (Figure 27). Median conductivity values in the Middle Fork were generally good in 2018 with upper exceptional values recorded at MF15 and MF16 (Figure 28). The North Branch mainstem site was at the 739 µS/cm excellent IPS threshold in 2018 (Figure 28). All median conductivity values in 2019 were within the good IPS threshold for all sites in the Middle Fork and North Branch mainstem.

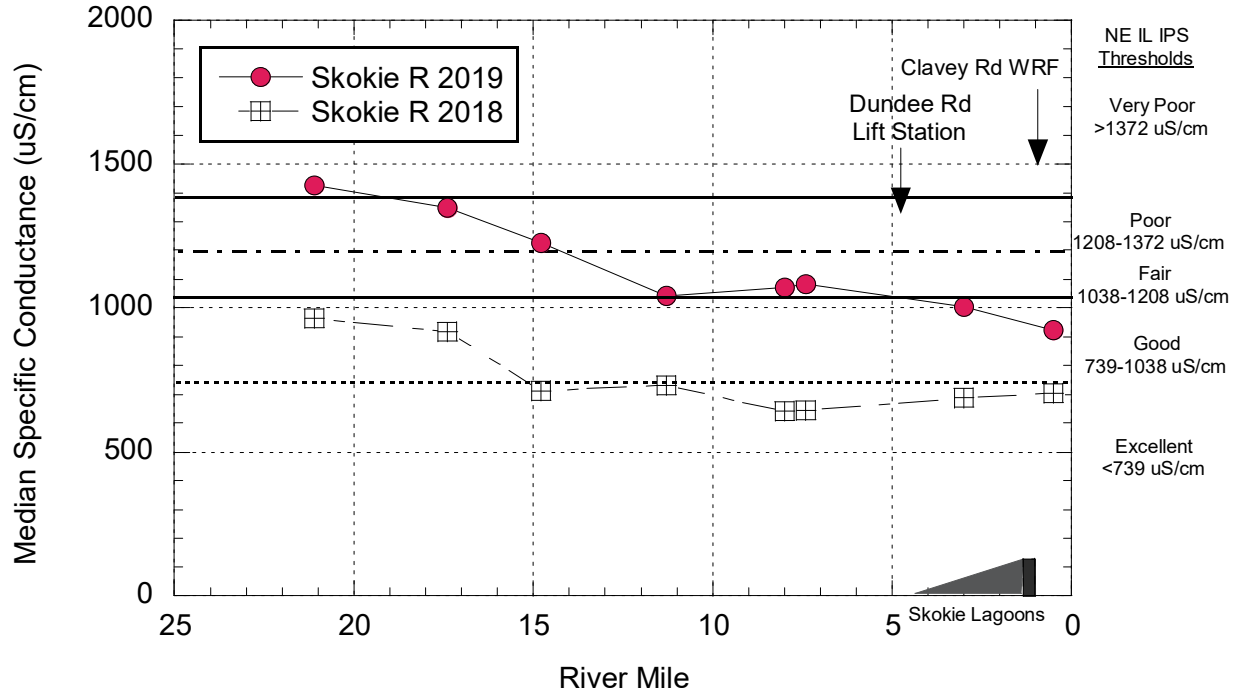

Figure 24. *Median specific conductance in the Skokie River during May-October of 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

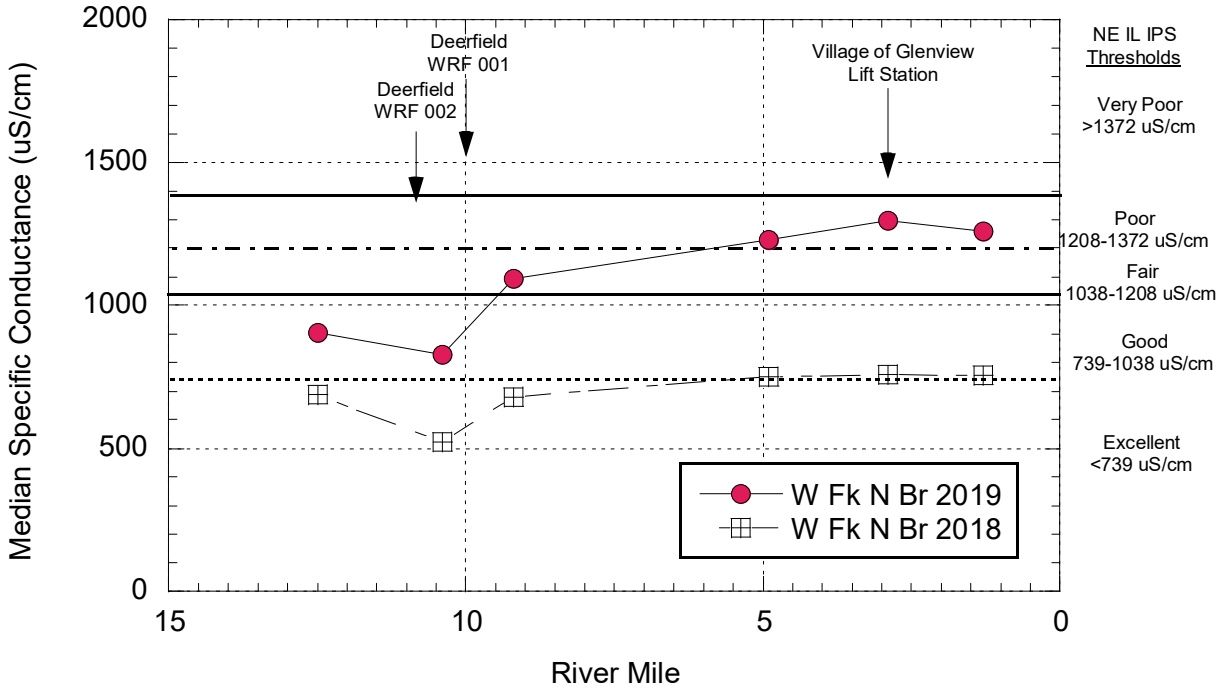

Figure 23*. Median specific conductance in the West Fork of the North Branch Chicago River during May-October of 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

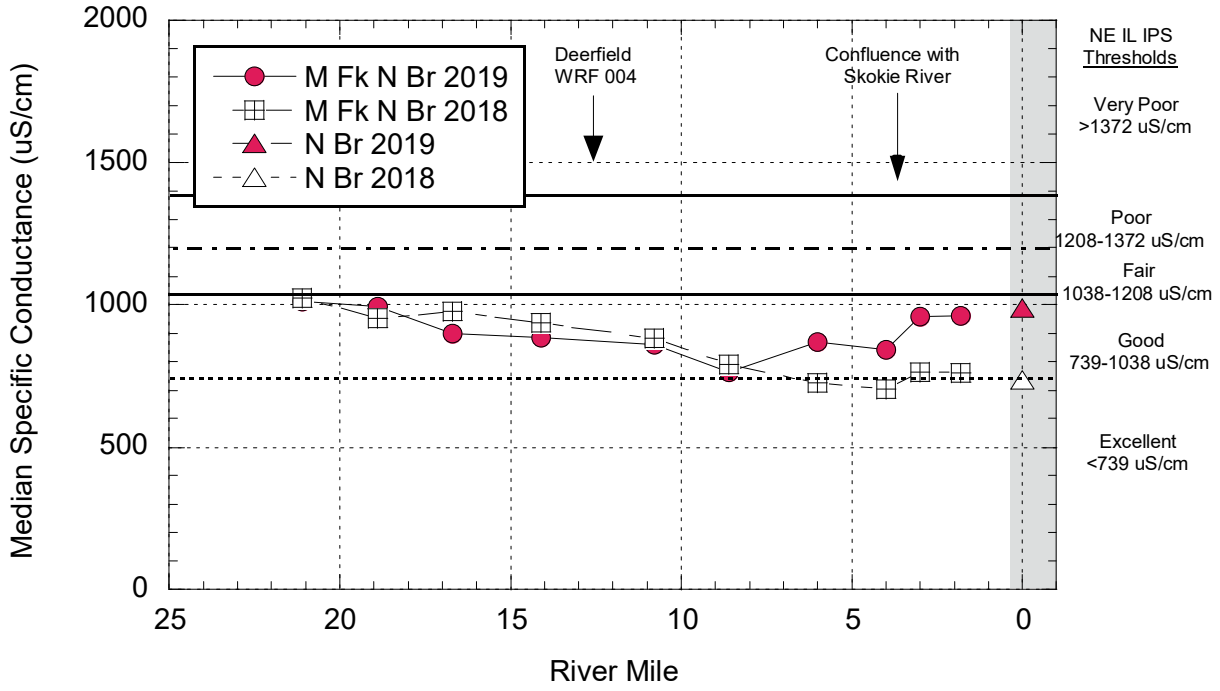

Figure 25. *Median specific conductance in the Middle Fork of the North Branch Chicago River and the North Branch Chicago River mainstem during May-October of 2018 and 2019. Dashed and solid lines represent IPS derived effect thresholds correlated with ranges of biological quality and as listed in Table 7.*

Water Column Metals and Organics

Water samples for the analysis of 14 metals and a scan for organic parameters were collected once annually at the 8 Tier 1 (Table 10). While the low frequency of sample collection inherently limits our analysis, there were some notable observations of metals and organics in relation to detections and IPS thresholds. Nine (9) of the 14 metal parameters were either below detection or within the excellent IPS threshold. The remaining five (5) parameters exhibited exceedances from infrequent to frequent and fair to very poor. Sodium had the highest frequency of IPS threshold exceedances with all 16 samples exceeding three of the IPS thresholds, four (4) fair, six (6) poor, and six (6) very poor. These were also allied with chloride exceedances reflecting runoff containing deicing salts. Copper, a common constituent in urban stormwater, had the next highest frequency of IPS threshold exceedances with nine (9) of 16 samples exceeding three of the IPS thresholds, two (2) fair, one (1) poor, and six (6) very poor. Zinc, which is another common metal in urban stormwater, had seven exceedances of the very poor IPS threshold. Nickel had two (2) exceedances of the fair IPS threshold. Iron exceeded the Illinois WQS three (3) times with no exceedances of any of the IPS thresholds. The number of exceedances at any single site ranged from one (1) parameter at four sites up to five (5) parameters in 2018 at SR1 which is the upstream most site in the Skokie River. Site MF8 had four (4) parameter exceedances in 2019 and SR18 had three (3) in 2018. Only one (1) site (WF 22) had three (3) parameters exceeding the poor or very poor IPS threshold. In terms of the POTWs only the Clavey Rd. WWTP has a site in close enough proximity to a metals sampling site – SR18 had three (3) parameter exceedances in 2018 and 2019 with two (2) exceeding the very poor thresholds for copper (2018) and zinc (2018, 2019). Only one organic parameter, acetone, was detected at levels well below any reported effect levels on aquatic life or human health.

***Table 10**. Heavy metal concentrations in water samples collected once in August at selected tier 1 locations. Color shading of cells corresponds to NE Illinois IPS threshold exceedances listed at the bottom of the table. Unsampled sites are shown for reference.*

Site ID	River Mile	Drainage Area (sq. mi.)	Arsenic (µg/L)	Barium (µg/L)	Cadmium (ug/L)	Calcium (mg/L)	Chrom-ium (ug/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Magnes-ium (mg/L)	Mercury, Low Level (ng/L)	Nickel (µg/L)	Silver (µg/L)	Sodium (mg/L)	Zinc (µg/L)
Skokie River: 2019																
SR1	21.1	2.7	3.00	46	nd	53	nd	4.3	1600	1.2	21	1.70	2.30	nd	210	43
SR2	17.4	7.8	-	-	-	-	-	-	-	-	-	-	-	-		-
SR3	14.8	11.5	-	-	-	-	-	-	-	-	-	-	-	-		-
SR4	11.3	15	-	-	-	-	-	-	-	-	-	-	-	-		-
SR5	8	20.6	-	-	-	-	-	-	-	-	-	-	-	-		-
SR6	7.4	21.5	-	-	-	-	-	-	-	-	-	-	-	-		-
SR7	3	23.7	-	-	-	-	-	-	-	-	-	-	-	-		-
SR18	0.5	30.9	3.10	25.5	nd	54.5	nd	5.1	470	1.5	22	1.85	1.75	nd	94	30
Skokie River: 2018																
SR1	21.1	2.7	1.60	32	nd	21.3	nd	6.5	2300	3.1	7	4.90	3.60	nd	58.2	25
SR2	17.4	7.8	-	-	-	-	-	-	-	-	-	-	-	-		-
SR3	14.8	11.5	-	-	-	-	-	-	-	-	-	-	-	-		-
SR4	11.3	15	-	-	-	-	-	-	-	-	-	-	-	-		-
SR5	8	20.6	-	-	-	-	-	-	-	-	-	-	-	-		-
SR6	7.4	21.5	-	-	-	-	-	-	-	-	-	-	-	-		-
SR7	3	23.7	-	-	-	-	-	-	-	-	-	-	-	-		-
SR18	0.5	30.9	2.35	32	nd	32.4	nd	7.6	935	2.8	16	3.70	2.85	nd	62.4	27
Middle Fork North Branch Chicago River: 2019																
MF8	21.1	5.81	2.60	51	nd	70	nd	3.1	1100	1.8	42	4.60	3.70	nd	160	21
MF9	18.9	8.91	-	-	-	-	-	-	-	-	-	-	-	-		-
MF10	16.7	11.9	-	-		-	-	-	-	-	-	-	-	-		-
MF11	14.1	16.11	-	-	-	-	-	-	-	-	-	-	-	-		-
MF12	10.8	19.23	-	-	-	-	-	-	-	-	-	-	-	-		-
MF13	8.6	20.96	-	-	-	-	-	-	-	-	-	-	-	-		-
MF14	6	22.48	-	-	-	-	-	-	-	-	-	-	-	-		-
MF15	4	24.29	2.50	34	nd	50	nd	12.0	430	0.7	23	0.81	3.20	nd	110	nd
MF16	3	56.1	-	-	-	-	-	-	-	-	-	-	-	-		-
MF17	1.8	57.3	-	-	-	-	-	-	-	-	-	-	-	-		-
Condition Category Thresholds	Excellent		-	<74.1	<0.937	<84425	<1.398	-	-	<2.851	-	-	-	-	<16.3	<7.47
	Good		<3.616	<84.88	<0.974	<86076	<1.540	<4.480	1000	<3.335	-	1100	<3.470	5	>16.3	<9.78
	Fair		>3.616	>84.88	>0.974	>86076	>1.540	>4.480	-	>3.335	-	-	>3.470	-	>45.0	>9.78
	Poor		>5.029	>101.8	>0.983	>86313	>2.682	>4.969	-	>3.884	-	-	>9.585	-	>79.1	>11.00
	Very Poor		>6.603	>118.6	>0.991	>86559	>3.824	>5.458	-	>4.334	-	-	>11.88	-	>113.1	>12.22
Source	**IPS**		IPS	IPS	IPS	IPS	IPS	IPS	IL WQS	IPS	NONE	IL WQS	IPS	IL WQS	IPS	IPS
	Illinois WQS		50	1000	2.7	NONE	11	30.2	1000	81.3	NONE	1100	12.7	5	None	55.5
	MDL		0.23	0.73	0.17	0.027	1.1	0.5	47	0.19	0.019	0.14	0.63	0.12	0.22	6.9

`

***Table 10**. (continued)*

Site ID	River Mile	Drainage Area (sq. mi.)	Arsenic (µg/L)	Barium (µg/L)	Cadmium (ug/L)	Calcium (mg/L)	Chromium (ug/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Magnesium (mg/L)	Mercury, Low Level (ng/L)	Nickel (µg/L)	Silver (µg/L)	Sodium (mg/L)	Zinc (µg/L)
Middle Fork North Branch Chicago River: 2018																
MF8	21.1	5.81	2.10	37	nd	35.7	nd	2.8	870	0.9	15	1.40	2.30	nd	167	nd
MF9	18.9	8.91	-	-	-	-	-	-	-	-	-	-	-	-		-
MF10	16.7	11.9	-	-	-	-	-	-	-	-	-	-	-	-		-
MF11	14.1	16.11	-	-	-	-	-	-	-	-	-	-	-	-		-
MF12	10.8	19.23	-	-	-	-	-	-	-	-	-	-	-	-		-
MF13	8.6	20.96	-	-	-	-	-	-	-	-	-	-	-	-		-
MF14	6	22.48	-	-	-	-	-	-	-	-	-	-	-	-		-
MF15	4	24.29	2.20	34	nd	34.1	nd	5.8	1000	1.3	14	2.80	2.70	nd	66.6	nd
MF16	3	56.1	-	-	-	-	-	-	-	-	-	-	-	-		-
MF17	1.8	57.3	-	-	-	-	-	-	-	-	-	-	-	-		-
West Fork North Branch Chicago River: 2019																
WF20	12.5	3.87	3.70	30	nd	42	nd	1.0	470	0.3	18	1.10	1.00	nd	130	nd
WF21	10.4	7.02	-	-	-	-	-	-	-	-	-	-	-	-		-
WF22	9.2	9.41	3.00	28	nd	57	nd	5.8	440	0.6	20	1.10	2.10	nd	110	30
WF23	4.9	17.86	-	-	-	-	-	-	-	-	-	-	-	-		-
WF24	2.9	24.52	-	-	-	-	-	-	-	-	-	-	-	-		-
WF25	1.3	27.97	3.40	45	nd	56	nd	3.8	190	0.6	24	0.25	2.50	nd	150	nd
West Fork North Branch Chicago River: 2018																
WF20	12.5	3.87	1.60	32	nd	27.5	nd	3.2	410	0.3	11	1.70	1.00	nd	81.8	nd
WF21	10.4	7.02	-	-	-	-	-	-	-	-	-	-	-	-		-
WF22	9.2	9.41	1.60	67	nd	65.2	nd	4.9	920	0.5	35	3.00	2.00	nd	260	nd
WF23	4.9	17.86	-	-	-	-	-	-	-	-	-	-	-	-		-
WF24	2.9	24.52	-	-	-	-	-	-	-	-	-	-	-	-		-
WF25	1.3	27.97	1.70	34	nd	33.8	nd	5.9	820	1.8	13	3.00	2.40	nd	69.6	nd
North Branch Chicago River: 2019																
MF19	18.6	93.4	3.50	35	nd	53	nd	4.2	390	1.1	22	1.10	2.70	nd	110	20
North Branch Chicago River: 2018																
MF19	18.6	93.4	1.80	33	nd	34.6	nd	5.2	930	2.2	15	4.30	2.80	nd	66.6	nd
Condition Category Thresholds	Excellent		-	<74.1	<0.937	<84425	<1.398	-	-	<2.851	-	-	-	-	<16.3	<7.47
	Good		<3.616	<84.88	<0.974	<86076	<1.540	<4.480	1000	<3.335	-	1100	<3.470	5	>16.3	<9.78
	Fair		>3.616	>84.88	>0.974	>86076	>1.540	>4.480	-	>3.335	-	-	>3.470	-	>45.0	>9.78
	Poor		>5.029	>101.8	>0.983	>86313	>2.682	>4.969	-	>3.884	-	-	>9.585	-	>79.1	>11.00
	Very Poor		>6.603	>118.6	>0.991	>86559	>3.824	>5.458	-	>4.334	-	-	>11.88	-	>113.1	>12.22
Source	**IPS**		IPS	IPS	IPS	IPS	IPS	IPS	IL WQS	IPS	NONE	IL WQS	IPS	IL WQS	IPS	IPS
	Illinois WQS		50	1000	2.7	NONE	11	30.2	1000	81.3	NONE	1100	12.7	5	None	55.5
	MDL		0.23	0.73	0.16	0.027	1.1	0.5	0.47	0.19	0.019	0.14	0.63	0.12	0.22	6.9

Sediment Chemistry

Sediment samples were evaluated against guidelines compiled by McDonald et al. (2000), Illinois sediment metals guidelines (Short 1998), and the new IPS derived narrative ranges (see Table 7). The MacDonald et al. (2000) threshold effect levels (TEL) are where toxic effects are initially apparent and likely to affect the most sensitive organisms. Probable effect levels (PEL) are where toxic effects are more likely to be observed over a wider range of organism sensitivities. Short (1998) identified elevated and extremely elevated sediment metal concentrations for Illinois streams and rivers. The new IPS thresholds are based on analyses against the most sensitive species to each sediment metal and PAH parameter (MBI 2020a). Sediment metal sampling results from 2018 and 2019 are summarized by concentration rating and parameter class in Table 11 and polycyclic aromatic hydrocarbon (PAHs) compounds in Table 12. PAHs result from the incomplete combustion of hydrocarbons and are a common component of stormwater runoff in urban areas – they are not a direct byproduct of any manufacturing process.

Metals in Sediment

Elevated levels of heavy metals in are commonly associated with runoff from roads and highways and industrial and municipal sources. Exceedances of the new IPS thresholds were extensive for aluminum, lead, zinc, chromium, copper, and nickel with numerous exceedances of poor and very poor values. These occurred throughout the NBWW survey area with aluminum being the most prevalent. Aluminum concentration values were poor or very poor at 19 of the 24 sites (Table 11). Copper exceeded the good threshold at 18 sites, 16 sites had concentration values of poor or very poor levels. Lead and zinc each exceeded the good IPS threshold at 17 sites with zinc concentration levels poor or very pool at 15 sites, while lead concentration levels exceeded the fair IPS threshold at 11 sites. Chromium and nickel each exceeded their respective good thresholds at 16 sites with seven (7) poor and nine (9) very poor values. Metal concentration levels in the Middle Fork at MF13 and MF14 as well as in the West Fork at WF23, WF24 and WF25 did not exceed the good IPS threshold for any of the parameters. Reduced concentration levels occur in the Skokie River in the Skokie Lagoons caused by dilution and lethargic flow rates allowing for contaminants to fall from the water column prior to reaching the site SR7. Concentration levels in the Skokie River downstream of the Skokie Lagoons abruptly increase to poor and very poor levels for aluminum, copper, lead, and zinc. This increase appears to be attributed to an increase in wastewater inputs.

PAH Compounds in Sediment

The levels of PAH compounds were elevated at every site with numerous very poor values observed. Only seven (7) excellent/good values were observed in the entire study area (Table 12). Of these excellent/good values three (3) were observed at MF11, three (3) at SR7 and one (1) MF10. Most fair values were located in the middle section of the Middle Fork (MF09, MF10, and MF11) with a majority of the very poor values located in the West Fork (Table 12). Benz(b)anthracene concentrations were very poor at most sites in the NBWW study area.

***Table 11**. Heavy metal concentrations (mg/kg) in sediment at 24 sites in the NBWW survey area. Highlighted cells indicate an exceedance of one or more of the effect thresholds listed at the bottom.*

Site ID	River Mile	Drainage Area (sq. mi.)	Year	Aluminum (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (µg/kg)	Nickel (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
Skokie River																				
SR1	21.10	2.70	2018	13000	7.80	68.00	19.00	0.730	26.00	11.00	45.00	25000	33.00	750.0	18.00	26.00	0.550	49.00	28.00	180.0
SR2	17.40	7.80	2018	9800	5.50	61.00	7.50	0.870	44.00	7.50	50.00	15000	96.00	410.0	270.0	19.00	0.750	33.00	21.00	270.0
SR3	14.80	11.50	2018	10000	5.40	71.00	17.00	0.930	33.00	9.00	69.00	18000	65.00	560.0	190.0	21.00	0.750	45.00	24.00	240.0
SR4	11.30	15.00	2018	14000	11.00	91.00	23.00	0.420	30.00	13.00	60.00	25000	53.00	1400.0	190.0	28.00	1.050	49.00	30.00	200.0
SR5	8.00	20.60	2018	10000	6.20	66.00	9.50	0.390	25.00	8.50	46.00	18000	44.00	750.0	420.0	19.00	0.950	43.00	22.00	160.0
SR6	7.40	21.50	2018	9800	6.90	64.00	8.50	0.870	26.00	8.00	53.00	17000	52.00	520.0	410.0	19.00	0.850	51.00	22.00	210.0
SR7	3.00	23.70	2018	9900	3.80	51.00	22.00	0.335	18.00	8.00	39.00	15000	18.00	350.0	28.50	22.00	0.850	74.00	20.00	77.0
SR18	0.50	30.90	2018	11000	4.30	70.00	17.00	0.295	24.00	7.80	58.00	17000	51.00	480.0	79.00	21.00	0.750	43.00	20.00	160.0
Middle Fork North Branch Chicago River																				
MF8	21.10	5.81	2019	15000	7.20	76.00	19.00	0.630	36.00	11.00	35.00	24000	86.00	1000.0	68.00	27.00	ND	44.00	33.00	160.0
MF9	18.90	8.91	2019	16000	6.60	80.00	19.00	0.780	29.00	12.00	44.00	23000	34.00	840.0	80.00	28.00	ND	50.00	30.00	180.0
MF10	16.70	11.90	2019	14000	7.10	68.00	18.00	0.670	25.00	12.00	41.00	23000	28.00	1100.0	57.00	27.00	ND	50.00	28.00	140.0
MF11	14.10	16.11	2019	9600	4.60	42.00	12.00	0.430	17.00	8.80	23.00	15000	20.00	510.0	40.00	18.00	ND	31.00	21.00	78.0
MF12	10.80	19.23	2019	13000	7.05	69.00	13.50	0.500	23.50	13.00	40.50	24500	29.00	645.0	61.00	27.00	ND	34.50	27.00	130.0
MF13	8.60	20.96	2019	15000	8.40	84.00	18.00	0.265	26.00	12.00	45.00	23000	33.00	910.0	74.00	27.00	ND	37.00	29.00	150.0
MF14	6.00	22.48	2019	5000	3.50	35.00	3.45	0.140	9.70	5.90	20.00	11000	15.00	440.0	37.00	11.00	ND	16.00	13.00	53.0
MF15	4.00	24.29	2019	4700	3.20	32.00	3.55	0.280	9.10	5.20	13.00	10000	15.00	440.0	33.00	10.00	ND	16.00	13.00	49.0
MF16	3.00	56.10	2018	11000	6.80	74.00	10.00	0.405	27.00	8.70	70.00	19000	58.00	500.0	110.0	21.00	1.000	48.00	23.00	200.0
MF17	1.80	57.30	2018	12000	5.50	72.00	17.00	0.690	24.00	8.70	49.00	18000	53.00	600.0	92.00	20.00	0.800	39.00	22.00	170.0
West Fork North Branch Chicago River																				
WF20	12.50	3.87	2019	11000	4.50	52.00	13.00	0.460	21.00	8.50	31.00	17000	25.00	370.0	48.00	21.00	ND	33.00	24.00	120.0
WF21	10.40	7.02	2019	10000	5.30	58.00	15.00	0.480	22.00	9.00	43.00	18000	23.00	650.0	42.00	20.00	ND	51.00	24.00	140.0
WF22	9.20	9.41	2019	13000	5.60	80.00	17.00	0.245	26.00	10.00	58.00	21000	24.00	670.0	55.00	27.00	ND	48.00	26.00	170.0
WF23	4.90	17.86	2019	5100	2.30	39.00	7.30	0.320	14.00	4.80	28.00	9800	17.00	230.0	36.00	12.00	ND	32.00	12.00	99.0
WF24	2.90	24.52	2019	4200	2.60	32.00	3.55	0.300	9.30	4.30	16.00	8700	15.00	290.0	51.00	9.50	ND	22.00	11.00	58.0
WF25	1.30	27.97	2019	3700	1.90	30.00	3.45	0.470	13.00	4.30	21.00	7500	32.00	230.0	48.00	8.90	ND	25.00	9.30	75.0
North Branch Chicago River																				
MF19	18.60	93.40	2018	19000	6.800	120.0	29.00	1.100	43.00	14.00	84.00	28000	80.00	920.0	370.0	33.00	1.300	67.00	35.00	270.0
MacDonald et al. 2000			TEC	None	9.790	None	None	0.990	43.40	None	31.60	20000	35.80	460.0	0.180	22.70	1.600	None	None	121.0
			PEC	None	33.00	None	None	4.980	111.0	None	149.0	40000	128.0	1100	1.060	48.60	2.200	None	None	459.0
Short 1998			L Elevated	None	7.200	145.0	None	2.000	37.00	None	37.00	26100	60.00	1100	0.280	26.00	None	None	None	170.0
			Highly Ele	None	18.00	230.0	None	9.300	110.0	None	170.0	53000	245.0	2300	1.400	45.00	5.000	None	None	760.0
NE IL IPS			Excellent	None	None	None	None	None	<20.53	None	<19.00	None	<15.50	<841.0	None	None	None	None	None	<75.0
			Good	<6480	<8.65	<141.0	None	<0.933	<23.30	None	<29.78	None	<24.80	<845.5	None	<19.50	<0.483	<81.80	None	<100.0
			Fair	>6480	>8.65	>141.0	None	>0.933	>23.30	None	>29.78	None	>24.80	>845.5	None	>19.50	>0.483	>81.80	None	>100.0
			Poor	>8272	>15.82	>150.3	None	>1.354	>26.22	None	>40.45	None	>33.04	>996.8	None	>22.52	>1.261	>106.8	None	>133.9
			Very Poor	>10064	>23.67	>168.7	None	>1.963	>29.15	None	>51.12	None	>41.27	>1148	None	>25.53	>2.039	>131.9	None	>167.8

Table 12. *Sediment PAH levels (mg/kg) in sediments at 25 sites in the NBWW survey area. Highlighted cells indicate an exceedance of one or more of the effect thresholds listed at the bottom (TEC – threshold effect concentration; PEC – probable effect concentration; ND – not detected).*

Site ID	River Mile	Drainage Area (sq. mi.)	Year	Acenaphtene (µg/kg)	Anthracene (µg/kg)	Benzo[a]anthracene (µg/kg)	Benzo[a]pyrene (µg/kg)	Benzo[b]fluoranthene (µg/kg)	Benzo[g,h,i]perylene (µg/kg)	Benzo[k]fluoranthene (µg/kg)	Chrysene (µg/kg)	Dibenzo[a,h]anthracene (µg/kg)	Fluoranthene (µg/kg)	Fluorene (µg/kg)	Indeno[1,2,3-cd]pyrene (µg/kg)	Phenanthrene (µg/kg)	Pyrene (µg/kg)
Skokie River																	
SR1	21.1	2.7	2018	ND	ND	1200	2000	4200	1400	1300	2600	ND	4800	ND	1600	1000	2700
SR2	17.4	7.8	2018	ND	830.0	3400	4600	7700	2700	3300	6000	810.0	13000	740.0	3100	5200	8100
SR3	14.8	11.5	2018	ND	620.0	1900	2300	4600	970.0	1600	3200	280.0	6400	290.0	1000	3400	6100
SR4	11.3	15	2018	ND	ND	2600	3300	6000	2200	1900	4400	ND	10000	890.0	2500	4700	6400
SR5	8	20.6	2018	ND	940.0	2500	3300	6300	1900	2200	4400	ND	10000	810.0	2100	4900	6100
SR6	7.4	21.5	2018	ND	880.0	3800	5800	10000	3800	3500	7100	1200	14000	800.0	4100	5200	9100
SR7	3	23.7	2018	ND	ND	ND	320.0	760	180.0	210.0	ND	ND	1600	ND	220.0	ND	ND
SR18	0.5	30.9	2018	ND	ND	2000	2900	5100	2100	1800	3600	ND	7000	ND	2300	2400	4300
Middle Fork North Branch Chicago River																	
MF8	21.1	5.81	2019	ND	ND	1100	1800	3000	750.0	670.0	1800	ND	3500	ND	910.0	1300	2800
MF9	18.9	8.91	2019	ND	ND	590.0	850.0	1300	460.0	610.0	1000	ND	1700	ND	450.0	470.0	1300
MF10	16.7	11.9	2019	ND	ND	430.0	600.0	840	340.0	370.0	690.0	ND	1200	ND	320.0	470.0	1000
MF11	14.1	16.11	2019	ND	91.00	520.0	640.0	770	310.0	460.0	770.0	65.00	1700	ND	290.0	720.0	1300
MF12	10.8	19.23	2019	ND	ND	1700	2300	3150	1300	1500	2750	ND	5150	ND	1300	2000	4000
MF13	8.6	20.96	2019	ND	360.0	1500	2000	2400	1200	1900	2500	330.0	4600	ND	1100	1700	3200
MF14	6	22.48	2019	ND	ND	710.0	1000	1300	630.0	830.0	1200	ND	2100	ND	630.0	940.0	1700
MF15	4	24.29	2019	ND	ND	800.0	1000	1400	600.0	570.0	1200	ND	2400	ND	670.0	1000	1900
MF16	3	56.1	2018	ND	3900	13000	17000	29000	11000	7900	21000	3200	42000	2000	11000	24000	32000
MF17	1.8	57.3	2018	ND	330.0	1700	2500	5500	1200	1500	3200	350.0	5400	190.0	1300	2200	4600
West Fork North Branch Chicago River																	
WF20	12.5	3.87	2019	ND	500.0	1900	2600	3700	1300	1800	3200	ND	6600	ND	1400	2300	5000
WF21	10.4	7.02	2019	ND	1600	6500	7800	12000	3900	3600	9700	1100	22000	ND	3900	9800	16000
WF22	9.2	9.41	2019	ND	930.0	4500	6500	11000	3700	3200	8600	ND	15000	ND	3700	5800	11000
WF23	4.9	17.86	2019	ND	ND	2700	3400	5400	1900	1900	4400	ND	8400	ND	1800	3500	6100
WF24	2.9	24.52	2019	ND	990.0	3600	4300	6100	2300	2100	5000	760.0	11000	ND	2200	5100	8200
WF25	1.3	27.97	2019	ND	1900	6700	7500	10000	3900	4000	9100	1100	19000	650.0	3700	9000	15000
North Branch Chicago River																	
MF19	18.6	93.4	2018	ND	ND	4200	6600	13000	4200	6100	8700	ND	18000	ND	4800	6400	10000
MacDonald et al. 2000			**TEC**	None	57.2	108	150	240	170	240	166	33	423	77.4	200	204	195
			PEC	None	845	1050	1450	13,400	320	13,400	1,290	135	2,230	536	3,200	1,170	1,520
NE IL IPS			**Exc./ Good**	<84.25	<78.00	<239.0	<230	<207.0	<335.0	<520.8	<266.0	<101.0	<774.0	<84.25	<260.5	<243.5	<393.0
			Fair	>84.25	>78.00	>239.0	>230	>207.0	>335.0	>520.8	>266.0	>101.0	>774.0	>84.25	>260.5	>243.5	>393.0
			Poor	>104.8	>119.9	>699.4	>798.3	>434.7	>792.1	>1437	>958.3	>167.3	>2432	>104.8	>623.3	>803.3	>1570
			V. Poor	>125.3	>161.8	>1160	>1367	>662.4	>1249.0	>2354	>1651	>233.7	>4091	>125.3	>986.2	>1363	>2747

Fluoranthene, phenanthene, and pyrene concentrations also exceeded the IPS very poor threshold at most sites, but fair and poor values were recorded in the Middle Fork. Only acenaphthene was not detected at any site while fluorene was detected at eight (8) sites, primarily in the Skokie River. The IPS thresholds coincide with the MacDonald et al. (2000) TEC/TEL and PEC/PEL values with the former generally less than the IPS good level and the latter only roughly consistent with the IPS very poor values. There were considerably more very poor values than non-detected PAHs with the chemicals generally being ubiquitous through the study area. The urban nature of each subwatershed increases the presence and concentrations of PAHs. Runoff from roads, parking lots and industrial centers being likely sources.

Physical Habitat Quality for Aquatic Life – QHEI

The physical habitat of a stream or river is a primary determinant of biological quality and potential. Streams in the glaciated Midwest, left in their natural state, typically offer pool-run-riffle sequences, moderate to high sinuosity, and well-developed channels with deep pools, heterogeneous substrates, and cover in the form of woody debris, hard substrates, and aquatic macrophytes. Lower gradient streams may not offer as distinct riffle habitats and are oftentimes run and glide dominated, but can still offer a diversity of substrates, well developed pool habitats, and well-developed instream cover features associated with woody debris and aquatic macrophytes. The Qualitative Habitat Evaluation Index (QHEI) categorically scores basic components of stream and riverine habitat into ranks according to the degree to which those components are found compared to a natural state, or conversely, in an altered or modified state. In the NBWW study area, QHEI scores and physical habitat attributes were recorded in conjunction with the fish sampling conducted at each site. Examples of the range of habitat offered in the study area are the Middle Fork at sites MF14 (Figure 30) and MF16 (Figure 31), the former offering the better habitat in the study area and the latter reflecting legacy modifications to the stream channel.

Based on the QHEI scores and the number and ratios of good and modified attributes (after Rankin 1989, 1995; Table 13 and Figure 32), overall habitat quality ranged from poor (nineteen sites) to fair (four sites) with three of the fair sites in the Middle Fork and one in the West Fork. The IPS derived QHEI thresholds for the five narrative categories were used and these are more stringent than the prior usage of narrative ratings from Ohio. The fair ratings for the Middle Fork North Branch sites located in the lower section (MF13, MF14, and MF15) resulted from a comparatively lower number of highly modified attributes. Other than MF14, these sites still had numerous moderate modified attributes and with very few good habitat attributes (Table 12). The highest habitat score in the NBWW survey area was recorded at MF14, which had six (6) good and four (4) modified attributes (0.70 ratio of modified:good; Table 13). The site reflected a continuation of some of the same issues affecting upstream habitat scores. There were no fast current types, moderate to high silt cover and moderate to high embeddedness of natural substrates. Moderate and high influence modified habitat attributes are common throughout the NBWW survey area.

The nineteen sites which rated poor were apportioned across each of the three subwatersheds. The Skokie River offered poor habitat throughout its length while only modest improvements in habitat were observed in the downstream sections of both the Middle and West Forks of the North Branch Chicago River. The mainstem of the North Branch offered poor quality habitat as judged by the IPS thresholds. Moderate and high influence modified attributes outnumbered

Figure 26. *The Middle Fork North Branch Chicago River downstream from Sunset Drive (MF14) during the 2019 sampling year. Only nine (9) of the twenty-five (25) sites in the NBWW survey area had riffle habitats which were moderately to extensively embedded at every site.*

Figure 27. *The Middle Fork North Branch Chicago River at E. Lake Ave. (MF16) in 2018. The long, sluggish pools with fine sediment and muck substrates were indicative of the generally poor habitat throughout the study area.*

Table 13. *QHEI matrix of good (■) and high influence (●) and moderate influence (●) modified habitat attributes for sites in the NBWW study area during 2018-19. QHEI scores are shaded in accordance with IPS derived narrative ratings; green – Good; yellow – Fair; orange – Poor. Ratios of poor to good attributes are shaded as yellow (fair >2.00), orange (poor >4.00), and red (very poor >6.00)*

			Good Habitat Attributes											High Influence Modified Attributes						Moderate Influence Modified Attributes													Ratios	
Site ID	River Mile	QHEI	No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	# of Good Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	< 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	# of Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
Skokie River 2018																																		
SR1	21.1	33.5						■					1	●	●	●		●	4		●			●				●	●		●	5	4.0	9.0
SR2	17.4	33.5		■				■					2	●	●	●	●	●	5		●			●				●	●	●		5	2.5	5.0
SR3	14.8	40.5		■				■			■		3	●		●	●		3		●			●				●	●		●	5	1.0	2.7
SR4	11.3	47.0		■				■			■		3				●		1	●	●			●	●			●	●		●	7	0.3	2.7
SR5	8.0	45.5						■			■		2	●		●	●		3		●			●				●	●		●	5	1.5	4.0
SR6	7.4	36.3									■		1	●		●	●		3		●			●				●	●		●	5	3.0	8.0
SR7	3.0	32.5						■			■		2		●				1		●			●	●			●	●		●	6	0.5	3.5
SR18	0.5	38.5						■			■		2	●	●				2		●			●	●			●	●		●	6	1.0	4.0
Middle Fork North Branch Chicago River 2019																																		
MF08	21.1	34.0						■					1	●	●			●	3		●			●	●			●	●		●	6	3.0	9.0
MF09	18.9	28.0						■					1	●	●	●		●	4		●			●				●	●		●	5	4.0	9.0
MF10	16.7	43.0		■				■					2	●				●	2		●			●	●			●	●		●	6	1.0	4.0
MF11	14.1	45.5						■			■		2	●					1		●			●	●			●	●		●	6	0.5	3.5
MF12	10.8	41.5						■			■		2	●		●	●		3		●			●				●	●	●		5	1.5	4.0

Table 13. *QHEI matrix of good (■) and high influence (●) and moderate influence (●) modified habitat attributes for sites in the NBWW study area during 2018-19. QHEI scores are shaded in accordance with IPS derived narrative ratings; green – Good; yellow – Fair; orange – Poor. Ratios of poor to good attributes are shaded as yellow (fair >2.00), orange (poor >4.00), and red (very poor >6.00)*

			Good Habitat Attributes											High Influence Modified Attributes						Moderate Influence Modified Attributes													Ratios	
Site ID	River Mile	QHEI	No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	# of Good Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	< 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	# of Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
MF13	8.6	54.5						■			■		2						0	●	●			●	●			●	●	●		7	0.0	3.5
MF14	6.0	67.0	■	■		■	■	■			■		6						0		●							●	●	●		4	0.0	0.7
MF15	4.0	59.0					■				■		2				●		1	●	●			●				●	●	●		6	0.5	3.5
Middle Fork North Branch Chicago River 2018																																		
MF16	3.0	44.0		■			■	■			■		4	●	●				2		●			●	●			●	●		●	6	0.5	2.0
MF17	1.8	45.0		■				■			■		3	●		●	●		3		●			●				●	●	●		5	1.0	2.7
West Fork North Branch Chicago River 2019																																		
WF20	12.5	30.5						■			■		2	●	●				2		●			●	●			●	●		●	6	1.0	4.0
WF21	10.4	40.5		■						■			2	●		●	●	●	4	●				●		●		●		●		5	2.0	4.5
WF22	9.2	46.0		■				■			■		3	●					1		●			●	●			●	●		●	6	0.3	2.3
WF23	4.9	38.5						■			■		2	●	●				2		●			●	●			●	●		●	6	1.0	4.0
WF24	2.9	53.5		■			■	■			■		4						0	●	●			●				●	●	●		6	0.0	1.5
WF25	1.3	45.5						■			■		2	●					1	●	●			●	●			●	●	●		7	0.5	4.0
North Branch Chicago River 2018																																		
MF19	18.6	49.0		■				■			■		3						0	●	●			●	●			●	●		●	7	0.0	2.3

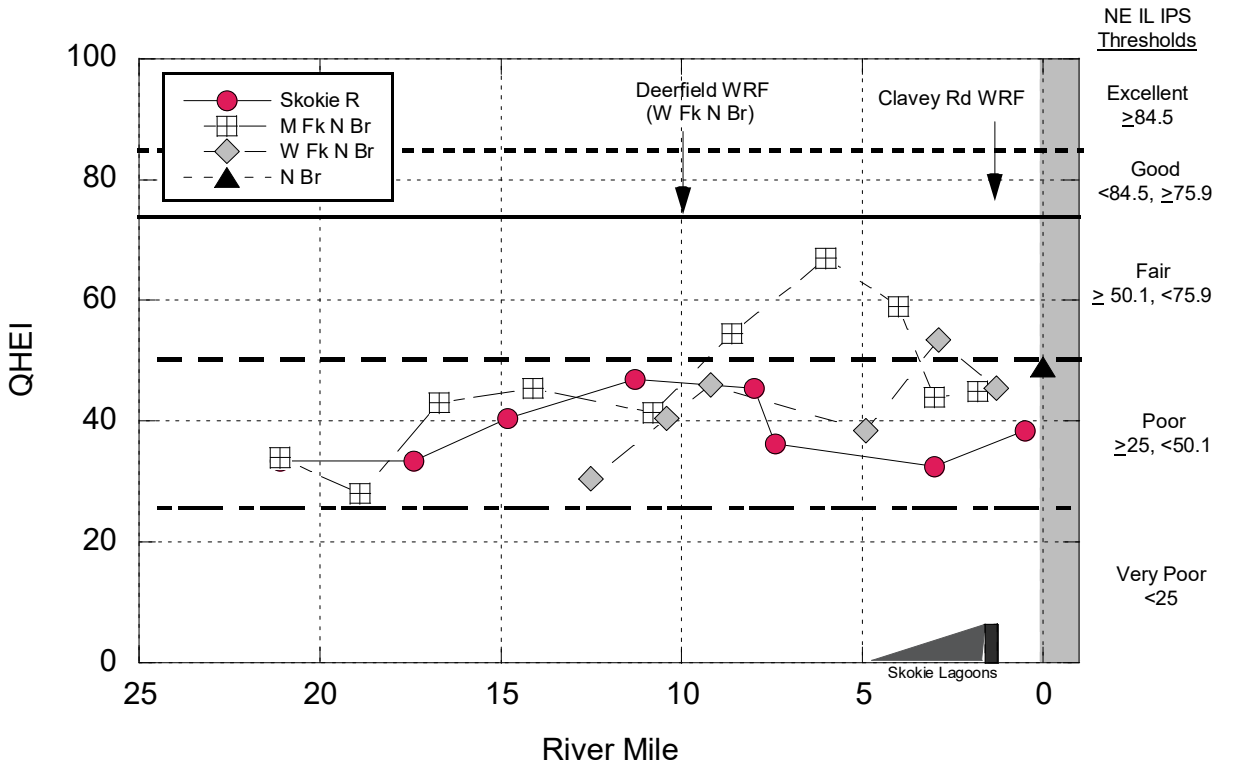

Figure 28. *Qualitative Habitat Evaluation Index (QHEI) scores in the NBWW survey area. Scores were recorded for the Skokie River, North Branch Chicago River and the lower two sites in the Middle Fork North Branch in 2018 while the West Fork North Branch and the upper Middle Fork North Branch values were recorded in 2019. The IPS narrative ranges of QHEI scores from excellent to very poor are indicated by solid and dashed lines.*

good attributes at 24 of the 25 sites in the NBWW survey area. Of these, 20 had at least one high influence modified attribute and fifteen (15) had multiple high influence modified attributes. Only two sites had a modified:good ratio <2.0 while four had very poor (>6.0), eight poor (>4.0) and 11 fair (>2.0) ratios (Table 12). Ratios <2.0 generally can support minimum biological goals such as the Illinois General Uses, but ratios >2.0 generally indicate a proportion of modified attributes that would require direct mitigation to reverse. It also means that meeting the General Use biocriteria would likely be precluded by habitat regardless of water quality conditions, thus raising concerns about use attainability (Rankin 1995). The sites with ratios <2.0 are the result of having fewer modified attributes coupled with enough good attributes to offset the negative influence of the modified attributes. All sites within the NBWW survey area lacked fast current types, possessed moderate to extensive silt coverage and all except one site had moderate to extensive embeddedness of natural substrates and fair to poor development. Most sites lacked riffles and of the sites that had riffles, they were moderately to extensively embedded by sand or silt. Low sinuosity was observed at half the sites and nearly three quarters had not recovered from historic channelization. Given the list of channel modifications and other hydrological alterations in the MWRD 2011 North Branch Watershed Plan (HDR 2011) executing needed habitat improvements may prove difficult.

Biological Assemblages – Macroinvertebrates

There were 109 unique macroinvertebrate taxa collected in the North Branch Chicago River survey area in 2018 and 2019 (Appendix C). The predominant taxa collected were mostly indicative of poor water quality. The most numerous was *Hyalella azteca,* an amphipod, followed by the genus *Gammarus sp.*, a crustacean; *Oligochaeta*, segmented worms; and the genus *Caecidotea sp.*, a crustacean (Table 14). The majority of the most numerous species collected were either of moderate tolerance or tolerant. The two most numerous species collected were significantly less tolerant than the majority of the top fifteen common species and were collected at 19 (*Hyalella azteca*) and 12 (*Gammarus sp.*) sites respectively (Table 14).

Table 14. *The fifteen (15) most abundant macroinvertebrate taxa collected in the NBWW survey area including number of times collected, total number collected, taxa group, and taxa tolerance assignments.*

Taxa Code	Scientific Name	Tolerance Group	Functional Group	Taxa Group	Times Collected	Total Numbers
06201	*Hyalella azteca*	4	CG	N	19	2220
06800	*Gammarus sp*	3	CG	N	12	1394
03600	*Oligochaeta*	10	CG	N	26	739
05800	*Caecidotea sp*	6	CG	N	21	609
84470	*Polypedilum (P.) illinoense*	6	SH	D	21	511
01801	*Turbellaria*	6	PR	N	23	352
84450	*Polypedilum (Uresipedilum) flavum*	6	SH	D	12	201
22001	*Coenagrionidae*	5.5	PR	O	23	196
83040	*Dicrotendipes neomodestus*	6	CG	D	18	185
98600	*Sphaerium sp*	5	CG	N	20	182
95100	*Physella sp*	9	SC	N	18	158
11130	*Baetis intercalaris*	4	CG	MA	3	107
52200	*Cheumatopsyche sp*	6	CF	CA	11	104
84540	*Polypedilum (Tripodura) scalaenum group*	6	SH	D	12	95
78655	*Procladius (Holotanypus) sp*	8	PR	D	11	78

Taxa Group: N - Non-Insect; MA - Mayfly; O - Odonata; CA - Caddisfly; D - Dipteran; T - Tribe Tanytarsini; CO - Coleoptera.
IL Functional Group: CG - Collecter/Gatherer; PR - Predator; CF - Collectors/Filterers; SH - Shredder; SC - Scraper.
IL Tolerance Score Ranges from 0 (Least Tolerant) to 10 (Most Tolerant).

Macroinvertebrate Assemblage

Samples were collected for the West Fork and the majority of the Middle Fork Branches of the Chicago River in 2019 with a single random resample conducted at WF20. Samples for the Skokie River, North Branch Chicago River mainstem site and the lower Middle Fork North Branch were collected in 2018 with a single random resample collected at SR3 and no sample collected at SR7 due to excessive depth. Macroinvertebrate assemblage in the NBWW survey area ranged from poor to fair (Figure 33). None of the sites met the mIBI General Use biocriterion of 41.8. The Middle Fork macroinvertebrate assemblage was generally fair with MF11 the only site with a rating in the upper poor range (Figure 33). The highest mIBI rating at MF14 coincides with the best habitat in the NBWW survey area. The site was the only site in the survey area that possessed more than 10% EPT taxa in the sample (43.6%; Table 17). The

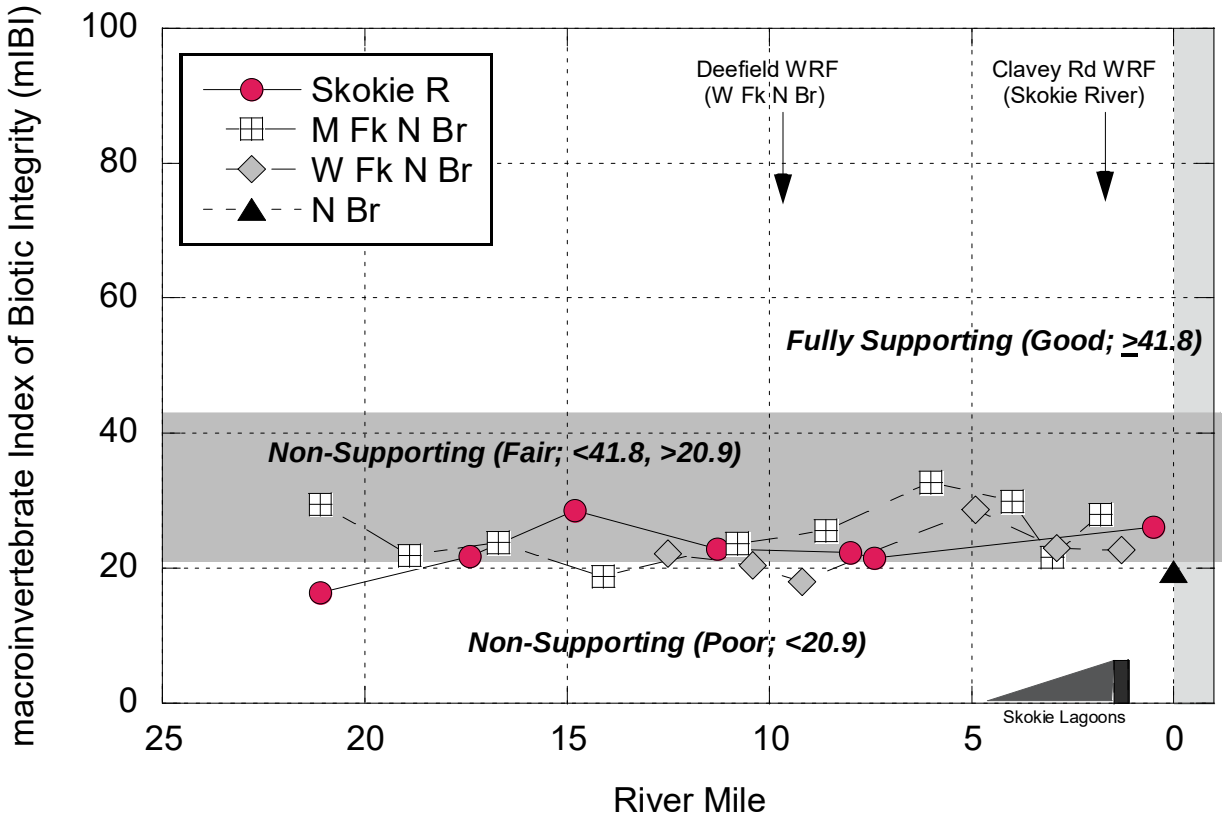

***Figure 29**. Illinois macroinvertebrate IBI (mIBI) scores for the NBWW survey area. Scores were recorded for the Skokie River, North Branch Chicago River and the lower two sites in the Middle Fork North Branch in 2018 while the West Fork North Branch and the upper Middle Fork North Branch values were recorded in 2019.*

macroinvertebrate assemblage in the North Branch Chicago River mainstem was consistent with the majority of the NBWW survey area, rating poor in the NE Illinois IPS thresholds.

Table 15 lists select mIBI metrics and other macroinvertebrate assemblage attributes, two of which are key biological response signatures associated with toxic impacts (% toxic tolerant taxa) and organic enrichment (% organic enrichment tolerant taxa; Yoder and DeShon 2003). Total taxa ranged from 7 to 27 taxa. The percent of organic enrichment taxa exceeded good thresholds at all except the lowest site in the West Fork, in the North Branch mainstem site, at half of the sites in the Skokie River and at MF16 in the Middle Fork. The West Fork North Branch organic enrichment taxa coincide with poor to fair concentrations of total phosphorus, TKN and high to wide diel D.O. swings (Table 15). Fewer sites (9) exceeded the good benchmark for the percent of toxic tolerant taxa with only two, SR3 and WF25, in the poor range (Table 15). The proportion of EPT taxa ranged from 0.0% to 43.6% with most sites in the poor range.

Table 15. *Selected fish and macroinvertebrate assemblage attributes for sites sampled in the NBWW watershed in 2018-19. Biological index scores are shaded by level of use support: Exceptional – blue; Good (fully supporting) - green; Fair (non-support) - yellow; Poor (non-support) – orange; Very Poor - red; key metrics as signatures of toxic or organic enrichment impacts are based on Yoder and DeShon (2003).*

				Fish Data							Macroinvertebrate Data								
Site ID	River Mile	Drainage Area (mi.^{2})	Year	fIBI	MIwb	Native Sp.	% DELT	Intolerant Sp.	%Mineral Spawners	% Tolerant	mIBI	Total Taxa	Intolerant Taxa	%Tolerant Taxa	EPT Taxa	%EPT	MBI	%Toxic Tolerant Taxa	%Organic Enrich. Taxa
Skokie River																			
SR1	21.10	2.70	2018	8.0		3	0.0	0	0	87.5	16.4	19.0	1.0	36.8	1	7.9	8.5	3.0	57.4
SR2	17.40	7.80	2018	14.0		5	0.0	0	0	78.0	21.8	14.0	2.0	3.2	0	0.0	4.2	0.0	5.1
SR3	14.80	11.50	2018	14.0		9	0.0	0	0	72.5	28.6	21.5	2.5	7.5	0	0.0	5.0	21.2	14.2
SR4	11.30	15.00	2018	12.5		8.5	0.0	0	0	69.0	22.9	12.0	1.0	2.8	1	8.1	4.0	1.1	2.1
SR5	8.00	20.60	2018	16.5	4.3	10.5	0.0	0	0.5	57.5	22.4	13.0	2.0	2.7	0	0.0	3.5	0.3	5.1
SR6	7.40	21.50	2018	15.5	5.5	7	0.0	0	1.0	71.5	21.5	16.0	2.0	7.7	0	0.0	5.5	10.6	35.3
SR7	3.00	23.70	2018	20.5	8.2	11	0.0	0	0	27.5									
SR18	0.50	30.90	2018	16.0	7.0	11	0.0	0	0	59.0	26.2	23.0	2.0	11.0	2	7.0	5.3	5.2	19.6
Middle Fork North Branch Chicago River																			
MF8	21.10	5.81	2019	14.0		5	0.0	0	0	40.0	29.6	13.0	1.0	4.9	3	6.7	4.6	0.0	8.7
MF9	18.90	8.91	2019	17.0		8	0.0	0	0	50.0	21.9	13.0	1.0	4.8	3	0.9	4.7	0.0	14.5
MF10	16.70	11.90	2019	16.0		7	0.0	0	0	29.0	23.9	12.0	2.0	1.4	3	2.3	4.2	0.0	2.0
MF11	14.10	16.11	2019	17.0		9	1.0	0	0	56.0	18.8	7.0	1.0	0.6	1	1.2	4.1	0.3	0.9
MF12	10.80	19.23	2019	15.0		7	0.0	0	0	57.0	23.7	17.0	2.0	2.4	2	1.2	4.4	0.0	6.6
MF13	8.60	20.96	2019	14.0	4.3	6	0.0	0	0	50.0	25.6	17.0	2.0	4.6	1	0.6	5.3	0.9	11.0
MF14	6.00	22.48	2019	14.0	5.5	12	0.0	0	0	58.0	32.8	18.0	2.0	2.9	3	43.6	5.3	0.6	12.8
MF15	4.00	24.29	2019	15.0	5.3	7	0.0	0	0	57.0	29.9	27.0	2.0	1.6	4	6.5	5.1	5.0	10.0
MF16	3.00	56.10	2018	15.0	5.3	9.5	0.3	0	0	46.5	21.7	27.0	1.0	20.2	1	0.3	6.3	16.7	25.0
MF17	1.80	57.30	2018	14.0	5.1	9.5	0.0	0	0	53.5	28	21.0	2.0	3.8	1	2.3	5.1	7.0	13.0
West Fork North Branch Chicago River																			
WF20	12.50	3.87	2019	16.0		4	0.0	0	0	50.0	22.2	17.0	0.5	16.2	0	0.0	6.5	10.3	33.6
WF21	10.40	7.02	2019	9.0		3	0.0	0	0	100.0	20.5	18.0	2.0	5.3	1	0.3	6.0	4.7	44.1
WF22	9.20	9.41	2019	12.0		6	0.9	0	0	67.0	18.1	18.0	0.0	9.6	1	0.3	6.3	4.2	57.8
WF23	4.90	17.86	2019	13.0		9	4.4	0	0	67.0	28.7	21.0	1.0	13.8	2	0.9	5.9	7.1	26.4
WF24	2.90	24.52	2019	4.0	3.2	4	0.0	0	0	100.0	23.1	26.0	0.0	7.4	2	2.3	5.8	0.8	22.2
WF25	1.30	27.97	2019	12.0	3.6	9	0.8	0	0	78.0	22.8	20.0	0.0	6.5	2	0.7	5.4	33.7	13.0
North Branch Chicago River																			
MF19	18.60	93.40	2018	12.0	4.6	10	0.0	0	0	60.0	19.5	18.0	2.0	20.9	0	0.0	6.5	3.4	35.5
Exceptional				≥50	>9.6	>29	0	≥5		≤16.1	>65.0							0	<5
Good				>41-49	>8.5	>14	<1.3	≥4	>40.7	<30.3	≥41.8	≥23	≥3	≤7.5	≥3	>24.5	≤4.9	<5	<15
Fair				30- <41	>5.8	>12	<3.0	<3	<40.7	<40	<41.8	<23	≥2	≤28	2	≥7.7	>4.9	<20	≥15
Poor				>15-29	<5.8	>7	>10	≤1	<10	>50	≤20.9	<16	<2	>28.1	1	<7.7		≥35	≥35
Very Poor				<15	<4.0	<7	>20		<0.8	≥70			0		0			>60	>60

Biological Assemblages – Fish

Twenty (20) native and three (3) non-native fish species and three (3) hybrids were collected in the NBWW survey area in 2018 and 2019. The fish assemblage was predominated by tolerant and moderately tolerant species (Table 16). Bluegill, Green Sunfish, White Sucker, Largemouth Bass, Gizzard Shad, Goldfish, Blackstripe Topminnow, Common Carp, Yellow Bullhead, and Golden Shiner were the most numerous species collected in 2018 and 2019 combined. White Sucker, Common Carp, Largemouth Bass, Bluegill, Green Sunfish, Walleye, Goldfish, Gizzard Shad, Yellow Bullhead and Black Bullhead comprised the highest percentages of biomass. Of the ten most abundant species six (6) are highly tolerant, two (2) are moderately tolerant and none are sensitive or intolerant. The species collected are common to highly disturbed streams and are adaptive to degraded or limited habitat availability.

Table 16*. The ten most abundant species by number weight collected in the NBWW survey area in 2018-19. Illinois and Ohio tolerance assignments, numbers and weight (kg) collected, and percent collected by each (T – highly tolerant; P moderately tolerant; species with blank tolerance cells are intermediate).*

Species	Tolerance		No./Wt. Collected	% By Number
	IL	OH		
Species Ranks by Numbers				
Bluegill		P	911	16.9
Green Sunfish	T	T	779	14.5
White Sucker	T	T	724	13.4
Largemouth Bass		P	627	11.6
Gizzard Shad			581	10.8
Goldfish	T	T	432	8.0
Blackstripe Topminnow			364	6.8
Common Carp	T	T	251	4.7
Yellow Bullhead	T	T	236	4.4
Golden Shiner	T	T	179	3.3
Species Ranks by Weight (Kg)				
White Sucker	T	T	2.8	31.1
Common Carp	T	T	2.7	30.1
Largemouth Bass		P	0.6	6.9
Bluegill		P	0.6	6.5
Green Sunfish	T	T	0.4	4.6
Walleye			0.4	4.3
Goldfish	T	T	0.4	4.0
Gizzard Shad			0.3	3.8
Yellow Bullhead	T	T	0.3	3.8
Black Bullhead		P	0.1	1.3

Fish Assemblage

Fish IBI (fIBI) scores are the mean of two sampling passes within the summer-early fall index period. The General Use biocriterion of 41 was not met at any sites (Table 15; Figure 34). Poor scores were recorded at all sites except for within the Skokie Lagoons (SR7) which scored in the lower fair range. The longitudinal plots for the Middle Fork and West Fork show little variation in the fish community from upstream to downstream, while the Skokie River shows some improvement from upstream to downstream. The site in the West Fork downstream of E. Lake Ave. (WF24) showed a sharp decline in the fIBI. This location is downstream of the Village of Glenview 1800 E. Lake Ave. lift station and where the highest median concentrations of

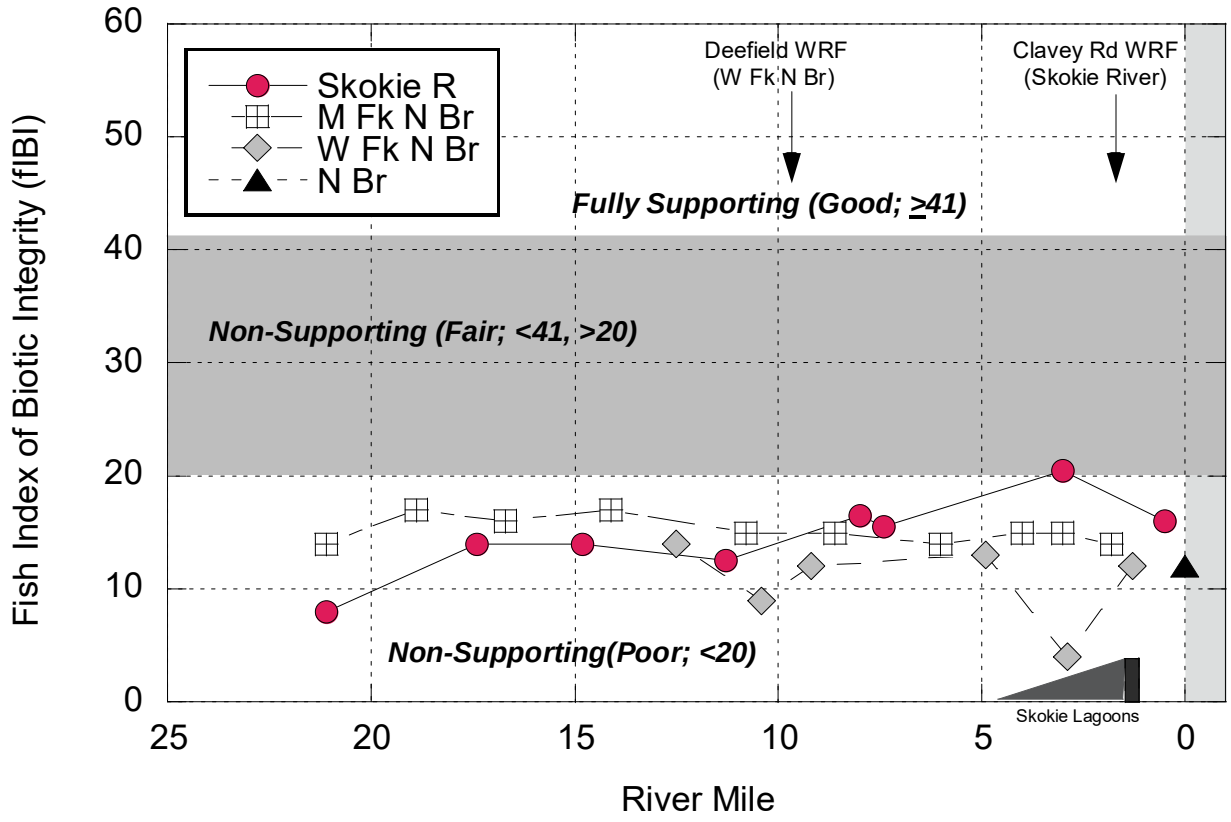

Figure 30. *Illinois fish IBI (fIBI) scores for the NBWW survey area. Scores were recorded for the Skokie River, North Branch Chicago River and the lower two sites in the Middle Fork North Branch in 2018 while the West Fork North Branch and the upper Middle Fork North Branch values were recorded in 2019.*

ammonia-N and chlorides in 2019 were located. The Skokie River site (SR7) which attained a fair rating was likely buoyed by stocking efforts by the Illinois DNR. Walleye, Northern Pike, Channel Catfish and Largemouth Bass (Figure 35) are stocked annually (Illinois DNR, 2020). Fish assemblages were dominated by tolerant, introduced and non-native species while no species that are considered sensitive or intolerant were collected. The assemblage present in the NBWW survey area provided little support for the fIBI to meet the General Use biocriterion.

The Modified Index of Well-Being (MIwb) has no formal biocriteria in Illinois, but using the Ohio biocriteria it attained the Ohio equivalent of the General Use at zero (0) sites and was fair at the lower two sites in the Skokie River. The MIwb is calculated for wadeable and boatable sites with drainage areas >20 mi^2 and was therefore assessed at twelve sites total in the NBWW survey area. Middle Fork North Branch sites possessed observed MIwb values in the poor range and the West Fork North Branch MIwb scores were very poor (Table 14). High proportions of tolerant fishes throughout the survey area limit both the MIwb and fIBI scores. The percent tolerant fish exceeded the good threshold at all but two sites (SR7 and MF10; Table 17). DELT anomalies were generally very low, with primarily good and excellent values were observed. Zero intolerant species were collected with a very limited number of sites possessing any mineral substrate spawners (Table 14).

Figure 31*. Largemouth Bass (Micropterus salmoides) collected in the Skokie Lagoons (SR7) during the first sampling event in 2018.*

Synthesis

The baseline biological condition of the North Branch River and its subwatersheds has been shaped by the naturally low gradient and wetland origins of the region. The current condition of the biological assemblages reflects the changes that have significantly altered these natural

features, mostly through hydrological and physical alterations related to suburban and urban development throughout the survey area. Both the direct and indirect influences of the altered hydrology and habitat were evident in the chemical, habitat, and bioassessment results. The legacy of hydrological and habitat alterations have resulted in sluggish flows, excessive siltation, embedded substrates, sparse instream cover, sediments high in organic matter, and indicators of excessive urban runoff that are further exacerbated by the altered flows and habitat. High levels of PAHs and metals in sediments are due to urban runoff and persist at greater concentrations during the low flow periods that occur during the summer and early fall months. Sediments that are high in organic matter have also indirectly resulted from sluggish flows and stream channel alterations that combine to exacerbate low D.O. concentrations and high to wide diel D.O. swings. The introduction of wastewater from the Clavey Rd. WRF in the Skokie River and the Deerfield WRF in the West Fork North Branch appear to be a source of nitrogen compounds including nitrites, TKN, and ammonia, but they also appear to reduce TSS and chloride levels. No site had QHEI scores that were considered good and only a few fair scores were recorded. In keeping with the same pattern, neither biological assemblage attained a rating of good or met their General Use biocriteria.

Newly derived IPS thresholds for water and sediment chemistry and physical habitat attributes (MBI 2020a) were available to better assess causes of impairment and their comparative severity. The approach for deriving these thresholds included a more refined stratification of biological effect threshold values for parameters that showed valid relationships with biological responses based on species and taxa level analyses and then correlated with the corresponding fish and macroinvertebrate IBI attainment thresholds and narrative ratings (MBI 2020a). This produced thresholds across four or five narrative categories of quality (excellent, good, fair, poor, and very poor). This replaces the formerly used binary (i.e., “pass/fail”) approach to evaluating exceedances of chemical and physical effect thresholds and criteria providing for a graded approach to the assignment of causes and sources of Illinois General Use biological impairments. The new IPS framework also offers the semblance of a tiered aquatic life use (TALU) stratification of goals and thresholds that has been incorporated into all IPS outputs to support local restoration and protection efforts by the respective watershed groups and stakeholders.

The biological criteria for fish and macroinvertebrates used by Illinois EPA (2018) establish the thresholds by which impaired sites and reaches are determined. The assignment of causes in this analysis generally attempts to follow the overall intent of the Illinois Integrated Report assessment guidelines, but is supplemented by the more extensive biological effect thresholds provided by the newly updated IPS tools and indicators (MBI 2020a) and more spatially refined by the intensive pollution survey design. The delineation of causes and sources was based on integrating and synthesizing the preceding analyses of categorical and parameter-specific stressor threshold exceedances. The most influential of these in 2018-19 are included in Table 17 along with the fish and macroinvertebrate IBI scores and other indicators of stress and response. Habitat alteration is represented by the QHEI and the QHEI modified:good attributes ratio, D.O. includes the minimum measured by Datasondes, the effect of nutrient enrichment by the diel D.O. swing narrative, the nutrient enrichment effect status, the new IPS nutrient

***Table 17**. Key chemical, physical, and biological response indicators of impairment observed at each site in the NBWW study area in 2018 and 2019. The causes associated with biological impairments are drawn from analyses of habitat, nutrient effects, chemical IPS and other threshold exceedances, sediment chemical IPS exceedances, and biological response signatures. Causes of impairment are classified as fair, poor, or very poor in accordance with the exceedance of corresponding thresholds. See footnotes for table references and biological, physical, and chemical threshold intervals.*

Site ID	River Mile	Drainage Area (mi.²)	Year	AQLU Status	fIBI[1]	mIBI[2]	QHEI[3]	QHEI Modified: Good Ratio[4]	Min. D.O. (Sonde) <WQC[5]	Diel D.O. Swing[5]	Diel D.O. Swing Narrative[5]	IPS Nutrient Index[6]	Chemical WQC Exceedances[7]	>Fair Chemical Thresholds[8]	No. of Sediment Metals >Thresholds[9]	No. of Sediment PAH >Thresholds[9]	Organic Enrichment Signatures[10]	Toxic Tolerant Signatures[10]	2018-19 MBI Causes by Stressor Threshold Narrative Category: Very Poor[11]	Poor[11]	Fair[11]	2018-19 MBI Sources	Restorability Score (0-100)
Skokie River 2018																							
SR1	21.1	2.7	2018	Non-Poor	8.0	18.4	33.5	9.0	2.38	5.05	High	20.2	None	Cu,Na,Zn	Al,Cr,Cu,Fe,Pb,Ni,Ag,Zn	PAH (10)	M (57.4%)	None	Urban-WS;Dev-WS; Substr; Chan; Metals-WC; PAH	Imperv-500m; TKN; QHEI	Low DO; BOD; Chloride; VSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	11.8
SR2	17.4	7.8	2018	Non-Poor	14.0	21.8	33.5	5.0				21.3	None	None	Al,Cr,Cu,Pb,Mn,Ag,Zn	PAH (13)	None	None	Urban-WS;Dev-WS; Substr; PAH	QHEI; Channel	Imperv-500m;TP; TKN; BOD; Nitrate	Urban, NPS, Altered Flow, Habitat Mod.	16.7
SR3	14.8	11.5	2018	Non-Poor	14.0	28.6	40.5	2.7	3.91	5.07	High	18.7	None	None	Al,Cr,Cu,Pb,Ni,Ag,Zn	PAH (13)	M (14.2%)	M (21.2%)	Urban-WS;Dev-WS; Substr; PAH	Imperv-500m; BOD; QHEI; Chan; TSS	Low DO; Chloride; VSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	21.1
SR4	11.3	15.0	2018	Non-Poor	12.5	22.9	47.0	2.7				16.5	None	TKN	Al,Cr,Cu,Fe,Pb,Mn,Ni,Ag,Zn	PAH (11)	None	None	Chan; PAH	Imperv-500m;Urban-WS;Dev-WS; QHEI; TSS	Low DO; BOD; Substr; Chloride; VSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	24.5
SR5	8.0	20.6	2018	Non-Poor	16.5	22.4	45.5	4.0	3.25	5.77	High	16.6	None	None	Al,Cr,Cu,Pb,Ag,Zn	PAH (12)	None	None	Urban-WS;Dev-WS; PAH	QHEI; Substr; Chan; TSS	Imperv-500m; TKN; BOD; Chloride; VSS	Urban, NPS, Altered Flow, Habitat Mod.	19.5
SR6	7.4	21.5	2018	Non-Poor	15.5	21.6	36.3	8.0				20.9	None	None	Al,Cr,Cu,Pb,Ag,Zn	PAH (13)	M (35.3%)	M (10.6%)	Urban-WS;Dev-WS; PAH	BOD; QHEI; Substr; Chan; TSS	Imperv-500m; Low DO; TKN; Chloride; VSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	19.2
SR7	3.0	23.7	2018	Non-Poor	20.5	N/A	32.5	3.5	1.33	6.47	High	18.9	None	None	Al,Cu,Ni,Ag	PAH (3)	None	None	Urban-WS;Dev-WS; Chan;	QHEI; Substr; TSS	Imperv-500m;Imperv-30;Imperv-30C; Low DO; BOD; Chloride; VSS; Turbidity; Sed. Metals; PAH	Urban, NPS, Altered Flow, Habitat Mod.	22.4
SR18	0.5	30.9	2018	Non-Poor	16.0	28.2	38.5	4.0	5.64	3.99	Low	18.8	None	Cu,Zn	Al,Cr,Cu,Pb,Ni,Ag,Zn	PAH (10)	M (19.6%)	M (5.2%)	Urban-WS;Dev-WS; Substr; Chan; PAH	QHEI, Metals-WC	Imperv-500m; Low DO; BOD; Chloride; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	25.1
Middle Fork North Branch Chicago River 2019																							
MF8	21.1	5.8	2019	Non-Poor	14.0	29.6	34.0	9.0				17.8	None	Na,Zn	Al,Cr,Cu,Fe,Pb,Mn,Ni,Zn	PAH (10)	None	None	Substr; PAH	Urban-WS;Dev-WS; Low DO; QHEI; Chan; Chloride; Metals-WC	Imperv-500m; Conduct	Urban, NPS, Altered Flow, Habitat Mod.	16.4
MF9	18.9	8.9	2019	Non-Poor	17.0	21.9	28.0	9.0				21.5	None	None	Al,Cr,Cu,Fe,Pb,Ni,Zn	PAH (10)	None	None	Low DO; PAH	Urban-WS; QHEI; Substr; Chan; Chloride	Imperv-500m;Dev-WS; TKN; Max DO; Conduct	Urban, NPS, Altered Flow, Habitat Mod.	24.6
MF10	16.7	11.9	2019	Non-Poor	16.0	23.9	43.0	4.0	1.12	15.25	Wide	21.6	None	None	Al,Cr,Cu,Fe,Pb,Mn,Ni,Zn	PAH(9)	None	None	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Substr; Chan; Chloride	Imperv-500m; TKN; Max DO; Conduct	Urban, NPS, Altered Flow, Habitat Mod.	25.7
MF11	14.1	16.1	2019	Non-Poor	17.0	18.8	45.5	3.5				23.5	None	None	Al	PAH(9)	None	None	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Substr; Chan; Chloride	Imperv-500m; TKN; Max DO; Conduct	Urban, NPS, Altered Flow, Habitat Mod.	24.4
MF12	10.8	19.2	2019	Non-Poor	15.0	23.7	41.5	4.0	3.72	3.64	Low	21.0	None	None	Al,Cr,Cu,Fe,Pb,Ni,Zn	PAH (10)	None	None	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Substr; Chan; Chloride	Imperv-500m; TKN; Max DO; Conduct; TSS	Urban, NPS, Altered Flow, Habitat Mod.	20.8
MF13	8.6	21.0	2019	Non-Poor	14.0	25.6	54.5	3.5				18.8	None	TKN	Al,Cr,Cu,Fe,Pb,Ni,Zn	PAH (12)	None	None	Substr; PAH	Urban-WS;Dev-WS; Chan; TSS	Imperv-500m; Low DO; TKN; QHEI; Chloride; VSS; Turbidity; Sed. Metals;	Urban, NPS, Altered Flow, Habitat Mod.	27.7
MF14	6.0	22.5	2019	Non-Poor	14.0	32.8	67.0	0.7	5.02	5.24	High	19.4	None	TKN	None	PAH (10)	None	None	PAH	Urban-WS;Dev-WS; Chloride	Imperv-500m; Low DO; TKN; Max DO; QHEI; Substr; Conduct; TSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	37.5
MF15	4.0	24.3	2019	Non-Poor	15.0	29.9	59.0	3.5	5.94	4.2	Moderate	17.0	None	Cu,Na	None	PAH (10)	None	M (5.0%)	PAH	Urban-WS;Dev-WS; Substr; Chloride; TSS, Metals-WC	Imperv-500m; BOD; Max DO; QHEI; Chan; Conduct; WC Metals	Urban, NPS, Altered Flow, Habitat Mod.	25.9
MF16	3.0	56.1	2018	Non-Poor	15.0	21.7	44.0	2.0				21.7	None	None	Al,Cr,Cu,Pb,Ni,Ag,Zn	PAH (13)	M (25.0%)	M (16.7%)	Substr; PAH	Urban-WS;Dev-WS; QHEI; Chan; VSS	Imperv-500m; TKN; BOD; Nitrate; Chloride; TSS	Urban, NPS, Altered Flow, Habitat Mod.	28.2
MF17	1.8	57.3	2018	Non-Poor	14.0	28.0	45.0	2.7	4.52	2.58	Low	21.7	None	None	Al,Cr,Cu,Pb,Ni,Ag,Zn	PAH (13)	None	M (7.0%)	Chan; PAH	Urban-WS;Dev-WS; QHEI; Substrate	Imperv-500m; Low DO; TKN; BOD; TSS; VSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	26.2
West Fork North Branch Chicago River 2019																							
WF20	12.5	3.9	2019	Non-Poor	16.0	22.2	30.5	4.0				23.9	None	TKN, TSS, TP, Na	Al,Cu,Pb,Ni,Zn	PAH (11)	M (33.6%)	M (10.3%)	Substr; PAH	Urban-WS;Dev-WS; Low DO; QHEI; Chan; Chloride; Metals-WC	Imperv-500m; TKN; BOD; Conduct; TSS	Urban, NPS, Altered Flow, Habitat Mod.	14.8
WF21	10.4	7.0	2019	Non-Poor	9.0	20.5	40.5	4.5	1.44	5.77	High	23.6	None	None	Al,Cu,Ni,Zn	PAH (12)	M (44.1%)	None	PAH	Urban-WS;Dev-WS; Low DO; QHEI; Channel	Imperv-500m; TKN; BOD; Max DO; Substr; Chloride	Urban, NPS, Altered Flow, Habitat Mod.	19.4
WF22	9.2	9.4	2019	Non-Poor	12.0	18.1	46.0	2.3				27.7	None	Cu,Na,Zn	Al,Cr,Cu,Fe,Ni,Zn	PAH (11)	M (57.8%)	None	Urban-WS;Dev-WS; WC Metals; PAH	Low DO; QHEI; Substr; Chan; Chloride,Metals-WC	Imperv-500m;Imperv-30;Imperv-30C;TP; TKN; BOD; Conductivity	Urban, NPS, Altered Flow, Habitat Mod.	11.3
WF23	4.9	17.9	2019	Non-Poor	13.0	28.7	38.5	4.0	1.62	6.67	Wide	23.6	None	None	None	PAH (10)	M (26.4%)	M (7.0%), DELT (4.4%)	Urban-WS;Dev-WS; Substr; Chloride; PAH	Imperv-500m;Imperv-30;Imperv-30C; Low DO; QHEI; Chan	TP; TKN; Max DO; Conductivity	Urban, NPS, Altered Flow, Habitat Mod.	18.3
WF24	2.9	24.5	2019	Non-Poor	4.0	23.1	53.5	1.5				26.0	None	TKN	None	PAH (12)	M (22.2%)	None	Urban-WS;Dev-WS; Chloride; PAH	Imperv-500m; TKN; Conduct	Imperv-30;Imperv-30C;TP; Low DO; Max DO; QHEI; Substr; Chan; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	19.6
WF25	1.3	28.0	2019	Non-Poor	12.0	22.8	45.5	4.0	2.77	5.16	High	23.8	None	Cu,Na	None	PAH (13)	None	M (33.7%)	Urban-WS;Dev-WS; Chloride; PAH	Imperv-500m; Low DO; QHEI; Substr; Chan; Conduct;	TP; TKN; Max DO	Urban, NPS, Altered Flow, Habitat Mod.	20.8
North Branch Chicago River 2018																							
WF19	18.6	93.4	2018	Non-Poor	12.0	19.5	49.0	2.3	3.89	2.93	Low	18.2	None	Cu,Na,Zn	Al,Cd,Cr,Cu,Fe,Pb,Mn,Ni,Ag,Zn	PAH (10)	M (35.5%)	None	Urban-WS;Dev-WS; PAH	Imperv-30;Imperv-30C, Metals-WC	Imperv-500m; Low DO; Chloride; VSS; Turbidity; Sed. Metals	Urban, NPS, Altered Flow, Habitat Mod.	30.2
	Narrative Category			***Narrative Range Thresholds & Criteria***																			**Narrative**
	Excellent			FULL	≥50	>73	>84.5	<0.50	>6.9	< 2.0	Normal	<10	None	None	None	None	0	<5					**Very High**
	Good			FULL	>41-49	41.8-72.9	>75.9	<2.00	6-6.9	2.0-4.0	Low	10-15	1	1	1	1	<5	<15					**High**
	Fair			PARTIAL	30-<41	30-41.7	<75.9	≥2.00	4.0-5.9	4.0-5.0	Moderate	15-25	2-4	2-4	2-4	2-3	<20	≥15					**Moderate**
	Poor			Non-Fair	>15-29	>15-29	<50.1	≥4.00	2.0-3.9	5.0-6.5	High	25-35	4-6	4-6	4-6	4-6	>35	>35					**Low**
	Very Poor			Non-Poor	<15	<15	<25	≥6.00	<2.0	>6.5	Wide	>35	>6	>6	>6	>6	>60	>60					**Very Low**

[1] fIBI: full support ≥41; nonsupport-fair ≥20<41; nonsupport-poor <20.

[2] mIBI: full support ≥41.8; nonsupport-fair ≥20.9<41.8; nonsupport-poor <20.9.

[3] From Table 6 - IPS thresholds for habitat attributes.

[4] From Table 11 - QHEI matrix of good and modified attributes.

[5] From Table 8 - modified SNAP variables matrix.

[6] IPS derived nutrient index - see Appendix F.

[7] Exceedances of Illinois water quality criteria.

[8] Number and magnitude of water column chemical threshold exceedances (Appendix E).

[9] Sediment metal and organic exceedences of NE IL IPS thresholds in Table 7 or MacDonald et al. (2000) PEC/TEC or IEPA elevated levels - see Tables 9 (metals) and 10 (PAH compounds).

[10] Biological response signatures for organic enrichment - see Table 13 (M - macoinvertebrates; F - fish).

[10] Biological response signatures for general toxicity - see Table 12 (M - macoinvertebrates; F - fish).

[11] IPS derived very poor (primary), poor (secondary), and fair (tertiary) causes assigned by weighting the stressor rank * FIT factor - see Appendix E; primary causes rank >8-10, secondary causes rank >6-8, tertiary causes rank >4-6.

index, new IPS chemical threshold exceedances for water and sediment, and biological response signatures for organic enrichment and toxic tolerant indicators. The rationale for listing the predominant causal categories in 2018 and 2019 follows:

- **PAH/Metals/Toxicity** (50 observations; weighted frequency of 29.3%) – any sediment or water column metal or PAH threshold exceedance in Table 8, *PEC or PEL* exceedance, or Illinois EPA elevated thresholds and any toxic *Biological Response* in Table 17.
- **Macro Habitat Related** (44 observations; weighted frequency of 25.7%) – any high influence *Channelized/No Recovery* or moderate influence *Recovering from Channelization* in the QHEI attributes matrix (Table 13) or a poor or very poor QHEI score.
- **Siltation/Embeddedness** (24 observations; weighted frequency of 14.3%) – any high influence *Silt/Muck Substrate* and/or moderate-extensive embeddedness in the QHEI attributes matrix (Table 13).
- **Organic Enrichment/Low D.O.** (46 observations; weighted frequency of 11.3%) – any low D.O. value, any TKN value of poor or very poor (TKN used as a proxy for BOD per Miltner 2018);
- **Chlorides** (22 observations; weighted frequency of 8.4%) any chloride value >biological effect fair, poor, or very poor threshold in Table 7.
- **Turbidity/TSS** (23 observations; weighted frequency of 6.4%).
- **Nutrient Enrichment** (25 observations; weighted frequency of 4.6%) - diel D.O. Swing narrative ratings of *High* or *Wide* and/or nutrient enrichment status of *Highly Enriched, Enriched, or Likely Nutrients* as described in Table 9. SNAP narrative ratings that were accompanied by high TKN and low total P and nitrate-N were also correlated the Organic Enrichment/Low D.O. cause category in the modified upper mainstem.

While Macro Habitat Related causes were not the most frequent limiting factor to aquatic life, they were the most severe and exhibited the highest number of Poor IPS threshold exceedances. Altered hydrology and habitat are the primary factors perpetuating the Macro Habitat Related deficiencies. Poor habitat persists throughout the North Branch Chicago River watershed, containing primarily poor habitat, with only a few fair QHEI scores located in the Middle Fork of the North Branch and a single fair score in the West Fork of the North Branch. Siltation/ Embeddedness was the second most limiting factor, and despite having fewer observations than Nutrient Enrichment (weighted frequency 14.3%) was pervasive throughout the study area with very poor narrative ratings in each subwatershed. Organic Enrichment/Low D.O. had 46 observations (11.3% weighted), primarily poor and fair ratings, with mostly low D.O. levels, high diel D.O. swings and high BOD_5 afflicting each subwatershed. Chlorides were primarily limiting in the Middle Fork of the North Branch and the West Fork of the North Branch, with primarily poor narrative ratings. Turbidity/TSS had 23 observations and a weighted frequency of 6.4% primarily were limiting in the Skokie River and Middle Fork of the Chicago River. Poor TSS ratings were observed in the Skokie River and Middle Fork of the North Branch

with few fair ratings in the West Fork of the North Branch. PAH/Metals/Toxicity (weighted frequency of 29.3%) primarily were fair ratings for sediment metals located in the Skokie River as well as the lower end of the Middle Fork of the North Branch. Very poor ratings were recorded at nearly every site for PAH concentrations in the survey area. Nutrient Enrichment was the least impactful limiting factor to aquatic life with 25 observations and a weighted frequency of 4.6%. TKN was the primary nutrient with fair ratings in the Middle Fork of the North Branch and in the West Fork of the North Branch.

Neither of the two major point sources (NSWRD Clavey Rd. and Deerfield WRFs) played a major role in the observed results with the exception of minor increases in some chemical constituents associated with municipal wastewater. No distinguishable signatures of excessive nutrient enrichment were apparent in the modified SNAP analysis even though the two WRFs heavily dominate the low flows of their receiving streams. Nor did they have any apparent beneficial effects as was observed in 2016 and 2018 with the entry of large volumes of treated wastewater discharges in the Upper Des Plaines River (MBI 2020b).

Perhaps the most important observation from the 2018-2019 bioassessment is that the overall habitat in each of the subwatersheds and in the mainstem North Branch Chicago River site is mostly poor. Heavy silt coverage and muck substrates coupled with the lingering effects of legacy channel and hydrological modifications reduce the habitat available for macro-invertebrates and fish and hamper the assimilation of pollution in general. Urban runoff contributes to toxic levels of PAHs and metals in sediments that are prevalent throughout the survey area. The biological results are associated with numerous exceedances of IPS thresholds with no sites meeting the Illinois EPA General Use designation for aquatic life.

Reinforcing these observations are the low and very low Restorability scores generated by the NE Illinois IPS (Table 17) which means that the challenges with restoring the streams of the NBWW study area to attaining the Illinois General Use for aquatic life are greater and dependent of restoration actions that address the most limiting chemical and physical factors as is demonstrated by the consistent repetition of very poor and poor causes of impairment related to urban land uses coupled with flow and habitat alterations.

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APPENDIX A

IPS Derived Biological Effect Thresholds

A-1: Northeast Illinois IPS Derived Biological Effect Thresholds for Water Column Parameters

A-2: Northeast Illinois IPS Derived Biological Effect Thresholds for Sediment Chemistry Parameters

A-3: Northeast Illinois IPS Derived Biological Effect Thresholds for Habitat and Land Use Parameters

Parameter Code	Variable Name	Units	Parameter Group	Limiting Assemblage	FIT Score	Sample N	Thresholds by Narrative Condition Category					Reference Site Values (Median-2X IQR)	Reference Site N
							Excellent	Good	Fair	Poor	Very Poor		
P665	Total Phosphorus	mg/L	Nutrients	Fish	0.04	1464	≤0.106	>0.106	>0.277	>1.002	>1.726	0.088 (0.062-0.115)	35
P94	Conductivity	µS/cm	Ionic	Fish	0.05	1464	≤739	≥739	>1038	>1208	>1378	922 (705-1158)	40
P70300	Total Dissolved Solids	mg/L	Ionic	Fish	0.10	1464	≤453.8	>453.8	>558.0	>651.2	>744.5	614 (512-664)	28
DO_MIN	Minimum DO	mg/L	Demand	Macros	0.10	985	>8.0	≥6.5	>5.47	<4.44	<3.4	8.6 (6.5-9.6)	29
P1092	Zinc, Total	µg/L	Metal_Tox	Fish	0.13	1464	≤7.47	>7.47	>9.78	>11.00	>12.22	2.0 (2.0-7.0)	23
P625	Total Kjeldahl Nitrogen	mg/L	Demand	Macros	0.14	985	≤1.07	>1.07	>1.12	>1.63	>2.14	0.74 (0.30-0.99)	30
P940	Chloride, Total	mg/L	Ionic	Fish	0.17	1464	≤40.00	>40.00	>120.0	>184.9	>249.8	154 (80.3-171.3)	33
P310	BOD (5-Day)	mg/L	Demand	Macros	0.21	985	≤1.30	>1.30	>2.35	>3.45	>4.54	2 (2.0-2.2)	27
P610	Total Ammonia	mg/L	Nutrients	Macros	0.28	985	≤0.084	>0.084	>0.100	>0.190	>0.280	0.1 (0.10-0.10)	34
P630	Nitrate-N	mg/L	Nutrients	Fish	0.29	1464	≤3.767	>3.767	>5.045	>7.344	>9.643	0.39 (0.29-0.97)	32
P929	Sodium, Total	mg/L	Ionic	Fish	0.29	1464	≤16275	>16275	>45000	>79056	>113112	14200 (10375-22500	21
P530	Total Suspended Solids	mg/L	Demand	Fish	0.32	1464	≤17.50	>17.50	>31.60	>35.15	>38.69	9.2 (5.4-20.3)	33
P1027	Cadmium, Total	µg/L	Metal_Tox	Fish	0.93	1464	≤0.937	>0.937	>0.974	>0.983	>0.991	<MDL (0.17)	23
DO_MAX	Maximum DO	mg/L	Demand	Macros	0.94	985	≤10.36	≥10.36	>12.21	>14.24	>16.28	8.74 (8.21-9.45)	29
P1042	Copper, Total	µg/L	Metal_Tox	Fish	1.75	1464	--	≤4.480	>4.480	>4.969	>5.458	2.00 (1.96-4.15)	22
P1051	Lead, Total	µg/L	Metal_Tox	Macros	2.11	985	≤2.851	>2.851	>3.335	>3.884	>4.434	0.24 (0.20-0.57)	23
P82078	Turbidity	NTU	Demand	Macros	2.61	985	--	≤19.3	>19.3	>25.9	>32.5	11.0 (4.5-24.5)	7
P1055	Manganese, Total	µg/L	Metal_Tox	Macros	2.74	985	≤53.71	>53.71	>77.03	>107.1	>137.2	32.0 (24.1-38.2)	23
P549	Volatile Suspended Solids	mg/L	Demand	Fish	2.81	1464	≤5.000	>5.000	>7.769	>9.825	>11.88	6.0 (4.8-7.4)	5
P1067	Nickel, Total	µg/L	Metal_Tox	Macros	3.26	985	--	≤3.470	>3.470	>9.585	>15.70	5 (1.5-21)	14
P945	Sulfate, Total	mg/L	Ionic	Macros	6.49	985	≤58.27	>58.27	>73.10	>83.45	>93.81	74.6 (61.8-81.8)	4
P1002	Arsenic	µg/L	Metal_Tox	Macros	9.19	985	--	≤3.616	>3.455	>5.029	>6.603	Insufficient Data	
P937	Potassium, Total	mg/L	Ionic	Macros	10.13	985	≤3158	>3158	>6300	>7718	>9129	2400 (1574-2817)	21
P1007	Barium, Total	µg/L	Metal_Tox	Fish	4.77	1464	≤74.1	>74.09	>84.88	>101.8	>118.6	56.3 (44.3-64.7)	21
P1034	Chromium, Total	µg/L	Metal_Tox	Fish	10.17	1464	≤1.398	>1.398	>1.540	>2.682	>3.824	1.73 (1.30-2.00)	6
P1082	Strontium	µg/L	Metal_Tox	Fish	2.69	1464	≤169.1	>169.1	>190.8	>280.4	>370.1	150 (135-181)	21
P1105	Aluminum, Total	µg/L	Metal_Tox	Fish	4.54	1464	≤310.0	>310.0	>393.3	>560.2	>727.0	200 (128-449)	21
P916	Calcium, Total	mg/L	Ionic	Fish	Unimodal	1464	≤84425	>84425	>86067	>86313	>86559	54,000 (80-74,250)	21
P299	Mean Dissolved Oxygen	mg/L	Demand	Macros	0.21	985	≥9.42	<9.42	<9.25	<6.11	<3.05	8.6 (7.9-9.0)	40
P615	Nitrite-N	mg/L	Nutrients	Macros	0.41	985	≤0.014	>0.014	>0.040	>0.068	>0.096	0.01 (0.01-0.01)	27
P720	Cyanide, Total	µg/L	Metal_Tox	Macros	5.17	985	≤8	>8	>10	>10	>10	3 (2-10)	6

Parameter Code	Variable Name	Units	Parameter Group	Limiting Assemblage	FIT Score	Sample N	Thresholds by Narrative Condition Category					Reference Site Values Median (IQR)
							Excellent	Good	Fair	Poor	Very Poor	
P1093	Zinc	mg/kg	Metal_Tox	Macros	2.22	985	≤75.00	>75.00	>100.0	>133.9	>167.8	Insufficient Data
P34524	Benzo(g,h,i)perylene	µg/kg	PAH	Macros	2.32	985	--	< 335.0	>335.0	>792.1	>1249	
P34406	Indeno(1,2,3-cd)pyrene	µg/kg	PAH	Macros	2.41	985	--	< 260.5	>260.5	>623.3	>986.2	
P1043	Copper	mg/kg	Metal_Tox	Macros	2.42	985	≤19.00	>19.00	>29.78	>40.45	>51.12	
P34233	Benzo(b)fluoranthene	µg/kg	PAH	Macros	2.51	985	--	<520.8	>520.8	>1437	>2354	
P1068	Nickel	mg/kg	Metal_Tox	Macros	2.67	985	--	<19.50	>19.50	>22.52	>25.53	
P34250	Benzo(a)pyrene	µg/kg	PAH	Macros	2.85	985	--	<230.0	>230.0	>798.3	>1367	
P34472	Pyrene	µg/kg	PAH	Macros	2.85	985	--	< 393.0	>393.0	>1570	>2747	
P1052	Lead	mg/kg	Metal_Tox	Macros	3.01	985	≤15.50	>15.50	>24.80	>33.04	>41.27	
P34529	Benzo[a]anthracene	µg/kg	PAH	Macros	3.48	985	--	< 239.0	>239.0	>699.4	>1160	
P34323	Chrysene	µg/kg	PAH	Macros	3.51	985	--	<266.0	>266.0	>958.3	>1651	
P34379	Fluoranthene	µg/kg	PAH	Macros	3.91	985	--	<774.0	>774.0	>2432	>4091	
P1083	Strontium	mg/kg	Metal_Tox	Macros	4.44	985	--	<81.80	>81.80	>106.8	>131.9	
P34559	Dibenz(a,h)anthracene	µg/kg	PAH	Macros	4.57	985	--	< 101.0	>101.0	>167.3	>233.7	
P34223	Anthracene	µg/kg	PAH	Macros	5.10	985	--	<78.00	>78.00	>119.9	>161.8	
P34464	Phenanthrene	µg/kg	PAH	Macros	5.10	985	--	< 243.5	>243.5	>803.3	>1363	
P1003	Arsenic	mg/kg	Metal_Tox	Macros	6.21	985	--	≤8.65	>8.65	>15.82	>23.67	
P1029	Chromium	mg/kg	Metal_Tox	Macros	6.29	985	≤20.53	>20.53	>23.30	>26.22	>29.15	
P1053	Manganese	mg/kg	Metal_Tox	Macros	7.08	985	≤841.0	>841.0	>845.5	>996.8	>1148	
P1078	Silver	mg/kg	Metal_Tox	Macros	7.11	985	--	<0.483	>0.483	>1.261	>2.039	
P1108	Aluminum	mg/kg	Metal_Tox	Macros	8.26	985	--	<6480	>6480	>8272	>10064	
P1008	Barium	mg/kg	Metal_Tox	Macros	8.88	985	--	≤141.0	>132.0	>150.3	>168.7	
P1028	Cadmium	mg/kg	Metal_Tox	Macros	11.00	985	--	≤0.933	>0.745	>1.354	>1.963	
P1013	Beryllium	mg/kg	Metal_Tox	Macros	ND[a]	985	--	≤0.411	>0.411	>0.496	>0.581	
P1103	Tin	mg/kg	Metal_Tox	Macros	ND	985	--	<8.86	>11.00	>16.73	>24.60	
P34203	Acenaphthylene	µg/kg	PAH	Macros	ND	985	--	<86.38	>86.38	>103.6	>120.9	
P34208	Acenaphthene	µg/kg	PAH	Macros	ND	985	--	<84.25	>84.25	>104.8	>125.3	
P34262	Delta-BHC	µg/kg	PAH	Macros	ND	985	--	<2.098	>2.098	>6.19	>10.28	
P34384	Fluorene	µg/kg	PAH	Macros	ND	985	--	<84.25	>84.25	>104.8	>125.3	
P34445	Naphthalene	µg/kg	PAH	Macros	ND	985	--	< 86.38	>86.38	>103.6	>120.9	

Parameter Code	Variable Name	Units	Parameter Group	Limiting Assemblage	FIT Score	Sample N	Thresholds by Narrative Condition Category					Reference Site Values (Median - 2X IQR)	Reference Site N
							Excellent	Good	Fair	Poor	Very Poor		
EMBEDDED	Embeddedness Score	QHEI Units	Habitat	Fish	0.03	1393	≤1.3	>1.3	>1.6	>2.4	>3.2	2 (2-2)	29
Urban	Urban (Ust. WS)	Wtd. %	Land Use	Fish	0.03	2657	≤8.8	>8.8	>45.0	>63.2	>81.3	8.7 (3.0-9.5)	48
QHEI	QHEI Score	QHEI Units	Habitat	Fish	0.04	1393	≥84.5	>75.9	<75.9	<50.1	<25.0	84 (76-90)	34
SUBSTRAT	Substrate Score	QHEI Units	Habitat	Fish	0.04	1393	≥16.0	<16.0	<15.0	<9.9	<5.0	8 (7-9)	33
WWH_ATTR	Good Habitat Attributes	Number	Habitat	Fish	0.04	1393	≥9	<9	<8	<5	<2	16 (15-17)	34
Imperv	Impervious (30 m)	Wtd. %	Land Use	Fish	0.04	2657	≤18.3	>18.3	>30.5	>53.4	>76.4	2.1 (0.0-14.7)	48
Imperv	Impervious (30 m Clipped)	Wtd. %	Land Use	Fish	0.04	2657	≤13.4	>13.4	>26.7	>50.9	>75.1	2.1 (0.0-6.1)	48
CHANNEL	Channel Score	QHEI Units	Habitat	Fish	0.07	1393	≥16.8	<16.8	<14.00	<9.2	<4.6	16 (13-19)	34
COVER	Cover Score	QHEI Units	Habitat	Fish	0.07	1393	≥16.0	<16.0	<14.0	<9.2	<4.6	16 (16-17)	34
SILTCOVE	Silt Cover Score	QHEI Units	Habitat	Fish	0.07	1393	≤2.0	<2.0	>2.0	>2.7	>3.33	2 (2-3)	29
Develop	Developed (Ust. WS)	Wtd. %	Land Use	Fish	0.07	2657	≤9.1	>9.1	>45.6	>63.6	>81.5	9.1 (2.9-9.6)	48
RIPARIAN	Riparian Score	QHEI Units	Habitat	Fish	0.10	1393	≥6.0	>6.0	<6.0	<4.0	<2.0	7.0 (6.0-9.5)	34
Imperv	Impervious (Ust. WS)	Wtd. %	Land Use	Macros	0.10	3096	≤5.6	>5.6	>13.2	>41.8	>70.5	5.2 (2.1-5.4)	48
DEPTH	Depth Score	QHEI Units	Habitat	Fish	0.11	1393	≥10.0	>10.0	<10.0	<6.6	<3.3	10 (9-11)	33
MWH_ATTR	Poor Habitat Attributes	Number	Habitat	Fish	0.12	1393	≤1	<1	>1	>3	>6	2 (1-5)	20
HYD_QHEI	Hydro-QHEI	QHEI Units	Habitat	Fish	0.13	1393	≥17.0	>17.0	<19.5	<12.9	<6.4	20 (14-22)	33
CURRENT	Current Score	QHEI Units	Habitat	Fish	0.14	1393	≥7.0	>7.0	<7.0	<4.6	<2.3	11 (5.8-11.0)	33
POOL	Pool Score	QHEI Units	Habitat	Fish	0.15	1393	≥11.3	<11.3	<10.0	<6.6	<3.3	11.5 (10-12)	34
Heavurb	Heavy Urban (Ust. WS)	Wtd. %	Land Use	Macros	0.17	3096	≤7.7	>7.7	>29.3	>52.6	>76.0	5.5 (1.1-6.0)	48
RIFFLE	Riff< Score	QHEI Units	Habitat	Fish	0.27	1393	≥5.8	≥5.8	<5.8	<3.9	<1.9	6 (5-7)	34
GRAD_S	Gradient Score	QHEI Units	Habitat	Fish	0.31	1393	≥10.0	>10.0	<10.0	<6.6	<3.3	10 (10-10)	34
Ag	Agricultural (Ust. WS)	Wtd. %	Land Use	Macros	4.82	3096	≤87.1	<87.1	>62.1	>74.6	>87.1	83.9 (11.7-85.4)	48
GRADIENT	Gradient (ft/mi)	feet/mile	Habitat	Fish	12.20	1393	≥8.8	<8.8	<4.3	<2.8	<1.4	8.6 (4.9-11.3)	34
Ag	Agricultural (30 m)	Wtd. %	Land Use	Macros	16.66	3096	≤87.2	<87.2	>43.2	>61.9	>80.7	0.0 (0.0-0.4)	48

APPENDIX B

North Branch Chicago River 2018-2019 Fish Assemblage Data

B-1: Fish Index of Biotic Integrity (IBI) Metrics & Scores
B-2 Fish Species Grand (all sites combined)
B-3: Fish Species by Sampling Event

Appendix Table B-1. Fish IBI results for data collected in the North Branch Chicago River study area 2018-2019.

Site ID	River Mile	Type	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Number of: Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Percent: Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert-ivores	Rel.No. /(0.3km)		IBI	Modified Iwb
NORTH BRANCH CHICAGO RIVER - (95009)																				
Year: 2018																				
MF19	18.60	D	07/29/2018	93.4	79.1	3	10(2)	3(3)	1(1)	0(0)	0(0)	1(1)	0(0)	60(3)	85(2)	0(0)	252		12.0	4.6
MIDDLE FORK NORTH BRANCH CHICAGO RIVER - (95291)																				
Year: 2018																				
MF16	3.00	D	07/29/2018	56.1	69.7	3	10(2)	4(4)	1(1)	0(0)	0(0)	1(1)	0(0)	60(3)	87(2)	0(0)	219		13.0	5.9
MF16	3.00	D	09/29/2018	56.1	69.7	3	9(2)	4(4)	1(1)	0(0)	0(0)	0(0)	0(0)	33(5)	66(5)	0(0)	123	*	17.0	4.8
MF17	1.80	D	07/29/2018	57.3	70.1	3	12(2)	4(4)	1(1)	0(0)	1(1)	2(2)	0(0)	50(4)	87(2)	0(1)	327		17.0	5.6
MF17	1.80	D	09/29/2018	57.3	70.1	3	7(1)	3(3)	1(1)	0(0)	0(0)	0(0)	0(0)	57(3)	84(3)	0(0)	156	*	11.0	4.6
Year: 2019																				
MF08	21.10	F	08/14/2019	5.8	28.0	3	5(1)	2(3)	0(0)	0(0)	0(0)	0(0)	0(0)	40(4)	8(6)	0(0)	106	*	14.0	4.1
MF09	18.90	F	08/14/2019	8.9	35.9	3	8(2)	3(4)	0(0)	0(0)	0(0)	1(1)	0(0)	50(4)	32(6)	0(0)	136	*	17.0	4.9
MF10	16.70	F	08/14/2019	11.9	41.2	3	7(1)	3(4)	0(0)	0(0)	0(0)	0(0)	0(0)	29(5)	44(6)	0(0)	344		16.0	4.9
MF11	14.10	E	08/14/2019	16.1	46.8	3	9(2)	4(5)	1(1)	0(0)	0(0)	1(1)	0(0)	56(3)	61(5)	0(0)	390		17.0	7.0
MF12	10.80	E	08/13/2019	19.2	50.0	3	7(1)	3(4)	1(1)	0(0)	0(0)	0(0)	0(0)	57(3)	38(6)	0(0)	138	*	15.0	4.4
MF13	8.60	F	08/18/2019	20.9	51.6	3	6(1)	3(4)	1(1)	0(0)	0(0)	0(0)	0(0)	50(4)	64(5)	0(0)	106	*	15.0	4.3
MF14	6.00	E	08/13/2019	22.4	52.8	3	12(2)	3(4)	1(1)	0(0)	0(0)	3(2)	0(0)	58(3)	92(2)	0(0)	240		14.0	5.5
MF15	4.00	E	08/13/2019	24.2	54.3	3	7(1)	3(4)	1(1)	0(0)	0(0)	0(0)	0(0)	57(3)	56(6)	0(0)	126	*	15.0	5.3
WEST FORK NORTH BRANCH CHICAGO RIVER - (95292)																				
Year: 2019																				
WF20	12.50	F	08/14/2019	3.8	20.3	3	4(1)	3(5)	0(0)	0(0)	0(0)	0(0)	0(0)	50(4)	57(6)	0(0)	14	* *	16.0	4.1

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table B-1. Fish IBI results for data collected in the North Branch Chicago River study area 2018-2019.

Site ID	River Mile	Type	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Number of: Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Percent: Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert-ivores	Rel.No. /(0.3km)	IBI	Modified Iwb
WF21	10.40	F	08/15/2019	7.0	31.5	3	3(0)	2(3)	0(0)	0(0)	0(0)	0(0)	0(0)	100(0)	52(6)	0(0)	42 * *	9.00	3.8
WF22	9.20	D	08/14/2019	9.4	36.9	3	6(1)	3(4)	1(2)	0(0)	0(0)	0(0)	0(0)	67(3)	91(2)	0(0)	173 *	12.0	4.6
WF23	4.90	D	08/13/2019	17.8	48.6	3	9(2)	4(5)	1(1)	0(0)	0(0)	1(1)	0(0)	67(3)	98(1)	0(0)	276	13.0	4.6
WF24	2.90	D	08/13/2019	24.5	54.5	3	4(0)	2(3)	0(0)	0(0)	0(0)	0(0)	0(0)	100(0)	98(1)	0(0)	123 *	4.00	3.2
WF25	1.30	D	08/13/2019	27.9	56.9	3	9(2)	3(4)	1(1)	0(0)	0(0)	2(2)	0(0)	78(2)	95(1)	0(0)	180 *	12.0	3.6
SKOKIE RIVER - (95403)																			
Year: 2018																			
SR1	21.10	E	07/30/2018	2.7	14.6	3	4(1)	3(6)	0(0)	0(0)	0(0)	0(0)	0(0)	75(2)	94(1)	0(0)	426	10.0	3.7
SR1	21.10	E	09/12/2018	2.7	14.6	3	2(0)	2(5)	0(0)	0(0)	0(0)	0(0)	0(0)	100(0)	99(1)	0(0)	316	6.00	1.8
SR2	17.40	E	07/30/2018	7.8	33.7	3	1(0)	1(2)	0(0)	0(0)	0(0)	0(0)	0(0)	100(0)	33(6)	0(0)	7 * *	8.00	2.0
SR2	17.40	E	09/12/2018	7.8	33.7	3	9(2)	4(6)	1(2)	0(0)	0(0)	1(1)	0(0)	56(3)	57(6)	0(0)	362	20.0	5.5
SR3	14.80	E	07/30/2018	11.5	40.8	3	9(2)	4(5)	1(1)	0(0)	0(0)	1(1)	0(0)	67(3)	90(2)	0(0)	376	14.0	5.5
SR3	14.80	E	09/29/2018	11.5	40.8	3	9(2)	4(5)	1(1)	0(0)	0(0)	2(2)	0(0)	78(2)	92(2)	0(0)	566	14.0	5.6
SR4	11.30	E	07/30/2018	15.0	45.6	3	6(1)	3(4)	1(1)	0(0)	0(0)	0(0)	0(0)	83(2)	91(2)	0(0)	508	10.0	5.2
SR4	11.30	E	09/12/2018	15.0	45.6	3	11(2)	6(6)	1(1)	0(0)	0(0)	1(1)	0(0)	55(3)	86(2)	0(0)	408	15.0	5.7
SR5	8.00	E	07/30/2018	20.6	51.4	3	10(2)	3(4)	1(1)	0(0)	0(0)	2(2)	0(0)	60(3)	85(2)	0(0)	202	14.0	3.9
SR5	8.00	E	09/12/2018	20.6	51.4	3	11(2)	5(6)	1(1)	0(0)	0(0)	2(2)	1(1)	55(3)	74(4)	0(0)	160 *	19.0	4.8
SR6	7.40	D	07/20/2018	21.5	52.1	3	7(1)	3(4)	1(1)	0(0)	0(0)	1(1)	0(0)	86(1)	50(6)	0(0)	174 *	14.0	5.5
SR6	7.40	D	09/29/2018	21.5	52.1	3	7(1)	4(5)	1(1)	0(0)	0(0)	1(1)	0(0)	57(3)	55(6)	0(0)	131 *	17.0	5.5
SR7	3.00	P	07/25/2018	23.7	53.9	3	10(2)	6(6)	0(0)	0(0)	0(0)	1(1)	0(0)	30(5)	58(6)	0(0)	788	20.0	7.6
SR7	3.00	P	09/17/2018	23.7	53.9	3	12(2)	5(6)	0(0)	0(0)	1(1)	1(1)	2(1)	25(5)	75(4)	0(1)	846	21.0	8.8

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table B-1. Fish IBI results for data collected in the North Branch Chicago River study area 2018-2019.

Site ID	River Mile	Type	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Number of						Percent				Rel.No. /(0.3km)	Modified	
							Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert-ivores		IBI	Iwb
SR18	0.50	D	07/29/2018	30.9	58.7	3	10(2)	4(5)	1(1)	0(0)	0(0)	2(2)	0(0)	60(3)	85(2)	0(0)	675	15.0	7.1
SR18	0.50	D	09/19/2018	30.9	58.7	3	12(2)	4(5)	1(1)	0(0)	1(1)	3(2)	0(0)	58(3)	88(2)	0(1)	314	17.0	6.9

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix B-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *North Branch Chicago River; Middle Fork North Branch Chicago River; West Fork North Branch Chicago River; Skokie River*

Years: 2018; 2019

Number of Samples: 35 Data Sources: 99 Data Types: D; E; F; P

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		581	26.7	10.79	351	3.83	13.1
34-001	CENTRAL MUDMINNOW	I	T	C		61	2.8	1.13	12	0.13	4.3
40-016	WHITE SUCKER	O	T	S	W	724	33.3	13.45	2849	31.07	85.5
43-001	COMMON CARP	O	T	M	G	251	11.6	4.66	2765	30.16	239.5
43-002	GOLDFISH	O	T	M	G	432	19.9	8.02	366	3.99	18.4
43-003	GOLDEN SHINER	I	T	M	N	179	8.2	3.32	54	0.59	6.5
43-034	SAND SHINER	I	M	M	N	1	0.1	0.02	0	0.00	3.0
43-042	FATHEAD MINNOW	O	T	C	N	24	1.1	0.45	1	0.02	1.7
43-043	BLUNTNOSE MINNOW	O	T	C	N	8	0.4	0.15	1	0.02	4.3
43-045	COMMON CARP X GOLDFISH	O	T		G	10	0.5	0.19	220	2.41	480.0
47-002	CHANNEL CATFISH			C	F	2	0.1	0.04	103	1.13	1125.0
47-004	YELLOW BULLHEAD	I	T	C		236	10.9	4.38	347	3.79	32.0
47-006	BLACK BULLHEAD	I	P	C		44	2.0	0.82	120	1.31	59.3
47-013	TADPOLE MADTOM	I		C		3	0.1	0.06	0	0.01	7.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		364	16.7	6.76	22	0.25	1.3
77-001	WHITE CRAPPIE	I		C	S	2	0.1	0.04	0	0.00	2.5
77-002	BLACK CRAPPIE	I		C	S	7	0.3	0.13	16	0.18	52.1
77-006	LARGEMOUTH BASS	C		C	F	627	28.8	11.65	633	6.90	21.9
77-008	GREEN SUNFISH	I	T	C	S	779	35.8	14.47	421	4.60	11.7
77-009	BLUEGILL SUNFISH	I	P	C	S	911	41.9	16.92	600	6.54	14.3
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	0.2	0.02	0	0.00	5.0
77-012	REDEAR SUNFISH	I		C	E	18	2.7	0.33	44	0.15	16.1
77-013	PUMPKINSEED SUNFISH	I	P	C	S	63	2.9	1.17	61	0.67	21.3
77-014	BLUEGILL X PUMPKINSEED					1	0.1	0.02	1	0.02	30.0
77-015	GREEN SF X BLUEGILL SF					47	2.2	0.87	78	0.85	36.1
80-002	WALLEYE	P		S	F	8	1.2	0.15	414	1.37	341.2

No Species: 26 **Nat. Species:** 20 **Hybrids:** 3 **Total Counted:** 5384 **Total Rel. Wt. :** 9491

Appendix B-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Skokie River*

Years: 2018

Number of Samples: 16 Data Sources: 99 Data Types: D; E; P

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
77-009	BLUEGILL SUNFISH	I	P	C	S	668	60.8	19.98	746	9.67	12.2
77-006	LARGEMOUTH BASS	C		C	F	492	44.8	14.71	911	11.80	20.3
77-008	GREEN SUNFISH	I	T	C	S	492	44.8	14.71	462	5.98	10.3
20-003	GIZZARD SHAD	O		M		413	37.6	12.35	565	7.32	15.0
40-016	WHITE SUCKER	O	T	S	W	377	34.3	11.27	1892	24.50	55.1
43-002	GOLDFISH	O	T	M	G	368	33.5	11.00	254	3.30	7.6
43-003	GOLDEN SHINER	I	T	M	N	157	14.3	4.69	80	1.04	5.6
43-001	COMMON CARP	O	T	M	G	98	8.9	2.93	1856	24.04	208.2
54-002	BLACKSTRIPE TOPMINNOW	I		M		62	5.6	1.85	7	0.10	1.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	59	5.4	1.76	116	1.51	21.6
47-006	BLACK BULLHEAD	I	P	C		34	3.1	1.02	170	2.20	55.0
77-015	GREEN SF X BLUEGILL SF					32	2.9	0.96	81	1.06	28.0
47-004	YELLOW BULLHEAD	I	T	C		28	2.6	0.84	137	1.78	53.9
43-042	FATHEAD MINNOW	O	T	C	N	19	1.7	0.57	3	0.04	1.7
77-012	REDEAR SUNFISH	I		C	E	18	1.6	0.54	26	0.34	16.1
80-002	WALLEYE	P		S	F	8	0.7	0.24	248	3.22	341.2
43-043	BLUNTNOSE MINNOW	O	T	C	N	6	0.6	0.18	2	0.04	5.0
77-002	BLACK CRAPPIE	I		C	S	6	0.6	0.18	32	0.42	60.0
47-013	TADPOLE MADTOM	I		C		2	0.6	0.06	3	0.01	5.5
77-001	WHITE CRAPPIE	I		C	S	2	0.2	0.06	0	0.01	2.5
47-002	CHANNEL CATFISH			C	F	1	0.3	0.03	411	1.59	1350.0
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	0.3	0.03	1	0.01	5.0
77-014	BLUEGILL X PUMPKINSEED					1	0.1	0.03	2	0.04	30.0

No Species: 23 **Nat. Species:** 18 **Hybrids:** 2 **Total Counted:** 3344 **Total Rel. Wt. :** 8016

Appendix B-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *North Branch Chicago River; Middle Fork North Branch Chicago River*

Years: 2018; 2019

Number of Samples: 13 Data Sources: 99 Data Types: D; E; F

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
54-002	BLACKSTRIPE TOPMINNOW	I		M		295	40.1	19.52	54	0.55	1.3
77-008	GREEN SUNFISH	I	T	C	S	247	33.6	16.35	456	4.58	13.6
40-016	WHITE SUCKER	O	T	S	W	240	32.6	15.88	5214	52.28	159.7
77-009	BLUEGILL SUNFISH	I	P	C	S	191	26.0	12.64	470	4.72	18.1
47-004	YELLOW BULLHEAD	I	T	C		130	17.7	8.60	326	3.28	18.4
77-006	LARGEMOUTH BASS	C		C	F	113	15.4	7.48	478	4.80	31.1
43-001	COMMON CARP	O	T	M	G	107	14.6	7.08	1941	19.47	133.4
34-001	CENTRAL MUDMINNOW	I	T	C		61	8.3	4.04	36	0.37	4.3
20-003	GIZZARD SHAD	O		M		53	7.2	3.51	106	1.07	14.8
43-002	GOLDFISH	O	T	M	G	21	2.9	1.39	541	5.43	189.6
43-003	GOLDEN SHINER	I	T	M	N	21	2.9	1.39	33	0.33	11.6
77-015	GREEN SF X BLUEGILL SF					11	1.5	0.73	88	0.89	59.0
47-006	BLACK BULLHEAD	I	P	C		9	1.2	0.60	91	0.92	74.5
43-042	FATHEAD MINNOW	O	T	C	N	4	0.5	0.26	0	0.01	1.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	0.4	0.20	6	0.06	15.6
43-034	SAND SHINER	I	M	M	N	1	0.1	0.07	0	0.00	3.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	0.1	0.07	0	0.00	2.0
47-002	CHANNEL CATFISH			C	F	1	0.1	0.07	122	1.23	900.0
47-013	TADPOLE MADTOM	I		C		1	0.1	0.07	1	0.01	10.0
77-002	BLACK CRAPPIE	I		C	S	1	0.1	0.07	0	0.01	5.0

No Species: 20 **Nat. Species:** 17 **Hybrids:** 1 **Total Counted:** 1511 **Total Rel. Wt. :** 9973

Appendix B-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *West Fork North Branch Chicago River*

Years: 2019

Number of Samples: 6 Data Sources: 99 Data Types: D; F

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		115	31.4	21.74	174	1.56	5.5
40-016	WHITE SUCKER	O	T	S	W	107	29.2	20.23	767	6.83	26.2
47-004	YELLOW BULLHEAD	I	T	C		78	21.3	14.74	993	8.85	46.6
77-009	BLUEGILL SUNFISH	I	P	C	S	52	14.2	9.83	377	3.36	26.5
43-001	COMMON CARP	O	T	M	G	46	12.6	8.70	6945	61.83	553.0
43-002	GOLDFISH	O	T	M	G	43	11.7	8.13	320	2.86	27.3
77-008	GREEN SUNFISH	I	T	C	S	40	10.9	7.56	196	1.75	18.0
77-006	LARGEMOUTH BASS	C		C	F	22	6.0	4.16	63	0.56	10.5
43-045	COMMON CARP X GOLDFISH	O	T		G	10	2.7	1.89	1310	11.67	480.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		7	1.9	1.32	1	0.01	0.7
77-015	GREEN SF X BLUEGILL SF					4	1.1	0.76	42	0.38	38.7
43-003	GOLDEN SHINER	I	T	M	N	1	0.3	0.19	13	0.12	50.0
43-042	FATHEAD MINNOW	O	T	C	N	1	0.3	0.19	0	0.00	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	0.3	0.19	0	0.01	3.0
47-006	BLACK BULLHEAD	I	P	C		1	0.3	0.19	19	0.17	70.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	0.3	0.19	5	0.05	20.0

No Species: 16 **Nat. Species:** 12 **Hybrids:** 2 **Total Counted:** 529 **Total Rel. Wt. :** 11232

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-009 North Branch Chicago River RM: 18.60 Date: 07/29/2018

Time Fished: 1087 Distance: 0.200 Drainge (sq mi): 93.4 Depth: 0

Location: ust. Dempster St. Lat: 42.04128 Long: -87.78799

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		13	19.5	7.74	60	0.09	3.0
34-001	CENTRAL MUDMINNOW	I	T	C		3	4.5	1.79	15	0.02	3.3
40-016	WHITE SUCKER	O	T	S	W	38	57.0	22.62	14850	22.19	260.5
43-001	COMMON CARP	O	T	M	G	36	54.0	21.43	50167	74.95	929.0
43-002	GOLDFISH	O	T	M	G	10	15.0	5.95	480	0.72	32.0
43-042	FATHEAD MINNOW	O	T	C	N	1	1.5	0.60	4	0.01	3.0
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.60	15	0.02	10.0
47-006	BLACK BULLHEAD	I	P	C		1	1.5	0.60	330	0.49	220.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	6.0	2.38	15	0.02	2.5
77-006	LARGEMOUTH BASS	C		C	F	18	27.0	10.71	165	0.25	6.1
77-008	GREEN SUNFISH	I	T	C	S	41	61.5	24.40	825	1.23	13.4
77-009	BLUEGILL SUNFISH	I	P	C	S	2	3.0	1.19	6	0.01	2.0

No Species: 12 **Nat. Species:** 10 **Hybrids:** 0 **Total Counted:** 168 **Total Rel. Wt. :** 66933

IBI: 26.0 **MIwb:** 4.6

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 1.80 Date: 07/29/2018

Time Fished: 891 Distance: 0.200 Drainge (sq mi): 57.3 Depth: 0

Location: dst. Glenview Rd. Lat: 42.06667 Long: -87.77310

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		19	28.5	8.72	127	1.52	4.4
34-001	CENTRAL MUDMINNOW	I	T	C		5	7.5	2.29	60	0.71	8.0
40-016	WHITE SUCKER	O	T	S	W	66	99.0	30.28	5400	64.31	54.5
43-001	COMMON CARP	O	T	M	G	35	52.5	16.06	600	7.15	11.4
43-002	GOLDFISH	O	T	M	G	1	1.5	0.46	15	0.18	10.0
43-003	GOLDEN SHINER	I	T	M	N	7	10.5	3.21	285	3.39	27.1
43-034	SAND SHINER	I	M	M	N	1	1.5	0.46	4	0.05	3.0
47-004	YELLOW BULLHEAD	I	T	C		7	10.5	3.21	210	2.50	20.0
47-013	TADPOLE MADTOM	I		C		1	1.5	0.46	15	0.18	10.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		8	12.0	3.67	22	0.27	1.8
77-006	LARGEMOUTH BASS	C		C	F	13	19.5	5.96	120	1.43	6.1
77-008	GREEN SUNFISH	I	T	C	S	39	58.5	17.89	900	10.72	15.3
77-009	BLUEGILL SUNFISH	I	P	C	S	15	22.5	6.88	600	7.15	26.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	1.5	0.46	37	0.45	25.0

No Species: 14 **Nat. Species:** 12 **Hybrids:** 0 **Total Counted:** 218 **Total Rel. Wt. :** 8397

IBI: 28.0 **MIwb:** 5.6

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 1.80 Date: 09/29/2018

Time Fished: 714 Distance: 0.200 Drainge (sq mi): 57.3 Depth: 0

Location: dst. Glenview Rd. Lat: 42.06667 Long: -87.77310

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		3	4.5	2.88	45	0.44	10.0
40-016	WHITE SUCKER	O	T	S	W	24	36.0	23.08	7725	76.28	214.5
43-001	COMMON CARP	O	T	M	G	14	21.0	13.46	825	8.15	39.2
47-004	YELLOW BULLHEAD	I	T	C		9	13.5	8.65	795	7.85	58.8
54-002	BLACKSTRIPE TOPMINNOW	I		M		12	18.0	11.54	24	0.24	1.3
77-006	LARGEMOUTH BASS	C		C	F	5	7.5	4.81	90	0.89	12.0
77-008	GREEN SUNFISH	I	T	C	S	30	45.0	28.85	585	5.78	13.0
77-009	BLUEGILL SUNFISH	I	P	C	S	7	10.5	6.73	37	0.37	3.5

No Species: 8 **Nat. Species:** 7 **Hybrids:** 0 **Total Counted:** 104 **Total Rel. Wt. :** 10126

IBI: 26.0 **MIwb:** 4.6

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 3.00 Date: 07/29/2018

Time Fished: 1152 Distance: 0.200 Drainge (sq mi): 56.1 Depth: 0

Location: ust. E. Lake Rd. Lat: 42.08152 Long: -87.77860

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		13	19.5	8.90	945	1.22	48.4
40-016	WHITE SUCKER	O	T	S	W	34	51.0	23.29	18600	24.05	364.7
43-001	COMMON CARP	O	T	M	G	12	18.0	8.22	49050	63.42	2725.0
43-002	GOLDFISH	O	T	M	G	5	7.5	3.42	5400	6.98	720.0
43-003	GOLDEN SHINER	I	T	M	N	7	10.5	4.79	15	0.02	1.4
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.68	75	0.10	50.0
47-006	BLACK BULLHEAD	I	P	C		1	1.5	0.68	165	0.21	110.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	3.0	1.37	7	0.01	2.5
77-002	BLACK CRAPPIE	I		C	S	1	1.5	0.68	7	0.01	5.0
77-006	LARGEMOUTH BASS	C		C	F	16	24.0	10.96	2160	2.79	90.0
77-008	GREEN SUNFISH	I	T	C	S	38	57.0	26.03	675	0.87	11.8
77-009	BLUEGILL SUNFISH	I	P	C	S	16	24.0	10.96	240	0.31	10.0

No Species: 12 **Nat. Species:** 10 **Hybrids:** 0 **Total Counted:** 146 **Total Rel. Wt. :** 77340

IBI: 26.0 **MIwb:** 5.9

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 3.00 Date: 09/29/2018

Time Fished: 731 Distance: 0.200 Drainge (sq mi): 56.1 Depth: 0

Location: ust. E. Lake Rd. Lat: 42.08152 Long: -87.77860

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	1.5	1.22	30	0.19	20.0
34-001	CENTRAL MUDMINNOW	I	T	C		1	1.5	1.22	3	0.02	2.0
40-016	WHITE SUCKER	O	T	S	W	20	30.0	24.39	9420	61.07	314.0
43-001	COMMON CARP	O	T	M	G	2	3.0	2.44	5400	35.01	1800.0
47-006	BLACK BULLHEAD	I	P	C		1	1.5	1.22	180	1.17	120.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		15	22.5	18.29	45	0.29	2.0
77-006	LARGEMOUTH BASS	C		C	F	11	16.5	13.41	180	1.17	10.9
77-008	GREEN SUNFISH	I	T	C	S	5	7.5	6.10	90	0.58	12.0
77-009	BLUEGILL SUNFISH	I	P	C	S	25	37.5	30.49	75	0.49	2.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	1.5	1.22	3	0.02	2.0

No Species: 10 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 82 **Total Rel. Wt. :** 15426

IBI: 32.0 **MIwb:** 4.8

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID:	River: 95-291	Middle Fork North Branch Chicago River	RM: 4.00	Date: 08/13/2019
Time Fished:	Distance:	Drainge (sq mi):	Depth:	
497	0.150	24.2	0	
Location:		Lat:	Long:	
Dst. Winnetka Ave.		42.09294	-87.77116	

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		2	4.0	3.17	6	0.19	1.5
40-016	WHITE SUCKER	O	T	S	W	5	10.0	7.94	900	28.94	90.0
43-002	GOLDFISH	O	T	M	G	1	2.0	1.59	4	0.13	2.0
47-004	YELLOW BULLHEAD	I	T	C		4	8.0	6.35	400	12.86	50.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		7	14.0	11.11	20	0.64	1.4
77-006	LARGEMOUTH BASS	C		C	F	14	28.0	22.22	100	3.22	3.5
77-008	GREEN SUNFISH	I	T	C	S	13	26.0	20.63	560	18.01	21.5
77-009	BLUEGILL SUNFISH	I	P	C	S	12	24.0	19.05	520	16.72	21.6
77-015	GREEN SF X BLUEGILL SF					5	10.0	7.94	600	19.29	60.0

No Species: 8 **Nat. Species:** 7 **Hybrids:** 1 **Total Counted:** 63 **Total Rel. Wt. :** 3110

IBI: 32.0 **MIwb:** 5.3

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID:	River: 95-291	Middle Fork North Branch Chicago River	RM: 6.00	Date: 08/13/2019
Time Fished:	Distance:	Drainge (sq mi):	Depth:	
1217	0.150	22.4	0	
Location:		Lat:	Long:	
Dst. Sunset Dr.		42.11541	-87.78472	

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		4	8.0	3.33	20	0.26	2.5
34-001	CENTRAL MUDMINNOW	I	T	C		2	4.0	1.67	6	0.08	1.5
40-016	WHITE SUCKER	O	T	S	W	17	34.0	14.17	4000	51.55	117.6
43-002	GOLDFISH	O	T	M	G	4	8.0	3.33	100	1.29	12.5
43-003	GOLDEN SHINER	I	T	M	N	4	8.0	3.33	10	0.13	1.2
43-042	FATHEAD MINNOW	O	T	C	N	3	6.0	2.50	6	0.08	1.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	0.83	4	0.05	2.0
47-002	CHANNEL CATFISH			C	F	1	2.0	0.83	1800	23.20	900.0
47-004	YELLOW BULLHEAD	I	T	C		14	28.0	11.67	200	2.58	7.1
54-002	BLACKSTRIPE TOPMINNOW	I		M		3	6.0	2.50	6	0.08	1.0
77-006	LARGEMOUTH BASS	C		C	F	4	8.0	3.33	100	1.29	12.5
77-008	GREEN SUNFISH	I	T	C	S	49	98.0	40.83	1200	15.46	12.2
77-009	BLUEGILL SUNFISH	I	P	C	S	13	26.0	10.83	108	1.39	4.1
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.83	200	2.58	100.0

No Species: 13 **Nat. Species:** 12 **Hybrids:** 1 **Total Counted:** 120 **Total Rel. Wt. :** 7760

IBI: 28.0 **MIwb:** 5.5

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID:	River: 95-291	Middle Fork North Branch Chicago River	RM: 8.60	Date: 08/18/2019
Time Fished:	Distance:	Drainge (sq mi):	Depth:	
1164	0.150	20.9	0	
Location:		Lat:	Long:	
Ust. IL68		42.13879	-87.81029	

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	11	22.0	20.75	2420	61.48	110.0
47-004	YELLOW BULLHEAD	I	T	C		4	8.0	7.55	740	18.80	92.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		13	26.0	24.53	30	0.76	1.1
77-006	LARGEMOUTH BASS	C		C	F	4	8.0	7.55	140	3.56	17.5
77-008	GREEN SUNFISH	I	T	C	S	18	36.0	33.96	400	10.16	11.1
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	1.89	6	0.15	3.0
77-015	GREEN SF X BLUEGILL SF					2	4.0	3.77	200	5.08	50.0

No Species: 6 **Nat. Species:** 6 **Hybrids:** 1 **Total Counted:** 53 **Total Rel. Wt. :** 3936

IBI: 30.0 **MIwb:** 4.3

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 10.80 Date: 08/13/2019

Time Fished: 1050 Distance: 0.150 Drainge (sq mi): 19.2 Depth: 0

Location: Ust. Carrige Way Lat: 42.15927 Long: -87.82470

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	14	28.0	20.29	4180	85.83	149.2
43-001	COMMON CARP	O	T	M	G	3	6.0	4.35	160	3.29	26.6
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	4.35	100	2.05	16.6
47-006	BLACK BULLHEAD	I	P	C		1	2.0	1.45	180	3.70	90.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		35	70.0	50.72	100	2.05	1.4
77-006	LARGEMOUTH BASS	C		C	F	8	16.0	11.59	60	1.23	3.7
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	4.35	60	1.23	10.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	2.90	30	0.62	7.5

No Species: 8 **Nat. Species:** 7 **Hybrids:** 0 **Total Counted:** 69 **Total Rel. Wt. :** 4870

IBI: 28.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: MF11 River: 95-291 Middle Fork North Branch Chicago River RM: 14.10 Date: 08/14/2019

Time Fished: 885 Distance: 0.150 Drainge (sq mi): 16.1 Depth: 0

Location: Dst. IL22 Lat: 42.19861 Long: -87.85362

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	11	22.0	5.64	4120	22.02	187.2
43-001	COMMON CARP	O	T	M	G	1	2.0	0.51	1000	5.34	500.0
43-003	GOLDEN SHINER	I	T	M	N	1	2.0	0.51	60	0.32	30.0
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	1.54	600	3.21	100.0
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.51	200	1.07	100.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		63	126.0	32.31	300	1.60	2.3
77-006	LARGEMOUTH BASS	C		C	F	10	20.0	5.13	6844	36.57	342.2
77-008	GREEN SUNFISH	I	T	C	S	6	12.0	3.08	350	1.87	29.1
77-009	BLUEGILL SUNFISH	I	P	C	S	95	190.0	48.72	4900	26.18	25.7
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	2.0	0.51	40	0.21	20.0
77-015	GREEN SF X BLUEGILL SF					3	6.0	1.54	300	1.60	50.0

No Species: 10 **Nat. Species:** 9 **Hybrids:** 1 **Total Counted:** 195 **Total Rel. Wt. :** 18714

IBI: 34.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 16.70 Date: 08/14/2019

Time Fished: 819 Distance: 0.150 Drainge (sq mi): 11.9 Depth: 0

Location: Dst. Westleigh St. Lat: 42.23196 Long: -87.86841

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		22	44.0	12.79	240	15.35	5.4
47-004	YELLOW BULLHEAD	I	T	C		72	144.0	41.86	1000	63.94	6.9
47-006	BLACK BULLHEAD	I	P	C		2	4.0	1.16	4	0.26	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		69	138.0	40.12	120	7.67	0.8
77-006	LARGEMOUTH BASS	C		C	F	5	10.0	2.91	80	5.12	8.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	0.58	40	2.56	20.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.58	80	5.12	40.0

No Species: 7 **Nat. Species:** 7 **Hybrids:** 0 **Total Counted:** 172 **Total Rel. Wt. :** 1564

IBI: 30.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-291 Middle Fork North Branch Chicago River RM: 18.90 Date: 08/14/2019

Time Fished: 693 Distance: 0.150 Drainge (sq mi): 8.9 Depth: 0

Location: Dst. foot bridge at FP Lat: 42.25635 Long: -87.88459

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		24	48.0	35.29	200	9.91	4.1
43-001	COMMON CARP	O	T	M	G	3	6.0	4.41	1280	63.43	213.3
43-003	GOLDEN SHINER	I	T	M	N	2	4.0	2.94	20	0.99	5.0
47-004	YELLOW BULLHEAD	I	T	C		10	20.0	14.71	300	14.87	15.0
47-006	BLACK BULLHEAD	I	P	C		2	4.0	2.94	60	2.97	15.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		19	38.0	27.94	20	0.99	0.5
77-006	LARGEMOUTH BASS	C		C	F	3	6.0	4.41	18	0.89	3.0
77-008	GREEN SUNFISH	I	T	C	S	4	8.0	5.88	100	4.96	12.5
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	1.47	20	0.99	10.0

No Species: 9 **Nat. Species:** 8 **Hybrids:** 0 **Total Counted:** 68 **Total Rel. Wt. :** 2018

IBI: 30.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID:	River: 95-291	Middle Fork North Branch Chicago River	RM: 21.10	Date: 08/14/2019
Time Fished:	Distance:	Drainge (sq mi):	Depth:	
0	0.150	5.8	0	
Location:		Lat:	Long:	
Ust. Rockland Rd.		42.28013	-87.89854	

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
34-001	CENTRAL MUDMINNOW	I	T	C		2	4.0	3.77	20	15.87	5.0
43-001	COMMON CARP	O	T	M	G	1	2.0	1.89	10	7.94	5.0
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	3.77	4	3.17	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		45	90.0	84.91	80	63.49	0.8
77-006	LARGEMOUTH BASS	C		C	F	2	4.0	3.77	8	6.35	2.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	1.89	4	3.17	2.0

No Species: 6 **Nat. Species:** 5 **Hybrids:** 0 **Total Counted:** 53 **Total Rel. Wt. :** 126

IBI: 32.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: WF25 River: 95-292 West Fork North Branch Chicago River RM: 1.30 Date: 08/13/2019

Time Fished: 1638 Distance: 0.200 Drainge (sq mi): 27.9 Depth: 0

Location: Ust. walking bridge Lat: 42.06345 Long: -87.78887

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	1.5	0.83	1	0.00	1.0
40-016	WHITE SUCKER	O	T	S	W	46	69.0	38.33	3990	6.24	57.8
43-001	COMMON CARP	O	T	M	G	14	21.0	11.67	46755	73.16	2226.4
43-002	GOLDFISH	O	T	M	G	29	43.5	24.17	1500	2.35	34.4
43-003	GOLDEN SHINER	I	T	M	N	1	1.5	0.83	75	0.12	50.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	1.5	0.83	4	0.01	3.0
43-045	COMMON CARP X GOLDFISH	O	T		G	5	7.5	4.17	10650	16.66	1420.0
47-004	YELLOW BULLHEAD	I	T	C		11	16.5	9.17	825	1.29	50.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	6.0	3.33	4	0.01	0.7
77-006	LARGEMOUTH BASS	C		C	F	2	3.0	1.67	12	0.02	4.0
77-008	GREEN SUNFISH	I	T	C	S	3	4.5	2.50	15	0.02	3.3
77-009	BLUEGILL SUNFISH	I	P	C	S	3	4.5	2.50	75	0.12	16.6

No Species: 11 **Nat. Species:** 9 **Hybrids:** 1 **Total Counted:** 120 **Total Rel. Wt. :** 63907

IBI: 24.0 **MIwb:** 3.6

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-292 West Fork North Branch Chicago River RM: 2.90 Date: 08/13/2019

Time Fished: 1031 Distance: 0.200 Drainge (sq mi): 24.5 Depth: 0

Location: Dst. Lake Ave. Lat: 42.07891 Long: -87.80765

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-001	COMMON CARP	O	T	M	G	2	3.0	2.44	45	0.96	15.0
43-002	GOLDFISH	O	T	M	G	3	4.5	3.66	90	1.93	20.0
47-004	YELLOW BULLHEAD	I	T	C		44	66.0	53.66	3450	73.81	52.2
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	1.5	1.22	1	0.03	1.0
77-008	GREEN SUNFISH	I	T	C	S	24	36.0	29.27	795	17.01	22.0
77-009	BLUEGILL SUNFISH	I	P	C	S	7	10.5	8.54	195	4.17	18.5
77-015	GREEN SF X BLUEGILL SF					1	1.5	1.22	97	2.09	65.0

No Species: 6 **Nat. Species:** 4 **Hybrids:** 1 **Total Counted:** 82 **Total Rel. Wt. :** 4674

IBI: 26.0 **MIwb:** 3.2

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-292 West Fork North Branch Chicago River RM: 4.90 Date: 08/13/2019

Time Fished: 865 Distance: 0.200 Drainge (sq mi): 17.8 Depth: 0

Location: Dst. Willow Rd. Lat: 42.10279 Long: -87.80994

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		101	151.5	54.89	825	1.20	5.4
40-016	WHITE SUCKER	O	T	S	W	25	37.5	13.59	795	1.16	21.2
43-001	COMMON CARP	O	T	M	G	19	28.5	10.33	52740	76.74	1850.5
43-002	GOLDFISH	O	T	M	G	10	15.0	5.43	165	0.24	11.0
43-042	FATHEAD MINNOW	O	T	C	N	1	1.5	0.54	3	0.00	2.0
43-045	COMMON CARP X GOLDFISH	O	T		G	4	6.0	2.17	12300	17.90	2050.0
47-004	YELLOW BULLHEAD	I	T	C		13	19.5	7.07	1125	1.64	57.6
47-006	BLACK BULLHEAD	I	P	C		1	1.5	0.54	105	0.15	70.0
77-006	LARGEMOUTH BASS	C		C	F	1	1.5	0.54	210	0.31	140.0
77-008	GREEN SUNFISH	I	T	C	S	1	1.5	0.54	37	0.05	25.0
77-009	BLUEGILL SUNFISH	I	P	C	S	6	9.0	3.26	300	0.44	33.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	1.5	0.54	30	0.04	20.0
77-015	GREEN SF X BLUEGILL SF					1	1.5	0.54	90	0.13	60.0

No Species: 11 **Nat. Species:** 9 **Hybrids:** 2 **Total Counted:** 184 **Total Rel. Wt. :** 68725

IBI: 20.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-292 West Fork North Branch Chicago River RM: 9.20 Date: 08/14/2019

Time Fished: 1066 Distance: 0.200 Drainge (sq mi): 9.4 Depth: 0

Location: Dst. Lake-Cook Rd. Lat: 42.15161 Long: -87.84602

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		13	19.5	11.30	135	0.64	6.9
40-016	WHITE SUCKER	O	T	S	W	36	54.0	31.30	165	0.79	3.0
43-001	COMMON CARP	O	T	M	G	10	15.0	8.70	17655	84.07	1177.0
43-045	COMMON CARP X GOLDFISH	O	T		G	1	1.5	0.87	1050	5.00	700.0
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.87	45	0.21	30.0
77-006	LARGEMOUTH BASS	C		C	F	8	12.0	6.96	90	0.43	7.5
77-008	GREEN SUNFISH	I	T	C	S	9	13.5	7.83	225	1.07	16.6
77-009	BLUEGILL SUNFISH	I	P	C	S	35	52.5	30.43	1590	7.57	30.2
77-015	GREEN SF X BLUEGILL SF					2	3.0	1.74	45	0.21	15.0

No Species: 7 **Nat. Species:** 6 **Hybrids:** 2 **Total Counted:** 115 **Total Rel. Wt. :** 21000

IBI: 24.0 **Mlwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-292 West Fork North Branch Chicago River RM: 10.40 Date: 08/15/2019

Time Fished: 511 Distance: 0.150 Drainge (sq mi): 7.0 Depth: 0

Location: Dst. Deerfield Rd. Lat: 42.16572 Long: -87.85696

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-001	COMMON CARP	O	T	M	G	1	2.0	4.76	20	22.73	10.0
47-004	YELLOW BULLHEAD	I	T	C		9	18.0	42.86	20	22.73	1.1
77-006	LARGEMOUTH BASS	C		C	F	10	20.0	47.62	40	45.45	2.0
77-008	GREEN SUNFISH	I	T	C	S	1	2.0	4.76	8	9.09	4.0

No Species: 4 **Nat. Species:** 3 **Hybrids:** 0 **Total Counted:** 21 **Total Rel. Wt. :** 88

IBI: 30.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-292 West Fork North Branch Chicago River RM: 12.50 Date: 08/14/2019

Time Fished: 412 Distance: 0.150 Drainge (sq mi): 3.8 Depth: 0

Location: Adj. Saundrers Rd. Lat: 42.18624 Long: -87.88178

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-002	GOLDFISH	O	T	M	G	1	2.0	14.29	10	31.25	5.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	4.0	28.57	4	12.50	1.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	14.29	6	18.75	3.0
77-008	GREEN SUNFISH	I	T	C	S	2	4.0	28.57	10	31.25	2.5
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	14.29	2	6.25	1.0

No Species: 5 **Nat. Species:** 4 **Hybrids:** 0 **Total Counted:** 7 **Total Rel. Wt. :** 32

IBI: 12.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 0.50 Date: 07/29/2018

Time Fished: 887 Distance: 0.200 Drainge (sq mi): 30.9 Depth: 0

Location: dst. I-94 Lat: 42.08834 Long: -87.76299

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		216	324.0	48.00	1560	10.52	4.8
40-016	WHITE SUCKER	O	T	S	W	26	39.0	5.78	5490	37.03	140.7
43-002	GOLDFISH	O	T	M	G	2	3.0	0.44	330	2.23	110.0
43-003	GOLDEN SHINER	I	T	M	N	4	6.0	0.89	7	0.05	1.2
43-042	FATHEAD MINNOW	O	T	C	N	4	6.0	0.89	12	0.08	2.0
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.22	7	0.05	5.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	6.0	0.89	22	0.15	3.7
77-006	LARGEMOUTH BASS	C		C	F	57	85.5	12.67	360	2.43	4.2
77-008	GREEN SUNFISH	I	T	C	S	34	51.0	7.56	1200	8.09	23.5
77-009	BLUEGILL SUNFISH	I	P	C	S	97	145.5	21.56	5550	37.44	38.1
77-013	PUMPKINSEED SUNFISH	I	P	C	S	2	3.0	0.44	60	0.40	20.0
77-015	GREEN SF X BLUEGILL SF					3	4.5	0.67	225	1.52	50.0

No Species: 11 **Nat. Species:** 10 **Hybrids:** 1 **Total Counted:** 450 **Total Rel. Wt. :** 14824

IBI: 32.0 **MIwb:** 7.1

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 0.50 Date: 09/19/2018

Time Fished: 815 Distance: 0.200 Drainge (sq mi): 30.9 Depth: 0

Location: dst. I-94 Lat: 42.08834 Long: -87.76299

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		44	66.0	21.05	615	11.35	9.3
40-016	WHITE SUCKER	O	T	S	W	4	6.0	1.91	705	13.01	117.5
43-001	COMMON CARP	O	T	M	G	1	1.5	0.48	75	1.38	50.0
43-003	GOLDEN SHINER	I	T	M	N	7	10.5	3.35	90	1.66	8.5
43-042	FATHEAD MINNOW	O	T	C	N	1	1.5	0.48	3	0.06	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	6	9.0	2.87	45	0.83	5.0
47-004	YELLOW BULLHEAD	I	T	C		7	10.5	3.35	90	1.66	8.5
47-013	TADPOLE MADTOM	I		C		1	1.5	0.48	13	0.25	9.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	1.5	0.48	1	0.03	1.0
77-006	LARGEMOUTH BASS	C		C	F	18	27.0	8.61	660	12.18	24.4
77-008	GREEN SUNFISH	I	T	C	S	42	63.0	20.10	1020	18.83	16.1
77-009	BLUEGILL SUNFISH	I	P	C	S	71	106.5	33.97	1875	34.61	17.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	4	6.0	1.91	60	1.11	10.0
77-014	BLUEGILL X PUMPKINSEED					1	1.5	0.48	45	0.83	30.0
77-015	GREEN SF X BLUEGILL SF					1	1.5	0.48	120	2.21	80.0

No Species: 13 **Nat. Species:** 12 **Hybrids:** 2 **Total Counted:** 209 **Total Rel. Wt. :** 5418

IBI: 34.0 **MIwb:** 6.9

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 3.00 Date: 07/25/2018

Time Fished: 2223 Distance: 0.500 Drainge (sq mi): 23.7 Depth: 0

Location: Skokie Lagoon boat ramp Lat: 42.11398 Long: -87.77361

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		9	18.0	2.28	100	0.12	5.5
43-001	COMMON CARP	O	T	M	G	10	20.0	2.54	48090	59.29	2404.5
43-003	GOLDEN SHINER	I	T	M	N	41	82.0	10.41	170	0.21	2.0
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.25	500	0.62	250.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		12	24.0	3.05	20	0.02	0.8
77-006	LARGEMOUTH BASS	C		C	F	124	248.0	31.47	19210	23.68	77.4
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	0.76	40	0.05	6.6
77-009	BLUEGILL SUNFISH	I	P	C	S	166	332.0	42.13	11020	13.59	33.1
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	2.0	0.25	10	0.01	5.0
77-012	REDEAR SUNFISH	I		C	E	2	4.0	0.51	460	0.57	115.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	25	50.0	6.35	1490	1.84	29.8

No Species: 11 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 394 **Total Rel. Wt. :** 81110

IBI: 40.0 **MIwb:** 7.6

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 3.00 Date: 09/17/2018

Time Fished: 2171 Distance: 0.500 Drainge (sq mi): 23.7 Depth: 0

Location: Skokie Lagoon boat ramp Lat: 42.11398 Long: -87.77361

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		136	272.0	32.15	25280	28.19	92.9
43-001	COMMON CARP	O	T	M	G	6	12.0	1.42	25970	28.96	2164.1
43-003	GOLDEN SHINER	I	T	M	N	59	118.0	13.95	860	0.96	7.2
47-002	CHANNEL CATFISH			C	F	1	2.0	0.24	2700	3.01	1350.0
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	0.71	2320	2.59	386.6
47-013	TADPOLE MADTOM	I		C		1	2.0	0.24	4	0.00	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		7	14.0	1.65	14	0.02	1.0
77-002	BLACK CRAPPIE	I		C	S	3	6.0	0.71	600	0.67	100.0
77-006	LARGEMOUTH BASS	C		C	F	64	128.0	15.13	19630	21.89	153.3
77-009	BLUEGILL SUNFISH	I	P	C	S	111	222.0	26.24	4620	5.15	20.8
77-012	REDEAR SUNFISH	I		C	E	10	20.0	2.36	1450	1.62	72.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	15	30.0	3.55	930	1.04	31.0
80-002	WALLEYE	P		S	F	7	14.0	1.65	5300	5.91	378.5

No Species: 13 **Nat. Species:** 11 **Hybrids:** 0 **Total Counted:** 423 **Total Rel. Wt. :** 89678

IBI: 32.0 **MIwb:** 8.8

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 7.40 Date: 07/20/2018

Time Fished: 918 Distance: 0.200 Drainge (sq mi): 21.5 Depth: 0

Location: Ust. Lake Cook Rd. Lat: 42.15269 Long: -87.79392

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	8	12.0	6.90	382	17.16	31.8
43-001	COMMON CARP	O	T	M	G	8	12.0	6.90	75	3.36	6.2
43-002	GOLDFISH	O	T	M	G	2	3.0	1.72	22	1.01	7.5
43-003	GOLDEN SHINER	I	T	M	N	1	1.5	0.86	6	0.27	4.0
47-004	YELLOW BULLHEAD	I	T	C		1	1.5	0.86	90	4.04	60.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	1.5	0.86	3	0.13	2.0
77-006	LARGEMOUTH BASS	C		C	F	54	81.0	46.55	750	33.65	9.2
77-008	GREEN SUNFISH	I	T	C	S	18	27.0	15.52	300	13.46	11.1
77-009	BLUEGILL SUNFISH	I	P	C	S	20	30.0	17.24	420	18.84	14.0
77-015	GREEN SF X BLUEGILL SF					3	4.5	2.59	180	8.08	40.0

No Species: 9 **Nat. Species:** 7 **Hybrids:** 1 **Total Counted:** 116 **Total Rel. Wt. :** 2229

IBI: 30.0 **MIwb:** 5.5

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 7.40 Date: 09/29/2018

Time Fished: 660 Distance: 0.200 Drainge (sq mi): 21.5 Depth: 0

Location: Ust. Lake Cook Rd. Lat: 42.15269 Long: -87.79392

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	4	6.0	4.60	513	44.36	85.5
43-002	GOLDFISH	O	T	M	G	8	12.0	9.20	315	27.24	26.2
43-042	FATHEAD MINNOW	O	T	C	N	1	1.5	1.15	1	0.13	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		25	37.5	28.74	52	4.54	1.4
77-006	LARGEMOUTH BASS	C		C	F	8	12.0	9.20	120	10.38	10.0
77-008	GREEN SUNFISH	I	T	C	S	15	22.5	17.24	52	4.54	2.3
77-009	BLUEGILL SUNFISH	I	P	C	S	20	30.0	22.99	75	6.49	2.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	5	7.5	5.75	22	1.95	3.0
77-015	GREEN SF X BLUEGILL SF					1	1.5	1.15	4	0.39	3.0

No Species: 8 **Nat. Species:** 7 **Hybrids:** 1 **Total Counted:** 87 **Total Rel. Wt. :** 1156

IBI: 32.0 **MIwb:** 5.5

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 8.00 Date: 07/30/2018

Time Fished: 876 Distance: 0.150 Drainge (sq mi): 20.6 Depth: 0

Location: ust. Clavey Rd. @ Solel Congregation Lat: 42.16077 Long: -87.79907

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.99	20	0.07	10.0
40-016	WHITE SUCKER	O	T	S	W	59	118.0	58.42	25380	90.66	215.0
43-001	COMMON CARP	O	T	M	G	3	6.0	2.97	470	1.68	78.3
43-003	GOLDEN SHINER	I	T	M	N	2	4.0	1.98	100	0.36	25.0
43-042	FATHEAD MINNOW	O	T	C	N	2	4.0	1.98	8	0.03	2.0
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	2.97	750	2.68	125.0
47-006	BLACK BULLHEAD	I	P	C		4	8.0	3.96	500	1.79	62.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	0.99	6	0.02	3.0
77-006	LARGEMOUTH BASS	C		C	F	13	26.0	12.87	140	0.50	5.3
77-008	GREEN SUNFISH	I	T	C	S	8	16.0	7.92	320	1.14	20.0
77-009	BLUEGILL SUNFISH	I	P	C	S	4	8.0	3.96	200	0.71	25.0
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.99	100	0.36	50.0

No Species: 11 **Nat. Species:** 10 **Hybrids:** 1 **Total Counted:** 101 **Total Rel. Wt. :** 27994

IBI: 28.0 **MIwb:** 3.9

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 8.00 Date: 09/12/2018

Time Fished: 638 Distance: 0.150 Drainge (sq mi): 20.6 Depth: 0

Location: ust. Clavey Rd. @ Solel Congregation Lat: 42.16077 Long: -87.79907

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		4	8.0	5.00	60	0.39	7.5
40-016	WHITE SUCKER	O	T	S	W	17	34.0	21.25	14350	93.17	422.0
43-001	COMMON CARP	O	T	M	G	2	4.0	2.50	116	0.75	29.0
43-002	GOLDFISH	O	T	M	G	9	18.0	11.25	300	1.95	16.6
43-003	GOLDEN SHINER	I	T	M	N	1	2.0	1.25	4	0.03	2.0
43-042	FATHEAD MINNOW	O	T	C	N	5	10.0	6.25	12	0.08	1.2
54-002	BLACKSTRIPE TOPMINNOW	I		M		7	14.0	8.75	20	0.13	1.4
77-006	LARGEMOUTH BASS	C		C	F	4	8.0	5.00	100	0.65	12.5
77-008	GREEN SUNFISH	I	T	C	S	7	14.0	8.75	80	0.52	5.7
77-009	BLUEGILL SUNFISH	I	P	C	S	14	28.0	17.50	120	0.78	4.2
77-012	REDEAR SUNFISH	I		C	E	4	8.0	5.00	40	0.26	5.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	5	10.0	6.25	40	0.26	4.0
80-002	WALLEYE	P		S	F	1	2.0	1.25	160	1.04	80.0

No Species: 13 **Nat. Species:** 10 **Hybrids:** 0 **Total Counted:** 80 **Total Rel. Wt. :** 15402

IBI: 30.0 **MIwb:** 4.8

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 11.30 Date: 07/30/2018

Time Fished: 543 Distance: 0.150 Drainge (sq mi): 15.0 Depth: 0

Location: ust. Half Day Rd. @ Sleepy Hollow Park Lat: 42.20196 Long: -87.82955

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	89	178.0	35.04	4000	50.19	22.4
43-001	COMMON CARP	O	T	M	G	7	14.0	2.76	200	2.51	14.2
43-002	GOLDFISH	O	T	M	G	34	68.0	13.39	800	10.04	11.7
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	0.79	140	1.76	35.0
47-006	BLACK BULLHEAD	I	P	C		12	24.0	4.72	680	8.53	28.3
77-006	LARGEMOUTH BASS	C		C	F	19	38.0	7.48	200	2.51	5.2
77-008	GREEN SUNFISH	I	T	C	S	82	164.0	32.28	1740	21.83	10.6
77-009	BLUEGILL SUNFISH	I	P	C	S	6	12.0	2.36	140	1.76	11.6
77-015	GREEN SF X BLUEGILL SF					3	6.0	1.18	70	0.88	11.6

No Species: 8 **Nat. Species:** 6 **Hybrids:** 1 **Total Counted:** 254 **Total Rel. Wt. :** 7970

IBI: 20.0 **Mlwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 11.30 Date: 09/12/2018

Time Fished: 503 Distance: 0.150 Drainge (sq mi): 15.0 Depth: 0

Location: ust. Half Day Rd. @ Sleepy Hollow Park Lat: 42.20196 Long: -87.82955

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.49	20	0.22	10.0
40-016	WHITE SUCKER	O	T	S	W	49	98.0	24.02	5980	65.30	61.0
43-001	COMMON CARP	O	T	M	G	14	28.0	6.86	620	6.77	22.1
43-002	GOLDFISH	O	T	M	G	30	60.0	14.71	1000	10.92	16.6
43-003	GOLDEN SHINER	I	T	M	N	9	18.0	4.41	100	1.09	5.5
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	2.94	120	1.31	10.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		3	6.0	1.47	6	0.07	1.0
77-001	WHITE CRAPPIE	I		C	S	2	4.0	0.98	10	0.11	2.5
77-006	LARGEMOUTH BASS	C		C	F	19	38.0	9.31	320	3.49	8.4
77-008	GREEN SUNFISH	I	T	C	S	32	64.0	15.69	760	8.30	11.8
77-009	BLUEGILL SUNFISH	I	P	C	S	34	68.0	16.67	180	1.97	2.6
77-012	REDEAR SUNFISH	I		C	E	2	4.0	0.98	20	0.22	5.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	2.0	0.49	6	0.07	3.0
77-015	GREEN SF X BLUEGILL SF					2	4.0	0.98	16	0.17	4.0

No Species: 13 **Nat. Species:** 10 **Hybrids:** 1 **Total Counted:** 204 **Total Rel. Wt. :** 9158

IBI: 24.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 14.80 Date: 07/30/2018

Time Fished: 656 Distance: 0.150 Drainge (sq mi): 11.5 Depth: 0

Location: dst. Deerpath Rd. Lat: 42.24616 Long: -87.85333

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.53	300	1.43	150.0
40-016	WHITE SUCKER	O	T	S	W	60	120.0	31.91	10500	50.04	87.5
43-001	COMMON CARP	O	T	M	G	3	6.0	1.60	5550	26.45	925.0
43-002	GOLDFISH	O	T	M	G	2	4.0	1.06	40	0.19	10.0
43-042	FATHEAD MINNOW	O	T	C	N	3	6.0	1.60	12	0.06	2.0
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	1.60	360	1.72	60.0
47-006	BLACK BULLHEAD	I	P	C		14	28.0	7.45	1760	8.39	62.8
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.53	100	0.48	50.0
77-006	LARGEMOUTH BASS	C		C	F	10	20.0	5.32	260	1.24	13.0
77-008	GREEN SUNFISH	I	T	C	S	76	152.0	40.43	1400	6.67	9.2
77-009	BLUEGILL SUNFISH	I	P	C	S	7	14.0	3.72	300	1.43	21.4
77-015	GREEN SF X BLUEGILL SF					8	16.0	4.26	400	1.91	25.0

No Species: 11 **Nat. Species:** 9 **Hybrids:** 1 **Total Counted:** 188 **Total Rel. Wt. :** 20982

IBI: 24.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 14.80 Date: 09/29/2018

Time Fished: 793 Distance: 0.150 Drainge (sq mi): 11.5 Depth: 0

Location: dst. Deerpath Rd. Lat: 42.24616 Long: -87.85333

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	O	T	S	W	58	116.0	20.49	16900	77.77	145.6
43-001	COMMON CARP	O	T	M	G	28	56.0	9.89	1220	5.61	21.7
43-002	GOLDFISH	O	T	M	G	31	62.0	10.95	1070	4.92	17.2
43-003	GOLDEN SHINER	I	T	M	N	32	64.0	11.31	390	1.79	6.0
43-042	FATHEAD MINNOW	O	T	C	N	3	6.0	1.06	12	0.06	2.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.35	60	0.28	30.0
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.35	100	0.46	50.0
77-002	BLACK CRAPPIE	I		C	S	2	4.0	0.71	20	0.09	5.0
77-006	LARGEMOUTH BASS	C		C	F	21	42.0	7.42	520	2.39	12.3
77-008	GREEN SUNFISH	I	T	C	S	41	82.0	14.49	860	3.96	10.4
77-009	BLUEGILL SUNFISH	I	P	C	S	64	128.0	22.61	460	2.12	3.5
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.35	120	0.55	60.0

No Species: 11 **Nat. Species:** 9 **Hybrids:** 1 **Total Counted:** 283 **Total Rel. Wt. :** 21732

IBI: 26.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 17.40 Date: 07/30/2018

Time Fished: 364 Distance: 0.130 Drainge (sq mi): 7.8 Depth: 0

Location: ust. IL 176 Lat: 42.27941 Long: -87.86409

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-002	GOLDFISH	O	T	M	G	1	2.3	33.33	69	75.00	30.0
77-006	LARGEMOUTH BASS	C		C	F	2	4.6	66.67	23	25.00	5.0

No Species: 2 **Nat. Species:** 1 **Hybrids:** 0 **Total Counted:** 3 **Total Rel. Wt. :** 92

IBI: 12.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 17.40 Date: 09/12/2018

Time Fished: 445 Distance: 0.150 Drainge (sq mi): 7.8 Depth: 0

Location: ust. IL 176 Lat: 42.27941 Long: -87.86409

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	O		M		1	2.0	0.55	16	0.54	8.0
40-016	WHITE SUCKER	O	T	S	W	3	6.0	1.66	60	2.02	10.0
43-002	GOLDFISH	O	T	M	G	1	2.0	0.55	20	0.67	10.0
43-003	GOLDEN SHINER	I	T	M	N	1	2.0	0.55	10	0.34	5.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.55	20	0.67	10.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	0.55	2	0.07	1.0
77-006	LARGEMOUTH BASS	C		C	F	66	132.0	36.46	800	26.92	6.0
77-008	GREEN SUNFISH	I	T	C	S	45	90.0	24.86	1100	37.01	12.2
77-009	BLUEGILL SUNFISH	I	P	C	S	51	102.0	28.18	544	18.30	5.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	2	4.0	1.10	20	0.67	5.0
77-015	GREEN SF X BLUEGILL SF					9	18.0	4.97	380	12.79	21.1

No Species: 10 **Nat. Species:** 9 **Hybrids:** 1 **Total Counted:** 181 **Total Rel. Wt. :** 2972

IBI: 36.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 21.10 Date: 07/30/2018

Time Fished: 429 Distance: 0.150 Drainge (sq mi): 2.7 Depth: 0

Location: adj. Gillett Plant Lat: 42.33089 Long: -87.88161

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-001	COMMON CARP	O	T	M	G	16	32.0	7.51	184	13.49	5.7
43-002	GOLDFISH	O	T	M	G	177	354.0	83.10	800	58.65	2.2
47-006	BLACK BULLHEAD	I	P	C		2	4.0	0.94	200	14.66	50.0
77-006	LARGEMOUTH BASS	C		C	F	12	24.0	5.63	50	3.67	2.0
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	1.41	40	2.93	6.6
77-009	BLUEGILL SUNFISH	I	P	C	S	3	6.0	1.41	90	6.60	15.0

No Species: 6 **Nat. Species:** 4 **Hybrids:** 0 **Total Counted:** 213 **Total Rel. Wt. :** 1364

IBI: 20.0 **MIwb:** N/A

Appendix Table B-3. Midwest Biodiversity Institute
Fish Species List

Site ID: River: 95-403 Skokie River RM: 21.10 Date: 09/12/2018

Time Fished: 534 Distance: 0.150 Drainge (sq mi): 2.7 Depth: 0

Location: adj. Gillett Plant Lat: 42.33089 Long: -87.88161

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-002	GOLDFISH	O	T	M	G	71	142.0	44.94	640	59.48	4.5
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.63	6	0.56	3.0
77-008	GREEN SUNFISH	I	T	C	S	86	172.0	54.43	430	39.96	2.5

No Species: 3 **Nat. Species:** 2 **Hybrids:** 0 **Total Counted:** 158 **Total Rel. Wt. :** 1076

IBI: 22.0 **MIwb:** N/A

APPENDIX C

North Branch Chicago River 2018-2019 Macroinvertebrate Assemblage Data

C-1: Macroinvertebrate IBI Metrics and Scores
C-2: Macroinvertebrate Taxa by Site and Sample

Appendix Table C-1. Illinois Macroinvertebrate IBI metrics and values from the North Branch Chicago River study area in 2018 and 2019.

River Mile	Site ID	Sample	Date	Drainage Area (sq mi)	Sub-samp	Number of: Total Taxa	Number of: Coleoptera Taxa	Number of: Mayfly Taxa	Number of: Intolerant Taxa	MBI	Percent: Percent Scrapers	Percent: Percent EPT	MIBI
North Branch Chicago River (95-009)													
Year: 2018													
18.60	MF19		08/04/2018	93.41		18(39.0)	0(0.0)	0(0.0)	2(22.2)	6.5(73.8)	0.3(1.2)	0.0(0.0)	19.5
Middle Fork North Branch Chicago River (95-291)													
Year: 2018													
3.00	MF16		08/05/2018	56.15		27(59.0)	0(0.0)	0(0.0)	1(11.1)	6.3(77.1)	1.3(4.3)	0.3(0.4)	21.7
1.80	MF17		08/04/2018	57.31		21(46.0)	1(20.0)	0(0.0)	2(22.2)	5.1(96.7)	2.3(7.9)	2.3(3.2)	28.0
Year: 2019													
21.10	MF08		07/29/2019	5.80		13(28.0)	2(40.0)	1(9.8)	1(11.1)	4.6(100)	2.7(9.3)	6.7(9.1)	29.6
18.90	MF09		07/28/2019	8.90		13(28.0)	0(0.0)	1(9.8)	1(11.1)	4.7(100)	0.9(3.1)	0.9(1.2)	21.9
16.70	MF10		07/28/2019	11.90		12(26.0)	0(0.0)	1(9.8)	2(22.2)	4.2(100)	1.7(5.8)	2.3(3.1)	23.9
14.10	MF11		07/28/2019	16.10		7(15.0)	0(0.0)	0(0.0)	1(11.1)	4.1(100)	1.2(4.0)	1.2(1.6)	18.8
10.80	MF12		07/28/2019	19.20		17(37.0)	0(0.0)	0(0.0)	2(22.2)	4.4(100)	1.4(4.9)	1.2(1.6)	23.7
8.60	MF13		07/30/2019	20.90		17(37.0)	1(20.0)	0(0.0)	2(22.2)	5.3(93.4)	1.6(5.3)	0.6(0.9)	25.6
6.00	MF14		07/29/2019	22.40		18(39.0)	0(0.0)	1(9.8)	2(22.2)	5.3(93.4)	1.9(6.5)	43.6(58.9)	32.8
4.00	MF15		07/29/2019	24.20		27(59.0)	0(0.0)	2(19.6)	2(22.2)	5.1(96.7)	0.9(3.1)	6.5(8.8)	29.9
West Fork North Branch Chicago River (95-292)													
Year: 2019													
12.50	WF20		07/30/2019	3.80		17(37.0)	0(0.0)	0(0.0)	0(0.0)	6.3(77.1)	19.7(66.5)	0.0(0.0)	25.8
12.50	WF20	2	09/10/2019	3.80		17(37.0)	0(0.0)	0(0.0)	1(11.1)	6.6(72.1)	2.9(9.7)	0.0(0.0)	18.6
10.40	WF21		07/30/2019	7.00		18(39.0)	0(0.0)	0(0.0)	2(22.2)	6.0(82.0)	0.0(0.0)	0.3(0.4)	20.5
9.20	WF22		07/29/2019	9.40		18(39.0)	0(0.0)	0(0.0)	0(0.0)	6.3(77.1)	3.1(10.4)	0.3(0.4)	18.1
4.90	WF23		07/29/2019	17.80		21(46.0)	0(0.0)	1(9.8)	1(11.1)	5.9(83.6)	14.5(48.9)	0.9(1.2)	28.7
2.90	WF24		07/29/2019	24.50		26(57.0)	0(0.0)	0(0.0)	0(0.0)	5.8(85.3)	4.8(16.2)	2.3(3.0)	23.1

Appendix Table C-1. Illinois Macroinvertebrate IBI metrics and values from the North Branch Chicago River study area in 2018 and 2019.

River Mile	Site ID	Sample	Date	Drainage Area (sq mi)	Sub-samp	Number of				MBI	Percent:		MIBI
						Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa		Percent Scrapers	Percent EPT	
1.30	WF25		07/29/2019	27.90		20(43.0)	0(0.0)	0(0.0)	0(0.0)	5.4(91.8)	7.1(23.8)	0.7(0.9)	22.8
Skokie River (95-403)													
Year: 2018													
21.10	SR1		08/05/2018	2.78		19(41.0)	0(0.0)	1(9.8)	1(11.1)	8.5(41.0)	0.3(1.1)	7.9(10.7)	16.4
17.40	SR2		08/05/2018	7.87		14(30.0)	0(0.0)	0(0.0)	2(22.2)	4.2(100)	0.0(0.0)	0.0(0.0)	21.8
14.80	SR3		08/04/2018	11.56		20(43.0)	1(20.0)	0(0.0)	2(22.2)	5.0(98.4)	2.3(7.7)	0.0(0.0)	27.3
14.80	SR3	2	09/23/2018	11.56		23(50.0)	1(20.0)	0(0.0)	3(33.3)	5.0(98.4)	2.2(7.6)	0.0(0.0)	29.9
11.30	SR4		08/04/2018	15.07		12(26.0)	0(0.0)	1(9.8)	1(11.1)	4.0(100)	0.7(2.4)	8.1(11.0)	22.9
8.00	SR5		08/04/2018	20.67		13(28.0)	0(0.0)	0(0.0)	2(22.2)	3.5(100)	2.0(6.8)	0.0(0.0)	22.4
7.40	SR6		08/04/2018	21.51		16(35.0)	0(0.0)	0(0.0)	2(22.2)	5.5(90.2)	0.9(3.1)	0.0(0.0)	21.5
0.50	SR18		08/04/2018	30.90		23(50.0)	0(0.0)	0(0.0)	2(22.2)	5.3(93.4)	2.5(8.3)	7.0(9.5)	26.2

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: ust. Dempster St.

Site ID: **MF19**

Subsample:

Collection Date: 08/04/2018 River Code: 95-009 River: North Branch Chicago River RM: 18.60

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	2
03600	Oligochaeta	N	10.0	87
04664	Helobdella stagnalis	N	8.0	1
04901	Erpobdellidae	N	8.0	25
05800	Caecidotea sp	N	6.0	39
06201	Hyalella azteca	N	4.0	9
06800	Gammarus sp	N	3.0	70
21001	Calopterygidae	O	3.5	1
22300	Argia sp	O	5.0	1
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	11
78655	Procladius (Holotanypus) sp	D	8.0	2
82820	Cryptochironomus sp	D	8.0	3
83040	Dicrotendipes neomodestus	D	6.0	3
84210	Paratendipes albimanus or P. duplicatus	D	3.0	5
84470	Polypedilum (P.) illinoense	D	6.0	10
84520	Polypedilum (Tripodura) halterale group	D	6.0	1
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	10
85500	Paratanytarsus sp	T	6.0	2
85818	Tanytarsus glabrescens group sp 4	T	7.0	1
85821	Tanytarsus glabrescens group sp 7	T	7.0	1
95100	Physella sp	N	9.0	1
98600	Sphaerium sp	N	5.0	5

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 22 Total Taxa: 22

Number of Organisms: 290 mIBI: 19.45

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: ust. E. Lake Rd.

Site ID: **MF16**

Subsample:

Collection Date: 08/05/2018 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 3.00

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	1
03600	Oligochaeta	N	10.0	70
04666	Helobdella papillata	N	8.0	1
04682	Placobdella montifera	N	8.0	1
04901	Erpobdellidae	N	8.0	2
05800	Caecidotea sp	N	6.0	2
06201	Hyalella azteca	N	4.0	29
06800	Gammarus sp	N	3.0	79
08250	Orconectes (Procericambarus) rusticus	N	5.0	1
59500	Oecetis sp	C	5.0	1
77500	Conchapelopia sp	D	6.0	2
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	42
80510	Cricotopus (Isocladius) sylvestris group	D	8.0	2
82730	Chironomus (C.) decorus group	D	11.0	1
82800	Cladopelma sp	D	6.0	5
82820	Cryptochironomus sp	D	8.0	1
83040	Dicrotendipes neomodestus	D	6.0	2
83300	Glyptotendipes (G.) sp	D	10.0	2
83400	Harnischia sp	D	6.0	1
84155	Paralauterborniella nigrohalteralis	D	6.0	1
84470	Polypedilum (P.) illinoense	D	6.0	52
84520	Polypedilum (Tripodura) halterale group	D	6.0	1
85800	Tanytarsus sp	T	7.0	2
92310	Valvata bicarinata	N	0.0	3
93200	Hydrobiidae	N	6.0	1
95100	Physella sp	N	9.0	2
95900	Gyraulus sp	N	6.0	1
97601	Corbicula fluminea	N	4.0	2
98600	Sphaerium sp	N	5.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 312 mIBI: 21.70

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: dst. Glenview Rd.

Site ID: **MF17**

Subsample:

Collection Date: 08/04/2018 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 1.80

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	10
03600	Oligochaeta	N	10.0	17
04664	Helobdella stagnalis	N	8.0	2
04910	Erpobdella sp (= Dina)	N	0.0	8
05800	Caecidotea sp	N	6.0	61
06201	Hyalella azteca	N	4.0	1
06800	Gammarus sp	N	3.0	84
22001	Coenagrionidae	O	5.5	2
52200	Cheumatopsyche sp	C	6.0	7
68901	Macronychus glabratus	O	2.0	1
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	18
78655	Procladius (Holotanypus) sp	D	8.0	1
80420	Cricotopus (C.) bicinctus	D	8.0	2
82820	Cryptochironomus sp	D	8.0	1
83040	Dicrotendipes neomodestus	D	6.0	5
84450	Polypedilum (Uresipedilum) flavum	D	6.0	22
84470	Polypedilum (P.) illinoense	D	6.0	21
84520	Polypedilum (Tripodura) halterale group	D	6.0	1
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	7
85625	Rheotanytarsus sp	T	6.0	11
93200	Hydrobiidae	N	6.0	6
95900	Gyraulus sp	N	6.0	1
97601	Corbicula fluminea	N	4.0	2
98600	Sphaerium sp	N	5.0	9

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 24 Total Taxa: 24

Number of Organisms: 300 mIBI: 27.99

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Ust. Rockland Rd.

Site ID: **MF08**

Subsample:

Collection Date: 07/29/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 21.10

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	13
03600	Oligochaeta	N	10.0	17
06201	Hyalella azteca	N	4.0	246
17200	Caenis sp	M	6.0	15
22001	Coenagrionidae	O	5.5	7
42700	Belostoma sp	O	99.9	2
52200	Cheumatopsyche sp	C	6.0	1
53800	Hydroptila sp	C	2.0	6
60900	Peltodytes sp	O	99.9	5
65800	Berosus sp	O	99.9	8
68708	Dubiraphia vittata group	O	5.0	1
69400	Stenelmis sp	O	7.0	1
77500	Conchapelopia sp	D	6.0	1
78200	Larsia sp	D	6.0	1
93200	Hydrobiidae	N	6.0	2
98200	Pisidium sp	N	5.0	5
98600	Sphaerium sp	N	5.0	12

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 17 Total Taxa: 17

Number of Organisms: 343 mIBI: 29.61

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. foot bridge at FP

Site ID: **MF09**

Subsample:

Collection Date: 07/28/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 18.90

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	21
03600	Oligochaeta	N	10.0	26
04664	Helobdella stagnalis	N	8.0	2
04930	Erpobdella sp	N	8.0	1
06201	Hyalella azteca	N	4.0	258
11200	Callibaetis sp	M	4.0	1
22001	Coenagrionidae	O	5.5	1
53800	Hydroptila sp	C	2.0	1
59500	Oecetis sp	C	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	2
82880	Cryptotendipes sp	D	6.0	1
84520	Polypedilum (Tripodura) halterale group	D	6.0	7
92615	Cipangopaludina japonica	N	6.0	2
98600	Sphaerium sp	N	5.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 14 Total Taxa: 14

Number of Organisms: 325 mIBI: 21.89

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Westleigh St.

Site ID: **MF10**

Subsample:

Collection Date: 07/28/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 16.70

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	1
03600	Oligochaeta	N	10.0	5
04901	Erpobdellidae	N	8.0	1
06201	Hyalella azteca	N	4.0	323
17200	Caenis sp	M	6.0	4
22001	Coenagrionidae	O	5.5	6
42700	Belostoma sp	O	99.9	1
48610	Nigronia fasciata	O	2.0	1
52200	Cheumatopsyche sp	C	6.0	1
53800	Hydroptila sp	C	2.0	3
60900	Peltodytes sp	O	99.9	2
93200	Hydrobiidae	N	6.0	2
95100	Physella sp	N	9.0	1
98600	Sphaerium sp	N	5.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 14 Total Taxa: 14

Number of Organisms: 352 mIBI: 23.85

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. IL22

Site ID: **MF11**

Subsample:

Collection Date: 07/28/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 14.10

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta	N	10.0	3
04930	Erpobdella sp	N	8.0	1
06201	Hyalella azteca	N	4.0	318
22001	Coenagrionidae	O	5.5	6
23700	Anax sp	O	5.0	3
53800	Hydroptila sp	C	2.0	4
84470	Polypedilum (P.) illinoense	D	6.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 7 Total Taxa: 7

Number of Organisms: 336 mIBI: 18.82

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Ust. Carrige Way

Site ID: **MF12**

Subsample:

Collection Date: 07/28/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 10.80

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	8
03600	Oligochaeta	N	10.0	10
04964	Erpobdella microstoma	N	8.0	1
05800	Caecidotea sp	N	6.0	10
06201	Hyalella azteca	N	4.0	289
22001	Coenagrionidae	O	5.5	2
22300	Argia sp	O	5.0	4
52200	Cheumatopsyche sp	C	6.0	2
53800	Hydroptila sp	C	2.0	2
65800	Berosus sp	O	99.9	1
77120	Ablabesmyia mallochi	D	6.0	1
79100	Thienemannimyia group	D	6.0	2
83040	Dicrotendipes neomodestus	D	6.0	3
83050	Dicrotendipes lucifer	D	6.0	1
84210	Paratendipes albimanus or P. duplicatus	D	3.0	2
84450	Polypedilum (Uresipedilum) flavum	D	6.0	3
85800	Tanytarsus sp	T	7.0	3
85814	Tanytarsus glabrescens group	T	7.0	1
93200	Hydrobiidae	N	6.0	2
95100	Physella sp	N	9.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 20 Total Taxa: 20

Number of Organisms: 348 mIBI: 23.66

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Ust. IL68

Site ID: **MF13**

Subsample:

Collection Date: 07/30/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 8.60

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	20
03600	Oligochaeta	N	10.0	12
04664	Helobdella stagnalis	N	8.0	3
04930	Erpobdella sp	N	8.0	7
05800	Caecidotea sp	N	6.0	107
06201	Hyalella azteca	N	4.0	130
08200	Orconectes sp	N	5.0	1
22001	Coenagrionidae	O	5.5	5
53800	Hydroptila sp	C	2.0	2
60900	Peltodytes sp	O	99.9	1
68708	Dubiraphia vittata group	O	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	4
83040	Dicrotendipes neomodestus	D	6.0	1
84210	Paratendipes albimanus or P. duplicatus	D	3.0	3
84450	Polypedilum (Uresipedilum) flavum	D	6.0	1
84470	Polypedilum (P.) illinoense	D	6.0	3
84520	Polypedilum (Tripodura) halterale group	D	6.0	2
84612	Saetheria tylus	D	4.0	1
93200	Hydrobiidae	N	6.0	1
95100	Physella sp	N	9.0	2
98200	Pisidium sp	N	5.0	3
98600	Sphaerium sp	N	5.0	8

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 22 Total Taxa: 22

Number of Organisms: 318 mIBI: 25.55

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Sunset Dr.

Site ID: **MF14**

Subsample:

Collection Date: 07/29/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 6.00

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	13
03600	Oligochaeta	N	10.0	16
05800	Caecidotea sp	N	6.0	32
06201	Hyalella azteca	N	4.0	46
11130	Baetis intercalaris	M	4.0	75
22001	Coenagrionidae	O	5.5	2
22300	Argia sp	O	5.0	8
49200	Climacia sp	O	1.0	1
52200	Cheumatopsyche sp	C	6.0	56
53800	Hydroptila sp	C	2.0	5
74100	Simulium sp	D	6.0	9
77120	Ablabesmyia mallochi	D	6.0	1
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)	D	6.0	3
84450	Polypedilum (Uresipedilum) flavum	D	6.0	35
84470	Polypedilum (P.) illinoense	D	6.0	2
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	1
85265	Cladotanytarsus vanderwulpi group sp 5	T	7.0	1
85625	Rheotanytarsus sp	T	6.0	1
95100	Physella sp	N	9.0	1
98200	Pisidium sp	N	5.0	1
98600	Sphaerium sp	N	5.0	3

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 21 Total Taxa: 21

Number of Organisms: 312 mIBI: 32.84

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Winnetka Ave.

Site ID: **MF15**

Subsample:

Collection Date: 07/29/2019 River Code: 95-291 River: Middle Fork North Branch Chicago RM: 4.00

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	10
03600	Oligochaeta	N	10.0	6
04935	Erpobdella punctata punctata	N	8.0	1
04964	Erpobdella microstoma	N	8.0	1
05800	Caecidotea sp	N	6.0	85
06201	Hyalella azteca	N	4.0	96
06800	Gammarus sp	N	3.0	11
08200	Orconectes sp	N	5.0	1
11130	Baetis intercalaris	M	4.0	9
17200	Caenis sp	M	6.0	1
21001	Calopterygidae	O	3.5	9
22001	Coenagrionidae	O	5.5	4
22300	Argia sp	O	5.0	3
52200	Cheumatopsyche sp	C	6.0	9
53800	Hydroptila sp	C	2.0	2
77500	Conchapelopia sp	D	6.0	1
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	3
78140	Labrundinia pilosella	D	4.0	3
81825	Rheocricotopus (Psilocricotopus) robacki	D	6.0	1
83040	Dicrotendipes neomodestus	D	6.0	10
84450	Polypedilum (Uresipedilum) flavum	D	6.0	12
84470	Polypedilum (P.) illinoense	D	6.0	16
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	6
84612	Saetheria tylus	D	4.0	8
85265	Cladotanytarsus vanderwulpi group sp 5	T	7.0	2
85500	Paratanytarsus sp	T	6.0	2
85625	Rheotanytarsus sp	T	6.0	3
93200	Hydrobiidae	N	6.0	1
97601	Corbicula fluminea	N	4.0	3
98600	Sphaerium sp	N	5.0	2

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 321 mIBI: 29.93

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Adj. Saundrers Rd.

Site ID: **WF20**

Subsample:

Collection Date: 07/30/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 12.50

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	39
03600	Oligochaeta	N	10.0	5
04660	Helobdella sp	N	8.0	5
04664	Helobdella stagnalis	N	8.0	18
04666	Helobdella papillata	N	8.0	2
04964	Erpobdella microstoma	N	8.0	8
05800	Caecidotea sp	N	6.0	1
06201	Hyalella azteca	N	4.0	42
06700	Crangonyx sp	N	4.0	9
22001	Coenagrionidae	O	5.5	19
23501	Aeshnidae	O	4.5	1
60900	Peltodytes sp	O	99.9	1
77140	Ablabesmyia peleensis	D	6.0	1
80510	Cricotopus (Isocladius) sylvestris group	D	8.0	3
83040	Dicrotendipes neomodestus	D	6.0	8
83050	Dicrotendipes lucifer	D	6.0	1
83051	Dicrotendipes simpsoni	D	6.0	3
84000	Parachironomus sp	D	8.0	1
84470	Polypedilum (P.) illinoense	D	6.0	37
85500	Paratanytarsus sp	T	6.0	2
95100	Physella sp	N	9.0	55
96264	Planorbella (Pierosoma) pilsbryi	N	6.5	9
98200	Pisidium sp	N	5.0	16
98600	Sphaerium sp	N	5.0	40

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 24 Total Taxa: 24

Number of Organisms: 326 mIBI: 25.80

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Adj. Saundrers Rd.

Site ID: **WF20**

Subsample:

Collection Date: 09/10/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 12.50

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	17
03600	Oligochaeta	N	10.0	66
04660	Helobdella sp	N	8.0	1
04664	Helobdella stagnalis	N	8.0	12
04964	Erpobdella microstoma	N	8.0	14
05800	Caecidotea sp	N	6.0	1
06201	Hyalella azteca	N	4.0	11
06700	Crangonyx sp	N	4.0	25
22001	Coenagrionidae	O	5.5	65
23501	Aeshnidae	O	4.5	1
28705	Pachydiplax longipennis	O	8.0	2
45900	Notonecta sp	O	99.9	1
66700	Helochares maculicollis	O	0.0	1
67700	Paracymus sp	O	99.9	1
81240	Nanocladius (N.) distinctus	D	3.0	1
83040	Dicrotendipes neomodestus	D	6.0	13
83300	Glyptotendipes (G.) sp	D	10.0	4
84470	Polypedilum (P.) illinoense	D	6.0	25
95100	Physella sp	N	9.0	8
96264	Planorbella (Pierosoma) pilsbryi	N	6.5	1
98001	Pisidiidae	N	5.0	46

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 21 Total Taxa: 21

Number of Organisms: 316 mIBI: 25.80

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Deerfield Rd.

Site ID: **WF21**

Subsample:

Collection Date: 07/30/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 10.40

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	67
03600	Oligochaeta	N	10.0	13
04664	Helobdella stagnalis	N	8.0	7
04901	Erpobdellidae	N	8.0	7
06201	Hyalella azteca	N	4.0	11
22001	Coenagrionidae	O	5.5	3
52200	Cheumatopsyche sp	C	6.0	1
74100	Simulium sp	D	6.0	3
77500	Conchapelopia sp	D	6.0	2
80350	Corynoneura sp	D	2.0	1
80420	Cricotopus (C.) bicinctus	D	8.0	1
80510	Cricotopus (Isocladius) sylvestris group	D	8.0	1
82820	Cryptochironomus sp	D	8.0	1
83000	Dicrotendipes sp	D	6.0	16
83040	Dicrotendipes neomodestus	D	6.0	12
83051	Dicrotendipes simpsoni	D	6.0	3
83300	Glyptotendipes (G.) sp	D	10.0	3
84210	Paratendipes albimanus or P. duplicatus	D	3.0	16
84400	Polypedilum sp	D	6.0	2
84450	Polypedilum (Uresipedilum) flavum	D	6.0	63
84470	Polypedilum (P.) illinoense	D	6.0	12
84520	Polypedilum (Tripodura) halterale group	D	6.0	1
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	43
85260	Cladotanytarsus vanderwulpi group	T	7.0	1
85625	Rheotanytarsus sp	T	6.0	1
98200	Pisidium sp	N	5.0	2
98600	Sphaerium sp	N	5.0	27

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 27 Total Taxa: 27

Number of Organisms: 320 mIBI: 20.52

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Lake-Cook Rd.

Site ID: **WF22**

Subsample:

Collection Date: 07/29/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 9.20

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	92
03600	Oligochaeta	N	10.0	49
04660	Helobdella sp	N	8.0	1
04666	Helobdella papillata	N	8.0	2
04964	Erpobdella microstoma	N	8.0	4
05800	Caecidotea sp	N	6.0	18
06201	Hyalella azteca	N	4.0	36
22001	Coenagrionidae	O	5.5	3
52200	Cheumatopsyche sp	C	6.0	1
77500	Conchapelopia sp	D	6.0	2
82730	Chironomus (C.) decorus group	D	11.0	1
82820	Cryptochironomus sp	D	8.0	1
83040	Dicrotendipes neomodestus	D	6.0	36
83050	Dicrotendipes lucifer	D	6.0	19
83051	Dicrotendipes simpsoni	D	6.0	1
83158	Endochironomus nigricans	D	6.0	2
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)	D	8.0	1
84450	Polypedilum (Uresipedilum) flavum	D	6.0	22
84470	Polypedilum (P.) illinoense	D	6.0	14
92310	Valvata bicarinata	N	0.0	4
95100	Physella sp	N	9.0	10
95501	Planorbidae	N	6.5	1
98200	Pisidium sp	N	5.0	8
98600	Sphaerium sp	N	5.0	30

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 24 Total Taxa: 24

Number of Organisms: 358 mIBI: 18.11

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Willow Rd.

Site ID: **WF23**

Subsample:

Collection Date: 07/29/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 4.90

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	1
03600	Oligochaeta	N	10.0	57
04664	Helobdella stagnalis	N	8.0	2
05800	Caecidotea sp	N	6.0	1
06201	Hyalella azteca	N	4.0	151
11200	Callibaetis sp	M	4.0	1
22001	Coenagrionidae	O	5.5	5
23700	Anax sp	O	5.0	2
53501	Hydroptilidae	C	3.5	2
60900	Peltodytes sp	O	99.9	1
77500	Conchapelopia sp	D	6.0	1
80510	Cricotopus (Isocladius) sylvestris group	D	8.0	2
82100	Thienemanniella sp	D	2.0	1
82730	Chironomus (C.) decorus group	D	11.0	1
82820	Cryptochironomus sp	D	8.0	2
83000	Dicrotendipes sp	D	6.0	1
83040	Dicrotendipes neomodestus	D	6.0	2
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)	D	8.0	3
84450	Polypedilum (Uresipedilum) flavum	D	6.0	5
84470	Polypedilum (P.) illinoense	D	6.0	23
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	3
92310	Valvata bicarinata	N	0.0	1
95100	Physella sp	N	9.0	22
95900	Gyraulus sp	N	6.0	25
98200	Pisidium sp	N	5.0	3
98600	Sphaerium sp	N	5.0	8

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 26 Total Taxa: 26

Number of Organisms: 326 mIBI: 28.66

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Dst. Lake Ave.

Site ID: **WF24**

Subsample:

Collection Date: 07/29/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 2.90

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	16
03600	Oligochaeta	N	10.0	24
04664	Helobdella stagnalis	N	8.0	1
04901	Erpobdellidae	N	8.0	5
05800	Caecidotea sp	N	6.0	79
06201	Hyalella azteca	N	4.0	89
08200	Orconectes sp	N	5.0	2
21001	Calopterygidae	O	3.5	1
22001	Coenagrionidae	O	5.5	15
52200	Cheumatopsyche sp	C	6.0	6
59500	Oecetis sp	C	5.0	2
77120	Ablabesmyia mallochi	D	6.0	2
77130	Ablabesmyia rhamphe group	D	6.0	2
77500	Conchapelopia sp	D	6.0	4
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	3
78655	Procladius (Holotanypus) sp	D	8.0	1
82800	Cladopelma sp	D	6.0	1
82820	Cryptochironomus sp	D	8.0	3
83040	Dicrotendipes neomodestus	D	6.0	12
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)	D	8.0	1
84450	Polypedilum (Uresipedilum) flavum	D	6.0	27
84470	Polypedilum (P.) illinoense	D	6.0	3
84520	Polypedilum (Tripodura) halterale group	D	6.0	2
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	14
85500	Paratanytarsus sp	T	6.0	2
85625	Rheotanytarsus sp	T	6.0	1
85800	Tanytarsus sp	T	7.0	5
93200	Hydrobiidae	N	6.0	4
95100	Physella sp	N	9.0	13
97601	Corbicula fluminea	N	4.0	8
98600	Sphaerium sp	N	5.0	8

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 31 Total Taxa: 31

Number of Organisms: 356 mIBI: 23.06

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Ust. walking bridge

Site ID: **WF25**

Subsample:

Collection Date: 07/29/2019 River Code: 95-292 River: West Fork North Branch Chicago RM: 1.30

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta	N	10.0	8
04664	Helobdella stagnalis	N	8.0	2
04666	Helobdella papillata	N	8.0	2
05800	Caecidotea sp	N	6.0	2
06201	Hyalella azteca	N	4.0	131
22001	Coenagrionidae	O	5.5	1
22300	Argia sp	O	5.0	1
52200	Cheumatopsyche sp	C	6.0	1
59500	Oecetis sp	C	5.0	1
66700	Helochares maculicollis	O	0.0	1
67700	Paracymus sp	O	99.9	2
77500	Conchapelopia sp	D	6.0	2
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	3
83000	Dicrotendipes sp	D	6.0	1
83040	Dicrotendipes neomodestus	D	6.0	5
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)	D	8.0	1
84450	Polypedilum (Uresipedilum) flavum	D	6.0	2
84470	Polypedilum (P.) illinoense	D	6.0	101
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	6
85625	Rheotanytarsus sp	T	6.0	2
85800	Tanytarsus sp	T	7.0	1
95100	Physella sp	N	9.0	20
95900	Gyraulus sp	N	6.0	1
98200	Pisidium sp	N	5.0	1
98600	Sphaerium sp	N	5.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 26 Total Taxa: 26

Number of Organisms: 300 mIBI: 22.79

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: adj. Gillett Plant

Site ID: **SR1**

Subsample:

Collection Date: 08/05/2018 River Code: 95-403 River: Skokie River RM: 21.10

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta	N	10.0	148
05800	Caecidotea sp	N	6.0	3
06800	Gammarus sp	N	3.0	5
08200	Orconectes sp	N	5.0	3
11200	Callibaetis sp	M	4.0	24
21001	Calopterygidae	O	3.5	1
22001	Coenagrionidae	O	5.5	12
67800	Tropisternus sp	O	99.9	1
77355	Clinotanypus pinguis	D	6.0	1
78655	Procladius (Holotanypus) sp	D	8.0	17
79000	Tanypus sp	D	8.0	26
80420	Cricotopus (C.) bicinctus	D	8.0	2
82730	Chironomus (C.) decorus group	D	11.0	26
82820	Cryptochironomus sp	D	8.0	2
82880	Cryptotendipes sp	D	6.0	1
83158	Endochironomus nigricans	D	6.0	6
84470	Polypedilum (P.) illinoense	D	6.0	9
84520	Polypedilum (Tripodura) halterale group	D	6.0	15
85800	Tanytarsus sp	T	7.0	1
87540	Hemerodromia sp	D	6.0	1
95100	Physella sp	N	9.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 21 Total Taxa: 21

Number of Organisms: 305 mIBI: 16.38

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: ust. IL 176

Site ID: **SR2**

Subsample:

Collection Date: 08/05/2018 River Code: 95-403 River: Skokie River RM: 17.40

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	1
03600	Oligochaeta	N	10.0	13
04901	Erpobdellidae	N	8.0	4
05800	Caecidotea sp	N	6.0	58
06800	Gammarus sp	N	3.0	191
08200	Orconectes sp	N	5.0	1
21001	Calopterygidae	O	3.5	2
22001	Coenagrionidae	O	5.5	1
82730	Chironomus (C.) decorus group	D	11.0	1
82820	Cryptochironomus sp	D	8.0	1
84210	Paratendipes albimanus or P. duplicatus	D	3.0	2
84520	Polypedilum (Tripodura) halterale group	D	6.0	1
84750	Stictochironomus sp	D	5.0	8
98200	Pisidium sp	N	5.0	2
98600	Sphaerium sp	N	5.0	9

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 15 Total Taxa: 15

Number of Organisms: 295 mIBI: 21.75

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: dst. Deerpath Rd.

Site ID: **SR3**

Subsample:

Collection Date: 08/04/2018 River Code: 95-403 River: Skokie River RM: 14.80

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	7
03600	Oligochaeta	N	10.0	13
05800	Caecidotea sp	N	6.0	12
06800	Gammarus sp	N	3.0	128
21200	Calopteryx sp	O	4.0	7
22001	Coenagrionidae	O	5.5	18
48200	Chauliodes sp	O	4.0	1
69400	Stenelmis sp	O	7.0	1
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	2
80510	Cricotopus (Isocladius) sylvestris group	D	8.0	3
82730	Chironomus (C.) decorus group	D	11.0	4
82820	Cryptochironomus sp	D	8.0	1
83000	Dicrotendipes sp	D	6.0	1
83040	Dicrotendipes neomodestus	D	6.0	8
84470	Polypedilum (P.) illinoense	D	6.0	80
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	1
84700	Stenochironomus sp	D	3.0	3
85500	Paratanytarsus sp	T	6.0	1
85800	Tanytarsus sp	T	7.0	7
95100	Physella sp	N	9.0	6
98200	Pisidium sp	N	5.0	1
98600	Sphaerium sp	N	5.0	1

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 23 Total Taxa: 23

Number of Organisms: 307 mIBI: 27.33

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: dst. Deerpath Rd.

Site ID: **SR3**

Subsample:

Collection Date: 09/23/2018 River Code: 95-403 River: Skokie River RM: 14.80

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	2
03600	Oligochaeta	N	10.0	39
04901	Erpobdellidae	N	8.0	5
05800	Caecidotea sp	N	6.0	4
06700	Crangonyx sp	N	4.0	1
06800	Gammarus sp	N	3.0	153
21200	Calopteryx sp	O	4.0	3
22001	Coenagrionidae	O	5.5	9
22300	Argia sp	O	5.0	1
68201	Scirtidae	O	7.0	1
69400	Stenelmis sp	O	7.0	1
69930	Lampyridae	O	0.0	1
80420	Cricotopus (C.) bicinctus	D	8.0	2
81231	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"	D	3.0	1
82730	Chironomus (C.) decorus group	D	11.0	2
83040	Dicrotendipes neomodestus	D	6.0	1
84210	Paratendipes albimanus or P. duplicatus	D	3.0	5
84470	Polypedilum (P.) illinoense	D	6.0	51
84520	Polypedilum (Tripodura) halterale group	D	6.0	1
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	1
85500	Paratanytarsus sp	T	6.0	1
85800	Tanytarsus sp	T	7.0	1
85821	Tanytarsus glabrescens group sp 7	T	7.0	1
95100	Physella sp	N	9.0	4
95900	Gyraulus sp	N	6.0	1
98200	Pisidium sp	N	5.0	15
98600	Sphaerium sp	N	5.0	5

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 27 Total Taxa: 27

Number of Organisms: 312 mIBI: 27.33

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: ust. Half Day Rd. @ Sleepy Hollow Park

Site ID: **SR4**

Subsample:

Collection Date: 08/04/2018 River Code: 95-403 River: Skokie River RM: 11.30

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	3
03600	Oligochaeta	N	10.0	1
04935	Erpobdella punctata punctata	N	8.0	2
05800	Caecidotea sp	N	6.0	44
06800	Gammarus sp	N	3.0	179
11130	Baetis intercalaris	M	4.0	23
77500	Conchapelopia sp	D	6.0	3
82820	Cryptochironomus sp	D	8.0	8
84450	Polypedilum (Uresipedilum) flavum	D	6.0	1
84470	Polypedilum (P.) illinoense	D	6.0	3
85800	Tanytarsus sp	T	7.0	3
95100	Physella sp	N	9.0	2
98200	Pisidium sp	N	5.0	5
98600	Sphaerium sp	N	5.0	6

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 14 Total Taxa: 14

Number of Organisms: 283 mIBI: 22.90

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: ust. Clavey Rd. @ Solel Congregation

Site ID: **SR5**

Subsample:

Collection Date: 08/04/2018 River Code: 95-403 River: Skokie River RM: 8.00

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	1
03600	Oligochaeta	N	10.0	5
04964	Erpobdella microstoma	N	8.0	1
05800	Caecidotea sp	N	6.0	8
06800	Gammarus sp	N	3.0	255
22001	Coenagrionidae	O	5.5	3
82820	Cryptochironomus sp	D	8.0	4
83040	Dicrotendipes neomodestus	D	6.0	3
83158	Endochironomus nigricans	D	6.0	1
84210	Paratendipes albimanus or P. duplicatus	D	3.0	1
84470	Polypedilum (P.) illinoense	D	6.0	1
95100	Physella sp	N	9.0	6
98200	Pisidium sp	N	5.0	3
98600	Sphaerium sp	N	5.0	5

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 14 Total Taxa: 14

Number of Organisms: 297 mIBI: 22.43

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: Ust. Lake Cook Rd.

Site ID: **SR6**

Subsample:

Collection Date: 08/04/2018 River Code: 95-403 River: Skokie River RM: 7.40

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	4
03600	Oligochaeta	N	10.0	8
05800	Caecidotea sp	N	6.0	37
06800	Gammarus sp	N	3.0	129
22001	Coenagrionidae	O	5.5	5
23700	Anax sp	O	5.0	1
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	1
80420	Cricotopus (C.) bicinctus	D	8.0	1
82730	Chironomus (C.) decorus group	D	11.0	37
82800	Cladopelma sp	D	6.0	1
82820	Cryptochironomus sp	D	8.0	1
83040	Dicrotendipes neomodestus	D	6.0	59
83050	Dicrotendipes lucifer	D	6.0	5
84210	Paratendipes albimanus or P. duplicatus	D	3.0	2
84470	Polypedilum (P.) illinoense	D	6.0	35
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	1
95100	Physella sp	N	9.0	3

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 18 Total Taxa: 18

Number of Organisms: 331 mIBI: 21.49

Appendix Table C-2. Macroinvertebrate taxa collected in the North Branch Chicago River study area during 2018 and 2019.

Site: dst. I-94

Site ID: **SR18**

Subsample:

Collection Date: 08/04/2018 River Code: 95-403 River: Skokie River RM: 0.50

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria	N	6.0	3
03600	Oligochaeta	N	10.0	21
05800	Caecidotea sp	N	6.0	5
06201	Hyalella azteca	N	4.0	4
06800	Gammarus sp	N	3.0	110
22001	Coenagrionidae	O	5.5	2
52200	Cheumatopsyche sp	C	6.0	19
53800	Hydroptila sp	C	2.0	1
77750	Hayesomyia senata or Thienemannimyia norena	D	5.0	1
78655	Procladius (Holotanypus) sp	D	8.0	3
80420	Cricotopus (C.) bicinctus	D	8.0	5
82800	Cladopelma sp	D	6.0	1
82820	Cryptochironomus sp	D	8.0	3
83000	Dicrotendipes sp	D	6.0	1
83040	Dicrotendipes neomodestus	D	6.0	2
83051	Dicrotendipes simpsoni	D	6.0	3
83158	Endochironomus nigricans	D	6.0	2
83300	Glyptotendipes (G.) sp	D	10.0	28
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)	D	8.0	1
84450	Polypedilum (Uresipedilum) flavum	D	6.0	8
84470	Polypedilum (P.) illinoense	D	6.0	12
84540	Polypedilum (Tripodura) scalaenum group	D	6.0	2
85800	Tanytarsus sp	T	7.0	2
92310	Valvata bicarinata	N	0.0	1
93200	Hydrobiidae	N	6.0	6
97601	Corbicula fluminea	N	4.0	18
98001	Pisidiidae	N	5.0	22

Taxa Code	Taxa	Feed Grp	Tol.	Qt./Ql.

No. Quantitative Taxa: 27 Total Taxa: 27

Number of Organisms: 286 mIBI: 26.20

APPENDIX D

North Branch Chicago River 2018-2019 Habitat Data

D-1: North Branch Chicago River Watershed Workgroup
2018-2019 QHEI Metrics and Scores
D-2: QHEI Field Sheets 2018-2019

Appendix D-1. QHEI metric scores for sites in the Chicago River study area in 2018 and 2019.

River Mile	QHEI	QHEI Metrics: Substrate	Cover	Channel	Riparian	Pool	Riffle	Gradient / Score	Narrative
95-009	*North Branch Chicago River*								
	Year: **2018**								
18.60	**49.00**	9.0	14.0	7.0	7.0	8.0	0.0	1.36 - (4)	Poor
95-291	*Middle Fork North Branch Chicago River*								
	Year: **2018**								
3.00	**44.00**	5.0	15.0	5.5	7.5	7.0	0.0	2.27 - (4)	Poor
1.80	**45.00**	9.5	13.0	4.5	8.0	6.0	0.0	2.27 - (4)	Poor
	Year: **2019**								
21.10	**34.00**	2.0	11.0	6.0	5.0	2.0	0.0	34.50 - (8)	Poor
18.90	**28.00**	6.0	11.0	5.0	0.0	2.0	0.0	2.72 - (4)	Poor
16.70	**43.00**	9.0	12.0	6.0	8.0	2.0	0.0	5.29 - (6)	Poor
14.10	**45.50**	8.0	13.0	6.0	7.5	7.0	0.0	2.64 - (4)	Poor
10.80	**41.50**	6.0	11.0	6.0	4.5	7.0	1.0	5.56 - (6)	Poor
8.60	**54.50**	5.0	14.0	8.0	8.5	8.0	1.0	8.70 - (10)	Fair
6.00	**67.00**	14.0	17.0	15.0	4.0	9.0	2.0	3.45 - (6)	Fair
4.00	**59.00**	9.0	11.0	10.5	9.5	9.0	0.0	6.29 - (10)	Fair
95-292	*West Fork North Branch Chicago River*								
	Year: **2019**								
12.50	**30.50**	0.0	11.0	6.0	6.5	1.0	0.0	6.60 - (6)	Poor
10.40	**40.50**	14.0	4.0	8.0	5.5	4.0	1.0	4.15 - (4)	Poor
9.20	**46.00**	9.0	16.0	6.0	4.0	5.0	0.0	3.51 - (6)	Poor
4.90	**38.50**	4.0	13.0	5.0	5.5	7.0	0.0	1.99 - (4)	Poor
2.90	**53.50**	11.5	15.0	11.0	5.0	7.0	0.0	1.99 - (4)	Fair
1.30	**45.50**	7.0	13.0	7.5	5.0	8.0	1.0	1.99 - (4)	Poor
95-403	*Skokie River*								
	Year: **2018**								
21.10	**33.50**	0.0	13.0	4.0	5.5	3.0	0.0	10.50 - (8)	Poor
17.40	**33.50**	5.0	11.0	5.0	5.5	3.0	0.0	2.99 - (4)	Poor
14.80	**40.50**	10.5	11.0	4.0	5.0	4.0	0.0	4.42 - (6)	Poor
11.30	**47.00**	10.0	12.0	9.0	5.0	5.0	0.0	3.27 - (6)	Poor
8.00	**45.50**	8.0	13.0	5.0	7.5	8.0	0.0	1.44 - (4)	Poor
7.40	**36.25**	8.0	9.0	4.0	7.2	4.0	0.0	1.44 - (4)	Poor
3.00	**32.50**	0.0	14.0	3.0	6.5	5.0	0.0	1.44 - (4)	Poor
0.50	**38.50**	4.0	15.0	6.0	6.5	5.0	0.0	0.92 - (2)	Poor

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 34

River Code: 95-291 RM: 21.1 Stream: M Fk N Br Chicago R
Site Code: MF08 Project Code: NBWWS10 Location: Ust Rockland Rd
Date: 8-14-19 Scorer: MAS Latitude: 42.28013 Longitude: -87.89854

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☐ ☐ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☒ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -MUCK [2]			☐ ☒ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2]
(High Quality Only, Score 5 or >) ☒ -3 or Less [0]

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE))
☐ -LIMESTONE [1]
☐ -TILLS [1]
☒ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
SILT:
☒ -SILT HEAVY [-2]
☐ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☒ -EXTENSIVE [-2]
☐ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

Substrate: 2 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]

TYPE: Score All That Occur
0 POOLS > 70 cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
2 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 11 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☒ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☐ -FAIR [3]
☒ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☐ -RECOVERING [3]
☒ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☒ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 6 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank))
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☒ ☒ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank))
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank))
☐ ☐ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☐ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☒ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☒ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 2 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☒ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 34.5 DRAINAGE AREA (sq.mi.): 5.81 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 8 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____

If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ____

Subjective Rating (1-10): 4

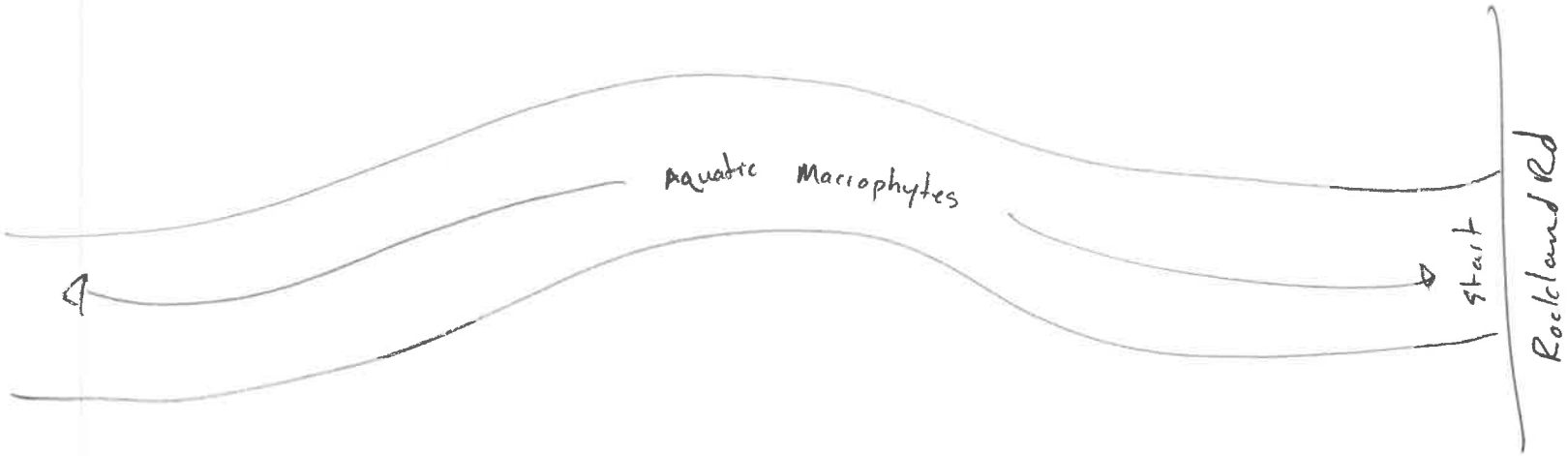
Aesthetic Rating (1-10): 4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal	100

Yes/ No	
☐ ☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐ ☐	Is there water upstream? How far:
☐ ☐	Is there water close downstream? How far:
☐ ☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 28

River Code: 95-291 RM: 18.9 Stream: M FK N Br Chicago R
Site Code: MF09 Project Code: NBWW19 Location: Dst Foot Bridge @ EP
Date: 8-14-19 Scorer: MAS Latitude: 42.25635 Longitude: -87.88459

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☐ ☒ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☐ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☒ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2]
(High Quality Only, Score 5 or >) ☒ -3 or Less [0]

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)): ☐ -LIMESTONE [1] ☐ -TILLS [1] ☒ -WETLANDS [0] ☐ -HARDPAN [0] ☐ -SANDSTONE [0] ☐ -RIP / RAP [0] ☐ -LACUSTRINE [0] ☐ -SHALE [-1] ☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
SILT: ☒ -SILT HEAVY [-2] ☐ -SILT MODERATE [-1] ☐ -SILT NORMAL [0] ☐ -SILT FREE [1]
EMBEDDEDNESS: ☒ -EXTENSIVE [-2] ☐ -MODERATE [-1] ☐ -NORMAL [0] ☐ -NONE [1]

Substrate: 6 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]

TYPE: Score All That Occur
0 POOLS > 70 cm [2]
0 ROOTWADS [1]
1 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 11 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY: ☐ -HIGH [4] ☐ -MODERATE [3] ☐ -LOW [2] ☒ -NONE [1]
DEVELOPMENT: ☐ -EXCELLENT [7] ☐ -GOOD [5] ☐ -FAIR [3] ☒ -POOR [1]
CHANNELIZATION: ☐ -NONE [6] ☐ -RECOVERED [4] ☐ -RECOVERING [3] ☒ -RECENT OR NO RECOVERY [1] ☐ -IMPOUNDED [-1]
STABILTIY: ☐ -HIGH [3] ☒ -MODERATE [2] ☐ -LOW [1]
MODIFICATIONS / OTHER: ☐ -SNAGGING ☐ -RELOCATION ☐ -CANOPY REMOVAL ☐ -DREDGING ☐ -ONE SIDE CHANNEL MODIFICATIONS ☐ -IMPOUNDMENT ☐ -ISLAND ☐ -LEVEED ☐ -BANK SHAPING

Channel: 5 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank))
☒ ☒ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☐ ☐ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank))
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank))
☐ ☐ -NONE / LITTLE [3]
☐ ☐ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 0 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☐ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☒ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1] ☐ -FAST [1] ☐ -MODERATE [1] ☒ -SLOW [1] ☐ -NONE [-1]
☐ -TORRENTIAL [-1] ☐ -INTERSTITIAL [-1] ☐ -INTERMITTENT [-2] ☐ -VERY FAST [1]

Pool / Current: 2 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☒ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 2.72 DRAINAGE AREA (sq.mi.): 8.91 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 4 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____

If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☑
- Mining ☐
- Channelization ☑
- Riparian Removal ☑
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ____

Subjective Rating (1-10): 4

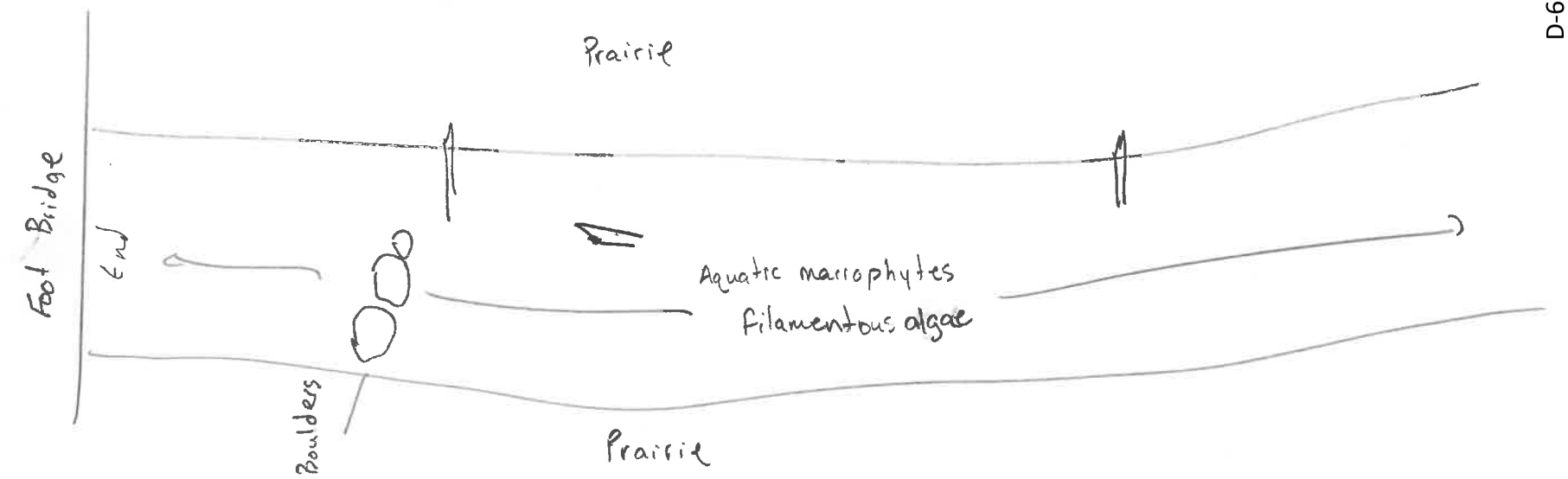
Aesthetic Rating (1-10): 4

Gradient: ☑ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal	100

Yes	No	
☐	☑	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☑	☐	Is there water upstream? How far:
☑	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 43

River Code: 95-291 RM: 16.7 Stream: M Fk N Br Chicago R
Site Code: MF10 Project Code: NBWW19 Location: Dst Westleigh St
Date: 8-14-19 Scorer: MAS Latitude: 42.23196 Longitude: -87.86841

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent)

TYPE	POOL	RIFFLE	Fine	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☑ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☑ ☐ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☐ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2] ☑ -3 or Less [0]
(High Quality Only, Score 5 or >)

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)): ☐ -LIMESTONE [1] ☐ -TILLS [1] ☑ -WETLANDS [0] ☐ -HARDPAN [0] ☐ -SANDSTONE [0] ☐ -RIP / RAP [0] ☐ -LACUSTRINE [0] ☐ -SHALE [-1] ☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)):
SILT: ☑ -SILT HEAVY [-2] ☐ -SILT MODERATE [-1] ☐ -SILT NORMAL [0] ☐ -SILT FREE [1]
EMBEDDEDNESS: ☑ -EXTENSIVE [-2] ☐ -MODERATE [-1] ☐ -NORMAL [0] ☐ -NONE [1]

Substrate: 9 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure):
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur:
0 POOLS > 70 cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☑ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 12 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY: ☐ -HIGH [4] ☐ -MODERATE [3] ☑ -LOW [2] ☐ -NONE [1]
DEVELOPMENT: ☐ -EXCELLENT [7] ☐ -GOOD [5] ☐ -FAIR [3] ☑ -POOR [1]
CHANNELIZATION: ☐ -NONE [6] ☐ -RECOVERED [4] ☐ -RECOVERING [3] ☐ -RECENT OR NO RECOVERY [1] ☐ -IMPOUNDED [-1]
STABILTIY: ☐ -HIGH [3] ☑ -MODERATE [2] ☐ -LOW [1]
MODIFICATIONS / OTHER: ☐ -SNAGGING ☐ -RELOCATION ☐ -CANOPY REMOVAL ☑ -DREDGING ☐ -ONE SIDE CHANNEL MODIFICATIONS ☐ -IMPOUNDMENT ☐ -ISLAND ☐ -LEVEED ☐ -BANK SHAPING

Channel: 6 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank)):
☑ ☑ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☐ ☐ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank)):
☑ ☑ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☑ ☑ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank)):
☐ ☐ -NONE / LITTLE [3]
☐ ☐ -MODERATE [2]
☑ ☑ -HEAVY / SEVERE [1]

Riparian: 8 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!):
☐ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☑ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE):
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☑ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply):
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☑ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 2 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH:
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☑ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH:
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE:
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS:
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 5.29 DRAINAGE AREA (sq.mi.): 11.99 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 6 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) _____ If Not, Explain: _____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: _____

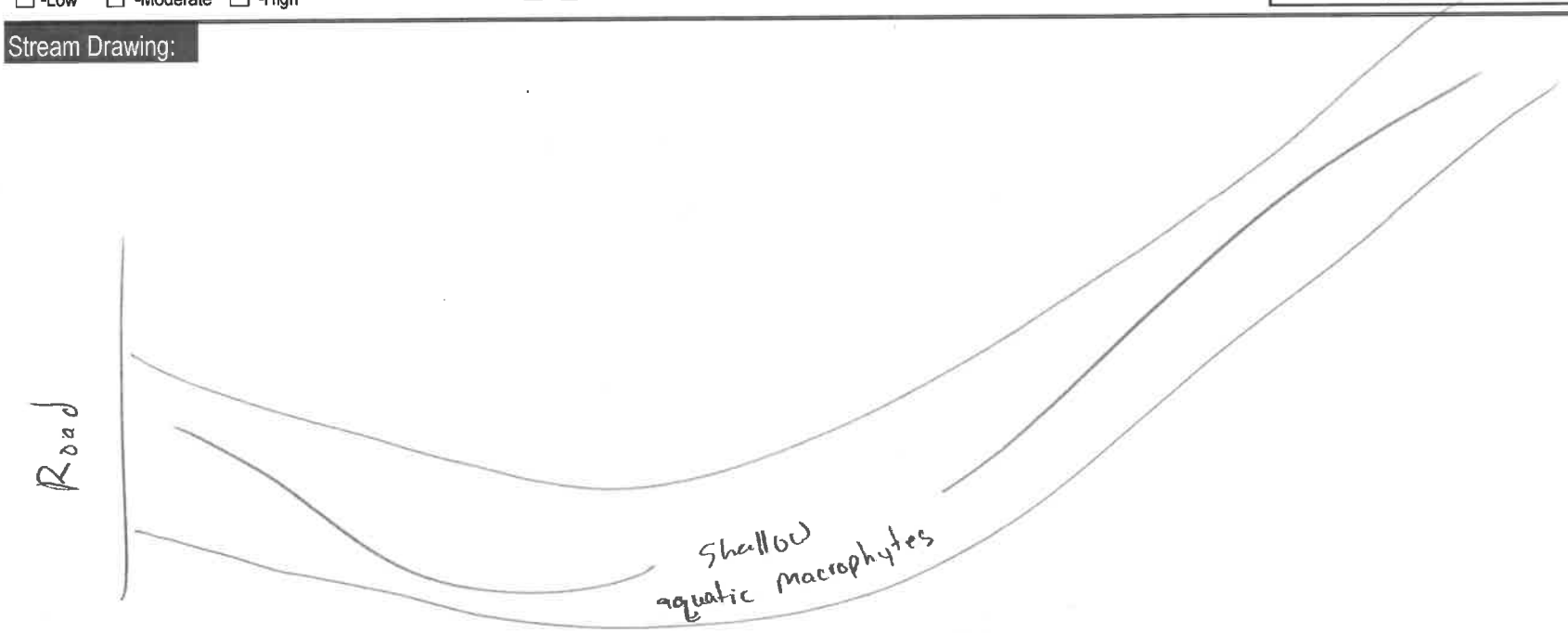
Subjective Rating (1-10)	Aesthetic Rating (1-10)
4	4

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal	90

Gradient: ☐ -Low ☐ -Moderate ☐ -High

Yes/ No	
☐ ☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐ ☐	Is there water upstream? How far:
☐ ☐	Is there water close downstream? How far:
☐ ☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

MBI Midwest Biodiversity Institute

QHEI Score: 45.5

River Code: 95-291 RM: 14.1 Stream: M Fk N Br Chicago R
Site Code: MF11 Project Code: NBCW319 Location: Dst IL 22
Date: 8-14-19 Scorer: MAS Latitude: 42.198861 Longitude: -87.85362

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☒ ☒ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☐ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)):
☐ -LIMESTONE [1]
☐ -TILLS [1]
☒ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)):
SILT: ☒ -SILT HEAVY [-2]; ☐ -SILT MODERATE [-1]; ☐ -SILT NORMAL [0]; ☐ -SILT FREE [1]
EMBEDDEDNESS: ☒ -EXTENSIVE [-2]; ☐ -MODERATE [-1]; ☐ -NORMAL [0]; ☐ -NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
☐ -4 or More [2]
☒ -3 or Less [0]

Substrate: 8 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]

TYPE: Score All That Occur
3 POOLS > 70 cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 13 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☒ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☐ -FAIR [3]
☒ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☐ -RECOVERING [3]
☒ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☒ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 6 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank))
☒ ☒ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☐ ☐ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) (L R (Most Predominant Per Bank))
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank))
☐ ☐ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☐ ☒ -HEAVY / SEVERE [1]

Riparian: 7.5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☒ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 7 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☒ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 2.64 DRAINAGE AREA (sq.mi.): 16.11 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 4 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____ If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ____

Subjective Rating (1-10): 4

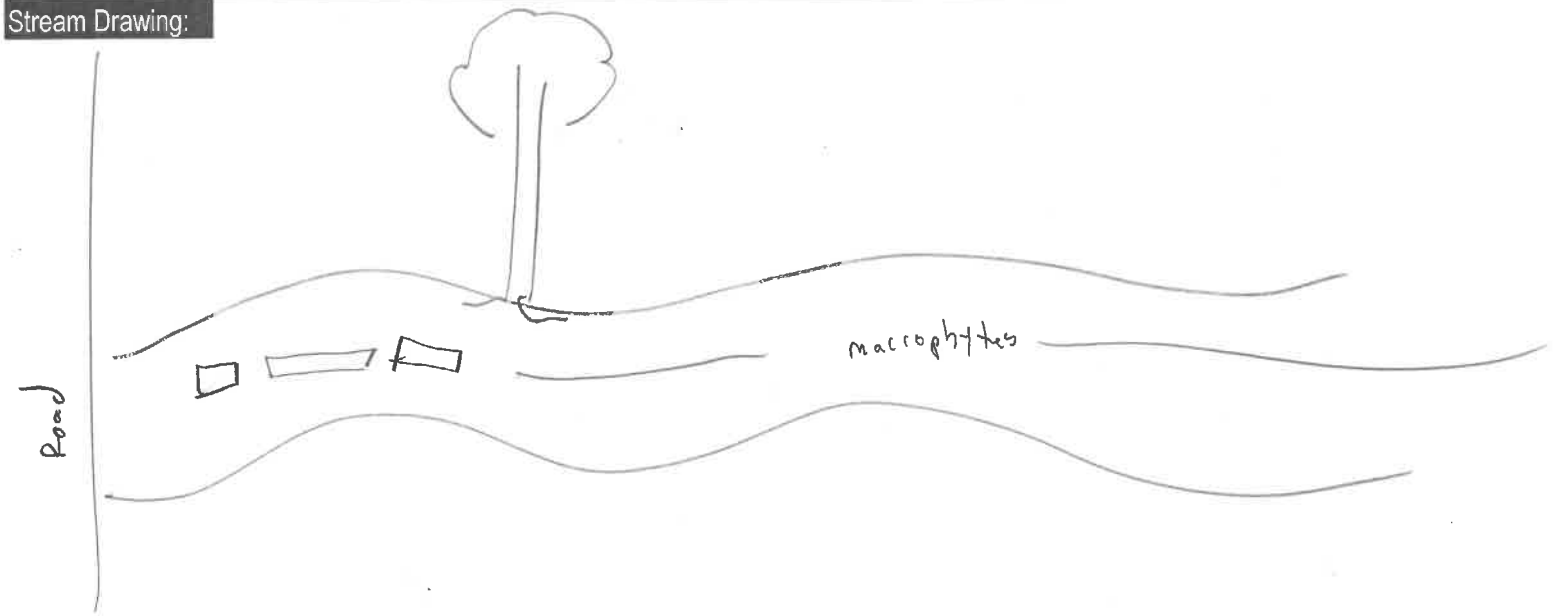
Aesthetic Rating (1-10): 4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Clear	Normal	100

Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 44 (42.5)

River Code: 95-291 RM: 10.8 Stream: M Fk N Br Chicago Rivers
Site Code: MF12 Project Code: NPNW19 Location: US Carriage Way
Date: 8-13-19 Scorer: MAS Latitude: 42.15927 Longitude: -87.82470

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☐ ☒ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☒ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2]
(High Quality Only, Score 5 or >) ☒ -3 or Less [0]

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)
☐ -LIMESTONE [1]
☐ -TILLS [1]
☒ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)
SILT:
☒ -SILT HEAVY [-2]
☐ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☒ -EXTENSIVE [-2]
☐ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

Substrate: 6 / Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
2 POOLS > 70 cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
___ OXBOWS, BACKWATERS [1]
___ AQUATIC MACROPHYTES [1]
___ LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☒ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 15 (11) / Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☐ -LOW [2]
☒ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☐ -FAIR [3]
☒ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☐ -RECOVERING [3]
☒ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☒ -HIGH [3]
☐ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 6 / Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) — River Right Looking Downstream

RIPARIAN WIDTH (L R Per Bank)
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☒ ☒ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) (L R Most Predominant Per Bank)
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R Per Bank)
☐ ☐ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☒ ☒ -HEAVY / SEVERE [1]

Riparian: 4.5 / Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☒ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 7 / Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☒ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☒ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☒ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☒ -EXTENSIVE [-1]

Riffle / Run: 1 / Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 5.56 DRAINAGE AREA (sq.mi.): 19.23 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 6 / Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) _____ If Not, Explain: _____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☒
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☒
- Riparian Removal ☒
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: _____

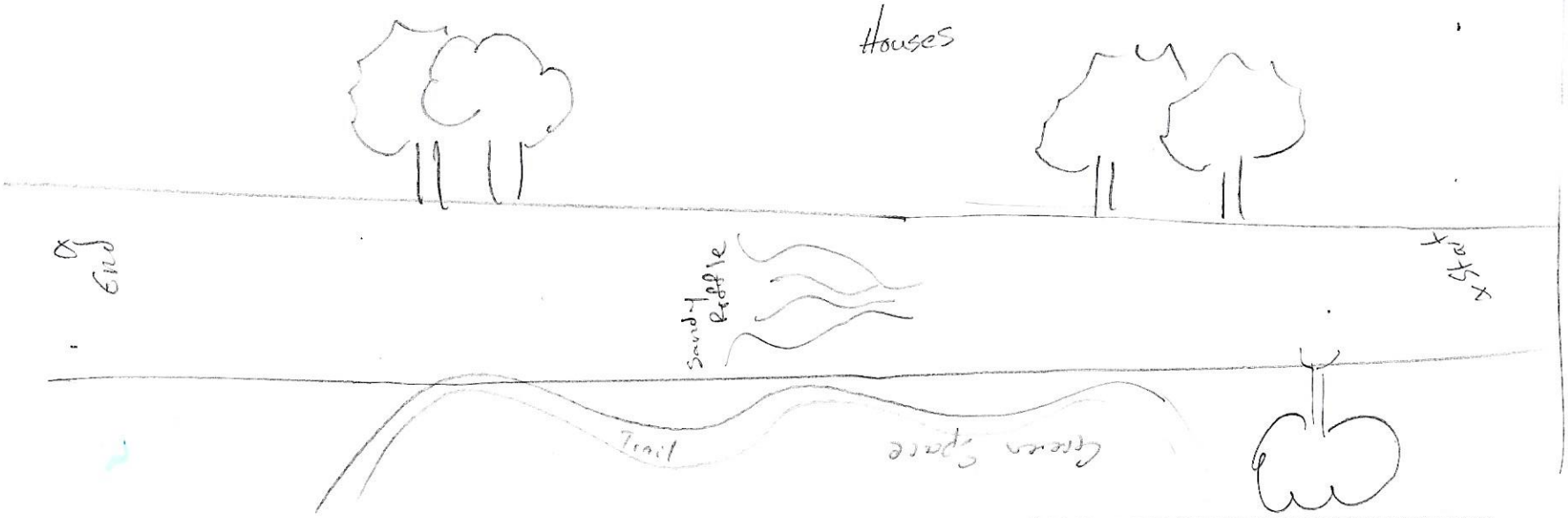
	Subjective Rating (1-10)	Aesthetic Rating (1-10)
	4	4

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal	95

Gradient: ☒ -Low ☐ -Moderate ☐ -High

Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Stream Drawing:



D-12

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 54.5

River Code: 95-291 RM: 8.6 Stream: M F k N Br Chicago R
Site Code: MF13 Project Code: NBWW19 Location: Ust IL-68
Date: 10-18-19 Scorer: MAS Latitude: 42 13879 Longitude: -87.81029

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent)

TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]		
☐ ☐ -Lg BOULD [10]		
☐ ☐ -BOULDER [9]		
☐ ☐ -COBBLE [8]		
☐ ☐ -HARDPAN [4]		
☐ ☐ -MUCK [2]		
☐ ☐ -GRAVEL [7]	X	
☐ ☒ -SAND [6]	X	X
☐ ☐ -BEDROCK [5]		
☐ ☒ -DETRITUS [3]	X	
☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -SILT [2]	X	

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)): ☐ -LIMESTONE [1] ☐ -TILLS [1] ☒ -WETLANDS [0] ☐ -HARDPAN [0] ☐ -SANDSTONE [0] ☐ -RIP / RAP [0] ☐ -LACUSTRINE [0] ☐ -SHALE [-1] ☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)):
SILT: ☒ -SILT HEAVY [-2] ☐ -SILT MODERATE [-1] ☐ -SILT NORMAL [0] ☐ -SILT FREE [1]
EMBEDDEDNESS: ☒ -EXTENSIVE [-2] ☐ -MODERATE [-1] ☐ -NORMAL [0] ☐ -NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >) ☐ -4 or More [2] ☒ -3 or Less [0]

Substrate: 5 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
2 ROOTMATS [1]

TYPE: Score All That Occur
2 POOLS > 70 cm [2]
2 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
2 AQUATIC MACROPHYTES [1]
3 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 14 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY: ☐ -HIGH [4] ☐ -MODERATE [3] ☒ -LOW [2] ☐ -NONE [1]
DEVELOPMENT: ☐ -EXCELLENT [7] ☐ -GOOD [5] ☒ -FAIR [3] ☒ -POOR [1]
CHANNELIZATION: ☐ -NONE [6] ☐ -RECOVERED [4] ☒ -RECOVERING [3] ☐ -RECENT OR NO RECOVERY [1] ☐ -IMPOUNDED [-1]
STABILTIY: ☐ -HIGH [3] ☐ -MODERATE [2] ☒ -LOW [1]
MODIFICATIONS / OTHER: ☐ -SNAGGING ☐ -RELOCATION ☐ -CANOPY REMOVAL ☐ -DREDGING ☐ -ONE SIDE CHANNEL MODIFICATIONS ☐ -IMPOUNDMENT ☐ -ISLAND ☐ -LEVEED ☐ -BANK SHAPING

Channel: 8 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) — River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank)):
☒ ☐ -VERY WIDE > 100m [5]
☐ ☒ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☐ ☐ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank)):
☒ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☐ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank)):
☐ ☐ -NONE / LITTLE [3]
☐ ☐ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 8.5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!):
☒ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE):
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☒ -POOL WIDTH = RIFFLE WIDTH [1]
☐ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply):
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 8 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH:
☐ -*Best Areas > 10cm [2]
☒ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH:
☐ - MAX > 50 cm [2]
☒ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE:
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☒ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS:
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☒ -EXTENSIVE [-1]

Riffle / Run: 1 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 8.7 DRAINAGE AREA (sq.mi.): 20.96 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 10 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____

If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☒
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ____

Subjective Rating (1-10): 4

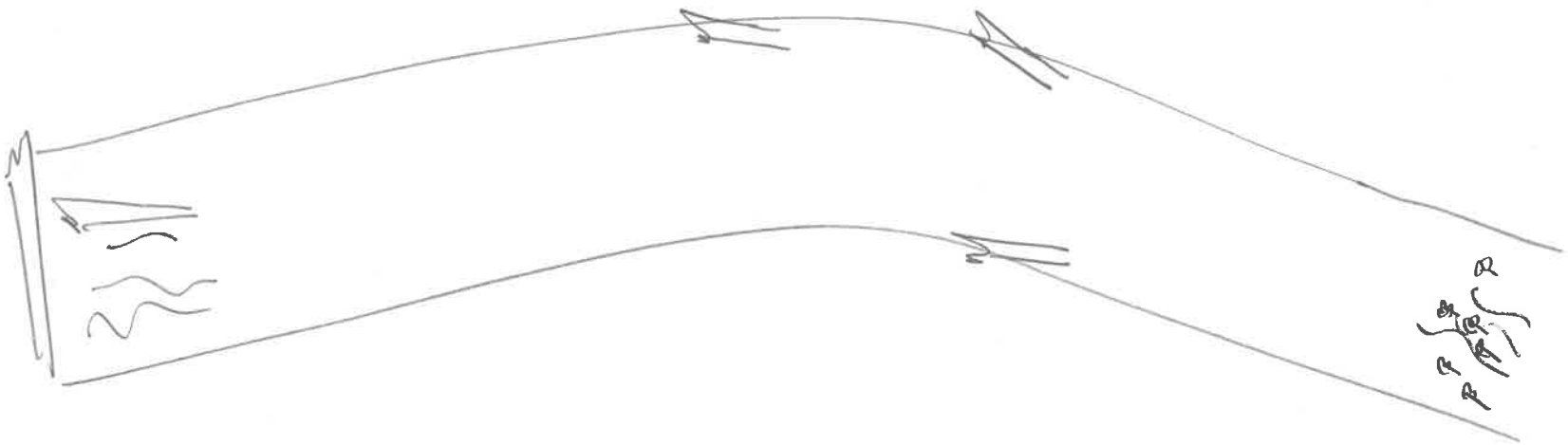
Aesthetic Rating (1-10): 4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal-High	30

Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

Midwest Biodiversity Institute

QHEI Score: 67

River Code: 95-291 RM: 6.0 Stream: M Fk N Br Chicago R
Site Code: MF14 Project Code: NBWW19 Location: D+ Sunset Dr
Date: 8-13-19 Scorer: MAS Latitude: 42.11541 Longitude: -87.78472

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☒ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☒ ☐ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☐ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)): ☐ -LIMESTONE [1]; ☒ -TILLS [1]; ☐ -WETLANDS [0]; ☐ -HARDPAN [0]; ☐ -SANDSTONE [0]; ☐ -RIP / RAP [0]; ☐ -LACUSTRINE [0]; ☐ -SHALE [-1]; ☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)):
SILT: ☐ -SILT HEAVY [-2]; ☒ -SILT MODERATE [-1]; ☐ -SILT NORMAL [0]; ☐ -SILT FREE [1]
EMBEDDEDNESS: ☐ -EXTENSIVE [-2]; ☒ -MODERATE [-1]; ☐ -NORMAL [0]; ☐ -NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >) ☒ -4 or More [2]; ☐ -3 or Less [0]

Substrate: 14 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure): 1 UNDERCUT BANKS [1]; 1 OVERHANGING VEGETATION [1]; 2 SHALLOWS (IN SLOW WATER) [1]; 1 ROOTMATS [1]

TYPE: Score All That Occur: 1 POOLS > 70 cm [2]; 2 ROOTWADS [1]; 1 BOULDERS [1]; 0 OXBOWS, BACKWATERS [1]; 3 AQUATIC MACROPHYTES [1]; 2 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE): ☐ -EXTENSIVE > 75% [11]; ☒ -MODERATE 25 - 75% [7]; ☐ -SPARSE 5 - 25% [3]; ☐ -NEARLY ABSENT < 5% [1]

Cover: 17 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY: ☐ -HIGH [4]; ☐ -MODERATE [3]; ☐ -LOW [2]; ☐ -NONE [1]
DEVELOPMENT: ☐ -EXCELLENT [7]; ☐ -GOOD [5]; ☐ -FAIR [3]; ☐ -POOR [1]
CHANNELIZATION: ☐ -NONE [6]; ☒ -RECOVERED [4]; ☐ -RECOVERING [3]; ☐ -RECENT OR NO RECOVERY [1]; ☐ -IMPOUNDED [-1]
STABILTIY: ☐ -HIGH [3]; ☒ -MODERATE [2]; ☐ -LOW [1]
MODIFICATIONS / OTHER: ☐ -SNAGGING; ☐ -RELOCATION; ☐ -CANOPY REMOVAL; ☐ -DREDGING; ☐ -ONE SIDE CHANNEL MODIFICATIONS; ☐ -IMPOUNDMENT; ☐ -ISLAND; ☐ -LEVEED; ☐ -BANK SHAPING

Channel: 15 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) — River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank)):
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☒ ☒ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) (L R (Most Predominant Per Bank)):
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank)):
☐ ☐ -NONE / LITTLE [3]
☐ ☐ -MODERATE [2]
☒ ☒ -HEAVY / SEVERE [1]

Riparian: 4 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!):
☒ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0}

MORPHOLOGY (Check 1 or 2 & AVERAGE):
☒ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☐ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES) (Check All That Apply):
☐ -EDDIES [1]; ☐ -FAST [1]; ☐ -MODERATE [1]; ☒ -SLOW [1]; ☐ -NONE [-1]
☐ -TORRENTIAL [-1]; ☐ -INTERSTITIAL [-1]; ☐ -INTERMITTENT [-2]; ☐ -VERY FAST [1]

Pool / Current: 9 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH:
☐ -*Best Areas > 10cm [2]
☒ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH:
☐ - MAX > 50 cm [2]
☒ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE:
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☒ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS:
☐ -NONE [2]
☐ -LOW [1]
☒ -MODERATE [0]
☒ -EXTENSIVE [-1]

Riffle / Run: 2 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 3.45 DRAINAGE AREA (sq.mi.): 22.48 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area

Gradient: 6 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ______

If Not, Explain: ______

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Subjective Rating (1-10)	Aesthetic Rating (1-10)
6	7

Gradient:

☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Clear	Normal	30

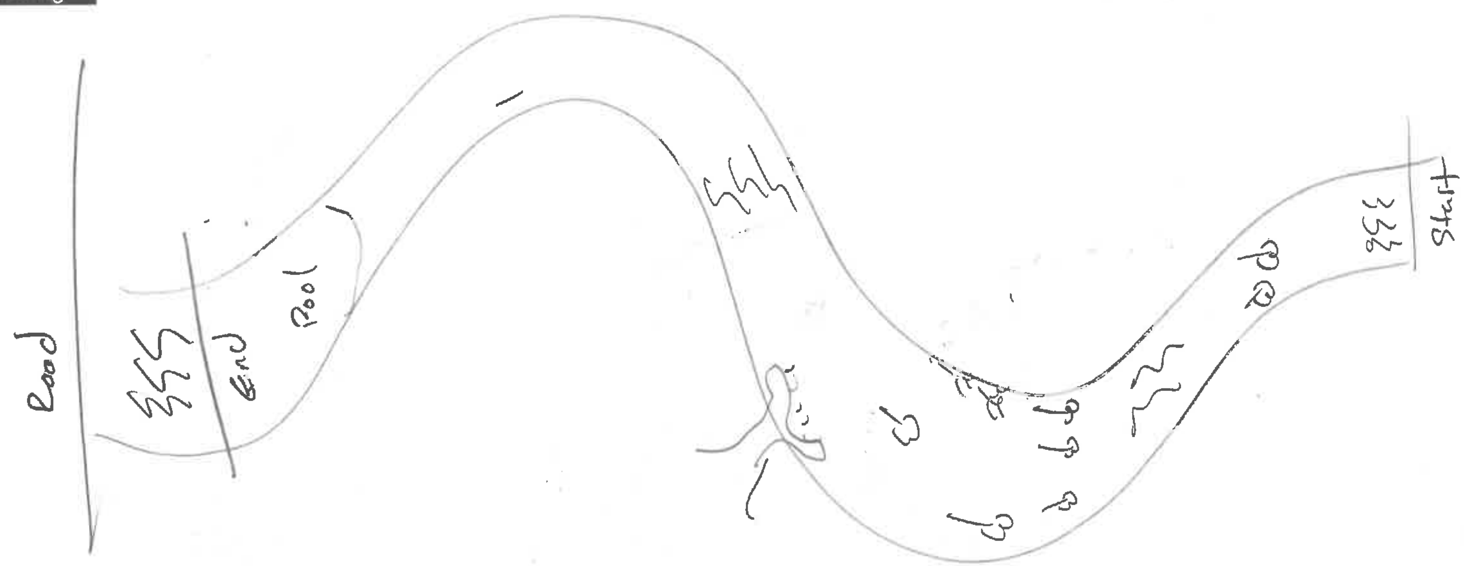
Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ______

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

Midwest Biodiversity Institute

QHEI Score: 69

River Code: 95-291 RM: 4.0 Stream: M Fk N Br Chicago R
Site Code: MF13 Project Code: NBWW19 Location: Dst Winnetka Rd
Date: 8-13-19 Scorer: MAS Latitude: 42.09294 Longitude: -87.77116

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent)

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ -BLDR/SLBS [10]			☐ -GRAVEL [7]		
☐ -Lg BOULD [10]			☒ -SAND [6]		
☐ -BOULDER [9]			☐ -BEDROCK [5]		
☐ -COBBLE [8]			☐ -DETRITUS [3]		
☐ ☒ -HARDPAN [4]			☐ -ARTIFICIAL [0]		
☐ -MUCK [2]			☐ -SILT [2]		

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE))
☐ -LIMESTONE [1]
☒ -TILLS [1]
☐ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
SILT:
☐ -SILT HEAVY [-2]
☒ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☐ -EXTENSIVE [-2]
☒ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
☐ -4 or More [2]
☒ -3 or Less [0]

Substrate: 9 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
1 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
1 POOLS > 70 cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
1 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☐ -MODERATE 25 - 75% [7]
☒ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 11 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☒ -MODERATE [3]
☐ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☒ -FAIR [3]
☐ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☒ -RECOVERING [3]
☐ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☒ -MODERATE [2]
☒ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 10.5 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank))
☒ ☒ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☐ ☐ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank))
☒ ☒ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☐ ☐ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank))
☐ ☐ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☒ ☒ -HEAVY / SEVERE [1]

Riparian: 9.5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☒ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☒ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☐ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 9 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☒ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☒ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☒ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☒ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 6.29 DRAINAGE AREA (sq.mi.): 24.29 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 10 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____ If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☑
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☑
- CSOs ☐
- Suburban Impacts ☑
- Mining ☐
- Channelization ☑
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ____

Subjective Rating (1-10): 5

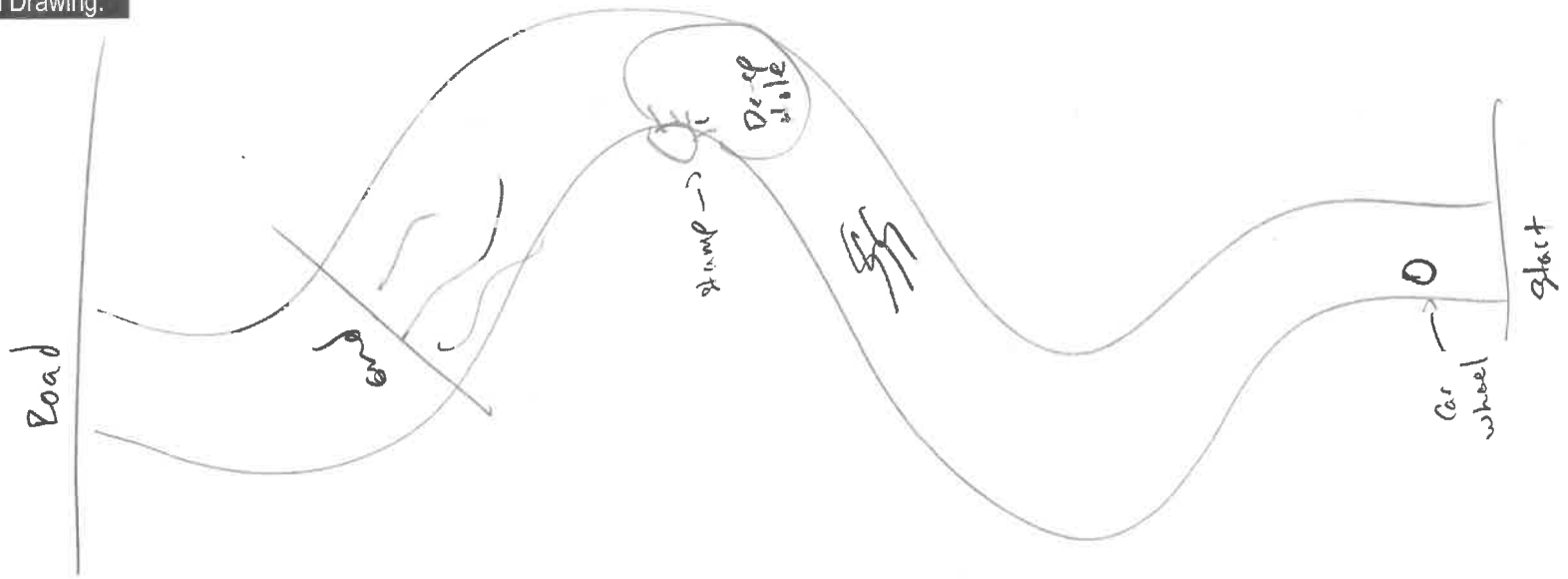
Aesthetic Rating (1-10): 5

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	150	E	Clear	Normal	100

Yes/ No	
☐ ☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐ ☐	Is there water upstream? How far:
☐ ☐	Is there water close downstream? How far:
☐ ☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 30.5

River Code: 95-292 RM: 12.5 Stream: WFk N Br Chicago R
Site Code: WF20 Project Code: NBWW19 Location: Adj Saunders Rd
Date: 8-14-19 Scorer: MAS Latitude: 42.18624 Longitude: -87.88178

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☐ ☐ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☐ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☒ ☒ -MUCK [2]			☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2] ☒ -3 or Less [0]
(High Quality Only, Score 5 or >)

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)): ☐ -LIMESTONE [1] ☐ -TILLS [1] ☒ -WETLANDS [0] ☐ -HARDPAN [0] ☐ -SANDSTONE [0] ☐ -RIP / RAP [0] ☐ -LACUSTRINE [0] ☐ -SHALE [-1] ☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)):
SILT: ☒ -SILT HEAVY [-2] ☐ -SILT MODERATE [-1] ☐ -SILT NORMAL [0] ☐ -SILT FREE [1]
EMBEDDEDNESS: ☒ -EXTENSIVE [-2] ☐ -MODERATE [-1] ☐ -NORMAL [0] ☐ -NONE [1]

Substrate: 0 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)	TYPE: Score All That Occur	
0 UNDERCUT BANKS [1]	0 POOLS > 70 cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	3 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT: (Check ONLY one or check 2 and AVERAGE) ☐ -EXTENSIVE > 75% [11] ☒ -MODERATE 25 - 75% [7] ☐ -SPARSE 5 - 25% [3] ☐ -NEARLY ABSENT < 5% [1]

Cover: 11 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY: ☐ -HIGH [4] ☐ -MODERATE [3] ☒ -LOW [2] ☐ -NONE [1]
DEVELOPMENT: ☐ -EXCELLENT [7] ☐ -GOOD [5] ☐ -FAIR [3] ☒ -POOR [1]
CHANNELIZATION: ☐ -NONE [6] ☐ -RECOVERED [4] ☐ -RECOVERING [3] ☒ -RECENT OR NO RECOVERY [1] ☐ -IMPOUNDED [-1]
STABILTIY: ☐ -HIGH [3] ☒ -MODERATE [2] ☐ -LOW [1]
MODIFICATIONS / OTHER: ☐ -SNAGGING ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 6 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank)):
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☒ ☒ -MODERATE 10 - 50m [3]
☐ ☐ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank)):
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank)):
☒ ☒ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 6.5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!):
☐ - 1m [6]
☐ - 0.7m [4]
☒ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE):
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply):
☐ -EDDIES [1] ☐ -FAST [1] ☐ -MODERATE [1] ☐ -SLOW [1] ☒ -NONE [-1]
☐ -TORRENTIAL [-1] ☐ -INTERSTITIAL [-1] ☐ -INTERMITTENT [-2] ☐ -VERY FAST [1]

Pool / Current: 1 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH:
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☒ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH:
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE:
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS:
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 6.6 DRAINAGE AREA (sq.mi.): 3.87 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 6 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____

If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: ____

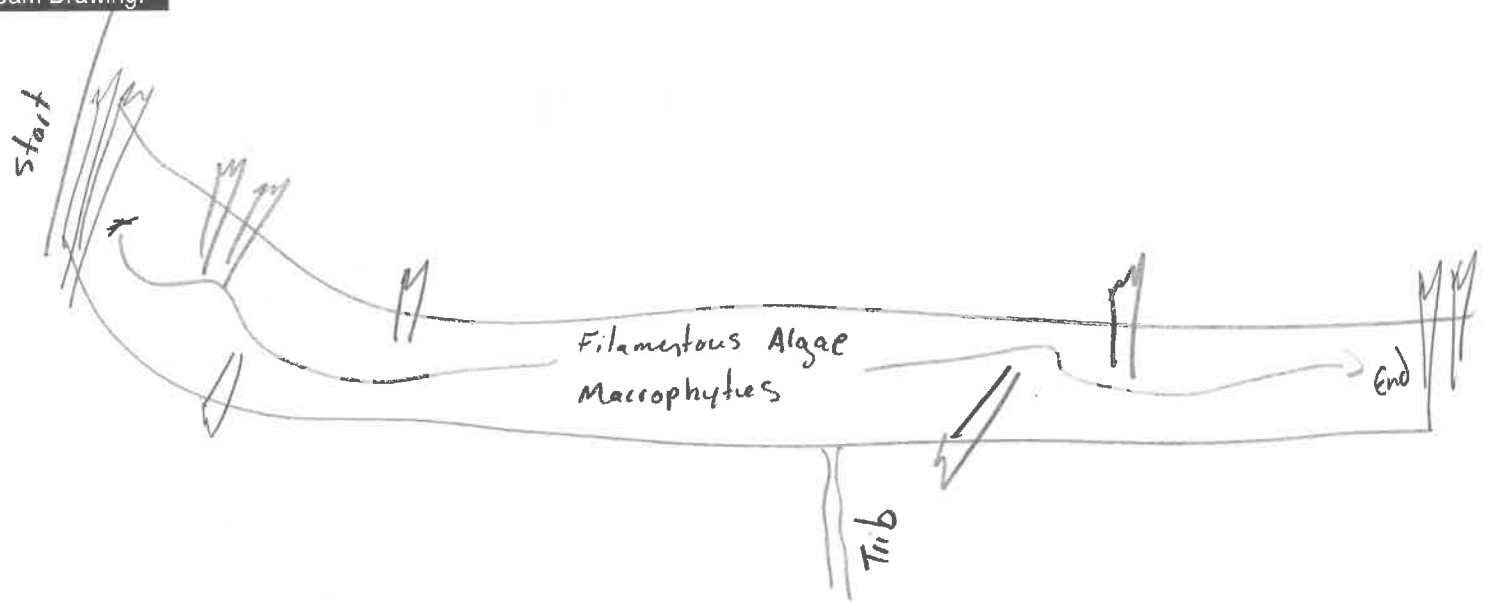
Subjective Rating (1-10)	Aesthetic Rating (1-10)
4	4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal	50

Yes/ No	
☐ ☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐ ☐	Is there water upstream? How far:
☐ ☐	Is there water close downstream? How far:
☐ ☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 40.5

River Code: 95-292 RM: 10.4 Stream: W Fk N Br Chicago R
Site Code: WF21 Project Code: NBWS19 Location: Dst Deerfield Rd
Date: 8-15-19 Scorer: MAS Latitude: 42.16572 Longitude: -87.85696

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent)

TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]		
☐ ☐ -Lg BOULD [10]		
☐ ☐ -BOULDER [9]		
☐ ☐ -COBBLE [8]		
☐ ☐ -HARDPAN [4]		
☐ ☐ -MUCK [2]		
☒ ☐ -GRAVEL [7] (Fine)	X	X
☐ ☒ -SAND [6]	X	X
☐ ☐ -BEDROCK [5]		
☐ ☐ -DETRITUS [3]		
☐ ☐ -ARTIFICIAL [0]	X	X
☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
☐ -4 or More [2]
☒ -3 or Less [0]

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE))
☐ -LIMESTONE [1]
☒ -TILLS [1]
☐ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
SILT:
☐ -SILT HEAVY [-2]
☐ -SILT MODERATE [-1]
☒ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☐ -EXTENSIVE [-2]
☐ -MODERATE [-1]
☒ -NORMAL [0]
☐ -NONE [1]

Substrate: 14 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
___ ROOTMATS [1]

TYPE: Score All That Occur
___ POOLS > 70 cm [2]
___ ROOTWADS [1]
___ BOULDERS [1]
___ OXBOWS, BACKWATERS [1]
___ AQUATIC MACROPHYTES [1]
___ LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☐ -MODERATE 25 - 75% [7]
☒ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 4 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☐ -LOW [2]
☒ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☒ -FAIR [3]
☐ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☒ -RECOVERING [3]
☒ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☒ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 8 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH (Per Bank)
L R
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☒ ☒ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) (Most Predominant Per Bank)
L R
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (Per Bank)
L R
☒ ☒ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 5.5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☐ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☒ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☒ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☐ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 4 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☒ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☒ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☒ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☒ -EXTENSIVE [-1]

Riffle / Run: 1 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 4.15 DRAINAGE AREA (sq.mi.): 7.02 % POOL: ___ % GLIDE: ___ % RIFFLE: ___ % RUN: ___

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 4 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) _____ If Not, Explain: _____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☒
- CSOs ☐
- Suburban Impacts ☒
- Mining ☐
- Channelization ☒
- Riparian Removal ☒
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: _____

	Subjective Rating (1-10)	Aesthetic Rating (1-10)
	4	4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal-Low	65

Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Stream Drawing:

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 46

River Code: 95-292 RM: 9.2 Stream: W FK E Br Chicago R
Site Code: WF22 Project Code: NBWSC19 Location:
Date: 8-14-19 Scorer: MAS Latitude: 42.15161 Longitude: -87.84602

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent)

TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]		
☐ ☐ -Lg BOULD [10]		
☐ ☐ -BOULDER [9]		
☐ ☐ -COBBLE [8]		
☐ ☐ -HARDPAN [4]		
☐ ☐ -MUCK [2]		
☐ ☐ -GRAVEL [7] (Fine)		☒
☐ ☒ -SAND [6]		
☐ ☐ -BEDROCK [5]		
☐ ☐ -DETRITUS [3]		
☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
☐ -4 or More [2]
☒ -3 or Less [0]

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE))
☐ -LIMESTONE [1]
☐ -TILLS [1]
☒ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
SILT:
☒ -SILT HEAVY [-2]
☐ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☒ -EXTENSIVE [-2]
☐ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

Substrate: 9 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
2 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
2 POOLS > 70 cm [2]
3 ROOTWADS [1]
0 BOULDERS [1]

0 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
3 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 16 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☒ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☐ -FAIR [3]
☒ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☐ -RECOVERING [3]
☒ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☒ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 10 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) — River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank))
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☒ ☒ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) (L R (Most Predominant Per Bank))
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☐ ☐ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☒ ☒ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank))
☐ ☐ -NONE / LITTLE [3]
☒ ☒ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 4 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☐ - 1m [6]
☒ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 5 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☒ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 10 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 3.51 DRAINAGE AREA (sq.mi.): 9.41 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 10 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) _____ If Not, Explain: _____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: _____

Subjective Rating (1-10): 4

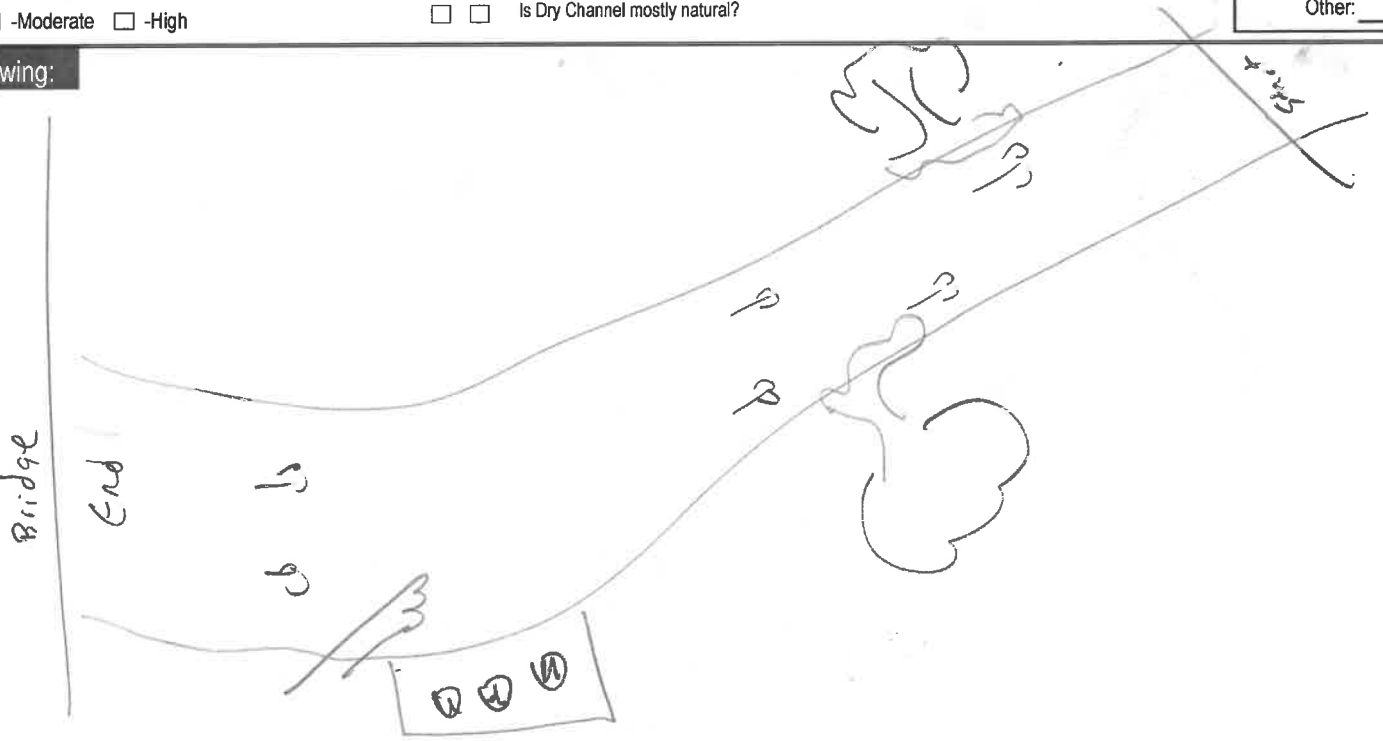
Aesthetic Rating (1-10): 4

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	D	200	Clear	Normal	50

Gradient: ☐ -Low ☐ -Moderate ☐ -High

Yes/ No	
☐ ☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐ ☐	Is there water upstream? How far:
☐ ☐	Is there water close downstream? How far:
☐ ☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

Midwest Biodiversity Institute

QHEI Score: 38.5

River Code: 95-292 RM: 4.9 Stream: W Fk NBr Chicago R
Site Code: WF23 Project Code: NBWW19 Location: Dst Willow Rd
Date: 8-13-19 Scorer: MAS Latitude: 42.10279 Longitude: -87.80994

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☒ ☐ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☐ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☒ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2]
(High Quality Only, Score 5 or >) ☒ -3 or Less [0]

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)
☐ -LIMESTONE [1]
☐ -TILLS [1]
☒ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)
SILT:
☒ -SILT HEAVY [-2]
☐ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☒ -EXTENSIVE [-2]
☐ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

Substrate: 4 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]

TYPE: Score All That Occur
2 POOLS > 70 cm [2]
0 ROOTWADS [1]
0 BOULDERS [1]
2 OXBOWS, BACKWATERS [1]
3 AQUATIC MACROPHYTES [1]
2 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☒ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 13 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☐ -MODERATE [3]
☒ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☐ -FAIR [3]
☒ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☐ -RECOVERING [3]
☒ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☐ -MODERATE [2]
☒ -LOW [1]

MODIFICATIONS / OTHER
☒ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 5 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐ ☐ -VERY WIDE > 100m [5]	☐ ☐ -FOREST, SWAMP [3]	☐ ☐ -CONSERVATION TILLAGE [1]	☐ ☐ -NONE / LITTLE [3]
☐ ☐ -WIDE > 50m [4]	☐ ☐ -SHRUB OR OLD FIELD [2]	☐ ☐ -URBAN OR INDUSTRIAL [0]	☒ ☒ -MODERATE [2]
☒ ☒ -MODERATE 10 - 50m [3]	☒ ☒ -RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐ -OPEN PASTURE, ROWCROP [0]	☐ ☐ -HEAVY / SEVERE [1]
☒ ☒ -NARROW 5 - 10m [2]	☐ ☐ -FENCED PASTURE [1]	☐ ☐ -MINING / CONSTRUCTION [0]	
☐ ☐ -VERY NARROW < 5m [1]			
☐ ☐ -NONE [0]			

Riparian: 5.5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☒ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☒ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☒ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 7 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☐ -NO RIFFLE but RUNS present [0]
☒ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☐ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Cobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☐ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☐ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 1.99 DRAINAGE AREA (sq.mi.): 17.86 % POOL: % GLIDE:
% RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 4 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____ If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☑
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☑
- CSOs ☐
- Suburban Impacts ☑
- Mining ☐
- Channelization ☑
- Riparian Removal ☑
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: Golf Course

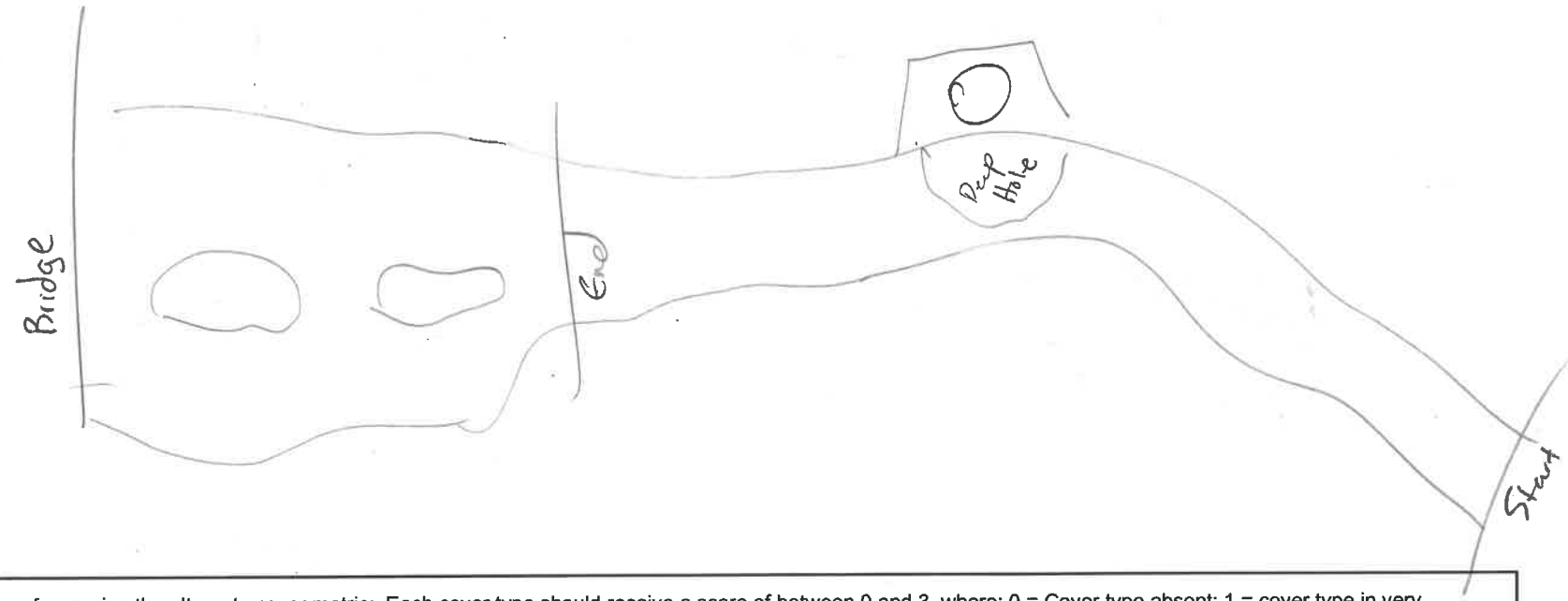
Subjective Rating (1-10)	Aesthetic Rating (1-10)
4	3

First Sampling Pass	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
	D	200	Clear	Normal	100

Gradient: ☐ -Low ☐ -Moderate ☐ -High

Yes/ No	
☐ ☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐ ☐	Is there water upstream? How far:
☐ ☐	Is there water close downstream? How far:
☐ ☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

Midwest Biodiversity Institute

QHEI Score: 53.5

River Code: 95-292 RM: 2.9 Stream: W Flk N Br Chicago R
Site Code: WF29 Project Code: NBWW19 Location: Dst Lake Ave
Date: 8-13-19 Scorer: MAS Latitude: 42.07891 Longitude: -87.80765

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent

TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]		
☐ ☐ -Lg BOULD [10]		
☐ ☐ -BOULDER [9]		
☐ ☐ -COBBLE [8]		
☐ ☐ -HARDPAN [4]		
☐ ☐ -MUCK [2]		
☐ ☑ -GRAVEL [7]		
☑ ☐ -SAND [6]		
☐ ☐ -BEDROCK [5]		
☐ ☐ -DETRITUS [3]		
☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -SILT [2]		

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE))
☐ -LIMESTONE [1]
☑ -TILLS [1]
☑ -WETLANDS [0]
☐ -HARDPAN [0]
☐ -SANDSTONE [0]
☐ -RIP / RAP [0]
☐ -LACUSTRINE [0]
☐ -SHALE [-1]
☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE))
SILT:
☐ -SILT HEAVY [-2]
☑ -SILT MODERATE [-1]
☐ -SILT NORMAL [0]
☐ -SILT FREE [1]
EMBEDDEDNESS:
☐ -EXTENSIVE [-2]
☑ -MODERATE [-1]
☐ -NORMAL [0]
☐ -NONE [1]

NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)
☐ -4 or More [2]
☑ -3 or Less [0]

Substrate: 11.5 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure)
3 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
2 POOLS > 70 cm [2]
3 ROOTWADS [1]
0 BOULDERS [1]

0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE)
☐ -EXTENSIVE > 75% [11]
☑ -MODERATE 25 - 75% [7]
☐ -SPARSE 5 - 25% [3]
☐ -NEARLY ABSENT < 5% [1]

Cover: 15 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY
☐ -HIGH [4]
☑ -MODERATE [3]
☐ -LOW [2]
☐ -NONE [1]

DEVELOPMENT
☐ -EXCELLENT [7]
☐ -GOOD [5]
☑ -FAIR [3]
☐ -POOR [1]

CHANNELIZATION
☐ -NONE [6]
☐ -RECOVERED [4]
☑ -RECOVERING [3]
☐ -RECENT OR NO RECOVERY [1]
☐ -IMPOUNDED [-1]

STABILTIY
☐ -HIGH [3]
☑ -MODERATE [2]
☐ -LOW [1]

MODIFICATIONS / OTHER
☐ -SNAGGING
☐ -RELOCATION
☐ -CANOPY REMOVAL
☐ -DREDGING
☐ -ONE SIDE CHANNEL MODIFICATIONS
☐ -IMPOUNDMENT
☐ -ISLAND
☐ -LEVEED
☐ -BANK SHAPING

Channel: 11 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank))
☐ ☐ -VERY WIDE > 100m [5]
☐ ☐ -WIDE > 50m [4]
☐ ☐ -MODERATE 10 - 50m [3]
☑ ☑ -NARROW 5 - 10m [2]
☐ ☐ -VERY NARROW < 5m [1]
☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank))
☐ ☐ -FOREST, SWAMP [3]
☐ ☐ -SHRUB OR OLD FIELD [2]
☑ ☑ -RESIDENTIAL, PARK, NEW FIELD [1]
☐ ☐ -FENCED PASTURE [1]
☐ ☐ -CONSERVATION TILLAGE [1]
☐ ☐ -URBAN OR INDUSTRIAL [0]
☐ ☐ -OPEN PASTURE, ROWCROP [0]
☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank))
☐ ☐ -NONE / LITTLE [3]
☑ ☑ -MODERATE [2]
☐ ☐ -HEAVY / SEVERE [1]

Riparian: 5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
☑ - 1m [6]
☐ - 0.7m [4]
☐ - 0.4 to 0.7m [2]
☐ - 0.2 to 0.4m [1]
☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE)
☐ -POOL WIDTH > RIFFLE WIDTH [2]
☐ -POOL WIDTH = RIFFLE WIDTH [1]
☑ -POOL WIDTH < RIFFLE WIDTH [0]
☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply)
☐ -EDDIES [1]
☐ -FAST [1]
☐ -MODERATE [1]
☑ -SLOW [1]
☐ -NONE [-1]
☐ -TORRENTIAL [-1]
☐ -INTERSTITIAL [-1]
☐ -INTERMITTENT [-2]
☐ -VERY FAST [1]

Pool / Current: 7 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH
☐ -*Best Areas > 10cm [2]
☐ -Best Areas 5 - 10cm [1]
☐ -Best Areas < 5cm [0]
☑ -NO RIFFLE but RUNS present [0]
☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH
☐ - MAX > 50 cm [2]
☑ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE
☐ -STABLE (e.g., Gobble, Boulder) [2]
☐ -MOD. STABLE (e.g., Large Gravel) [1]
☑ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
☐ -NONE [2]
☐ -LOW [1]
☐ -MODERATE [0]
☑ -EXTENSIVE [-1]

Riffle / Run: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 1.99 DRAINAGE AREA (sq.mi.): 24.52 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area.

Gradient: 4 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) _____ If Not, Explain: _____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☐
- WWTP ☐
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☐
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☐
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐

Other: _____

Subjective Rating (1-10) ☐

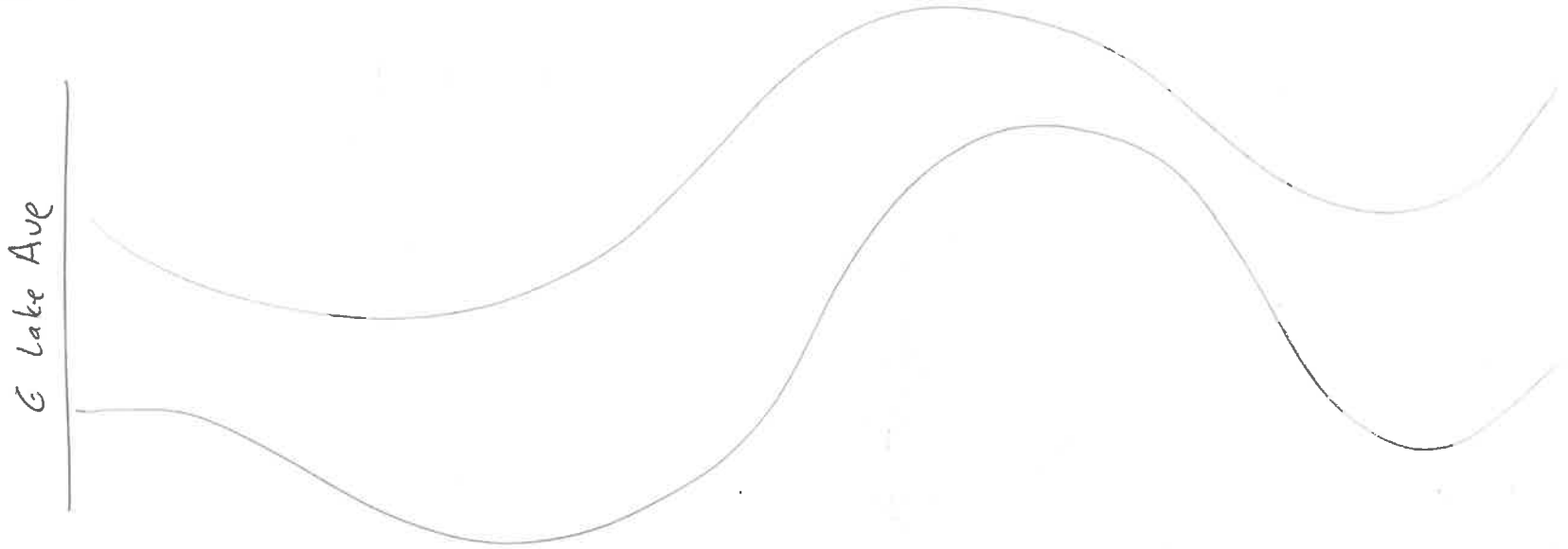
Aesthetic Rating (1-10) ☐

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

Gradient: ☐ -Low ☐ -Moderate ☐ -High

Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 45.5

River Code: 95-292 RM: 1.3 Stream: W Flk N Br Chicago R
Site Code: WF25 Project Code: NBNW19 Location: Ust Foot Bridge
Date: 8-13-19 Scorer: MAS Latitude: 42.06345 Longitude: -87.78887

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent)

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☐ -GRAVEL [7]		
☐ ☐ -Lg BOULD [10]			☐ ☒ -SAND [6]		
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☐ -COBBLE [8]			☐ ☐ -DETRITUS [3]		
☒ ☐ -HARDPAN [4]			☐ ☐ -ARTIFICIAL [0]		
☐ ☐ -MUCK [2]			☐ ☐ -SILT [2]		

NUMBER OF SUBSTRATE TYPES: ☐ -4 or More [2] ☒ -3 or Less [0]
(High Quality Only, Score 5 or >)

SUBSTRATE ORIGIN (Check ONE (OR 2 & AVERAGE)): ☐ -LIMESTONE [1] ☐ -TILLS [1] ☒ -WETLANDS [0] ☐ -HARDPAN [0] ☐ -SANDSTONE [0] ☐ -RIP / RAP [0] ☐ -LACUSTRINE [0] ☐ -SHALE [-1] ☐ -COAL FINES [-2]

SUBSTRATE QUALITY (Check ONE (OR 2 & AVERAGE)): SILT: ☒ -SILT HEAVY [-2] ☐ -SILT MODERATE [-1] ☐ -SILT NORMAL [0] ☐ -SILT FREE [1]
EMBEDDEDNESS: ☐ -EXTENSIVE [-2] ☒ -MODERATE [-1] ☐ -NORMAL [0] ☐ -NONE [1]

Substrate: 7 Max 20

COMMENTS:

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure): 0 UNDERCUT BANKS [1]; 1 OVERHANGING VEGETATION [1]; 3 SHALLOWS (IN SLOW WATER) [1]; 0 ROOTMATS [1]

TYPE: Score All That Occur: 3 POOLS > 70 cm [2]; 0 ROOTWADS [1]; 0 BOULDERS [1]; 0 OXBOWS, BACKWATERS [1]; 3 AQUATIC MACROPHYTES [1]; 1 LOGS OR WOODY DEBRIS [1]

AMOUNT: (Check ONLY one or check 2 and AVERAGE): ☐ -EXTENSIVE > 75% [11] ☒ -MODERATE 25 - 75% [7] ☐ -SPARSE 5 - 25% [3] ☐ -NEARLY ABSENT < 5% [1]

Cover: 13 Max 20

COMMENTS:

3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)

SINUOSITY: ☐ -HIGH [4] ☐ -MODERATE [3] ☒ -LOW [2] ☐ -NONE [1]

DEVELOPMENT: ☐ -EXCELLENT [7] ☐ -GOOD [5] ☒ -FAIR [3] ☒ -POOR [1]

CHANNELIZATION: ☐ -NONE [6] ☐ -RECOVERED [4] ☒ -RECOVERING [3] ☒ -RECENT OR NO RECOVERY [1] ☐ -IMPOUNDED [-1]

STABILTIY: ☐ -HIGH [3] ☒ -MODERATE [2] ☒ -LOW [1]

MODIFICATIONS / OTHER: ☐ -SNAGGING ☒ -RELOCATION ☒ -CANOPY REMOVAL ☐ -DREDGING ☐ -ONE SIDE CHANNEL MODIFICATIONS ☐ -IMPOUNDMENT ☐ -ISLAND ☐ -LEVEED ☒ -BANK SHAPING

Channel: 9.5 Max 20

COMMENTS:

4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) — River Right Looking Downstream

RIPARIAN WIDTH (L R (Per Bank)): ☐ ☐ -VERY WIDE > 100m [5] ☐ ☐ -WIDE > 50m [4] ☐ ☐ -MODERATE 10 - 50m [3] ☒ ☒ -NARROW 5 - 10m [2] ☐ ☐ -VERY NARROW < 5m [1] ☐ ☐ -NONE [0]

FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) (L R (Most Predominant Per Bank)): ☐ ☐ -FOREST, SWAMP [3] ☒ ☒ -SHRUB OR OLD FIELD [2] ☐ ☐ -RESIDENTIAL, PARK, NEW FIELD [1] ☐ ☐ -FENCED PASTURE [1] ☐ ☐ -CONSERVATION TILLAGE [1] ☐ ☐ -URBAN OR INDUSTRIAL [0] ☐ ☐ -OPEN PASTURE, ROWCROP [0] ☐ ☐ -MINING / CONSTRUCTION [0]

BANK EROSION (L R (Per Bank)): ☐ ☐ -NONE / LITTLE [3] ☒ ☒ -MODERATE [2] ☐ ☐ -HEAVY / SEVERE [1]

Riparian: 5 Max 10

COMMENTS:

5.) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAX. DEPTH (Check 1 ONLY!): ☒ - 1m [6] ☐ - 0.7m [4] ☐ - 0.4 to 0.7m [2] ☐ - 0.2 to 0.4m [1] ☐ - < 0.2m [POOL = 0]

MORPHOLOGY (Check 1 or 2 & AVERAGE): ☐ -POOL WIDTH > RIFFLE WIDTH [2] ☒ -POOL WIDTH = RIFFLE WIDTH [1] ☐ -POOL WIDTH < RIFFLE WIDTH [0] ☐ -IMPOUNDED [-1]

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All That Apply): ☐ -EDDIES [1] ☐ -FAST [1] ☐ -MODERATE [1] ☒ -SLOW [1] ☐ -NONE [-1] ☐ -TORRENTIAL [-1] ☐ -INTERSTITIAL [-1] ☐ -INTERMITTENT [-2] ☐ -VERY FAST [1]

Pool / Current: 8 Max 12

COMMENTS:

CHECK ONE OR CHECK 2 AND ADVERAGE

RIFFLE DEPTH: ☐ -*Best Areas > 10cm [2] ☒ -Best Areas 5 - 10cm [1] ☐ -Best Areas < 5cm [0] ☐ -NO RIFFLE but RUNS present [0] ☐ -NO RIFFLE / NO RUN [Metric = 0]

RUN DEPTH: ☐ - MAX > 50 cm [2] ☒ - MAX < 50 cm [1]

RIFFLE / RUN SUBSTRATE: ☐ -STABLE (e.g., Cobble, Boulder) [2] ☐ -MOD. STABLE (e.g., Large Gravel) [1] ☒ -UNSTABLE (Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ -NONE [2] ☐ -LOW [1] ☐ -MODERATE [0] ☒ -EXTENSIVE [-1]

Riffle / Run: 1 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 1.99 DRAINAGE AREA (sq.mi.): 27.97 % POOL: % GLIDE: % RIFFLE: % RUN:

*Best areas must be large enough to support a population of riffle-obligate species

Gradient Score from Table 2 of Users Manual based on gradient and drainage area

Gradient: 4 Max 10

Is Sampling Reach Representative of the Stream? (Y/ N) ____ If Not, Explain: ____

Lat / Long (Beg):	
Lat / Long (Mid):	
Lat / Long (End):	
Lat / Long (X-Loc):	

Subjective Rating (1-10): 4

Aesthetic Rating (1-10): 4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

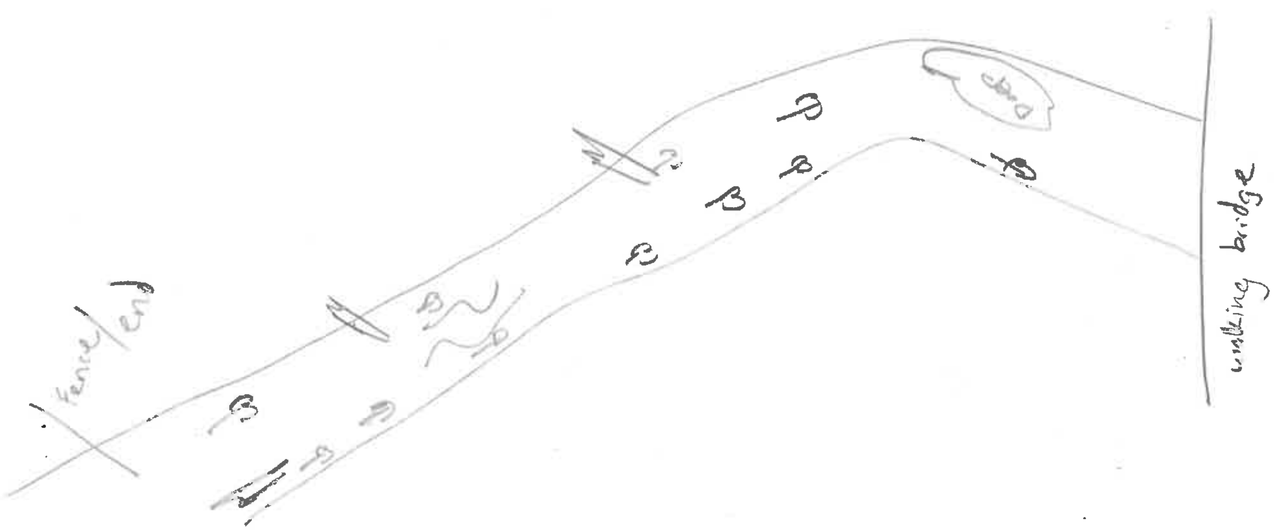
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	D	200	Clear	Normal	90

Yes	No	
☐	☐	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☐	☐	Is there water upstream? How far:
☐	☐	Is there water close downstream? How far:
☐	☐	Is Dry Channel mostly natural?

Major Suspected Sources of Impacts (Check All That Apply):

- None ☐
- Industrial ☑
- WWTP ☑
- Agriculture ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☑
- CSOs ☐
- Suburban Impacts ☑
- Mining ☐
- Channelization ☑
- Riparian Removal ☐
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☐
- Other: ____

Stream Drawing:



Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

APPENDIX E

E-1: FIT Factors for Deriving Primary, Secondary, and Tertiary Causes of Impairment
E-2: Northeast Illinois IPS Nutrient Ranking Index

Appendix E-1: Development of FIT Factors for Deriving Primary, Secondary, and Tertiary Causes of Impairment

The NE IL IPS thresholds were developed for the primary nutrient and nutrient-related parameters based on grab sample data. The thresholds were based on relationships between that data and stressor-specific sensitive fish species and macroinvertebrate taxa. The relationship between the sensitive species/taxa with the fIBI and mIBI supported benchmarking these thresholds to the General Use criteria and an "Excellent" level of biological performance.

The FIT weighting score influences the categories of narrative condition (i.e., very poor, poor, or fair) each cause of impairment is placed. Each stressor is ranked from 0.1 (excellent) to 10 (very poor) based on the respective relationships with the number of stressor-sensitive fish species or macroinvertebrate taxa as the response variable with a particular stressor. Where the association is very strong (i.e., FIT value < 0.1) it means there were few outliers and a stronger power of prediction. The weighting factor is 1 and stressors that scored as very poor are still considered to be predictive of very poor biological assemblages. As the FIT value increases (i.e., >0.1 to 0.3) it signals increased variability (more outliers are observed). The weighting factor declines to 0.8 and a stressor value of 9 (very poor) would be down weighted to a score of 7.2 (poor) because the stress:response relationship had more outliers. While the ability to distinguish poor vs. very poor assemblages is reduced, it still reflects a severe impairment. A FIT value of >0.3-1 indicates a weaker causative relationship and has lower weighting factor (X 0.6). This would change a stressor score of 9 (very poor) to a score of 5.4 (fair). Parameters with FIT vales of >3 were not used to identify causes of impairment. A summary of FIT values for 69 variables is in Appendix Table E-2.

Appendix Table E-1. FIT weighting scores based on FIT coefficients.

FIT (< 0.10) X 1;
FIT (> 0.10 – <0.3) X 0.8
FIT (> 0.30 – < 1.0) X 0.6
FIT (> 1.00 – < 3.0) X 0.5
FIT (> 3.00 – < 10.0) X 0.2
FIT (> 10 0) X 0.1

Stressor relationships can become stronger as more data is added to the IPS databases hence the need for continued monitoring. Some parameters that have weak FIT scores are because of a lack of data along a complete stressor gradient. For example, there are fewer data points at excellent biological sites for parameters such as sediment PAHs and sediment metals. This weakens the FIT values for the excellent narrative range thus in these situations only a good narrative threshold is derived. There are other important variables (e.g., benthic chlorophyll a) where the current datasets are insufficient to develop a ranking thus highlighting the need to build up the dataset.

The severity of effect of some stressors (e.g., FIT Scores <0.1) could possibly mask the effects of other stressors. As more data is collected and as some of the more prevalent stressors are abated, the influence of masked stressors may become more evident. As such, the FIT values and scores could change in future iterations of the IPS. More data will also improve the accuracy of assigning species and taxa as sensitive or tolerant to a particular stressor.

Appendix Table E-2. *FIT values based on the deviation between ambient stressor rank vs. predicted stressor rank based on fish species or macroinvertebrate taxa for streams in the NE IL IPS study area. The algorithm for FIT calculation is summarized in the text. The cell shading is related to FIT weighting coefficients: 1.0; 0.8; 0.6; 0.5; 0.2.*

Stressor	FIT Value	Stressor	FIT Value
Impervious Land Use (500m)	0.01	Copper (Wat.)	1.75
QHEI Embeddedness Score	0.03	Lead (Wat.)	2.11
Urban Land Uses (WS)	0.03	Zinc (Sed.)	2.22
QHEI Overall Score	0.04	Benzo(g,h,i)perylene	2.32
QHEI Substrate Score	0.04	Indeno(1,2,3-cd)pyrene (Sed.)	2.41
QHEI Good Attributes	0.04	Copper (Sed.)	2.42
Total Phosphorus	0.04	Benzo(b)fluoranthene (Sed.)	2.51
Impervious Land Use (30m)	0.04	Turbidity	2.61
Impervious Land Use (30m Clipped)	0.04	Nickel (Sed.)	2.67
Conductivity	0.05	Manganese (Wat.)	2.74
QHEI Channel Score	0.07	Benzo(a)pyrene (Sed.)	2.85
QHEI Silt Cover Score	0.07	Pyrene (Sed.)	2.85
Developed Land Use (WS)	0.07	Voluble Suspended Solids	2.81
Minimum Dissolved Oxygen	0.10	Lead (Sed.)	3.01
Total Dissolved Solids	0.10	Nickel (Wat.)	3.26
Impervious Land Use (WS)	0.10	Benzo(a)anthracene (Sed.)	3.48
Hydro-QHEI Depth Score	0.11	Chrysene (Sed.)	3.51
QHEI Poor Habitat Attributes	0.12	Fluoranthene (Sed.)	3.91
Hydro-QHEI Overall Score	0.13	Strontium (Sed.)	4.44
Zinc (Wat.)	0.13	Dibenz(a,h)anthracene (Sed.)	4.57
Hydro-QHEI Current Score	0.14	Agricultural Land Use (WS)	4.82
TKN	0.14	Anthracene (Sed.)	5.10
QHEI Pool Score	0.15	Phenanthrene (Sed.)	5.10
Heavy Urban Land Use (WS)	0.17	Arsenic (Sed.)	6.21
Chloride	0.17	Chromium (Sed.)	6.29
QHEI Cover Score	0.17	Sulfate	6.49
BOD (5-Day)	0.21	Manganese (Sed.)	7.08
QHEI Riffle Score	0.27	Silver (Sed.)	7.11
Total Ammonia	0.28	Aluminum (Sed.)	8.26
Nitrate	0.29	Barium (Sed.)	8.88
Sodium	0.29	Arsenic (Wat.)	9.19
QHEI Gradient Score	0.31	Potassium (Wat.)	10.13
Total Suspended Solids	0.32	Cadmium (Sed.)	11.0
Maximum Dissolved Oxygen	0.94		
Cadmium (Wat.)	0.93		
Arsenic (Sed.)	1.26		

Appendix E-2: Northeast Illinois IPS Nutrient Ranking Index

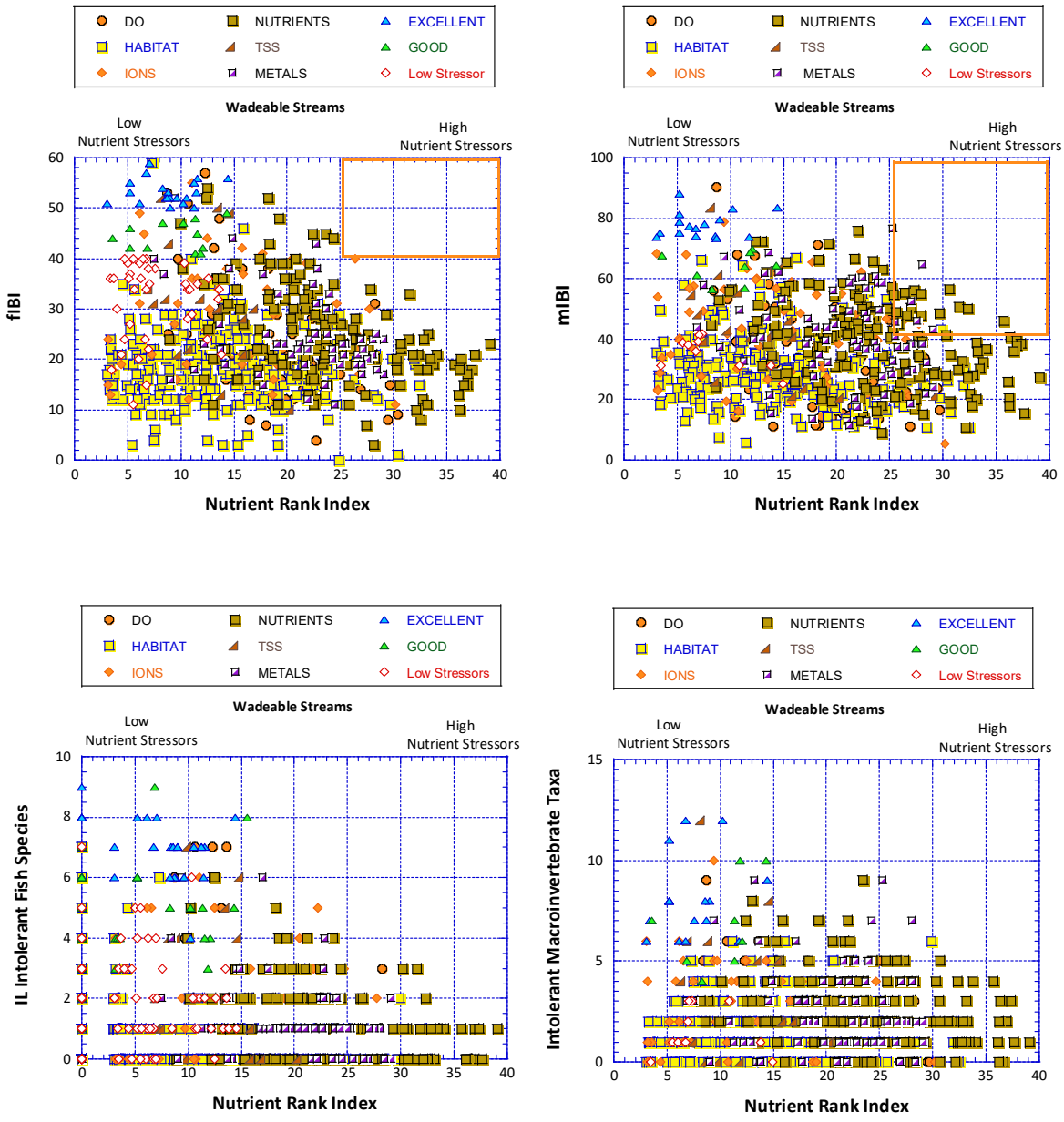
With the emphasis on nutrients in NE Illinois a Nutrient Ranking Index (NRI) was developed by summing the ranking of each of the individual primary nutrient or nutrient-related parameters with each weighted based on the FIT coefficient (Appendix Table E-2). The equation is as follows:

Nutrient Rank Index = (TPR*1) + (Min. DOR*1) + (TKNR*0.8) + (BOD_5R*0.8) + (NITRR*0.8) + (Max. DOR*0.6)

Where; TPR = Total Phosphorus Rank
Min. DOR = Minimum Dissolved Oxygen Rank
TKNR = Total Kjeldahl Nitrogen Rank
BODR = Biochemical Oxygen Demand (5-day) Rank
NITRR = Nitrate Rank
Max. DOR = Maximum Dissolved Oxygen Rank

Appendix Figure E-1 illustrates the correlation between the Nutrient Rank Index (NRI) and the fIBI (top, left), mIBI (top, right), the number of Illinois intolerant fish species (bottom, left) and the number of Illinois intolerant macroinvertebrate taxa (bottom, right). In these graphs points were coded to the strongest stressor rank for all categories of stressors (excluding land use parameters) and where the most limiting stressor rank was greater than a score of four (i.e., General Use benchmark). Boxes in the upper right corner reflect Nutrient Rank Index ranges where biological performance is clearly limited. In these plots fish appear a bit more limited than macroinvertebrates. We expect the relationship between the NRI and biological response variables to improve other indicators such as continuous dissolved oxygen-based maximum daily D.O. swings and algal indicators (benthic chlorophyll). Even so there is a strong enough relationship to make this indicator a useful marker for stressor identification efforts eutrophication in a study area. NRI values of >25 are always associated with degraded fish assemblages and often associated with degraded macroinvertebrate indices (Appendix Figure E-1).

Where a biological assemblage is of excellent quality NRI values are nearly always less than 15. The Power BI dashboard for nutrients will provide this data for all sites where it is available and will also provide individual parameter (e.g., TP, TKN, min D.O.) rankings for nutrients and other parameter categories as well. Such data can be matched to recent local data on continuous D.O., and benthic and sestonic chlorophyll where it exists. Sites with high NRI values and high D.O. swings from continuous data can be examined along with biological data responses to see if patterns of response are similar. The Power BI will also have NRI values, among other data, summarized at both the reach and Huc12 scale to determine whether nutrient signatures are rare or prevalent nearby and across the watershed. The goal for developing the NRI is to have a screening value that can then be matched to more site specific data to conduct a stressor identification analysis.



APPENDIX FIGURE E-1. *CORRELATION BETWEEN THE NUTRIENT RANK INDEX AND THE FIBI (TOP, LEFT), MIBI (TOP, RIGHT), THE NUMBER OF ILLINOIS INTOLERANT FISH SPECIES (BOTTOM, LEFT) AND THE NUMBER OF ILLINOIS INTOLERANT MACROINVERTEBRATE TAXA (BOTTOM, RIGHT). IN THESE GRAPHS POINTS ARE CODED BY THE STRONGEST STRESSOR RANK FOR ALL CATEGORIES OF STRESSORS (EXCLUDING LAND USE) AND WHERE THE MOST LIMITING STRESSOR RANK WAS GREATER THAN A SCORE OF FOUR (I.E., GENERAL USE BENCHMARK).*