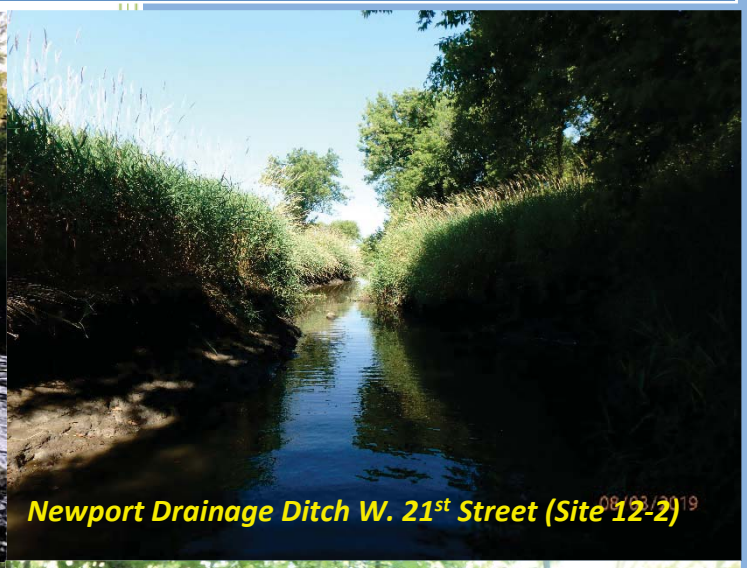
Biological and Water Quality Assessment of Upper Des Plaines River Subwatersheds: Year 3 Rotation 2019

Mill Creek upstream Mill Creek WWTP (Site 11-2)



Newport Drainage Ditch W. 21st Street (Site 12-2)

Bull Creek adjacent University Drive (Site 14-5)

Bull's Brook at Almond Rd. (Site 13-15)

Peter A. Precario, MBI Executive Director
James Lane, MBI Board President

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Biological and Water Quality Assessment of Upper Des Plaines Subwatersheds: Year 3 Rotation 2019

Mill Creek, Bull Creek, and Des Plaines River Tributary Subwatersheds

Lake County, Illinois

Technical Report MBI/2021-7-7

--FINAL REPORT--

October 15, 2021

Prepared for:

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Table of Contents

List of Tables

List of Figures

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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 watershed scale. This may involve a relatively simple setting focusing on one or two small streams, one or two principal 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 2019 Year 2 subwatershed monitoring rotation included 30 sites on Mill Creek, North Mill Creek, Hastings Creek, Bull's Creek and other tributaries to the Des Plaines River all within Lake County. All of these sites were previously sampled in 2016 biological assemblages and habitat. The principal focus of the 2019 bioassessment is on the status of the Illinois General Use for aquatic life and recreation.

Scope of the Year 3 Biological and Water Quality Assessment

The Midwest Biodiversity Institute (MBI) was contracted by the Des Plaines Watershed Workgroup (DRWW) to develop a biological and water quality monitoring and assessment plan for Upper Des Plaines River watershed within Lake County, IL. The plan was incorporated into a Quality Assurance Project Plan (QAPP; DRWW 2016) 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 from major discharges, other sources of potential pollution releases and contamination, and major tributaries to provide a "pollution profile" of the major mainstem streams and rivers. Sampling locations in the smaller tributaries were allocated by a geometric progression of drainage area to a "resolution" of 0.5-1.0 square miles. The major program 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 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 (DRWW 2016). Previous biological assessments of the Upper Des Plaines River basin streams and rivers include major surveys by Illinois EPA (Illinois EPA 1988,), Illinois DNR (IDNR; Pescitelli and Widloe 2018; Pescitelli 2016; Pescitelli and Rung 2010a,b; Day 1991; Heidinger 1989; Bertrand 1984; Langbein and Wright 1976; Muench 1968), Illinois Natural History Survey (Bilger et al. 2016; Sherwood et al. 2016), U.S. Geological Survey (Steffeck and Streigl 1989), Shedd Aquarium (Bland and Willink 2015), and others (Slawski et al. 2008). Some of these surveys included the entirety of the Des Plaines River and others focused on the Upper Des Plaines River defined as the mainstem and tributaries upstream from the confluence with Salt Creek. Smaller surveys of specific tributaries in Lake Co. have also been conducted, but none were of sufficient scope or coverage to meaningfully compare to the baseline watershed biological assessment conducted in 2016 (MBI 2017), the Year 1 subwatershed bioassessment of the Indian, Aptakisic, Buffalo Creek subwatersheds (MBI 2018), or the Year 3 subwatershed bioassessment of the Mill Creek, Bull Creek, or Upper Des Plaines Tributary subwatersheds. The recent basin-wide fish surveys by IDNR included three (3) sites in the Year 3 subwatersheds, two in Mill Creek and a single site in Bull Creek. Other fish surveys included locations sampled in the Bull Creek and Bull's Brook subwatersheds by Integrated Lakes Management (2003) that supported the reintroduction of state listed fish species to selected lakes and streams. The initial stocking in Sanctuary Pond at Prairie Crossing for five state listed fish species including Blackchin Shiner *(Notropis heterodon),* Blacknose Shiner *(Notropis heterolepis),* Banded Killifish *(Fundulus diaphanus),* Iowa Darter *(Etheostoma exile),* and Pugnose Shiner *(Notropis anogenus)* was accomplished in the mid-1990s (Lake Co. SMC 2008).

The 2019 Year 3 assessment is the second DRWW effort to utilize the analyses and outputs of the Northeastern Illinois Integrated Prioritization System (NE Illinois IPS; MBI 2020a), the first being the 2018 Year 2 bioassessment of the mainstem (MBI 2020b). Specifically biological effect thresholds for five narrative condition categories (i.e., excellent, good, fair, poor, and very poor) were developed for 87 chemical water quality, sediment chemistry, and habitat attributes. These provide biological effect thresholds that are more regionally relevant than what has been used in the watershed bioassessments prior to 2018. For nutrients, this includes not only more refined thresholds for nutrient parameters, but also a nutrient index that synthesizes IPS variables into a more tractable scale of overall nutrient effects, and a modified Stream Nutrient Assessment Procedure (SNAP) that utilizes a combined approach to assessing the severity of nutrient enrichment. The IPS also provides a Restorability factor for impaired sites, reaches, and watersheds (HUC12 scale) and a Threat/Susceptibility factor for fully supporting or attaining sites. The regional relevance of the IPS thresholds and being stratified across five narrative condition categories provides additional clarity and certainty to the assignment of causes and sources of impairment and threats.

EXECUTIVE SUMMARY

Summary of Findings

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 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; the partial support category was added to clarify instances where only one of the two assemblages attains the General Use support fish or macroinvertebrate threshold. Of the 30 sites assessed for the General Use in the Upper Des Plaines subwatersheds for aquatic life one (1) was in full support (based on a single assemblage), three (3) in partial support, three (3) in non-support fair, and the remainder (23) in non-support poor. As in other NE Illinois watersheds the fish assemblage was the most limiting factor in the non-support and partial support determinations in failing to meet the Illinois EPA General Use threshold for the fIBI in the Upper Des Plaines River tributaries in 2016 (MBI 2017), 2017 (MBI 2018), and most recently the 2019 Year 3 subwatersheds assessment.

Recently 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 of Non-attainment

A total of 16 causes associated with varying degrees of impairment of the General Use for aquatic life were determined by relating threshold exceedances of the various physical and chemical parameters measured alongside the biological assemblages in a synthesis analysis. These were then tallied and grouped into five (5) categories and weighted in accordance with the exceedance eclipsing a fair, poor, or very poor threshold. Most of the thresholds are from the NE Illinois IPS (MBI 2020a), but other sources were used for parameters and indicators not directly included or yet derived in the IPS. The weighting was done as follows – 5 times for very

***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). Restorability, Susceptibility, and Threat scores are included. See glossary of terms used next page.*

Site ID	River Mile	Drainage Area (sq. mi.)	fIBI	mIBI	QHEI	AQLU Status	2019 Causes by IPS Stressor Threshold Narrative Category			2019 Sources	IPS Restora-bility Score (0-100)	IPS Suscept-ibility Score (0-100)	IPS Threat Score (0-100)
							Very Poor[1]	Poor[1]	Fair[1]				
Mill Creek													
11-6	17.20	4.50	20	29.6	40.0	NON-Poor	QHEI Ratio;Substr;TKN	QHEI;Chan;	Min. D.O.;Ammonia;	Hydromodification; Agricultural NPS	60.1		
11-5	13.80	10.40	22	32.1	52.8	NON-Poor	Min.&Diel D.O.	Substr;Chan;TKN	QHEI&Ratio;Chloride;Ammonia;Toxicity;	Hydromodification; Agricultural NPS	49.3		
11-4	10.10	18.30	-	43.0	-	[FULL]	TKN;	Min. D.O.	Chloride;Ammonia;	Agricultural NPS	-	49.5	85.7
11-3	7.20	21.40	21	45.1	62.0	NON-Poor	TKN;		QHEI;Substr;Chloride;	Agricultural NPS	68.1		
11-2	1.71	62.30	29	-	80.0	[NON-Poor]		TSS; TKN	TKN;VSS;Organic Enrich.	Agricultural NPS	73.0		
11-1	0.70	63.80	23	58.5	68.5	NON-Poor	TSS;	TSS;TKN	QHEI;Substr;Chan; VSS;	Agricultural NPS; WWTP	53.8		
North Mill Creek													
10-7	11.30	19.23	18	54.2	37.0	NON-Poor	QHEI Ratio;Substr;	QHEI; Chan; Min. D.O.	TKN;Ammonia;Organic Enrich.;	Hydromodification; Agricultural NPS	55.6		
10-3	10.20	20.86	16	36.3	59.0	NON-Poor	Substr; Diel D.O.	TKN;	QHEI;Chan;	Hydromodification; Agricultural NPS	58.7		
10-2	8.10	29.57	15	56.0	67.8	NON-Poor		Diel D.O.	TKN;QHEI;Substr;Ammonia;Organic Enrich.	Agricultural NPS	64.5		
10-1	1.10	31.97	18	58.2	59.0	NON-Poor		Substr; Metals	TKN;QHEI&Ratio;Chan;Ammonia;	Agricultural NPS; Urban Stormwater	64.9		
Hastings Creek													
10-5	3.12	3.91	15	31.0	60.0	NON-Poor	TKN;	TKN;	QHEI&Ratio;Substr;Chan;Chloride;Min. D.O.	Agricultural NPS	72.6		
10-4	1.68	5.60	21	27.5	44.5	NON-Poor	Diel D.O.;TKN;	QHEI; Chan; Min. D.O.	Substr;Chloride;	WWTP;Agricultural NPS;Urban Stormwater	61.3		
Unnamed Tributary to North Mill Creek @RM 0.75													
10-6	0.04	0.99	25	40.4	53.5	NON-Poor		TKN;	QHEI;Substr;Chan;	Urban Stormwater	67.1		
Newport Drainage Ditch													
12-2	3.03	2.80	20	28.4	45.0	NON-Poor	Substr;Diel D.O.;TKN;Metals	QHEI; Chan;	Min. D.O.;QHEI Ratio;	Agricultural NPS; Hydromod.;Urban Stormwater	65.0		
12-1	0.70	7.35	27	40.6	63.0	NON-Poor			TKN;Max D.O.;QHEI;Substr;Chan;Amm;Org.Enrich.;	Agricultural NPS	68.4		
Suburban Country Club Tributary to DPR @RM 98.4													
13-10	2.00	4.00	20	18.0	39.0	NON-Poor	Chan;Ammonia;TKN	Substr; Metals	QHEI Ratio;TKN;Toxicity;	Urban Stormwater	52.0		
Slocum Creek													
13-11	1.36	2.4	16	36.9	63.8	NON-Poor		TKN;	QHEI;Max. D.O.;Ammonia	Urban Stormwater	72.5		
Unnamed Tributary to Greenleaf Creek @RM 0.64													
13-13	0.40	1.10	37	21.5	63.8	NON-Poor	Ammonia;TKN,Chloride		TKN; QHEI; Substr; Conduct;Organic Enrich.;	Urban Stormwater	67.4		
Unnamed Tributary to Des Plaines River @RM 89.5													
13-17	0.13	0.90	34	30.9	62.0	NON-Fair		TKN;	QHEI; Substr; Chan;	Urban Stormwater	82.5		
West Fork Belvidere Rd. Tributary to DPR @RM 94.0													
13-14	0.21	2.30	14	25.7	68.8	NON-Poor	TKN;		TKN;QHEI;Chan;Max. D.O.;Chloride;	Urban Stormwater	62.5		
13-8	0.15	3.80	34	45.2	70.0	PARTIAL		TKN;	TKN;QHEI;Chan;Chloride;Org.Enrich.;Toxicity	Urban Stormwater	67.8		
Stoneroller Creek													
13-9	0.42	4.10	39	57.6	82.0	PARTIAL	Chloride;Metals		TKN;Conduct;Org. Enrich.;Ammonia;Toxicity	Urban Stormwater	78.0		
Bull's Brook													
13-15	1.95	1.90	28	33.2	76.5	NON-Poor	TKN;			Urban Stormwater	76.7		
13-7	0.25	2.70	23	49.3	69.0	NON-Poor	TKN:	Metals	QHEI;	Urban Stormwater	85.6		
Bull Creek													
14-6	5.95	2.40	12	19.3	57.5	NON-Poor			TKN;QHEI;Chan;Ammonia;	Urban Stormwater	79.9		
14-5	4.70	1.30	29	20.0	57.3	NON-Fair		TKN;	QHEI; Substr; Chan;	Urban Stormwater	62.2		
14-2	1.00	8.40	30	34.8	53.3	NON-Fair	PAH Compounds	Chloride;	TKN; QHEI; Substr; Conductivity;	Urban Stormwater	58.7		
14-1	0.50	11.70	37	47.9	78.0	PARTIAL		TKN;	TKN;Chloride;Ammonia;Toxicity	Urban Stormwater	59.1		
West Branch Bull Creek													
14-4	2.54	5.10	11	24.9	47.8	NON-Poor	Min. D.O.;TKN;Chloride	QHEI; Substr; Metals	Substr;Chan;QHEI Ratio;Ammonia;	Urban Stormwater	63.3		
14-3	1.60	7.10	26	48.5	65.8	NON-Poor		Chloride;	TKN; QHEI;Organic Enrich.	Urban Stormwater	70.4		
	Narrative Category		**fIBI**	**mIBI**	**QHEI**	**AQLU Status**					**IPS Narrative Rankings**		
	Excellent		≥50	>73	>84.5	FULL					Very High	Very Low	Very Low
	Good		>41-49	41.8-72.9	>75.9	FULL					High	Low	Low
	Fair		30-<41	30-41.7	<75.9	PARTIAL					Moderate	Moderate	Moderate
	Poor		>15-29	>15-29	<50.1	NON-Fair					Low	High	High
	Very Poor		≤15	≤15	<25.0	NON-Poor					Very Low	Very High	Very High

[1] IPS derived very poor, poor, and fair causes assigned by weighting the stressor rank * FIT factor - see Appendix D; very poor causes rank >8-10, poor causes rank >6-8, fair causes rank >4-6; other stressor rankings are described throughout the report.

poor, 3 times for poor, and none for fair parameter exceedances and other indicator values. This amplifies the very poor threshold exceedances as being more likely to exert a true causal influence as opposed to simply being associated with an impairment on a spatial basis. Nutrient and organic enrichment indicators included TKN, ammonia-N, and organic enrichment responses in the biota comprised 35.2% of the weighted causes (Figure 1). Habitat related causes followed closely comprising 32.4% of the causes. These were followed by urban related (12.8%), D.O. related (11.5%), and toxics and toxicity (8.2%).

Synthesis of Results

The baseline biological condition of the Year 3 Upper Des Plaines subwatersheds has been shaped by the naturally low gradient and wetland origins of the region. The current condition of the biological assemblages reflects historical changes that have significantly altered these natural features, mostly through hydrological and physical alterations related to agricultural, suburban, and urban development throughout the study 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 where they are most evident have resulted in sluggish flows, excessive siltation, embedded substrates, sparse instream cover, sediments high in organic matter, and indicators of agricultural and urban runoff that are further exacerbated by the altered flows and habitat. TKN values were very poor and poor at numerous sites and indication of excessive runoff and instream algal production. Runoff containing sediments that are high in organic matter also combined with sluggish flows and stream channel alterations to exacerbate low D.O. concentrations and high to wide diel D.O. swings in several streams. Another indicator of excessive organic enrichment were the consistently high *E. coli* maximum values at the 2420 cfu/100 mL upper limit of the analytical method at all sites in North Mill Creek, Hastings Creek, Newport Drainage Ditch, Slocum Creek, Unnamed Tributary to Greenleaf Creek, West Fork Belvidere Rd. Tributary, and West Branch of Bull Creek. At sites with more "normal" mean *E. coli* values this is an

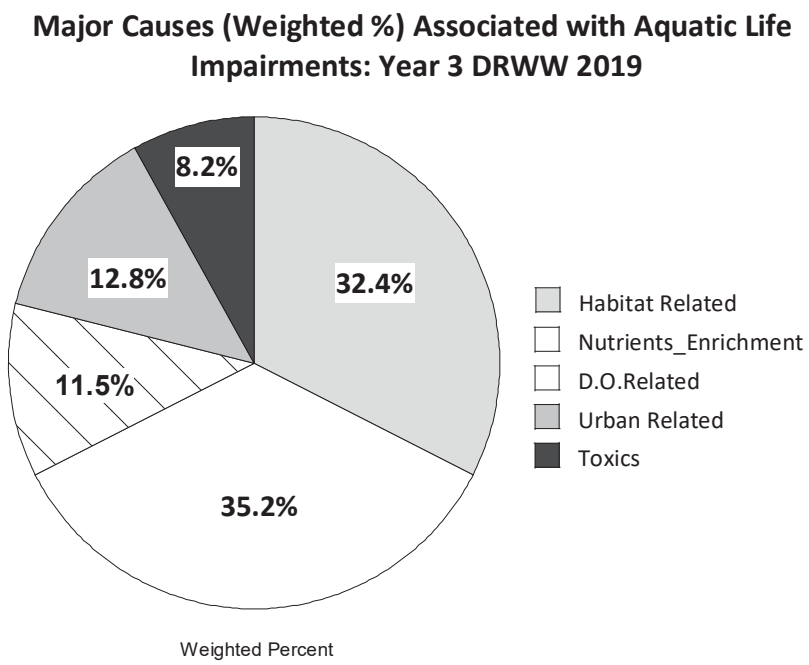

Figure 1*. Categorical causes associated with aquatic life impairments in the 2019 Upper Des Plaines subwatersheds survey area in 2019 based on the number of observations weighted based on the narrative rating of threshold exceedances (very poor = 5, poor = 3, and fair = 1).*

indication of periodic spates from periods of runoff. However, some sites had elevated means indicating a more routine bacterial contamination. A higher upper limit for the analytical method could possibly better separate sites with sewage contamination versus general nonpoint source runoff. The introduction of wastewater from the Lindenhurst WWTP into Hastings Creek did not add appreciably to the existing upstream delivery of nutrients, oxygen demanding wastes, and ammonia-N. The LCDPW Mill Creek WWTP discharges to Mill Creek only one mile from the Des Plaines mainstem thus only its immediate and seemingly negligible impact could be assessed. Only four (4) sites had QHEI scores that were considered good with the majority of sites scoring in the fair range. Where habitat alteration was a factor it was severe with two (2) sites exhibiting extremely high poor to modified attribute ratios. Together these have resulted in essentially complete non-attainment of the General Use for aquatic life throughout the study area. However, the severity of the non-attainment varies at the subwatershed, reach, and site scales.

Restorability, Susceptibility, and Threat Factors

The NE Illinois IPS was developed to provide an organized and robust framework for determining restoration and protection priorities and options for both impaired and attaining watersheds, reaches, and sites (MBI 2020a). A Restorability factor is derived for impaired sites and Susceptibility and Threat factors are derived for attaining sites. These factors are provided in the synthesis (Table 19) and aquatic life use attainment (Table 1) tables. Five narrative ranges of Restorability from very high to very low have been established on an interim basis – these are subject to revision as these factors are applied in NE Illinois watersheds by the watershed groups. Narrative ranges for Susceptibility and Threat from very low to very high run in the reverse of the Restorability narratives.

In the 2019 Upper Des Plaines subwatersheds only one site was in full attainment and this being based on a single assemblage. This site had a moderate susceptibility and a very low threat ranking. The balance of the 30 sites were all impaired and thus were assigned Restorability scores. Two (2) sites, the Unnamed Tributary to the Des Plaines River at RM 89.5 and the downstream site on Bulls Brook had Very High Restorability scores. This means that few precluding factors that might otherwise deter recovery following a restoration project exist. The majority of the remaining sites (18) had High Restorability scores and the remaining 10 sites had Moderate scores. No sites had Low or Very Low scores. Based on the Very High and High scores much of the watershed has good potential to respond positively to restoration. However, restoration projects will need to focus on the limiting factors for each site, reach, and watershed that are available in the IPS databases and dashboard.

Recreational Use Assessment

Levels of fecal bacteria in the form of *Escherichia coli* (*E. coli*) as colony forming units (cfu)/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, so the U.S. EPA national criteria for *E. coli* were used their place. 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 percent of the samples. 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). There were insufficient samples collected at each site to calculate a true geometric mean so the mean of the samples collected May-October was used as a surrogate.

E. coli samples collected during the summer months of 2019 were used to assess recreational status (Table 2). Of the 30 sites sampled, 28 had exceedances of the U.S. EPA maximum STV criterion and 27 exceeded the geometric mean criterion. Only two (2) sites in Bull Creek (14-2, 14-5) had geometric means *and* maximum STVs below the U.S. EPA *E. coli* recreational use criteria. Of the highest geometric mean values, 10 exceeded the maximum STV reflecting sustained elevated values. This contrasted with the majority of sites that had minimum values below the geometric mean criterion, but with higher mean and/or maximum values that indicate episodic exceedances related to runoff events in all likelihood. The highest maximum STV levels were observed at all of the North Mill Creek subwatershed sites, Newport Drainage Ditch (12-1 and 12-2), Slocum Creek (13-11), West Fork Belvidere Rd. Tributary (13-11), West Branch Bull Creek (14-3 and 14-4) and the Unnamed Tributary to Greenleaf Creek (13-13). The unnamed tributary to Greenleaf Creek also had the highest minimum and geometric mean values, the latter which was nearly 10 times higher than the U.S. EPA recommended level. A total of 16 sites had the maximum analytical value of 2420 cfu/100 mL reported. The maximum reported analytical value of 2420 cfu/100 mL in 2019 was a limitation in that much higher actual values were likely and would have added to the diagnosis of the *E. coli* exceedances. For example, raw and poorly treated sewage frequently result in values in the 10,000 or even 100,000 cfu/100 mL ranges. Future surveys should be provided with better resolution by reporting the true maximum values. The non-exceedances in Bull Creek are possibly due to sites 14-2 and 14-5 being located in and downstream from a series of lakes and wetlands that could have diluted the *E. coli* concentrations that were markedly higher elsewhere in the 2019 study area. Only one other site in Mill Creek (11-4) met the geometric mean criterion. Other subwatersheds including Mill Creek, North Mill Creek, Newport Drainage Ditch and Slocum Creek receive runoff from agricultural and suburban areas. The 2019 values represent substantial increases from the 2016 baseline survey the latter of which was conducted under lower flows resulting in reduced runoff events. During the 2019 sampling 14 sites were observed to reach the maximum analytical value of 2420 cfu/100 mL, while the highest value in 2016 was 1100 cfu/100 mL. These increased levels could be attributed to the increase in runoff events that occurred during the 2019 sampling season.

***Table 2**. E. coli values (cfu/100 mL) for samples collected in the Year 3 Upper Des Plaines River study area during May-October 2019. Yellow shaded values exceed the recommended U.S. EPA (2012) 90-day geometric mean (126 cfu/100 mL) and orange shaded values exceeded the maximum STV (410 cfu/100 mL) recreation use criteria.*

Site ID	River Mile	Drainage Area (sq. mi.)	Samples	Minimum	Mean	Maximum
Mill Creek						
11-6	17.20	4.5	4	42	264	613
11-5	13.80	10.4	4	108	371	1414
11-4	10.10	18.3	4	13	115	613
11-3	7.20	21.4	5	88	704	2420
11-2	1.71	62.3	4	201	503	1986
11-1	0.70	63.8	4	119	607	1553
North Mill Creek (95-996)						
10-7	11.30	19.2	4	70	261	2420
10-3	10.20	20.9	4	96	338	2420
10-2	8.10	29.6	4	128	365	2420
10-1	1.10	32.0	3	98	286	2420
Hastings Creek						
10-5	3.12	3.9	4	27	149	2420
10-4	1.68	5.6	4	67	355	2420
Unnamed Tributary to North Mill Creek @RM 0.75						
10-6	0.04	1.0	4	24	209	2420
Newport Drainage Ditch						
12-2	3.03	2.8	4	186	893	2420
12-1	0.70	7.4	4	219	665	2420
Suburban Country Club Tributary to Des Plaines River @RM 98.4						
13-10	2.00	4.0	4	148	532	1733
Slocum Creek						
13-11	1.36	2.4	4	20	305	2420
Unnamed Tributary to Greenleaf Creek @RM 0.64						
13-13	0.40	1.1	4	416	1243	2420
Unnamed Tributary to Des Plaines River @RM 89.5						
13-17	0.13	0.9	4	285	502	1986
Stoneroller Creek						
13-9	0.42	4.1	5	99	295	1011
West Fork Belvidere Rd. Tributary @Des Plaines River RM 94.0						
13-14	0.21	2.3	4	35	369	2420
13-8	0.15	3.8	5	4	218	2420
Bull's Brook						
13-15	1.95	1.9	4	104	252	921
13-7	0.25	2.7	6	5	157	1120
Bull Creek						
14-6	5.95	2.4	6	51	372	1733
14-5	4.70	1.3	5	13	41	161
14-2	1.00	8.4	5	75	117	194
14-1	0.50	11.7	6	81	290	1120
West Branch Bull Creek						
14-4	2.54	5.1	5	114	513	2420
14-3	1.60	7.1	4	228	610	2420
	exceeds U.S. EPA 126 cfu/100 mL geometric mean criterion					
	exceeds U.S. EPA 416 cfu/100 mL statisitcal threshold value (STV) criterion					

Biological and Water Quality Assessment of the Upper Des Plaines River Tributaries: Year 3 Rotation 2019

Study Area Description

Lake County is comprised of 53 individual communities and 18 townships with a total area of 1368 square miles of which a significant fraction are waterbodies comprised of lakes, wetlands, rivers, and streams in the Upper Des Plaines River basin. According to the 2018 American Community Survey estimate there are 700,832 residence in Lake County and 263,360 housing units, making it the third most populated county in Illinois (USCB, 2020). The 2019 study area covers roughly 135 square miles of the Upper Des Plaines River watershed including Mill Creek, Bull Creek, and seven direct tributaries to the Des Plaines River. North Mill Creek originates in Wisconsin near Bristol and flows 17 miles to its confluence with Mill Creek near Lindenhurst, IL. Mill Creek originates near the Village of Grayslake, IL, and flowing 18.5 miles to its confluence with the Des Plaines River near Wadsworth, IL. Mill Creek tributaries as well tributaries to the Des Plaines River throughout northern Lake County offer a mix of agricultural and urban land uses.

General Landscape Setting

The 2019 study area lies mostly within the Kettle Moraine subregion of the Southeastern Wisconsin Till Plains Level III ecoregion with the Newport Drainage Ditch and Suburban Country Club Tributary located in the Chiwaukee Prairie subregion of the Central Corn Belt Plains ecoregion (Table 3; Woods et al. 1995). The Kettle Moraine subregion is characterized by poorly drained, hilly to hummocky morainal areas that include conspicuous glacial landforms, numerous lakes, and wetlands including bogs, fens, and marshes. Drainage networks are less integrated and more poorly developed than on the older till and outwash plains of the adjacent Rock River Drift Plain subregion. Lakes are typically larger and more concentrated than to the south in the Valparaiso Morainal Complex subregion and much more common than in other neighboring subecoregions. Soils are largely derived from thick late-Wisconsinan glacial drift and thin loess deposits where they occur. Alfisols are common, but Mollisols and Histosols are also present. Overall, organic soils are more extensive than elsewhere in Illinois, and Mollisols are less common than in subregions to the west. In the early 1800s moraines were covered by savanna, prairie, and forest (oak-hickory) with depressions containing wetlands. Landscape alterations in the early 1900s reduced the tracts of forest and nonforested wetlands replacing them with agricultural, urban, and suburban development. However, wooded areas, lakes, and wetlands are still common especially in Lake County forest preserves.

The Chiwaukee Prairie subregion of the Central Corn Belt Plains ecoregion is characterized by alluvium, outwash deposits, glacial tills, Silurian limestone, thin loess, beach deposits, dolomite and some shale. Alfisols are the primary soil type and are poorly drained. Prior to European settlement this subregion was dominated by tall-grass prairies, scrub oak forests, sand prairies,

sand savannas, fens and marshes (Woods et al. 1995). Today, cropland, urban, and industrial development have replaced much of the prairie and forested land uses. Forested and wetland areas remain common, especially in county owned forest preserves. Land uses are varied and include agriculture and urban and suburban development.

Table 3. *Level IV subregions of the 2019 Upper Des Plaines 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
Kettle Moraine (53b)	Glaciated, hummocky to hilly area with steeply sloping moraines, outwash plains, closed depressions, mounds, level areas, and many wetlands and natural lakes.	Wisconsinan-age glacial till, outwash gravels, and thin loess (<20"). Silurian & Ordovician dolomite, lime-stone, and shale bedrock.	Mostly Alfisols (Hapludalfs, Epiaqualfs); also, Mollisols (Argiudolls, Endoaquolls), Histosols.	Oak–hickory forest, oak savanna, & bluestem prairie occur on moraines. Wetlands (bogs, fens, seeps, sedge meadows, marshes) were common.	Forest, pastureland, & wetland. Home sites common on moraines and lakes.
Chiwaukee Prairie (54e)	Lake and till plains with beaches, well developed sand dunes, low beach ridges, swales and bluffs	Quaternary nearshore lake deposits, beach deposits, glacial till, thin loess, alluvium, outwash deposits, and colluvium.	Alfisols (Hapludalfs, Endoaqualfs)	Bluestem prairie and oak savanna. Tall-grass prairies, scrub oak forests, sand prairies, sand savannas, fens and marshes.	Cropland, urban and industrial development. Some forested areas.

Major Point Sources

Point sources of pollution were originally inventoried as part of the 2016 Upper Des Plaines Bioassessment (MBI 2017) to understand the extent of their potential impact and for the intensive pollution survey monitoring design. There are two wastewater treatment plants (WWTP) in the 2019 study area. The Mill Creek WWTP discharges to the lower reach of Mill Creek at RM 1.0 and is capable of discharging 2.1 million gallons per day (MGD) of treated wastewater. It is the smallest among the North Shore Sanitary District (NSWRD) facilities many of which discharge to the Des Plaines River mainstem. It was included in the 2018 assessment of the Upper Des Plaines River mainstem (MBI 2020b). This facility provides advanced treatment for oxygen demanding wastes (BOD), ammonia-N, and suspended solids (TSS). Total phosphorus and nitrogen levels are monitored by the Mill Creek WWTP. The Village of Lindenhurst Sewage Treatment Plant (STP) is located on Hastings Creek (RM 2.8) and is capable of discharging 5.7 MGD of treated wastewater. This facility has advanced treatment for BOD,

TSS, ammonia-N, and total phosphorus (TP). Nitrate-N, dissolved phosphorus, and total nitrogen are monitored.

Table 4. *Major wastewater treatment facilities that discharge to the 2019 Upper Des Plaines River northern tributaries (NSWRD – North Shore Water Reclamation District; WWTP - Wastewater Treatment Plant). Treatment levels and nutrient information from U.S. EPA Discharge Monitoring Report (DMR) Pollutant Loading Tool and DRWW. (https://cfpub.epa.gov/dmr/facility_detail.cfm)*

Facility	Receiving Water Body	River Mile	Latitude	Longitude	Avg. Flow 2019 (MGD)[1]	Design Avg. Flow (MGD)[2]	Treatment Type[3]	Nutrient Removal
Lake Co. DPW Mill Creek WWTP	Mill Creek/Des Plaines River	1.0/102.0	42°25'00"N	87°55'40"W	0.9	2.1	AWT	P
Village of Lindenhurst STP	Hastings Creek	2.8	42° 26' 01" N	88° 01' 56" W	1.28	5.7	AWT	P, N

NPDES Permit Special Conditions

All of the major permitted WWTPs are subject to Special Conditions related to the discharge of nutrients, but not all have final language. The first special condition states:

> *"The Permittee shall, within twelve (12) 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."*

The second special condition states:

> *"The Permittee shall submit a Nutrient Implementation Plan (NIP) for Agency approval with the NPDES renewal application. The NIP must identify phosphorus input reductions by point source discharges, non-point source discharges and other measures necessary to remove dissolved oxygen and offensive condition impairments in the Des Plaines River watershed. The Permittee shall implement the recommendations of the plan that are applicable to said Permittee per the schedule approved by the Agency. The Permittee may work cooperatively with the Des Plaines River Watershed Workgroup (DRWW) to prepare a single NIP that is common among DRWW permittees."*

In addition all of the WWTPs that are members of the DRWW are subject to additional special conditions in their respective NPDES permits as follows:

> *"The Permittee shall conduct monthly water quality sampling in the receiving stream both upstream and downstream of the NPDES outfall for the following parameters: dissolved phosphorus, total phosphorus, total organic carbon, chlorophyll a, dissolved oxygen, total ammonia nitrogen, nitrate/nitrite, total Kjeldahl nitrogen, pH, total suspended solids, volatile suspended solids and temperature. The results shall be submitted to the Agency by March 31 of each year. The Permittee may work cooperatively with the DRWW to conduct monitoring and prepare a single annual monitoring report that is common among DRWW permittees."*

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. All of the major WWTPs that are members of the DRWW have initiated planning for meeting the NARP requirements. Depending on the findings of the DRWW NARP process additional controls on discharges of N and P could be forthcoming.

Nonpoint Sources

Nonpoint sources in the Year 3 2019 study area include urban and agricultural sources ranging from light urban and industrial to heavy agricultural and suburban land uses. These have been extensively classified and delineated by the Lake Co. SMC. Alteration of stream flows and habitat related to urban and agricultural land use modifications as well as riparian encroachment and channelization have occurred as the landscape has been modified. The 2019 study area consists of three distinct subwatersheds, Mill Creek, North Mill Creek, and Bull Creek-Bulls Brook for which land use data is available. The remainder of the study area is comprised of direct tributaries to the Des Plaines River mainstem for which specific land use data was not accessed. However, these tributaries have land uses similar to the subwatersheds with which they are bundled in Table 5 and for the portrayal of the chemical, habitat, and biological results.

An edge of pavement coverage illustrates the extent of urbanization in the 2017 study area and between the four subwatershed groupings (Figure 1). Urban land uses are the highest in the southern portion and agricultural and opens space land uses highest in the northern one-half of the Year 3 2019 study area. Land use in the Mill Creek subwatershed is a combination of rural and suburban, with residential and open space/wetlands land uses at 21% and 37%, respectively (Lake Co. SMC 2016). Another Agricultural land uses occupy 18% of the subwatershed. Municipalities cover 12,840 acres, or 64% of the watershed, including the Villages of Grayslake, Gurnee, Libertyville, Lindenhurst, Old Mill Creek, Round Lake Beach, Third Lake, and Wadsworth. Unincorporated areas such as Grandwood Park and Wildwood cover 7,270 acres or 36% of the subwatershed. Future land use projections indicate that impervious surfaces may increase by 2½ times by 2040 covering more than 15% of the subwatershed. The

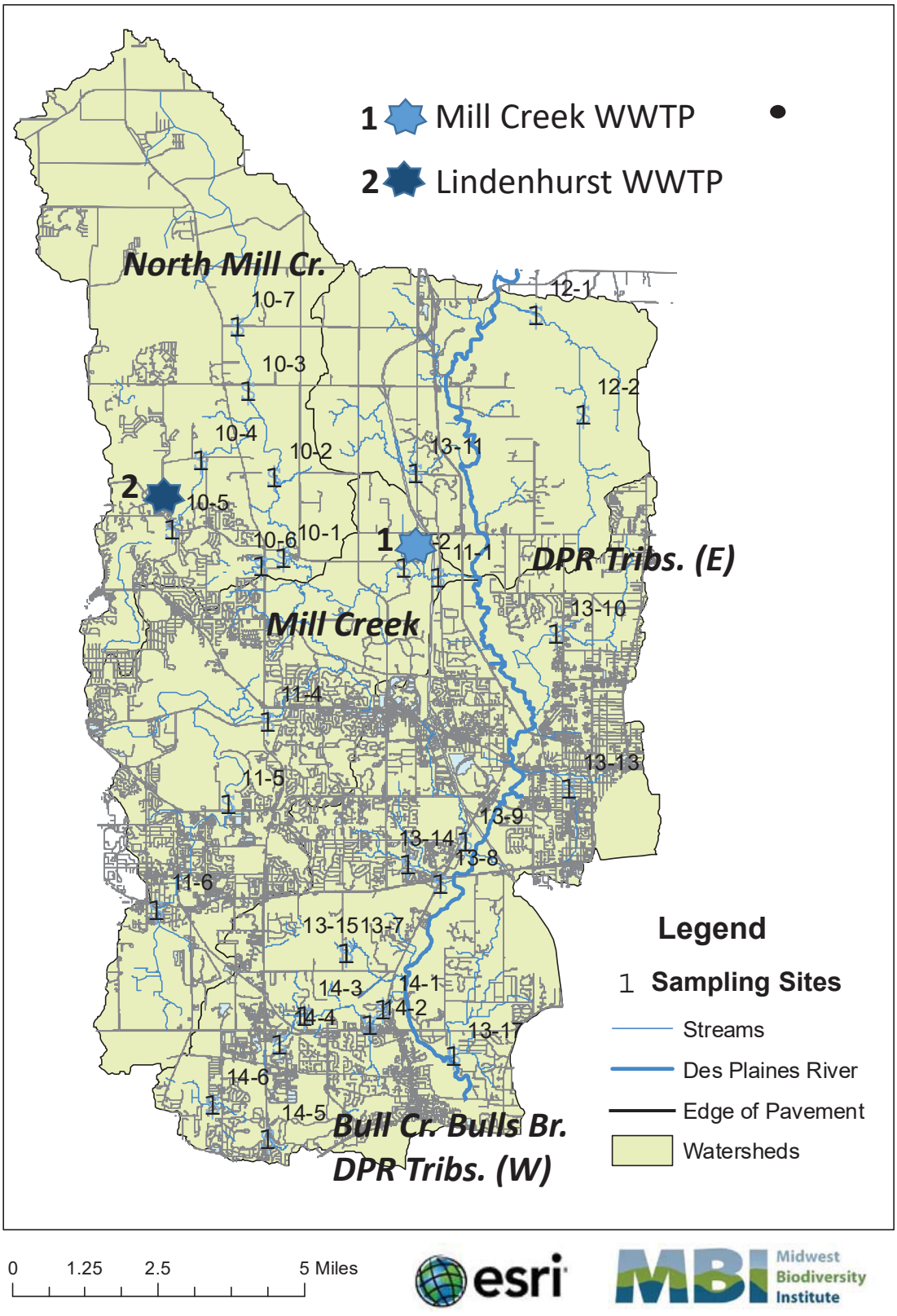

***Figure 2**. The degree of urbanization in the 2019 Year 3 study area as reflected by the edge of pavement coverage for Lake Co. The 2019 sampling locations are included along with the four subwatershed bundles and the two major WWTPs.*

North Mill Creek/Dutch Gap Canal subwatershed encompasses approximately 23,532 acres or 37 square miles in north central Lake County and south central Kenosha County in Wisconsin with a population of 14,860 people, which is expected to increase to more than 36,000 by 2035 (Lake Co. SMC 2011). Land uses are currently predominated by agriculture and open space at 74%, but residential, commercial, institutional, and industrial land uses are expected to increase with the largest changes being from the conversion of agriculture and open space to residential land uses. The Bull Creek/Bull's Brook subwatershed encompasses approximately 14 square miles (8,970 acres) covering portions of Grayslake, Libertyville, and Mundelein in Avon, Warren, Fremont, and Libertyville townships, smaller areas of Gurnee and Waukegan, and interspersed with unincorporated areas. Residential land use accounts for 22%, open space 17.8%, and agriculture 16.0% of the subwatershed, respectively (Lake Co. SMC 2008). The population of 34,777 persons is excepted to increase to 40,172 by 2030 and also corresponding to an increase in residential land use and a corresponding reduction in open space and agriculture land uses.

Sampling Sites Selection and Locations

The Monitoring Strategy for the Upper Des Plaines River Watershed was developed by the Monitoring Committee of the Des Plaines River Watershed Workgroup in 2015 (DRWW 2016). The spatial allocation of sites was established by the DRWW for water sampling in 2015 and this was used as the core for the initial allocation of additional biological and habitat sites. 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 DRWW, other watershed groups, and their respective stakeholders. The data and assessments provided by these periodic watershed assessments and by the NE Illinois Integrated Prioritization System (IPS) framework (MBI 2020a), 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 watersheds.

While the initial baseline survey of the entire Upper Des Plaines River watershed in 2016 included 70 sites, a rotation through three subsets of the Upper Des Plaines River basin in Lake Co. was initiated in 2017. The 2019 survey of 30 sites in the Mill Creek and Bull Creek subwatersheds and several Des Plaines River tributaries comprises Year 3 of that rotation (Table 5; Figure 1). The sites were assigned to four bundles of subwatersheds and neighboring Des Plaines River tributaries, the latter of which were grouped as east and west tributaries (Table 5). The presentation of the data and results follow this organization throughout the report.

***Table 5**. Locations of sampling sites in the Year 3 Des Plaines River study area in 2019 showing the site ID stream name, location, river mile, and what sampling was performed at each (F – fish; MH – multihabitat macroinvertebrate; QHEI – Qualitative Habitat Evaluation Index; Datasonde; Benthic Chlorophyll a, and water chemistry in accordance with the Tier 1-4 designation). The four bundles of sites by subwatershed and tributary association are shaded yellow for Mill Creek, salmon for North Mill Creek, blue for East Des Plaines River direct tributaries, and orange for Bulls Creek-Bulls Brook and West Des Plaines River direct tributaries.*

Site ID	Stream	Location	River Mile	Gradient	Drainage Area ($mi.^2$)	Biota	Habitat	Datasode	Benthic Chlorophyll-a	Water Chemistry			
										Tier 1	Tier 2	Tier 3	Tier 4
11-6	Mill Creek	Wick Street	17.20	10.8	4.5	F, MH	QHEI	X	X			3	
11-5	Mill Creek	Washington Street	13.80	6.7	10.4	F, MH	QHEI	X	X			3	
11-4	Mill Creek	U.S. Route 45	10.10	5.4	18.3	MH	-	X	X			3	
11-3	Mill Creek	Sterns School Road	7.20	5.6	21.4	F, MH	QHEI	X	X			3	
11-2	Mill Creek	Hunt Club Road	1.71	7.4	62.3	F	QHEI	X	X		2		
11-1	Mill Creek	Dilley's Road	0.70	7.3	63.8	F, MH	QHEI	X	X	1			
10-7	North Mill Creek	Edwards Road	11.30	2.6	19.2	F, MH	QHEI						4
10-3	North Mill Creek	St. Route 173	10.20	7.7	20.9	F, MH	QHEI	X	X		2		
10-2	North Mill Creek	Kelly Road	8.10	6.7	29.6	F, MH	QHEI	X	X			3	
10-1	North Mill Creek	Milbourne Road	1.10	5.2	32.0	F, MH	QHEI	X	X			3	
10-5	Hastings Creek	Grass Lake Rd	3.12	10.5	3.9	F, MH	QHEI	X	X			3	
10-4	Hastings Creek	Miller Rd	1.68	6.9	5.6	F, MH	QHEI	X	X		2		
10-6	Unnamed Trib. to North Mill Cr. @RM 0.75	U.S. Route 45	0.04	15.7	0.99	F, MH	QHEI						4
12-2	Newport Drainage Ditch	W. 21st St along Union Pacific RR	3.03	3.7	2.8	F, MH	QHEI					3	
12-1	Newport Drainage Ditch	Kilbourne Avenue	0.70	6.7	7.4	F, MH	QHEI	X	X			3	
13-10	Suburban Country Club Trib. to DPR @RM 98.4	Shirley Drive	2.00	15.7	4.0	F, MH	QHEI					3	
13-11	Slocum Creek	N. Mill Creek Rd; E. of I-94	1.36	30.6	2.4	F, MH	QHEI					3	
13-13	Unnamed Trib. to Greenleaf Creek @RM 0.64	Swanson Trigg Conservation Area	0.40	27.0	1.1	F, MH	QHEI						4
13-17	Unnamed Trib. to Des Plaines River @RM 89.5	Behind Pump Station off Sprucewood Lane	0.13	26.8	0.90	F, MH	QHEI						4
13-14	West Fork Belvidere Rd. Trib. to DPR @94.0	Leonard Drive	0.21	36.6	2.3	F, MH	QHEI						4
13-8	West Fork Belvidere Rd. Trib. to DPR @94.0	St. Route 21	0.15	33.6	3.8	F, MH	QHEI					3	
13-9	Stoneroller Creek	Lake Carina	0.42	19.2	4.1	F, MH	QHEI					3	
13-15	Bull's Brook	Almond Road	1.95	32.6	1.9	F, MH	QHEI						4
13-7	Bull's Brook	N. Milwaukee Road	0.25	32.8	2.7	F, MH	QHEI					3	
14-6	Bull Creek	Hazelnut Crossing	5.95	9.1	2.4	F, MH	QHEI					3	
14-5	Bull Creek	Adj. University Drive	4.70	14.0	1.3	F, MH	QHEI						4
14-2	Bull Creek	St. Route 137	1.00	4.0	8.4	F, MH	QHEI					3	
14-1	Bull Creek	St. Route 21	0.50	6.3	11.7	F, MH	QHEI	X	X		2		
14-4	West Branch Bull Creek	Northwind Boulevard	2.54	4.4	5.1	F, MH	QHEI	X	X			3	
14-3	West Branch Bull Creek	N. Countryside Drive	1.60	2.9	7.1	F, MH	QHEI						4
					Site Totals	30	30	14	14	1	4	17	8

	Mill Creek Subwatershed
	N. Mill Creek Subwatershed
	Des Plaines R. Tributaries (East)
	Bull Creek-Bull's Brook DPR Tribs. (West)

Spatial Survey Design

MBI developed a combined intensive pollution survey and geometric allocation of sites for the sampling of fish, macroinvertebrates, and habitat in 2016 (MBI 2017). This consisted of deriving progressive geometric panels of drainage area and assigning sampling sites where these occurred throughout the Upper Des Plaines watershed. Adding targeted sites to fill gaps in the longitudinal continuum left by the DRWW tiered design to fulfill a pollution survey design for the mainstem and major tributaries resulted in a total of 70 sites. Each sampling site was assigned a unique DRWW numeric site code, a river mile, and UTM coordinates by individual river or stream.

The 2019 (Year 3) study area included 30 sites total including 13 in the Mill Creek watershed, 6 in the Bull Creek watershed, and 11 in direct tributaries to the Des Plaines River. All sites were sampled for habitat, fish, macroinvertebrates and meter-read water quality at a minimum. Fourteen (14) sites were sampled continuously with YSI Datasonde units with one-half deployed for consecutive one-week low flow periods during August 2019 and with benthic chlorophyll-a samples collected at the same sites at which the Datasondes were deployed. DRWW grab water samples were collected during May-October 2019 in accordance with designations as Tier 1-3, for which specific analytes varied. No water samples were collected at Tier 4 sites, only the four (4) parameters that were measured with a water quality meter.

METHODS

All methods followed Illinois EPA and DNR procedures, except as modified to meet the needs of the DRWW, 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 selected parameters, and benthic chlorophyll a. Recreational use attainment was evaluated with *Escherichia coli* and using the U.S. EPA national criteria since none are available in the Illinois WQS.

Chemical/Physical Water Quality – Methods

Water Column Sampling

The specific methods of data collection followed Illinois EPA (2012a) and chemical laboratory analyses were provided by Suburban Labs. The chemical/physical parameter categories (demand, nutrients, metals, and organics) and the frequency of sample collection are summarized in DRWW (2016, 2018). DRWW assigned tiers to the sampling sites as follows:

- **Tier 1:** One (1) site located in Mill Creek that was sampled monthly for water May through September and November and March (seven times per year) for all demand[3], nutrient and bacteria parameters. Sediment samples analyzed for metals and organics are collected concurrent with a bioassessment.
- **Tier 2:** Four (4) sites (1 Mill Creek, 1 North Mill Creek, 1 Hastings Creek, 1 Bull Creek) were sampled monthly from May through September and in November and March (seven times per year) for the majority of demand, nutrient, and bacteria parameters. Sediment samples analyzed for metals and organics are collected concurrent with a bioassessment.
- **Tier 3:** Eighteen (18) sites (4 Mill Creek, 1 North Mill Creek, 2 Hastings Creek, 3 Bull Creek, 1 West Branch Bull Creek, 6 Des Plaines River Tribs.) were sampled from May through September and in November and March (seven times per year) for the majority of demand, nutrient, and bacteria parameters. Sediment samples analyzed for metals and organics are collected concurrent with bioassessment.
- **Tier 4:** Eight (8) sites (1 North Mill Creek, 1 Bull Creek, 1 West Branch Bull Creek, 5 Des Plaines River Tribs.) were not sampled for water chemistry. These sites were sampled with a water quality meter during each fish sampling event.

Sediment Sampling

Surficial sediments were sampled for bulk chemical analysis at 22 mainstem locations (Tier 1- 3) following Illinois EPA methods (Illinois EPA 2011b). Samples were collected in October 2019 and were analyzed by Suburban Labs.

Nutrient Effect Assessment Procedure

The 2019 assessment of the effects from nutrient enrichment was modeled after the Stream Nutrient Assessment Procedure (SNAP) developed by the Ohio EPA (2015b) and as used in the

Year 1 and 2 DRWW assessments (MBI 2018, 2020b), it includes consideration of the width of the diel variation in continuously measured D.O. and the biomass of chlorophyll a in benthic algae in addition to the concentration of total phosphorus and dissolved inorganic nitrogen (nitrates + nitrites). Other relevant parameters such as volatile suspend solids (VSS), turbidity, and total Kjeldahl nitrogen (TKN) are included when available at the 14 Datasonde and benthic chlorophyll a locations (Table 3). Datasondes were deployed for consecutive 3-4 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 IL IPS stressor analyses and a Nutrient Ranking Index that was also developed with IPS outputs were added to the analysis in 2019 (MBI 2020a; Appendix E). Together these results were used to determine five states of nutrient enrichment (none, low, moderate, high, and severe).

A summary of the number of water and sediment parameters and samples collected in 2019 are found in Table 6. The parameters analyzed and frequencies of collection varied by DRWW 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 Parameters	24	3538	73	1606
E. coli	1	306	0	0
Field Parameters	4	342	0	0
Demand[1]	1	304	0	0
Nutrients[2]	6	1375	1	22
Ionic Strength[3]	4	944	0	0
Suspended Materials[4]	2	186	0	0
Metals	8	81	20	440
Organic Compounds	0	0	51	1122
Other (Cyanide)	0	0	1	22

1 Includes field measured grab and continuous dissolved oxygen.
2 Includes total ammonia, total phosphorus, total nitrate, TKN, benthic chlorophyll a, sestonic chlorophyll a.
3 Includes total chloride, sodium, magnesium, and field/lab conductivity.
4 Includes total suspended solids and volatile suspended solids.

Biological Assemblage Sampling

Biological assemblages in the 2019 Year 3 study area included fish and macroinvertebrates at 30 instream locations. Biological and habitat sampling was conducted within a summer to early fall index period of June 16-October 15 for fish and July 1-September 30 for macroinvertebrates with exceptions noted below. All sampling occurred during periods of summer-fall base flows – periods of higher flows and elevated runoff were avoided. High flows caused by frequent rain events in July, August, and September prevented a second fish sampling pass at sites >20 square miles drainage area, prevented a sample from being conducted at all in Mill Creek at site 11-4, and delayed sampling of Mill Creek site 11-5 until October 18. Macroinvertebrate sampling was likewise affected by elevated flows preventing a sample from being collected in Mill Creek at 11-2. A habitat assessment was performed at all fish sites using the QHEI (Ohio

EPA 2006) and a site description accompanied each of the Illinois EPA multihabitat macroinvertebrate samples.

Fish Assemblage Methods

Fish were collected at 29 sites using wadeable electrofishing units and gear. Larger sites (>20 $mi.^2$) were sampled with a tote barge mounted electrofishing unit while headwater sites (<20 $mi.^2$) were sampled using a bank set long-line unit or a Wisconsin AbP-3 battery-powered backpack electrofishing unit and only where stream width and depth were within specifications for that unit (Ohio EPA 1989). Wadeable sites were sampled over a distance of 0.20 km and headwater sites were sampled at a distance of 0.15 km, each in an upstream direction. Tote barge and bank set long-line units utilized pulsed D.C. current produced by a Smith-Root 2.5 GPP pulsator powered by a 2.5 kW alternator and a 5.5 HP gasoline engine. Deference was given to the most effective method given the prevailing site and water characteristics. The upper boundary for using the battery-powered back pack electrofishing unit was two times the depth and five times the width of the net ring (anode; Ohio EPA 1989). Wider and deeper sites were sampled with the 2.5 GPP generator powered unit as a bank set longline or tote barge arrangement. Dip nets were used to assist in the capture of stunned fish. A two or three-person crew consisting of a fish crew leader and one or two field technicians conducted the sampling under summer-early fall base flow conditions.

Captured fish were placed in a live well or live net for processing at the end of each site. Water was regularly replaced and/or aerated to maintain adequate oxygen levels in the water as to minimize mortality. Samples from each site were processed by enumerating and recording weights by species and by life stage (young-of-the-year, juvenile, and adult) on a standard water resistant field sheet. The incidence of external anomalies was recorded following procedures outlined by Ohio EPA (1996, 2015a) based on refinements made by Sanders et al. (1999). Fish were released back into the water after they were identified to species, examined for external anomalies, and weighed either individually or in batches. Larval fish, if collected, were not included in a 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 a sampling reach) and site data was recorded on the QHEI field form.

While the majority of captured fish were identified to species in the field, any uncertainty about a field identification required vouchering for laboratory identification. Voucher specimens were preserved in borax buffered 10% formalin solution and labeled by date, stream, and geographic identifier (e.g., river mile and site number). Regional ichthyology keys were used including the Fishes of Illinois (Smith 1979) and updates available through the Illinois Natural History Survey (INHS). Scientific nomenclature followed Page et al. (2012). Vouchers were deposited at The Ohio State University Museum of Biodiversity (OSUMB) in Columbus, 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 and the Modified Index of Well-Being (MIwb; Ohio EPA 1987) in addition to expressions of species richness and relative abundance.

Macroinvertebrate Methods

Macroinvertebrate methods followed the Illinois EPA multi-habitat method (Illinois EPA 2011c,d) at all sites (Table 3). The Illinois EPA multi-habitat method involves the selection of a sampling reach that has instream and riparian habitat conditions typical of the assessment reach. Sampling reach requirements included flow conditions that approximate typical summer-early fall base flows, the absence of highly influential tributary streams, the presence of one riffle/pool sequence or analog (i.e., run/bend meander or alternate point-bar sequence), if present, and a length of at least 300 feet and a maximum of up to 800 feet. The collection of macroinvertebrates was accomplished with a d-frame dip net in all bottom-zone and bank-zone habitat types that occurred within a sampling site. Water conditions must allow a sampler to apply the 11-transect habitat-sampling method or to estimate with reasonable accuracy via visual or tactile cues the amount of each of several bottom-zone and bank-zone habitat types. All sites were marked with GPS coordinates (beginning and end of a sampling reach) and site data was recorded on a standard field form. Multi-habitat macroinvertebrate samples were field preserved in 10% formalin. Upon delivery to the MBI lab in Hilliard, OH the preserved samples were transferred to 70% ethyl alcohol. Laboratory procedures followed the Illinois EPA (2011e) methodology which requires the production of a 300-organism subsample from a gridded tray following a scan and pre-pick of large and/or rare taxa. Taxonomic resolution was at the lowest practicable resolution for the common macroinvertebrate assemblage groups such as mayflies, stoneflies, caddisflies, midges, and crustaceans, which goes beyond the genus level requirement of Illinois EPA (2011g). However, the calculation of the Macroinvertebrate IBI (mIBI) adhered to the Illinois EPA methods by using genera as the benchmark level of taxonomic resolution for mIBI scoring. Other analyses using the lowest resolution data were also accomplished.

Habitat Assessment

The QHEI (Rankin, 1989, 1995; Ohio EPA, 2006) was utilized as the primary habitat assessment methodology at each site. The assessment was conducted as a part of the fish assemblage method by the fish crew leader, who is trained and experienced in using the QHEI, during the initial sampling pass. The QHEI is comprised of six categories of habitat that influence the quality of the aquatic biota. The sum of the six categories ranges from 0-100, with scores of 60 or greater generally being regarded as sufficient to support the Genera Use for aquatic life while scores below 45 indicate substantial deficiencies in habitat for aquatic communities. These rules-of-thumb have been altered by the NE IL IPS analyses and the newer thresholds were used to assess habitat quality. A QHEI matrix (Rankin 1989, 1995) showing the occurrence of good and modified attributes was also developed to evaluate the overall capacity of the stream habitat to support the General Use at each site and to diagnose potential deficiencies that might be limiting to the aquatic assemblages.

Data Management

All data was managed by MBI in internal databases that permit ready access and analysis.

Biological and habitat data is stored in MBI ECOS which is a routine based on the Ohio ECOS format that MBI uses for all biological data management tasks. Biological data analysis included the calculation of the 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 A-C.

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. This is the presumed use applicable to all rivers and streams in Illinois which includes the 2019 study area. An assessment of aquatic life use attainability is therefore not a routine outcome of a biological and water quality assessment and was not performed herein. However, the data collected is adequate to determine if habitat is a limiting factor for any instances of non-support. Stressor thresholds, Restorability and Susceptibility/Threat factors, and other analyses based on five narrative categories consisting of excellent, good (meets General Use), fair, poor, and very poor quality were completed. These boundaries simulate the application of a tiered aquatic life use (TALU) framework (MBI 2020a).

Determining Use Attainment

The determination of the attainment status of the Illinois General Use for aquatic life generally followed the guidance in the 2018 Illinois EPA Integrated Report (Illinois EPA 2018) relying primarily on the biological results and attainment of the fIBI and mIBI thresholds expressed as fully supporting, partially supporting, non-supporting fair, and non-supporting poor, with the most limiting result of either the fish or macroinvertebrates determining the assignment of fair or poor. The addition of a partial support category and the five narrative condition categories goes beyond the current Illinois EPA structure, the former done to highlight where one assemblage attained their respective fIBI or mIBI biocriterion and the latter to support incremental analyses of condition both above and below the General Use benchmark.

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). The Northeastern Illinois Integrated Prioritization System (NE IPS; MBI 2020a) produces regionally derived stressor thresholds for more than 70 chemical and habitat variables as well as Restorability rankings for impaired sites and Susceptibility and Threat rankings for sites that attained the Illinois General Use biological criteria. These were used along with other stressor thresholds to evaluate the severity of any observed exceedances that correspond to biological impairments and response signatures.

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 (MBI 2020) to further refine the relative importance of categorical and/or parameter specific causes (Tables 7-9). 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 IL IPS derived exceedance thresholds for chemical and habitat parameters used in the causal analyses are used in the tabular and graphical presentation of the chemical water and sediment results. When combined with the Restorability and Susceptibility/Threat rankings, this improves the certainty of the assignment of causes and sources that correspond 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 our analyses. This 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). The administrative steps taken by Illinois EPA to issue NPDES permits (Level 1) and the steps taken by the permit holders (Level 2)

***Table 7**. Biological effect thresholds derived from Northeast Illinois streams and rivers for 31 water column parameters as part of the NE Illinois IPS development and used to assess results from the Year 3 Upper Des Plaines River 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 and reference site values (median and 2 times the interquartile range).*

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 30 sediment chemical parameters as part of the NE Illinois IPS development and used to assess results from the Year 2 Des Plaines River 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.*

Parameter Code	Variable Name	Units	Parameter Group	Limiting Assemblage	FIT Score	Sample N	Thresholds by Narrative Condition Category				
							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
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

***Table 9**. Biological effect thresholds derived from Northeast Illinois streams and rivers for 25 habitat and land use parameters as part of the NE Illinois IPS development and used to assess results from the Year 2 Des Plaines River 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.*

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

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.

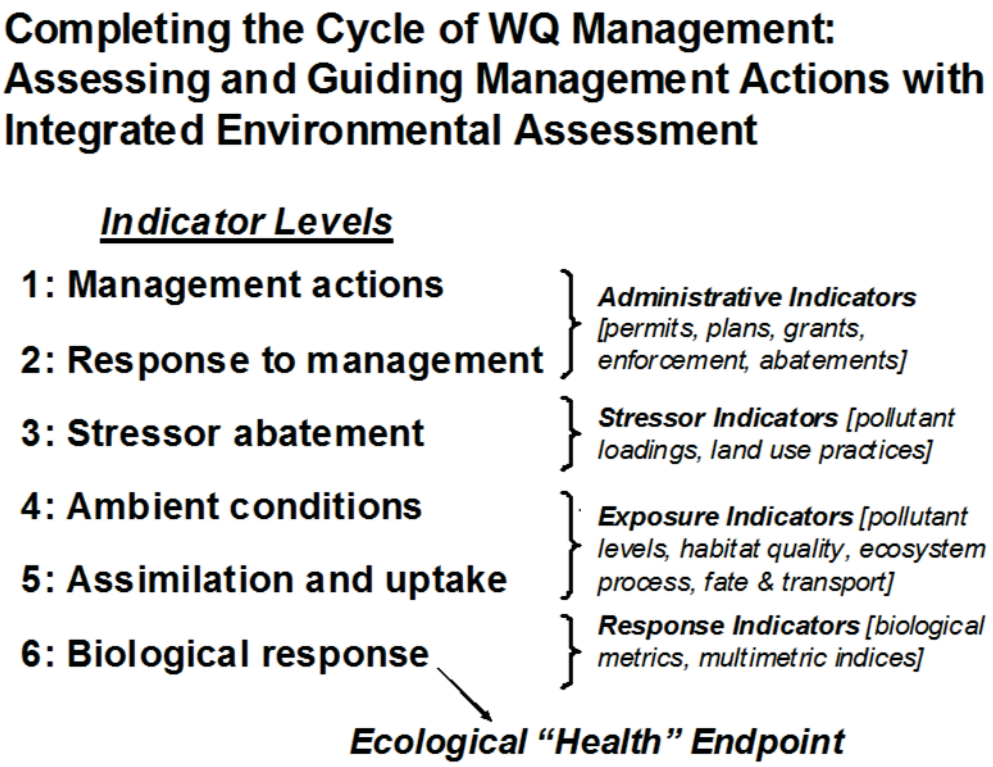

Figure 3*. The hierarchy of administrative and environmental indicators which can be used to support monitoring and assessment, reporting, and an evaluation of the effectiveness of pollution controls on a receiving stream. This is patterned after a model developed by U.S. EPA (1995a,b) and enhanced by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

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 2019 Year 3 study area was characterized by grab sample data collection from the water column six times at each Tier 1-3 sites during summer-fall base flows and four times at the Tier 4 sites[1]. Sediment chemistry was collected at the 22 Tier 1-3 sites in October 2019. Commonly detected chemical parameters were compared either to the criteria in the Illinois WQS, Illinois EPA non-standard benchmarks, reference benchmarks, and/or biologically derived thresholds from the NE IL IPS tool and dashboard (MBI 2020a; Table 4). 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 of the Year 3 study area during the period of May 1 – October 31 for 2016 and 2019 monitoring years is depicted in Figure 4 based on the gauge operated by the U.S. Geological Survey on Mill Creek near Old Mill Creek, IL (USGS 05527950). The flow regime was comparatively higher in 2019, primarily above the 75th percentile with a single period below the $Q_{7,10}$ during the month of August. By contrast flows during the baseline bioassessment in 2016 were much lower with extended periods at or even below the $Q_{7,10}$ for extended periods during the summer-early fall index period. The high flows during the months of August and September 2019 prevented a second sampling event by the fish crew and samples were not collected in Mill Creek at site 11-4 for fish or site 11-2 for macroinvertebrates. Flows were at levels acceptable to conduct the biological survey in late July-early August and by mid-October 2019.

Point Source Effluent Quality

The two major point sources in the 2019 Year 3 study area are the Mill Creek WWTP and the Village of Lindenhurst Sewage Treatment Plant (STP). The Mill Creek WWTP discharges one mile upstream from the confluence of Mill Creek with the Des Plaines River mainstem and has previously been included in the mainstem bioassessment (MBI 2017, 2020b). The WWTP has a maximum discharge rate of 2.1 million gallons per day (MGD) which is 11% of the $Q_{7,10}$ of Mill Creek measured at the USGS gauge at Old Mill Creek, IL (05527950). The Village of Lindenhurst WWTP has a maximum discharge rate of 5.7 MGD, which is 2600% of the $Q_{7,10}$ flow measured at the gauge in Hastings Creek near Lindenhurst, IL (05527905). As a result Hastings Creek is effluent dominated due to the majority of the flow being provided by the Village of Lindenhurst WWTP, while the lower one mile of Mill Creek has a comparatively lower amount of effluent influencing flow for the lesser distance affected by the Mill Creek WWTP.

[1] The DRWW chemical monitoring includes samples collected outside the summer-fall seasonal index period and are not reported herein.

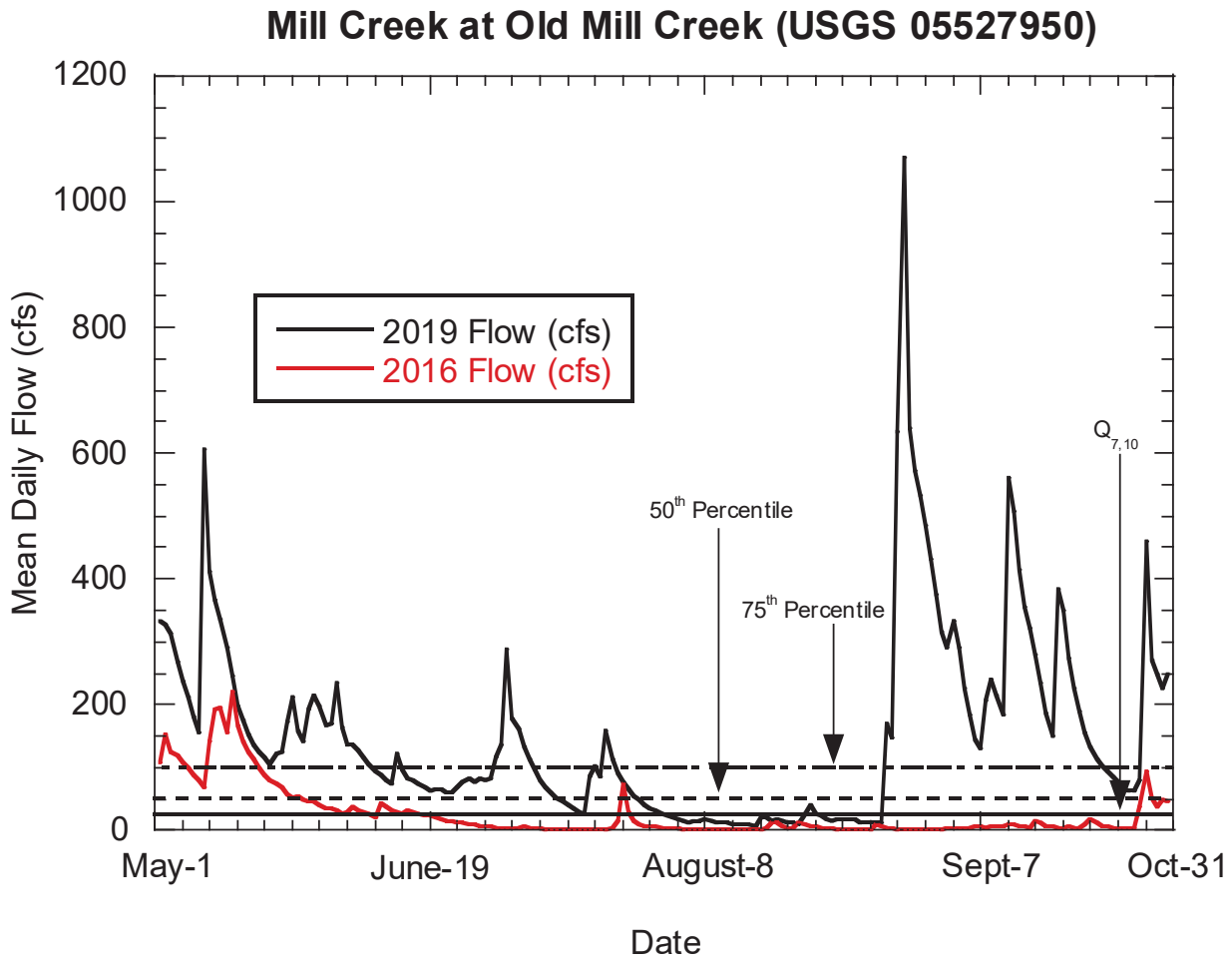

***Figure 4**. Daily flow measured at the USGS gage on Mill Creek (USGS 05527950) at Old Mill Creek, IL during the calendar year of 2019. The horizontal lines are the 75th percentile, 50th percentile and the seven-day, ten year ($Q_{7,10}$) critical low flows.*

Lake Co. DPW Mill Creek WWTP

An annual average of 0.908 MGD from the Mill Creek plant (NPDES Permit No. IL0071366) was recorded flowing into Mill Creek at river mile 1.2 in 2019. The design average flow (DAF) is 0.9 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 2.1 MGD. Treatment consists of screening, grit removal, activated sludge, sedimentation, filtration, ultraviolet disinfection, sludge handling facilities, and biological phosphorus removal with chemical addition as a backup system.

Village of Lindenhurst WWTP

An annual average of 1.28 MGD from the Village of Lindenhurst STP (NPDES Permit No. IL0020796) was recorded flowing into Hastings Creek at river mile 2.8, downstream of County Highway 18, in 2019. The DAF for the facility is 2.0 MGD and the DMF is 5.7 MGD. Treatment consists of screening, activated sludge, sedimentation, filtration, disinfection, aerobic digestion and sludge storage.

Between the two WWTPs, the Lindenhurst WWTP had the highest effluent flow (1.28 vs. 0.91 MGD), $CBOD_5$ loading (29.55 vs. 7.41 lbs./day), total suspended solids loading (34.21 vs. 15.97 lbs./day), ammonia-N loading (1.50 vs. 0.77 lbs./day), and total phosphorus loading (6.79 vs. 0.92 lbs./day; Figure 4). The Mill Creek WWTP discharged a higher loading of nitrate-N (85.95 vs. 28.89 lbs./day).

Water Column Chemistry

The water column chemistry results were analyzed for spatial patterns resulting from the pollution survey design in the Year 3 Des Plaines River study area. The results were screened for exceedances of Illinois WQS, Illinois non-standard benchmarks, regional reference benchmarks, and biological effect thresholds derived from the NE Illinois IPS (Tables 7 and 8) were assessed. Exceedances of these benchmarks and thresholds are indicated on the plots and tables of the 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 of these consist of correlations between concentrations of substances that correspond to biological quality gradients across significant 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 Working Group (DRSCWG; 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 in the Des Plaines Year 3 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 Illinois EPA (Short 1998). 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 the chemical exceedance with the biological impairment. The chemical results are also displayed graphically for selected parameters and in tables of exceedances of effect thresholds for select parameter groups for both water column and sediment chemistry results. With the exception of D.O. there were no exceedances of parameters that have Illinois EPA water quality criteria.

Demand and Nutrient Related Parameters

Demand and nutrient related parameters consist of those related to the discharges of treated

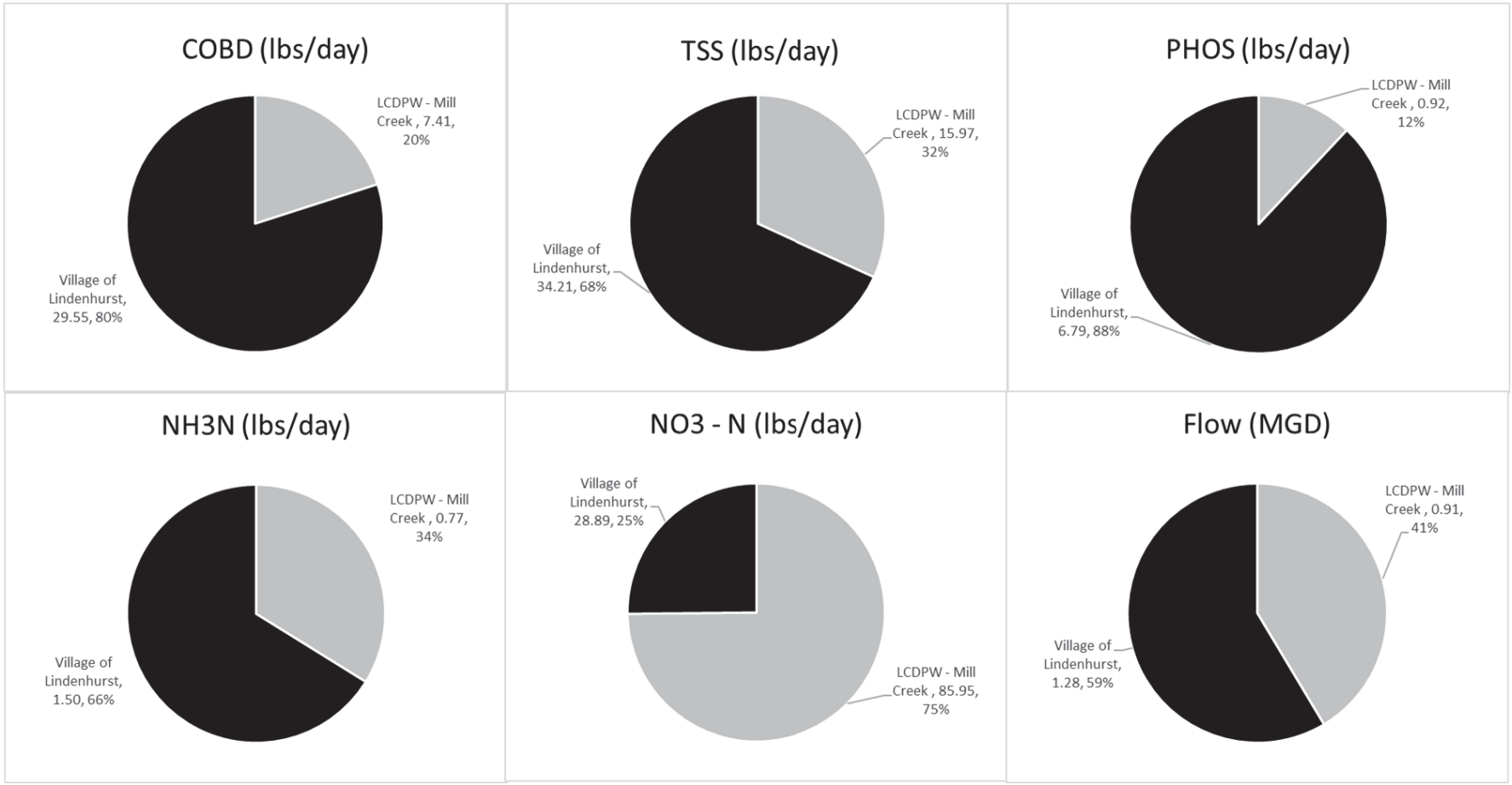

***Figure 5**. Proportions of effluent flow (MGD) and pollutant loadings (lbs./day) discharged by the two major WWTPs in the 2019 study area. Proportions and loadings are based on the annual averages of each parameter. Discharges are listed in order from upstream to downstream in the inset table (below).*

Facility	Flow (MGD)	$CBOD_5$ (lbs/day)	TSS (lbs/day)	NH_3-N (lbs/day)	NO_3-N (lbs/day)	Total P (lbs/day)
Village of Lindenhurst	1.28	29.55	34.21	1.50	28.89	6.79
LCDPW-Mill Creek	0.91	7.41	15.97	0.77	85.95	0.92

and untreated sewage, organic enrichment from point and nonpoint sources, and nutrient related parameters (nitrogen and phosphorus) and those that reflect their effects such as benthic and sestonic chlorophyll a and dissolved oxygen (D.O.).

Dissolved Oxygen (D.O.)

Exceedances of dissolved oxygen (D.O.) were assessed primarily with continuous data obtained from short-term Datasonde deployments during mid to late August 2019, but grab samples collected by the fish crew are included in Table 10. The deployments of Datasonde continuous recorders in mid-August 2019 recorded exceedances of parts of the Illinois EPA D.O. criteria (Figure 5). All of the deployments were made after August 1 hence the minimum was evaluated against the 3.5 mg/L minimum criterion and the 5.5 mg/L 30-day average criteria. There was insufficient data to evaluate the weekly and rolling average aspects of the Illinois EPA D.O. criteria. Exceedances of the 3.5 mg/L minimum criterion occurred at four sites in the 2019 study area (Figure 5). The median value indicating that more than one half of the readings were below the 3.5 mg/L minimum criterion occurred in Mill Creek at RM 13.8 (site 11-5 at Washington Str.) and at RM 2.54 in the West Branch of Bull Creek (site 14-4 at Northwind Blvd.). The other two sites, RM 10.1 in Mill Creek (site 11-4) and RM 1.68 in Hastings Creek (site 10-4) had minimum values at or just below the 3.5 mg/L minimum. Exceedances of the 30-day average of 5.5 mg/L occurred at eight (8) sites with exceedances occurring in each of the monitored watersheds. Most exceedances of the 30-day average were minor compared to RM 13.8 and 10.1 in Mill Creek mainstem and RM 2.5 in the West Branch of Bull Creek. More than 75% of the readings at the two Mill Creek sites were below the 30-day average of 5.5 mg/L with nearly all readings in the West Branch of Bull Creek below the 30-day average. The Mill Creek (site 11-5) and West Branch Bull Creek (site 14-4) are located between a wetland pond and a lake, respectively, that correspond to the low D.O. levels. The results in Mill Creek suggest a classic sag and recovery longitudinal pattern with the source as of yet unknown. The site in Hastings Creek at RM 1.68 located downstream and upstream of the Lindenhurst WWTP showed the widest diel variation of nearly 10 mg/L with more than one half of the D.O. values below the 30-day average criterion. The daytime grab sample data did reveal daytime values above the NE Illinois IPS fair threshold indicative of moderate nutrient enrichment at three sites (Newport Drainage Ditch, Slocum Creek, and West Fork Belvidere Rd.) that were not assessed with continuous data nor the SNAP procedure. Three sites with low daytime values below the NE Illinois IPS poor threshold were confirmed by the Datasonde results.

Ammonia-Nitrogen (N)

Mean total ammonia-N were mostly at background or only slightly elevated levels in 2019 (Figure 6; Table 10) with the exception of three sites including mean and maximum values of 0.88 mg/L and 2.44 mg/L in the Suburban Country Club Tributary at RM 2.75, 0.77 mg/L and 2.11 mg/L in the Unnamed Tributary to Greenleaf Creek at RM 0.4, and 0.65 mg/L and 1.73 mg/L at the second most upstream site in Mill Creek at RM 13.8. Both the maximum and mean values exceeded a representative ammonia-N criterion for the General Use at a temperature of 25°C and pH of 8.5 S.U. and all exceeded the very poor threshold of the NE Illinois IPS (Table 7). However, ammonia-N criteria exceedances are sensitive to elevated pH especially and, as such,

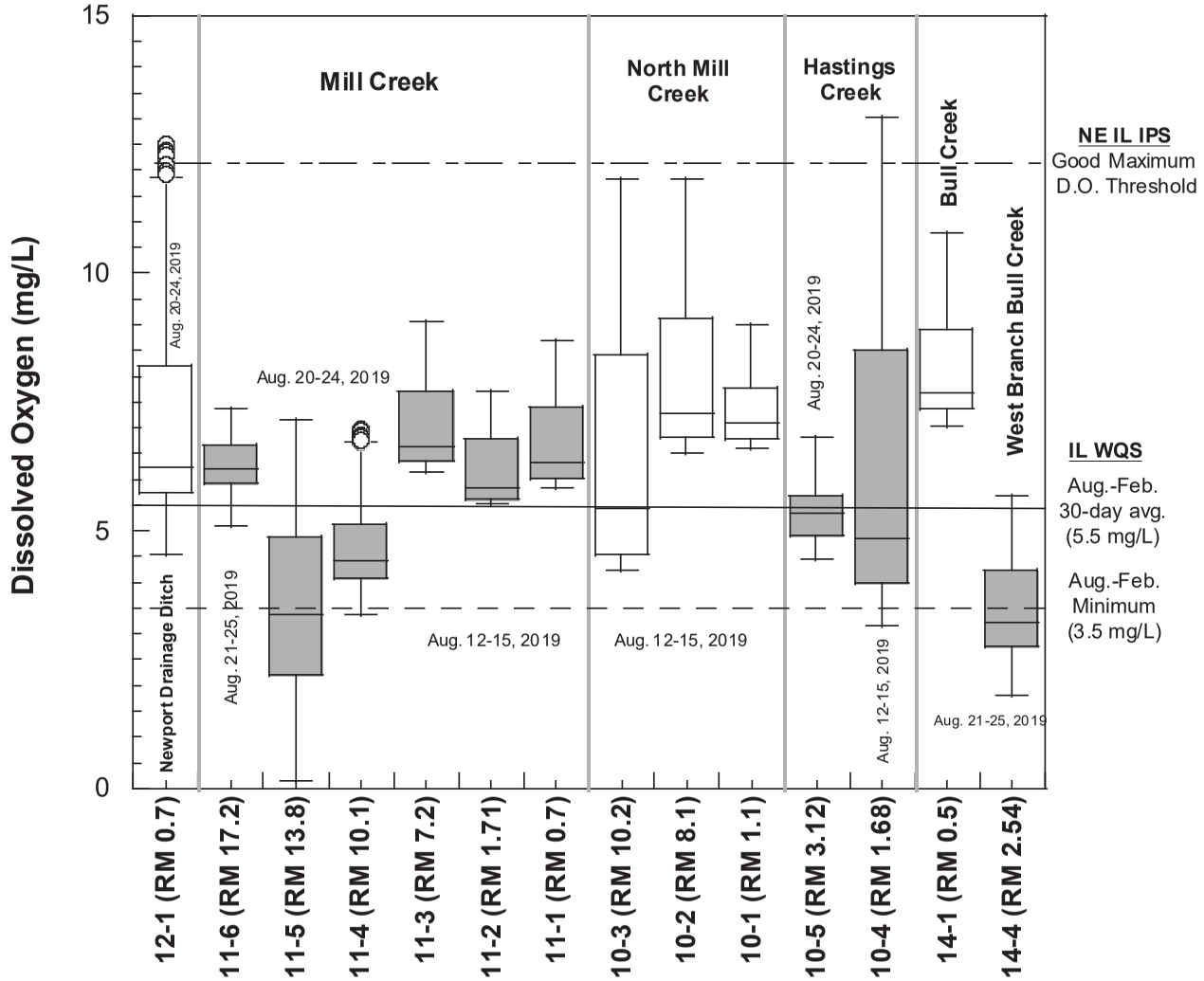

***Figure 6**. Dissolved oxygen (D.O.) concentrations (mg/L) measured continuously by Datasondes deployed for 3-4 day periods during August 12-15, 2019, August 20-24, 2019, and August 21-25, 2019 at 14 locations in the Year 3 Upper Des Plaines study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The Illinois EPA August-February minimum (3.5 mg/L) and the 30-day average D.O. criteria are shown by solid and dashed lines.*

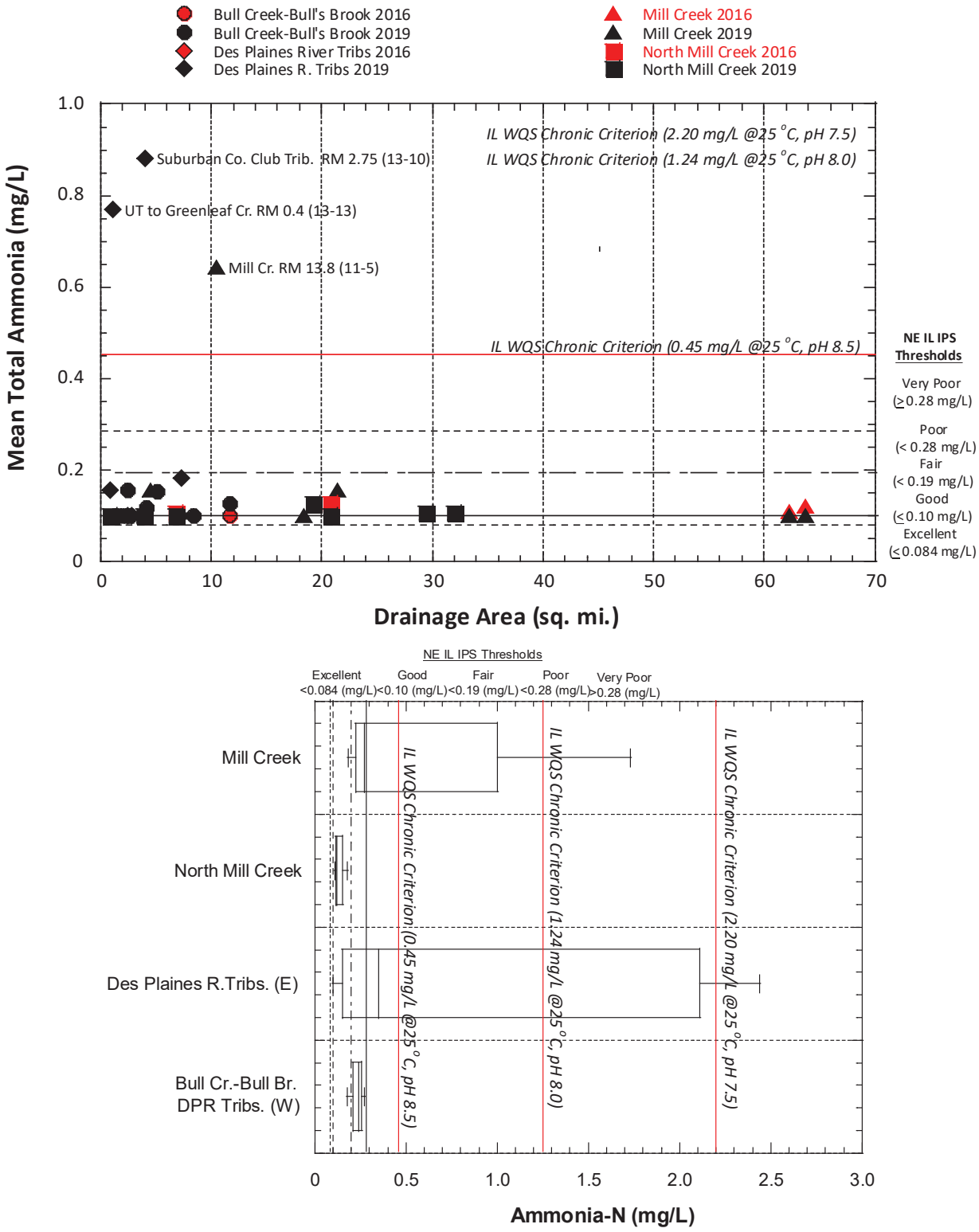

***Figure 7**. Concentrations of ammonia-N by subwatershed and stream in the Year 3 2019 study area. Mean values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent effect thresholds from the NE Illinois IPS (Table 7).*

concentrations (mg/L) and chlorophyll a values based on grab samples collected at 30 locations in the Year 3 2019 Upper Des Plaines River subwatershed study area. Shading is based on threshold exceedances listed at the bottom of the table.

Site ID	River Mile	Drainage Area (sq. mi.)	D.O. (mg/L)	Ammonia-N (mg/L)	Nitrate-N (mg/L)	TKN (mg/L)	Total Phos-phorus (mg/L)	Chloro-phyll a Benthic	Chloro-phyll a Sestonic
Mill Creek									
11-6	17.20	4.50	7.1	0.160	0.824	2.80	0.093	43.42	8.90
11-5	13.80	10.40	10.4	0.640	0.346	1.87	0.100	17.05	8.00
11-4	10.10	18.30	-	ND	0.126	2.37	0.071	29.14	8.40
11-3	7.20	21.40	8.5	0.160	0.177	3.03	0.109	37.19	9.70
11-2	1.71	62.30	6.4	ND	0.617	1.84	0.129	34.45	14.20
11-1	0.70	63.80	7.3	ND	1.013	1.99	0.167	17.64	14.85
North Mill Creek									
10-7	11.30	19.23	4.1	0.180	0.604	1.45	0.153	-	-
10-3	10.20	20.86	9.3	ND	0.398	2.04	0.144	22.46	4.45
10-2	8.10	29.57	9.0	0.107	0.922	1.46	0.169	37.30	6.85
10-1	1.10	31.97	6.5	0.105	0.909	1.54	0.127	31.30	ND
Hastings Creek									
10-5	3.12	3.91	7.3	ND	ND	2.64	0.061	30.02	7.40
10-4	1.68	5.60	9.3	ND	1.121	2.74	0.146	43.70	11.45
Unnamed Tributary to North Mill Creek @RM 0.75									
10-6	0.04	0.99	8.9	ND	0.381	1.81	0.101	-	ND
Newport Drainage Ditch									
12-2	3.03	2.80	9.5	ND	0.208	2.28	0.116	-	8.80
12-1	0.70	7.35	12.3	0.183	0.161	1.57	0.100	33.61	4.40
Suburban Country Club Tributary									
13-10	2.00	4.00	8.8	0.880	ND	2.74	0.074	-	4.30
Slocum Creek									
13-11	1.36	2.40	12.9	0.100	0.211	1.99	0.102	-	7.00
Unnamed Tributary to Greenleaf Creek @RM 0.64									
13-13	0.40	1.10	7.7	0.770	0.266	1.92	0.097	-	-
Unnamed Tributary to DesPlaines River @RM 89.5									
13-17	0.13	0.90	11.3	ND	0.508	2.18	0.116	-	-
Stoneroller Creek									
13-9	0.42	4.10	9.4	0.117	0.294	ND	0.045	-	5.00
West Fork Belvidere Rd. Tributary									
13-14	0.21	2.30	12.3	ND	0.150	2.89	0.083	-	-
13-8	0.15	3.80	12.1	ND	0.199	1.65	0.086	-	ND
Bull's Brook									
13-15	1.95	1.90	7.2	ND	ND	3.10	0.065	-	-
13-7	0.25	2.70	8.0	ND	0.180	2.91	0.059	-	6.60
Bull Creek									
14-6	5.95	2.40	3.5	0.117	0.164	2.21	0.161	-	7.35
14-5	4.70	1.30	10.2	ND	0.137	2.39	0.092	-	-
14-2	1.00	8.40	8.6	ND	0.232	ND	0.062	-	5.20
14-1	0.50	11.70	10.6	0.128	0.246	1.86	0.075	48.29	12.00
West Branch Bull Creek									
14-4	2.54	5.10	3.9	0.153	0.567	2.42	0.106	19.77	13.00
14-3	1.60	7.10	9.0	ND	0.525	ND	0.107	-	-
Condition Category Thresholds	Excellent		>8.0;<10.3	<0.084	<3.767	<1.07	<0.106	<35	<2.5
	Good		<6.5;>10.4	<0.100	<5.045	<1.12	<0.277	35-79	>2.5-5.1
	Fair		<5.5;>12.2	<0.190	<7.344	<1.63	<1.022	79-150	>5.1-13.8
	Poor		<4.5;>14.2	<0.280	<9.643	<2.14	<1.726	150-320	>13.8-28.9
	Very Poor		<3.4;>16.3	>0.280	>9.643	>2.14	>1.726	>320	>28.9
Source	**IPS**		IPS	IPS	IPS	IPS	IPS	SNAP/NSAC	MBI/NSAC
	Illinois WQS		Yes	0.450*	None	None	500.000	None	0.0302

* - at pH 8.0 and temperature 25°C.

there can be higher total ammonia-N values that are not exceedances of the water quality criterion at lower ambient pH levels. The criterion increases to 2.20 mg/L at a pH of 7.5 and is 1.24 at a pH of 8.0. Nevertheless, ammonia-N levels that exceed the very poor IPS threshold are likely problematic for aquatic life use attainment. The source of these highly elevated ammonia-N values is unknown, but the Mill Creek value corresponds to the very low D.O. value measured at the same site (Figure 5) which corresponds to the influence of wetlands. None of the ammonia-N values seemed to correspond to the two WWTP discharges as each provides ample treatment as evidenced by values below detection immediately downstream from each. While values from 2016 are depicted in Figure 6 there were significantly fewer measurements taken under the prior chemical monitoring strategy and while none were at levels of concern, the comparatively paltry coverage likely missed the "hotspots" revealed by the more spatially robust sampling in 2019.

Nitrate-Nitrogen (N)

Levels of nitrate-N were low throughout the Year 3 subwatersheds being well within the excellent threshold of the NE Illinois IPS and well below other recognized thresholds including reference values (Table 10; Figure 7). The highest values tended to occur at sites in the lower reaches of the mainstems and the two highest values occurred below the Lindenhurst WWTP on Hastings Creek and the LCDPW Mill Creek WWTP on Mill Creek. By comparison the values in 2016 were higher at selected locations especially in North Mill Creek, but still within the excellent range of the NE Illinois IPS threshold.

Total Kjeldahl Nitrogen (TKN)

Total organic nitrogen as measured by Total Kjeldahl Nitrogen (TKN), an indicator of the living or recently dead fraction of sestonic algae, can be an indicator of nutrient enrichment. While TKN is not a direct effect parameter, it is indicative of the effects of organic enrichment by nitrogenous biomass. It has proven to be an effective indicator of excessive organic enrichment in runoff from urban and suburban nonpoint sources. Median TKN values were above the poor and very poor NE Illinois IPS threshold at 19 of the 29 sites where it was measured in 2019 (Table 10). With the exception of two sites with values below detection, the remainder were in excess of the fair IPS threshold. Very poor values occurred in Mill Creek, Hastings Creek, Newport Drainage Ditch, Suburban Country Club Tributary, Unnamed Tributary to the Des Plaines River at RM 89.5, the West Fork Belvidere Rd. Tributary, Bulls Brook, upper Bull Creek, and the West Branch Bull Creek. Mill Creek and the Des Plaines East Tributaries had the highest TKN values among the four subwatershed bundles (Figure 8). There were no clear patterns related to stream size (Figure 8). While the 2016 database was comparatively sparse what TKN values were measured were consistently lower than at the same locations in 2019. This is possibly a reflection of the reduced runoff during the much drier seasonal index period in 2016 compared to the frequent runoff events in 2019 as reflected by elevated stream flows.

Total Phosphorus (P)

All median total P values were in the excellent or good range of the NE Illinois IPS thresholds in 2019 (Table 10). Values tended to increase with watershed size with the smaller drainages and

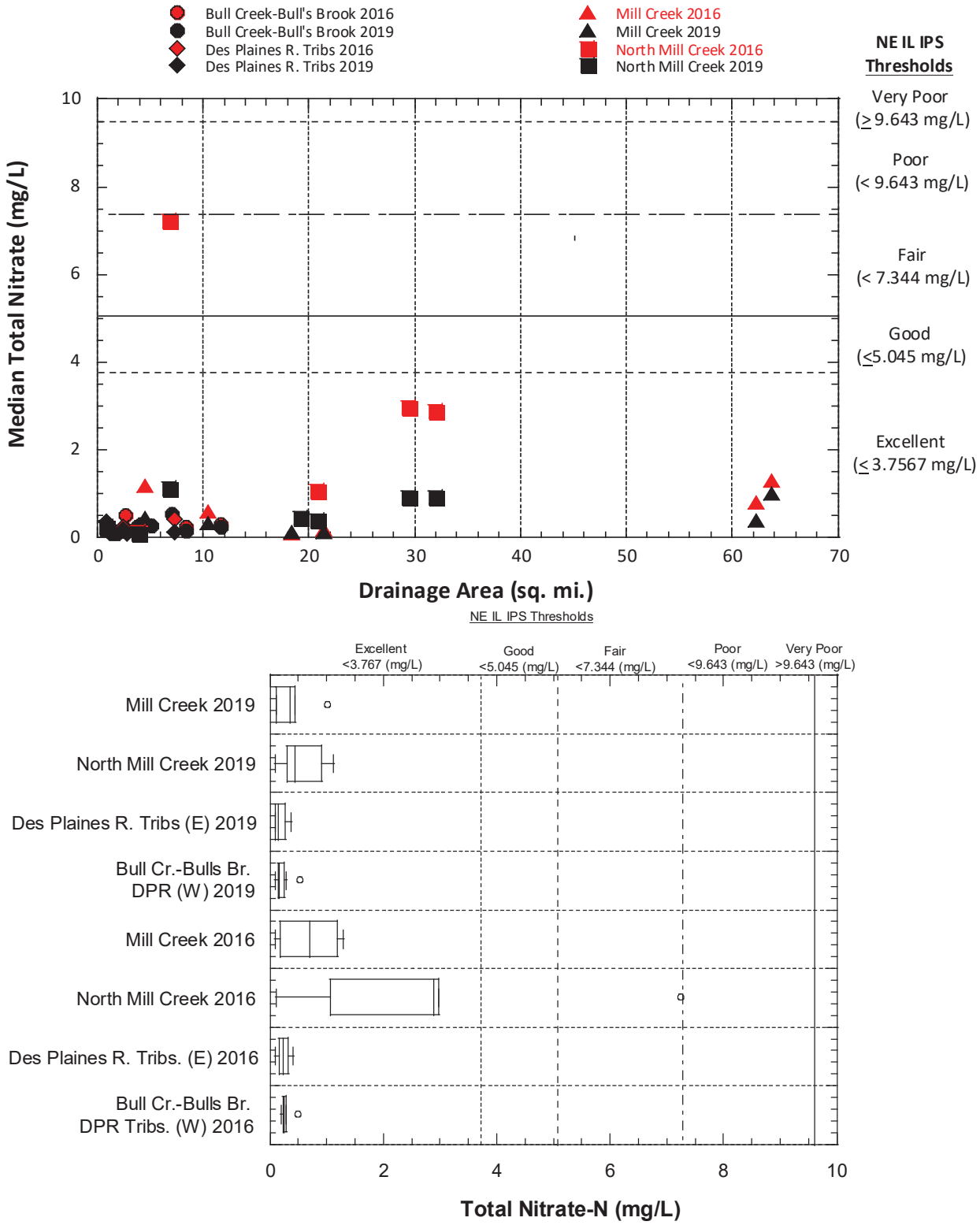

***Figure 8**. Concentrations of nitrate-N by subwatershed and stream in the Year 3 2019 study area. Median values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent effect thresholds from the NE Illinois IPS (Table 7).*

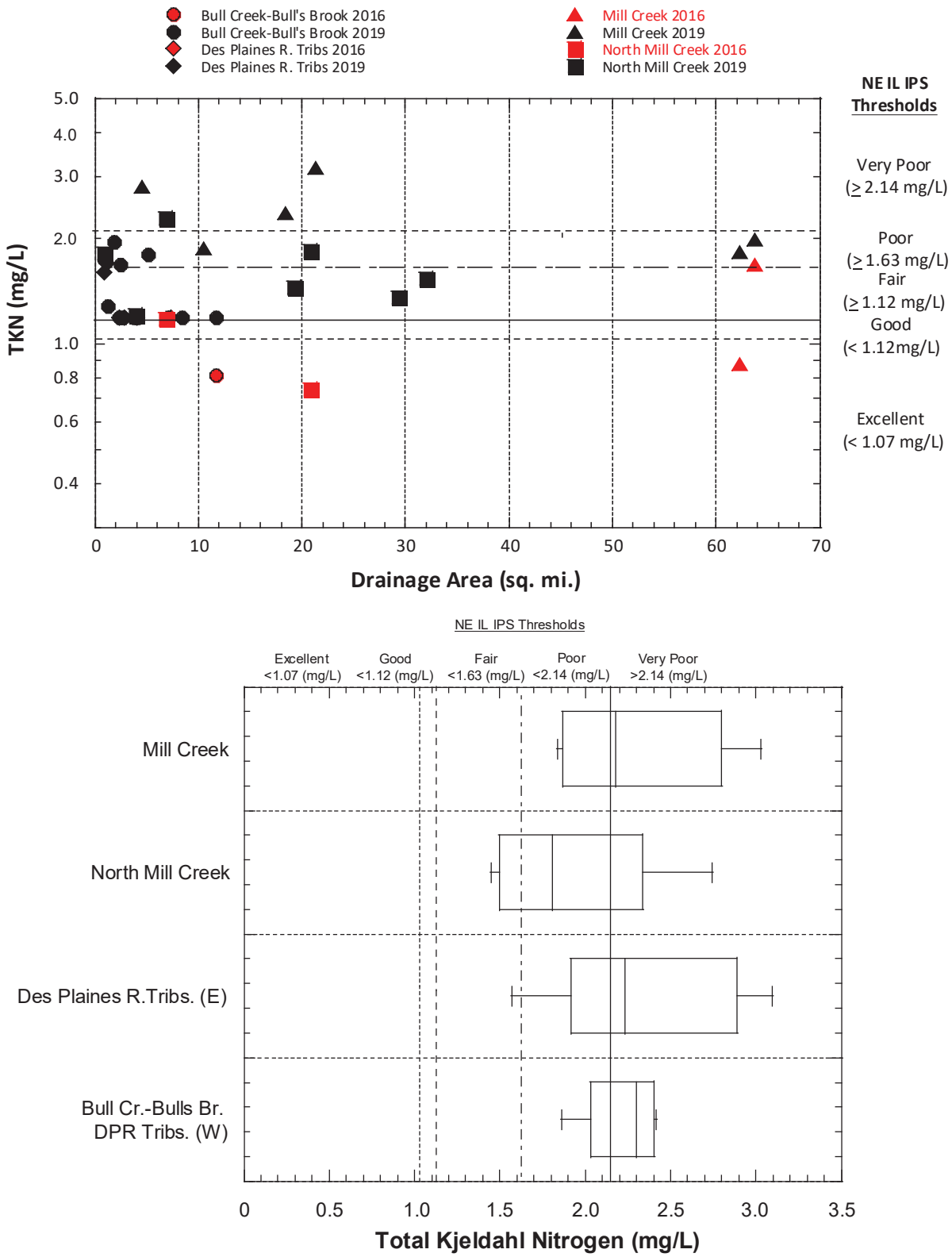

***Figure 9**. Concentrations of total Kjeldahl nitrogen (TKN) by subwatershed and stream in the Year 3 2019 study area. Median values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent effect thresholds from the NE Illinois IPS (Table 7).*

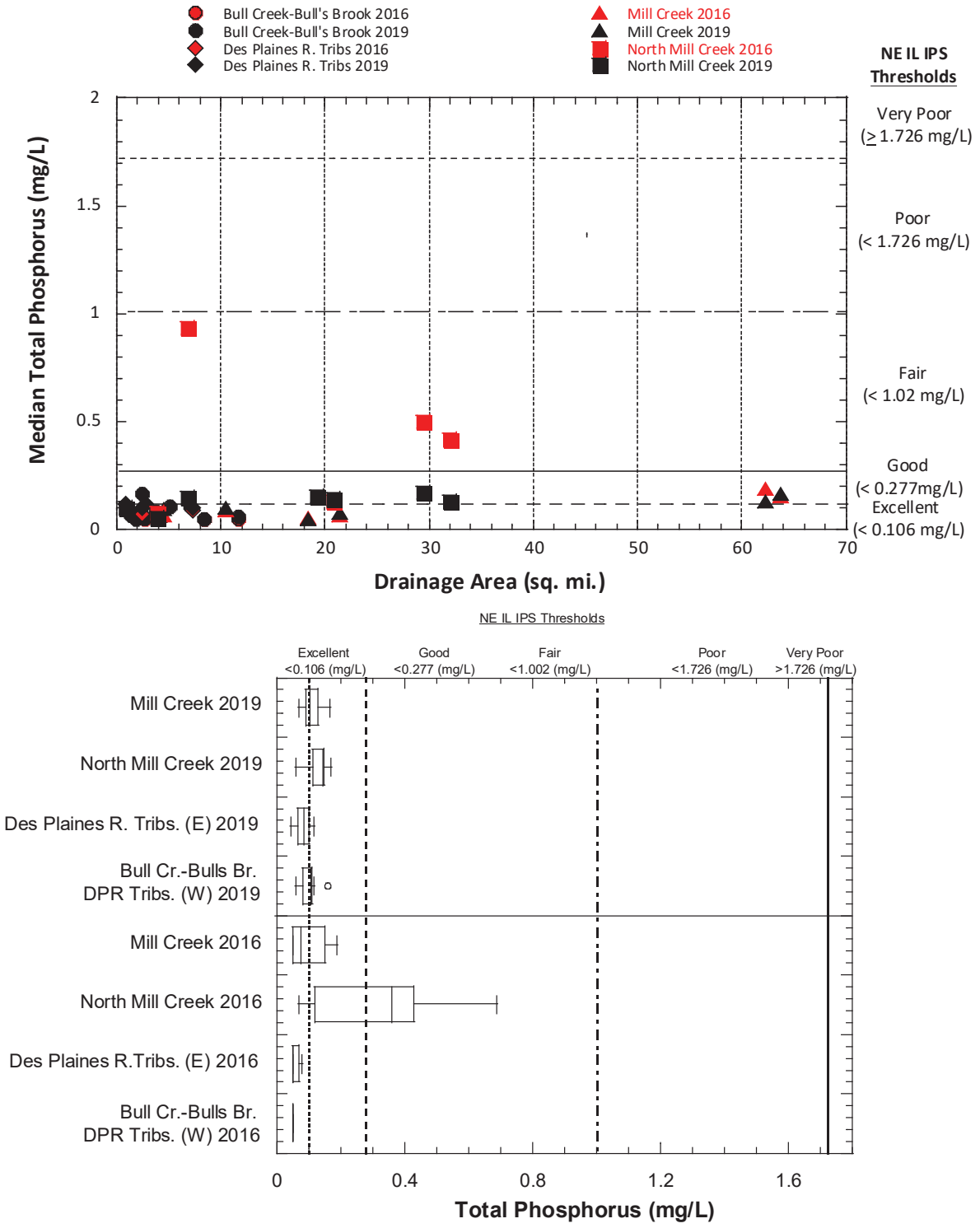

***Figure 10**. Concentrations of total phosphorus (P) by subwatershed and stream in the Year 3 2019 study area. Median values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent effect thresholds from the NE Illinois IPS (Table 7).*

the tributaries consistently in the exceptional range (Figure 9). There were no obvious patterns related to the two major WWTPs. Values were similar in 2016 to 2019 with the exception of North Mill Creek that had higher values in 2016 in the fair range of the IPS thresholds (Figure 9).

Chlorophyll a

The biomass of chlorophyll a was measured as sestonic (suspended in the water column) at all tier 1-3 sites and as benthic (periphytic growth on substrates) at the 14 Datasonde sites once during their deployment in August 2019 (Table 10). Chlorophyll is a green pigment that is present in all green plants and in cyanobacteria that absorbs light energy for photosynthesis. Generally the sestonic and benthic chlorophyll a samples consist of algae the populations and biomass of which are related to nutrient enrichment, phosphorus in particular. While algae are an expected component of any aquatic system an overabundance can adversely affect water quality via excessive algal and plant photosynthesis (daytime) and respiration (nighttime) that in turn affects the D.O. and pH regimes. Wide diel swings in D.O. between daytime and nighttime can occur and in turn have adverse effects of aquatic life. The same can happen with pH becoming excessively high during the day which can increase the toxicity of pollutants such as unionized ammonia-N. Previous studies of the relationship between chlorophyll a biomass and adverse effects on the D.O. regime and aquatic life (Ohio EPA 2015b; Illinois NSAC 2018) have resulted in MBI developing preliminary thresholds that are associated with aquatic life condition and well-being (Table 10). The 2019 survey was the first attempt to use chlorophyll a biomass in a combined nutrient effects assessment that also included allied parameters in addition to the primary nutrients of phosphorus and nitrate-N. Miltner (2018) identified these other non-nutrient parameters as co-indicators of the adverse effects of nutrient enrichment.

Benthic chlorophyll a values were well within the excellent and good ranges as derived mostly from the Ohio EPA Stream Nutrient Assessment Procedure (Ohio EPA 2015b) and also from the Illinois Nutrient Science Advisory Committee (Illinois NSAC 2018). These results alone do not suggest algal biomass is excessive enough to reflect serious nutrient enrichment, but the Ohio EPA SNAP was developed mostly in streams with moderate gradients and gravel-cobble substrates which are less common in NE Illinois. Nevertheless, MBI has employed this methodology since 2017 beginning with the Year 1 Upper Des Plaines subwatersheds assessment (MBI 2018), the Year 2 Upper Des Plaines mainstem assessment (MBI 2020b), and the 2018-19 North Branch Chicago River watershed assessment (MBI 2021). The results in those surveys were somewhat similar showing mostly excellent and good levels of benthic chlorophyll a biomass with the exception of four Year 1 Upper Des Plaines sites that had two fair, one poor, and one very poor result (MBI 2018). With increasing collection of this data throughout NE Illinois these thresholds will likely be reevaluated.

Sestonic chlorophyll a values in 2019 were excellent and good at six sites, fair at 14 sites, and poor at two sites as derived mostly from the Illinois NSAC (2018) recommendations. In Mill Creek the four upstream sites were fair and the two downstream most sites were poor. The remaining fair sites were located in North Mill Creek (1), Hastings Creek (2), Newport Drainage Ditch (1), Slocum Creek (1), Bulls Brook (1), West Branch Bull Creek, and all sites sampled in Bull Creek (3). These results roughly compare to the 2018-19 North Branch results (MBI 2021).

Values were consistently higher in the Upper Des Plaines mainstem, but this would be expected in a larger river. Here again, as the database is better developed across NE Illinois these thresholds will likely be reevaluated.

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 DRWW 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 more conventional descriptions of concentrations 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 refinements made in the 2018 Upper Des Plaines River mainstem assessment (MBI 2020b) and the 2018-19 North Branch Chicago River watersheds assessment (MBI 2021). 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 Biological 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 and sestonic chlorophyll a (as biomass), and an overall rating of the degree of nutrient enrichment based on the frequency and magnitude of

***Table 11**. Results of applying an interim modified Stream Nutrient Assessment Procedure to 14 sites in the 2019 Year 3 Upper Des Plaines watersheds study area. Descriptions of how each result reflects the degree of nutrient enrichment effects and results in an assignment of enrichment status are at the bottom of the matrix along with the source of the narrative thresholds for each parameter. Biological sampling sites that lacked sufficient D.O., chemical, and chlorophyll a data are included for comparison of the biologic, habitat, and water quality results.*

Site ID	River Mile	Drainage Area ($mi.^2$)	fIBI	mIBI	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 Chlorophyll a (mg/m^3)	Benthic Chlorophyll a Narrative	TSS (mg/L)	TKN (mg/L)	Sestonic Chloro-phyll a (mg/L)	Enrichment Status	Biological Nutrient Index	Rationale for Enrichment Status
Mill Creek																				
11-6	17.20	4.50	20	29.6	40.00	NON-Poor	0.093	0.824	7.37	5.11	1.99	Normal	43.42	Very Low	-	2.80	8.90	Likely Nutrients	9.46	Elevated Sestonic; extreme elevated TKN
11-5	13.80	10.40	22	32.1	52.75	NON-Poor	0.100	0.346	7.16	0.16	6.51	Wide	17.05	Very Low	-	1.87	8.00	Enriched	7.76	Wide D.O. swing; elevated TKN, Sestonic
11-4	10.10	18.30	-	43.0	-	[FULL]	0.071	0.126	6.96	3.38	3.08	Low	29.14	Very Low	-	2.37	8.40	Enriched	8.98	Elevated Sestonic; extreme elevated TKN
11-3	7.20	21.40	21	45.1	62.00	NON-Poor	0.109	0.177	9.07	6.15	2.76	Low	37.19	Very Low	-	3.03	9.70	Likely Nutrients	10.18	Elevated Sestonic; extreme elevated TKN
11-2	1.71	62.30	29	-	80.00	[NON-Poor]	0.129	0.617	7.71	5.53	2.18	Low	34.45	Very Low	62.25	1.84	14.20	Enriched	8.54	Highly elevated Sestonic; highly elevated TKN
11-1	0.70	63.80	23	58.5	68.50	NON-Poor	0.167	1.013	8.7	5.85	2.85	Low	17.64	Very Low	64.25	1.99	14.85	Enriched	10.08	Highly elevated Sestonic; highly elevated TKN
North Mill Creek																				
10-7	11.30	19.23	18	54.2	37.00	NON-Poor	0.153	0.604	-	-	-	-	-	-	-	1.45	-	-	8.76	-
10-3	10.20	20.86	16	36.3	59.00	NON-Poor	0.144	0.398	11.83	4.23	7.50	Wide	22.46	Very Low	21.00	2.04	4.45	Enriched	7.58	Wide D.O. swing; highly elevated TKN
10-2	8.10	29.57	15	56.0	67.75	NON-Poor	0.169	0.922	11.84	6.51	5.33	High	37.30	Very Low	-	1.46	6.85	Enriched	9.18	High D.O. swing; elevated Sestonic, TKN
10-1	1.10	31.97	18	58.2	59.00	NON-Poor	0.127	0.909	9.01	6.60	2.40	Low	31.30	Very Low	-	1.54	ND	Not Nutrients	8.00	TKN only slightly elevated
Hastings Creek																				
10-5	3.12	3.91	15	31.0	60.00	NON-Poor	0.061	ND	6.83	4.45	2.21	Low	30.02	Very Low	-	2.64	7.40	Likely Nutrients	7.68	Elevated Sestonic; extreme elevated TKN
10-4	1.68	5.60	21	27.5	44.50	Non-Poor	0.146	1.121	13.02	3.15	9.87	Wide	43.70	Very Low	15.60	2.74	11.45	Enriched	13.06	Wide D.O. swing; extreme elev. TKN, Sestonic
Unnamed Tributary to North Mill Creek @RM 0.75																				
10-6	0.04	0.99	25	40.4	53.50	NON-Poor	0.101	0.381	-	-	-	-	-	-	-	1.81	ND	-	7.58	-
Newport Drainage Ditch																				
12-2	3.03	2.80	20	28.4	45.00	NON-Poor	0.116	0.208	12.5	4.54	7.37	Wide	-	-	-	2.28	8.80	Enriched	7.18	Wide D.O. swing; extreme elev. TKN, Sestonic
12-1	0.70	7.35	27	40.6	63.00	NON-Poor	0.100	0.161	-	-	-	-	33.61	Very Low	-	1.57	4.40	-	6.58	-
Suburban Country Club Tributary to DPR @RM 98.4																				
13-10	2.00	4.00	20	18.0	39.00	NON-Poor	0.074	ND	-	-	-	-	-	-	-	2.74	4.30	-	6.88	-
Slocum Creek																				
13-11	1.36	2.4	16	36.9	63.75	NON-Poor	0.102	0.211	-	-	-	-	-	-	-	1.99	7.00	-	6.68	-
Unnamed Tributary to Greenleaf Creek @RM 0.64																				
13-13	0.40	1.10	37	21.5	63.75	NON-Poor	0.097	0.266	-	-	-	-	-	-	-	1.92	-	-	7.36	-
Unnamed Tributary to the Des Plaines River @RM 89.5																				
13-17	0.13	0.90	34	30.9	62.00	NON-Fair	0.116	0.508	-	-	-	-	-	-	-	2.18	-	-	8.16	-
West Fork Belvidere Rd. Tributary to DPR @RM 94.0																				
13-14	0.21	2.30	14	25.7	68.75	NON-Poor	0.083	0.150	-	-	-	-	-	-	-	2.89	-	-	6.88	-
13-8	0.15	3.80	34	45.2	70.00	PARTIAL	0.086	0.199	-	-	-	-	-	-	-	1.65	ND	-	6.16	-
Stoneroller Creek																				
13-9	0.42	4.10	39	57.6	82.00	PARTIAL	0.045	0.294	-	-	-	-	-	-	-	ND	5.00	-	5.26	-
Bull's Brook																				
13-15	1.95	1.90	28	33.2	76.50	NON-Poor	0.065	ND	-	-	-	-	-	-	-	3.10	-	-	8.18	-
13-7	0.25	2.70	23	49.3	69.00	NON-Poor	0.059	0.180	-	-	-	-	-	-	-	2.91	6.60	-	7.78	-
Bull Creek																				
14-6	5.95	2.40	12	19.3	57.50	NON-Poor	0.161	0.164	-	-	-	-	-	-	-	2.21	7.35	-	8.56	-
14-5	4.70	1.30	29	20.0	57.25	NON-Fair	0.092	0.137	-	-	-	-	-	-	-	2.39	-	-	8.38	-
14-2	1.00	8.40	30	34.8	53.25	NON-Fair	0.062	0.232	-	-	-	-	-	-	-	ND	5.20	-	7.08	-
14-1	0.50	11.70	37	47.9	78.00	PARTIAL	0.075	0.246	10.77	7.02	3.75	Normal-Low	48.29	Very Low	16.70	1.86	12.00	Not Nutrients	5.86	Only elevated TKN, Sestonic; no D.O.swing
West Branch Bull Creek																				
14-4	2.54	5.10	11	24.9	47.75	NON-Poor	0.106	0.567	5.68	1.81	3.17	Normal-Low	19.77	Very Low	-	2.42	13.00	Likely Nutrients	8.44	Extreme elevated TKN, Sestonic; low min. D.O.
14-3	1.60	7.10	26	48.5	65.75	NON-Poor	0.107	0.525	-	-	-	-	-	-	-	ND	-	-	6.34	-
Condition Category Thresholds		**Excellent**	≥50	>73	>84.5	FULL	≤ 0.106	≤ 3.77	< 10.36	>6.9	< 2.0	Normal	<35	Very Low	≤17.50	<1.07	<2.5	Not Nutrients	<10	All Excellent
		Good	>41-49	41.8-72.9	>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	>17.50	1.07-1.12	>2.5-5.1	Not Nutrients	10-15	All Good, 1-2 exceed Fair
		Fair	30- <41	30-41.7	<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	>31.60	1.12-1.63	>5.1-13.8	Likely Nutrients	15-25	2-3 exceed Fair, 1-2 Poor
		Poor	>15-29	>15-29	<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	>35.15	1.63-2.14	>13.8-28.9	Enriched	25-35	2-3 exceed Poor, 1 V. Poor
		Very Poor	<15	<15	<25	NON-Poor	≥ 1.726	≥ 9.64	≥ 16.3	<2.0	>6.5	Wide	>320	Very High	>38.69	>2.14	>28.9	Highly Enriched	>35	2-3 exceed Poor; 2-3 V. Poor
Source			IPS	IEPA	IEPA	IPS	IPS	IPS	IPS	IPS	IPS	MBI/SNAP	MBI/SNAP	MBI/SNAP/NSAC	MBI/SNAP	IPS	IPS	MBI/NSAC	MBI/SNAP	IPS	MBI

exceedances of thresholds for the aforementioned indicators and parameters (Table 11). 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 11) 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 nutrient parameter exceedances. The evaluations based on incomplete data should be regarded as preliminary. Fourteen (14) of the 30 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 “Likely Nutrients” (5 sites) or enriched (8 sites) conditions at 13 of the 14 locations (Table 11) that had the full suite of SNAP parameters. Five of the eight enriched sites had a high or wide diel D.O. swing, a high maximum D.O., and/or low minimum D.O. levels. Two sites had minimum D.O. below very poor, two below poor and, six below fair. Maximum D.O. levels that exceeded the fair IPS threshold occurred at only two sites. As was previously described benthic chlorophyll a biomass was low reflecting excellent and good conditions at all 14 sites. Sestonic chlorophyll a reflected poor conditions at two SNAP sites in lower Mill Creek and fair conditions at 11 sites, and good at only one site. TKN values exceeded very poor threshold at seven of the 14 SNAP sites and exceeded the poor threshold at the remaining seven sites. The highly elevated TKN results along with the elevated sestonic chlorophyll a results drove the assignments of likely nutrients and enriched conditions, the latter being assigned where the corresponding D.O. results also indicated excessive algal activity. All of the SNAP sites in Mill Creek, North Mill Creek, and Hastings Creek were assigned the enriched or likely nutrients status. The single site that was assessed by SNAP in Bull Creek resulted in a “Not Nutrients” assignment. The West Branch Bull Creek was assigned “Likely Nutrients” as a result of highly elevated TKN, elevated sestonic chlorophyll a, and a very poor minimum D.O., but with a narrow diel swing. This suggests the low D.O. being due to a cause other than nutrients. Habitat did not appear to be a major factor in the assignment of enriched status as QHEI values ranged from good to poor seemingly independent of the SNAP results.

Conventional and Urban Parameters

Conventional parameters include temperature, pH, D.O., and conductivity that are generally collected with a water quality meter as grab samples while collecting chemical and biological samples. Urban parameters are those that originate in runoff from urban and industrial land surfaces and can typically be in the form of elevated concentrations of dissolved materials, suspended solids delivered by runoff events and increased bank erosion due to altered flows, heavy metals, nutrients, and polycyclic aromatic hydrocarbon (PAH) compounds from

automobiles and road and parking surfaces. Temperature can also be influenced by the alteration of runoff due to exposure of water to surfaces some of which can more readily absorb solar radiation. Several parameters measured in the water column (Table 12) plus heavy metals and organics measured in sediments (Tables 13 and 14) were used to assess for urban related water quality impacts. TKN was included in Table 12 as it is an indicator of urban nonpoint source runoff in addition to organic enrichment related to nutrients. Some parameters that are normally standard indicators for urban stormwater were measured at many fewer sites and included total suspended solids (TSS), volatile suspended solids (VSS), and common heavy metals. As a result these were limited to assessing only the sites where they were collected and were not sufficient to support analyses of watershed and subwatershed wide patterns.

Temperature

Temperature was measured via grab samples (Table 12) collected by the fish crew and continuously (Figure 10) during the short-term deployment of Datasondes in mid to late August 2019. The temperature results were assessed for aquatic life with the Illinois General Use criterion, which is a constant 32.2C (90F) during May-November, and maximum and average criteria applicable to streams in the Ohio River basin developed by Ohio EPA. The Ohio temperature criteria are stream size specific with a maximum and average criteria of 29.4°C (84.9°F) and 27.8°C (82.0F) and are based on tolerances of representative fish species with thermal characteristics similar to the Illinois stream fish fauna. The grab sample data indicate temperatures well below the Illinois and Ohio thresholds (Table 12). The continuous data revealed one site in North Mill Creek (site10-2) with a maximum that exceeded the Ohio maximum threshold and two sites in lower Mill Creek (sites 11-1 and 11-2) that approached it and exceeded the Ohio average. None of these results indicate any serious concerns with the thermal regime in the 2019 Year 3 study area.

pH

pH (S.U.) was measured by grab samples (Table 12) collected by the fish crew as the Datasonde units either lacked pH probes or delivered faulty data. pH can act the same as D.O. being elevated due to algal photosynthesis during daytime and deceasing due to algal respiration at night this producing a diel swing. Elevated daytime values are likewise indicative of nutrient enrichment effects on algal photosynthesis. pH can also be a strong determinant of the toxicity of ammonia-N with the toxic unionized fraction increasing with elevated pH. All of the pH results were well within the 6.5-9.0 water quality criterion and mostly in the range of 7.6-8.4. Values greater than 8.0 can be indicative of moderate nutrient enrichment and occurred in numerous streams across the 2019 Year 3 study area.

Specific Conductance

Specific conductance (“conductivity”) is a measure of how well water can conduct an electrical current. Conductivity increases with increasing amount and mobility of ions and is positively correlated with the concentration of dissolved substances in the water column. As such it is positively correlated with the concentration of dissolved ions such as sulfates ad chlorides.

***Table 12**. Median conventional and urban related parameter concentrations (mg/L) based on grab samples collected at 30 locations in the Year 3 2019 Upper Des Plaines River subwatershed study area. Shading is based on threshold exceedances listed at the bottom of the table.*

Site ID	River Mile	Drainage Area (sq. mi.)	Tempera-ture (°C)	pH (S.U.)	Specific Conduct-ivity µS/cm	TSS (mg/L)	Volatile Suspended Solids (mg/L)	Chloride (mg/L)	TKN (mg/L)
Mill Creek									
11-6	17.20	4.50	19.6	7.73	728	-	-	95.1	2.80
11-5	13.80	10.40	10.6	6.54	809	-	-	122.0	1.87
11-4	10.10	18.30	-	-	883	-	-	165.5	2.37
11-3	7.20	21.40	23.8	8.35	779	-	-	131.0	3.03
11-2	1.71	62.30	21.8	7.99	829	62.3	9.17	101.1	1.84
11-1	0.70	63.80	22.2	8.08	851	64.3	8.99	93.5	1.99
North Mill Creek									
10-7	11.30	19.23	21.5	7.72	627	-	-	31.2	1.45
10-3	10.20	20.86	22.5	8.05	728	21.0	3.10	35.9	2.04
10-2	8.10	29.57	20.1	8.25	817	-	-	55.7	1.46
10-1	1.10	31.97	20.1	8.24	765	-	-	65.6	1.54
Hastings Creek									
10-5	3.12	3.91	20.1	8.08	856	-	-	147.5	2.64
10-4	1.68	5.60	22.0	7.62	873	15.6	2.23	130.5	2.74
Unnamed Tributary to North Mill Creek @RM 0.75									
10-6	0.04	0.99	19.9	8.18	662	-	-	96.4	1.81
Newport Drainage Ditch									
12-2	3.03	2.80	18.7	7.30	806	-	-	80.2	2.28
12-1	0.70	7.35	19.4	7.53	819	-	-	89.8	1.57
Suburban Country Club Tributary									
13-10	2.00	4.00	14.8	7.79	823	-	-	104.5	2.74
Slocum Creek									
13-11	1.36	2.40	10.4	7.74	779	-	-	86.3	1.99
Unnamed Tributary to Greenleaf Creek @RM 0.64									
13-13	0.40	1.10	17.6	8.19	1410	-	-	253.5	1.92
Unnamed Tributary to DesPlaines River @RM 89.5									
13-17	0.13	0.90	18.2	8.36	640	-	-	59.0	2.18
Stoneroller Creek									
13-9	0.42	4.10	16.3	7.90	1050	-	-	276.0	ND
West Fork Belvidere Rd. Tributary									
13-14	0.21	2.30	13.8	7.89	1130	-	-	184.0	2.89
13-8	0.15	3.80	13.5	7.86	1020	-	-	179.0	1.65
Bull's Brook									
13-15	1.95	1.90	18.1	8.13	778	-	-	94.2	3.10
13-7	0.25	2.70	19.5	7.91	765	-	-	88.5	2.91
Bull Creek									
14-6	5.95	2.40	16.9	7.88	555	-	-	55.3	2.21
14-5	4.70	1.30	12.6	7.97	694	-	-	121.0	2.39
14-2	1.00	8.40	21.8	8.23	978	-	-	193.0	ND
14-1	0.50	11.70	15.0	7.87	904	16.7	2.67	152.5	1.86
West Branch Bull Creek									
14-4	2.54	5.10	19.3	7.62	1030	-	-	218.0	2.42
14-3	1.60	7.10	20.3	8.27	938	-	-	173.0	ND
Condition Category Thresholds	Excellent				<739	<17.5	<5.00	<40.0	<1.07
	Good				<1038	<31.6	<7.77	<120.0	<1.12
	Fair				<1208	<35.2	<9.83	<184.9	<1.63
	Poor				<1378	<38.7	<11.88	<249.8	<2.14
	Very Poor				>1378	>38.7	>11.88	>249.8	>2.14
Source	**IPS**		None	None	IPS	IPS	IPS	IPS	IPS
	Illinois WQS		<32.2	>6.0;<9.0	None	None	None	500.0	None

IPS - NE Illinois Integrated Prioritization System (IPS; MBI 2020a)

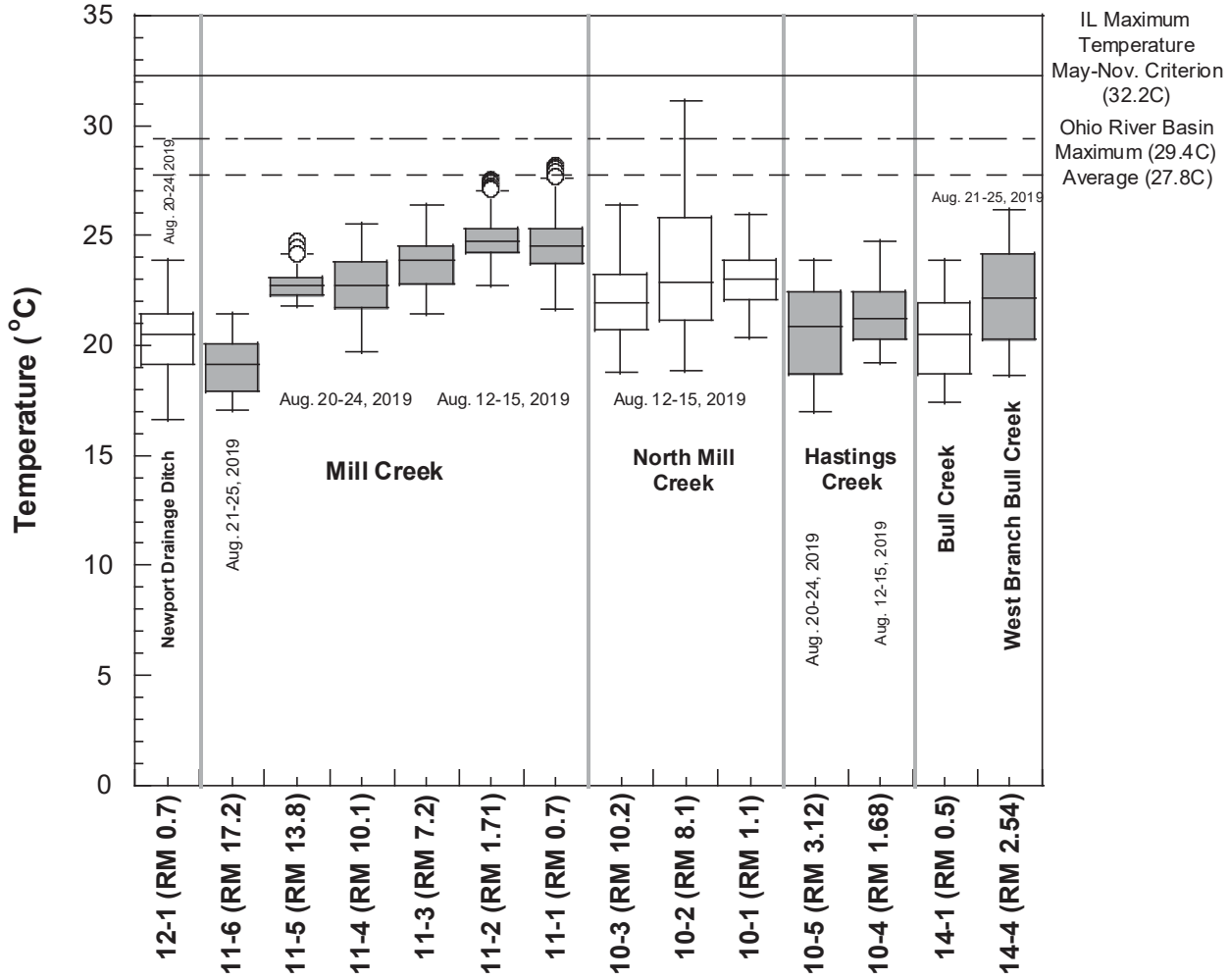

***Figure 11**. Temperature (℃) measured continuously by Datasondes deployed for 3-4 day periods during August 12-15, 2019, August 20-24, 2019, and August 21-25, 2019 at 14 locations in the Year 3 Upper Des Plaines study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The Illinois EPA May-November maximum temperature criterion (32.2 ℃) is shown by a solid line. Maximum (29.4 ℃) and average (27.8 ℃) Ohio River Basin criteria for streams are shown by solid and dashed lines (from the Ohio WQS).*

Conductivity was measured with a water quality meter at each fish sampling site Table 12) and continuously via the short-term Datasonde deployments at 14 locations (Figure11). Single values in the grab samples were with the excellent and good thresholds of the NE Illinois IPS with the exception of three sites, Stoneroller Creek (site 13-9) and the upstream site on the West Fork Belvidere Rd. tributary (site 13-14), each if which were in the fair range, and a very poor value in the unnamed tributary to Greenleaf Creek (site 13-13; Figure 12). The boxplot comparing 2016 and 2019 results showed consistently higher values in 2016 owing largely to the much lower flows experienced in that year compared to the higher flows in 2019. The continuous data measured in mid to late August at the 14 Datasonde sites (Figure 11) was generally in agreement with the exception of consistently fair values in Bull Creek (site 14-1)

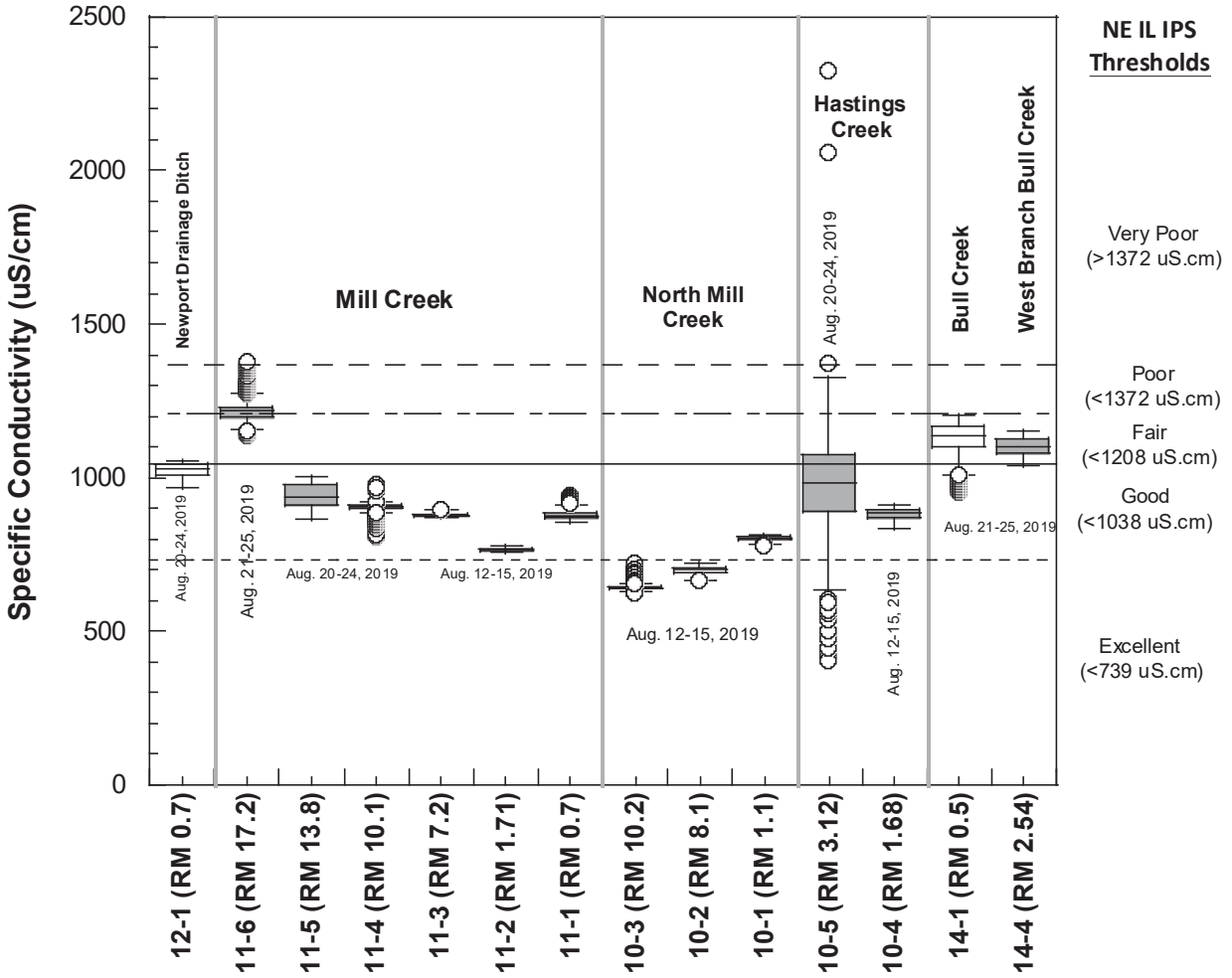

***Figure 12**. Specific conductance (µS/cm) measured continuously by Datasondes deployed for 3-4 day periods during August 12-15, 2019, August 20-24, 2019, and August 21-25, 2019 at 14 locations in the Year 3 Upper Des Plaines study area. Box-and-whisker plots show the minimum, maximum, 25th and 75th percentiles, median, and outlier (>2 interquartile ranges from the median) values. The NE Illinois IPS thresholds are shown by solid and dashed lines.*

and the West Branch Bull Creek (site 14-4), consistently fair and poor values at the upstream most site in Mill Creek (site 11-6), and wide range of values in Hastings Creek at the upstream most site (site 10-5) some well into the poor and very poor ranges. These results indicate the transient nature of dissolved materials inputs in certain parts of the Year 3 subwatersheds.

Chlorides

In temperate climates such as northern Illinois, chlorides are an emerging problem because they reflect their accumulation in soils and shallow groundwater resulting from repeated application of deicing materials. It is only over the past two decades that they have been documented to reach concentrations that can threaten and impair aquatic life. Existing aquatic life criteria for chloride (230 mg/L U.S. EPA recommended) do not protect sensitive species

(Miltner 2021). 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.

Median concentrations of chloride were within the excellent range of the NE Illinois IPS threshold of 40 mg/L at the two upstream sites in North Mill Creek (sites 10-3 and 10-7) reflecting the lower proportion of urban relates land uses (Table 12). The IPS excellent threshold is similar to the value Miltner (2021) described as reflecting unperturbed conditions. An additional 14 sites were within the good range of the IPS thresholds and were also in subwatersheds with comparatively low urban land uses. Another 10 sites were in the fair range. The four remaining sites with values exceeding the poor and very poor thresholds (Figure 13) occurred in the most urbanized portions of the Year 3 subwatersheds and included the upstream West Branch Bull Creek (14-4, poor), a single site in Bull Creek (14-2, poor), unnamed tributary to Greenleaf Creek (13-13, very poor), and the highest value in Stoneroller Creek (13-9, very poor). The concentrations of chloride were substantially lower in 2019 compared to 2016 throughout the Year 3 subwatersheds by one narrative condition class in each if the four subwatershed bundles (Figure 13). This is at least partly due the lower flows experienced throughout the summer-fall of 2016 and the dilution offered by higher flows in 2019, but may also be a reflection of improved deicing practices since 2016.

Total Kjeldahl Nitrogen (TKN)

The TKN were previously described in the Demand and Nutrient Related Parameters section of this report, but are included here (Table 12) as an indicator of urban nonpoint source runoff. Major sources of organic nitrogen in urban stormwater runoff include lawn and garden fertilizers, pet waste, leaking septic tanks, landfills, effluent from sewage treatment plants, and vehicle exhaust (U.S. EPA 2020). Nitrogen from aerial and terrestrial sources accumulates on urban roads and parking lots until runoff from a precipitation event carries the pollutants into stormwater drains and directly to local waterbodies. Among different land uses, the highest concentrations of TKN originate from impervious surfaces (e.g., freeways, parking lots, and high density residential). In the Year 3 subwatersheds TKN was highly elevated exceeding the poor and very poor IPS thresholds at 22 of the 31 sites where it was analyzed reflecting impacts by both agricultural and urban sources. It was below detection at only three sites, Stoneroller Creek (13-9), Bull Creek at RM 1.0 (14-2), and the West Branch Bull Creek at RM 1.6 (14-3). The

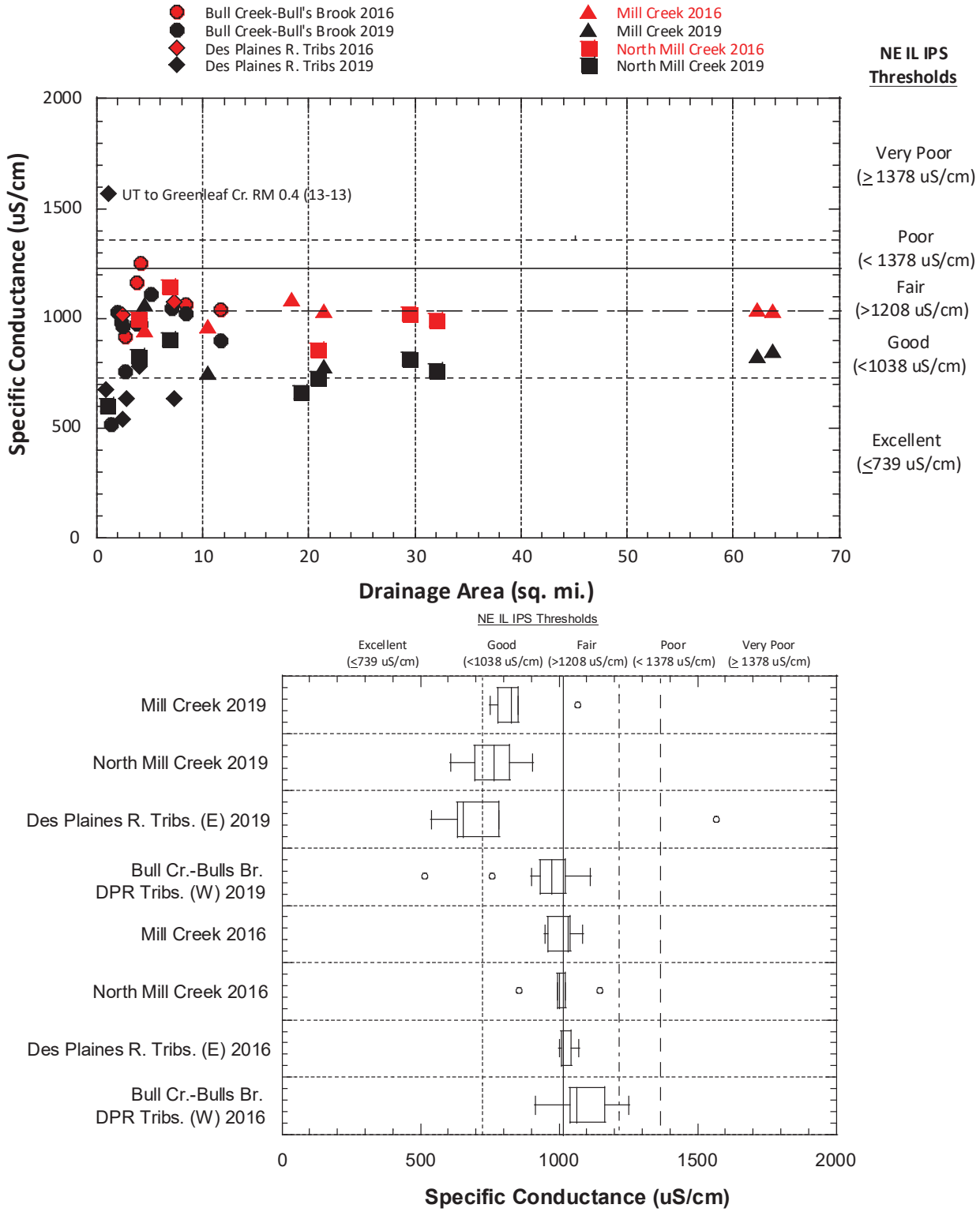

***Figure 13**. Specific conductance (µS/cm) values by subwatershed and stream in the Year 3 2019 study area. Single grab sample values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent effect thresholds from the NE Illinois IPS (Table 7).*

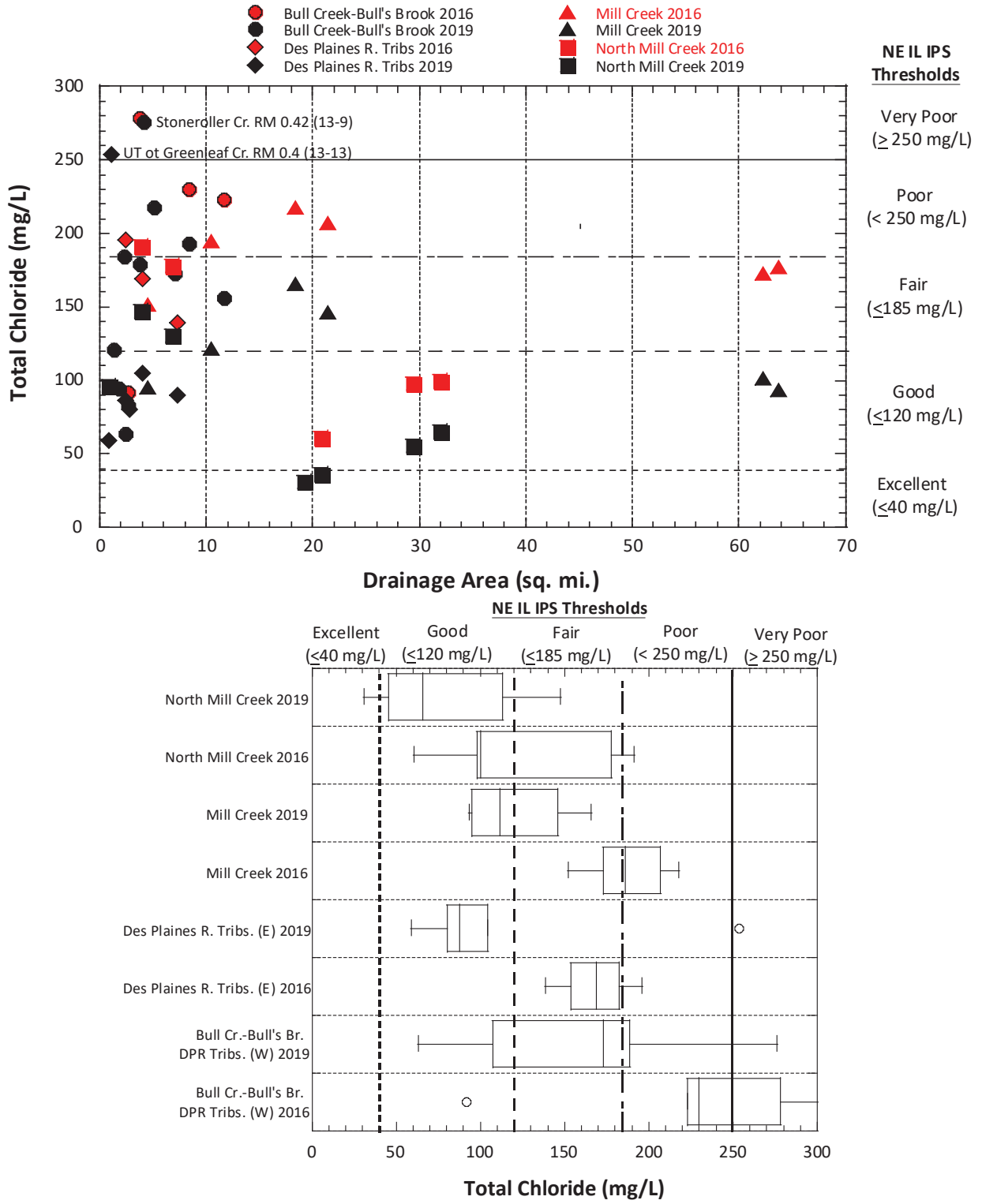

***Figure 14**. Concentrations of chloride (mg/L) by subwatershed and stream in the Year 3 2019 study area. Median values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent effect thresholds from the NE Illinois IPS (Table 7).*

sampling in 2019 was more thorough than in 2016, but the median values were higher in 2019 at corresponding sites than in 2016, which corresponds to the higher flows in 2019 reflecting higher runoff.

Other Urban Related Parameters

Some of the commonly used parameters to assess nonpoint source runoff in general, and urban runoff in particular were collected at only a few sites thus precluding a watershed or subwatershed wide assessment. Total suspended solids (TSS) was collected at five sites (Table 12) and exceeded the NE Illinois very poor threshold at two sites in lower Mill Creek (11-1 and 11-2). Volatile suspended solids (VSS), intended to serve as a proxy for measuring biochemical oxygen demand, exceeded the fair threshold at the same two sites in Mill Creek. Deducing anything about the meaning of these results other than the IPS threshold exceedances is limited by the low spatial density of the data. Heavy metals were sampled at only one site in lower Mill Creek at RM 0.70 (site 11-1) and included arsenic, copper, iron, magnesium (four sites), mercury, nickel, sodium, and zinc. None of the results suggested any serious issues for General Use aquatic life use attainment.

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 8). 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 newer IPS thresholds are based on analyses against the most sensitive species to each sediment metal and PAH parameter (MBI 2020a), but are limited by insufficient samples from excellent quality rivers and streams. Sediment metal sampling results from 2019 are summarized by concentration rating and parameter class in Table 13 and polycyclic aromatic hydrocarbon (PAHs) compounds in Table 14. 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

Nineteen (19) heavy metals were analyzed in sediment samples collected at 22 sites in the 2019 Year 3 subwatersheds (Table 13). The concentrations in bulk sediment were evaluated by the thresholds established by MacDonald et al. (2000), Short (1998), and the NE Illinois IPS (MBI 2020a). Only six (6) parameters had levels that exceeded any of the effect thresholds of the aforementioned sources. The NE Illinois IPS has the more stringent thresholds and anything exceeding the fair threshold was included as an exceedance of concern. Of the six parameters with exceedances that potentially correspond to an impairment of the General Use for aquatic life only two (2), cadmium and zinc occurred at multiple locations. For the remainder a single aluminum value in the Newport Drainage Ditch at RM 3.03 (site 12-2) exceeded the very poor

***Table 13**. Heavy metal concentrations (mg/kg) in sediment at 22 sites in the 2019 Year 3 Upper Des Plaines River subwatersheds. 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.)	Aluminum (mg/Kg)	Barium (mg/Kg)	Beryllium (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 (mg/Kg)	Nickel (mg/Kg)	Potassium (mg/Kg)	Silver (mg/Kg)	Sodium (mg/Kg)	Strontium (mg/Kg)	Vanadium (mg/Kg)	Zinc (mg/Kg)
Mill Creek																					
11-6	17.20	4.5	3560	30.70	ND	3.58	0.902	8.14	4.74	12.00	8050	7.26	379	ND	10.70	1210	ND	170	22.90	12.7	37.20
11-5	13.80	10.4	7050	78.20	ND	4.37	1.790	20.70	7.80	35.90	11800	21.50	499	0.1	18.50	2070	ND	473	34.30	18.2	112.0
11-4	10.10	18.3	5380	62.50	ND	5.19	0.992	12.30	5.55	21.10	8450	15.20	504	0.1	13.10	1190	ND	453	23.90	11.5	59.50
11-3	7.20	21.4	2480	23.00	ND	2.41	ND	6.32	3.40	3.40	6180	7.59	334	ND	6.09	587	ND	188	14.60	8.8	31.30
11-2	1.71	62.3	3190	30.60	ND	2.05	0.728	7.15	4.40	6.62	7560	6.13	464	0.029	8.17	762	ND	139	12.90	11.4	29.70
11-1	0.70	63.8	4700	46.50	ND	2.75	1.090	10.40	6.23	13.60	9620	9.22	669	0.045	12.30	1200	ND	761	22.80	13.4	50.00
North Mill Creek																					
10-3	10.20	20.9	4010	37.80	ND	2.63	0.928	8.49	4.74	9.60	8420	7.63	470	ND	9.36	949	ND	151	16.40	11.6	44.40
10-2	8.10	29.6	3150	32.80	0.2	2.12	0.811	7.15	5.00	7.47	8060	8.19	579	ND	8.74	821	ND	129	18.60	11.6	30.70
10-1	1.10	32.0	4090	44.30	0.4	3.36	1.420	9.29	5.38	10.50	9150	8.79	684	ND	10.90	1080	ND	162	20.80	13.1	35.50
Hastings Creek																					
10-5	3.12	3.9	2110	25.20	ND	2.19	ND	5.25	2.38	5.29	5700	9.04	277	ND	5.21	439	ND	147	12.80	7.6	23.10
10-4	1.68	5.6	3120	27.70	ND	2.53	0.796	7.17	4.38	10.30	8040	6.87	367	ND	9.32	930	ND	170	21.50	10.4	35.00
Newport Drainage Ditch																					
12-2	3.03	2.8	10700	115.0	ND	11.50	2.170	21.70	8.57	30.40	13400	15.30	546	ND	22.30	3030	ND	574	39.30	25.0	164.0
12-1	0.70	7.4	3600	34.60	ND	2.25	0.834	7.31	3.65	7.79	7820	7.43	360	ND	7.53	749	ND	211	13.20	12.0	41.00
Suburban Country Club Tributary to DPR @RM 98.4																					
13-10	2.00	4.0	7440	73.80	ND	4.21	1.480	16.60	7.69	20.10	11600	13.20	555	ND	16.70	1540	ND	229	18.40	20.5	91.70
Slocum Creek																					
13-11	1.36	2.4	5080	53.50	ND	4.24	1.260	12.10	6.30	18.70	10300	16.80	616	ND	13.80	1590	ND	310	23.60	18.3	93.60
13-8	0.15	3.8	2500	26.80	ND	2.95	1.000	7.40	3.65	16.30	8750	14.30	361	0.030	9.13	772	ND	209	22.30	12.5	73.00
Stoneroller Creek																					
13-9	0.42	4.1	5870	101.0	ND	3.17	1.540	13.10	6.52	18.00	12000	13.70	1180	ND	14.60	1360	ND	321	24.40	20.7	73.30
Bull's Brook																					
13-7	0.25	2.7	3680	48.40	ND	3.45	1.140	8.16	5.62	9.26	10300	9.52	972	ND	10.30	1110	ND	151	23.20	12.9	42.70
Bull Creek																					
14-6	5.95	2.4	4370	56.10	ND	2.23	1.200	9.16	10.20	11.40	10600	10.40	850	0.039	16.60	1090	ND	101	12.70	13.2	34.10
14-2	1.00	8.4	4220	57.30	ND	4.95	1.230	11.60	4.52	16.70	9980	17.20	490	ND	9.90	851	ND	367	30.10	15.3	85.00
14-1	0.50	11.7	3500	43.40	ND	3.31	1.180	7.85	4.57	11.40	10300	10.70	636	ND	9.65	762	ND	202	26.00	13.6	48.30
West Branch Bull Creek																					
14-4	2.54	5.1	5245	44.45	ND	3.56	1.180	10.95	5.09	14.50	9900	9.69	224	0.05	12.20	1365	ND	180	18.60	14.8	50.50
MacDonald et al. 2000	TEC	None	None		None	0.990	43.40	None	31.60	20000	35.80	460	0.180	22.70	None	1.600	None	None	None	121.0	
	PEC	None	None		None	4.980	111.0	None	149.0	40000	128.0	1100	1.06	48.60	None	2.200	None	None	None	459.0	
Short 1998	Elevated	None	145.0		None	2.000	37.00	None	37.00	26100	60.00	1100	0.280	26.00	None	None	None	None	None	170.0	
	Highly Elev.	None	230.0		None	9.300	110.0	None	170.0	53000	245.0	2300	1.40	45.00	None	5.000	None	None	None	760.0	
NE Illinois IPS	Excellent	None	None	None	None	None	<20.53	None	<19.00	None	<15.50	<841.0	None	None	None	None	None	None	None	<75.0	
	Good	<6480	<141.0	≤0.411	None	<0.933	<23.30	None	<29.78	None	<24.80	<845.5	None	<19.50	None	<0.483	None	<81.80	None	<100.0	
	Fair	>6480	>141.0	>0.411	None	>0.933	>23.30	None	>29.78	None	>24.80	>845.5	None	>19.50	None	>0.483	None	>81.80	None	>100.0	
	Poor	>8272	>150.3	>0.496	None	>1.354	>26.22	None	>40.45	None	>33.04	>996.8	None	>22.52	None	>1.261	None	>106.8	None	>133.9	
	Very Poor	>10064	>168.7	>0.581	None	>1.963	>29.15	None	>51.12	None	>41.27	>1148	None	>25.53	None	>2.039	None	>131.9	None	>167.8	

IPS threshold, two copper values, one in Mill Creek at RM 13.80 (site 11-5) and one at the same Newport Drainage Ditch location (12-2), exceeded the fair IPS threshold, and three manganese values, an exceedance of the very poor threshold in Stoneroller Creek (13-9), and exceedances of the poor threshold in Bulls Brook (site13-15) and Bull Creek (14-6). Cadmium exceeded the very poor threshold at the same Newport Drainage Ditch site (12-2), and the poor threshold in Mill Creek (11-5), North Mill Creek (10-1), and the suburban Country Club tributary (13-10), with another 10 sites exceeding the fair threshold, the majority in the most urbanized portions of the Year 3 study area. Zinc exceeded the IPS poor threshold in the Newport Drainage Ditch site (12-2) and the fair threshold at four other sites scattered throughout the study area. The Newport Drainage Ditch site at RM 3.03 (site 12-2) stood out with exceedances of five (5) parameters, two of which were very poor and one poor. Mill Creek at RM 13.8 (site 11-5) had three parameters in excess of at least an IPS fair threshold with all other sites having only two, one, or no exceedances.

PAH Compounds in Sediment

Polycyclic aromatic hydrocarbon (PAH) compounds are a common pollutant found in stream sediments particularly in urbanized or urbanizing watersheds. Most of the common PAH compounds such as benzo(a)pyrene, benzo(ghi)perylene, chrysene, fluoranthene, phenanthrene, and pyrene originate from oil-based and coal tar-based compounds (e.g., asphalt sealants, tars, gasoline, car exhaust, tire residues, motor oil, etc.). Acenaphthylene, anthracene, benzo(a)pyrene, naphthalene, phenanthrene, and pyrene are also manufactured and used in various industrial processes. The remaining PAH compounds are not commercially produced and are solely the result of the incomplete combustion of coal or oil-based products. As such, multiple PAH compounds are usually found in urbanized watersheds with a high density of asphalt paved surfaces and heavy automobile traffic and entering streams via runoff from highways and other paved surfaces.

Fifteen (15) PAH compounds were analyzed in sediment samples collected at 22 sites throughout the 2019 Year 3 subwatersheds (Table 14). The vast majority of the analyses revealed PAH compound concentrations either below the method detection limits or with the excellent/good range of the NE Illinois IPS thresholds. Only one site, Bull Creek at RM 1.0 (site 14-2) had any threshold exceedances with 14 of the 15 compounds exceeding the very poor IPS thresholds and 10 exceeding the Probable Effect Concentration (PEC) of MacDonald et al. (2000) and 12 exceeding the Threshold Effect Concentration (TEC) most by more than one order of magnitude. This site is in one of the most heavily urbanized portions of the Year 3 study area.

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

***Table 14**. Polycyclic aromatic hydrocarbon (PAH) concentrations (µg/kg) in sediment at 22 sites in the 2019 Year 3 Upper Des Plaines River subwatersheds. 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.)	Acenaphthene (µg/Kg)	Acenaph-thylene (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)	Naphthalene (µg/Kg)	Phenanthrene (µg/Kg)	Pyrene (µg/Kg)
Mill Creek																	
11-6	17.20	4.50	ND	ND	68.1	ND	76.9	ND	ND	192.0	ND	60.6	ND	ND	ND	ND	55.3
11-5	13.80	10.40	ND	ND	68.0	59.7	106.0	95.9	ND	119.0	ND	153.0	ND	76.4	ND	54.3	135.0
11-4	10.10	18.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	89.3	ND	ND	ND	69.9	ND
11-3	7.20	21.40	ND	ND	90.8	84.8	128.0	87.4	72.5	131.0	ND	201.0	ND	79.9	ND	56.5	165.0
11-2	1.71	62.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11-1	0.70	63.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
North Mill Creek																	
10-3	10.20	20.86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10-2	8.10	29.57	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10-1	1.10	31.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hastings Creek																	
10-5	3.12	3.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10-4	1.68	5.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.2	ND
Newport Drainage Ditch																	
12-2	3.03	2.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12-1	0.70	7.35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Suburban Country Club Tributary to DPR @RM 98.4																	
13-10	2.00	4.00	ND	ND	44.3	ND	ND	56.0	ND	66.7	ND	83.0	ND	ND	ND	ND	74.3
Slocum Creek																	
13-11	1.36	2.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
West Fork Belvidere Rd. Tributary to DPR @RM94.0																	
13-8	0.15	3.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	27.4	ND	ND	ND	ND	ND
Stoneroller Creek																	
13-9	0.42	4.10	ND	ND	64.9	48.5	79.4	63.7	ND	93.1	ND	157.0	ND	57.3	ND	66.6	121.0
Bull's Brook																	
13-7	0.25	2.70	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bull Creek																	
14-6	5.95	2.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
14-2	1.00	8.40	2380	66.50	10600	8280	14600	5340	5000	14300	1420	38200	2530	5680	328.0	31900	30300
14-1	0.50	11.70	ND	ND	111.0	101.0	168.0	96.7	61.9	171.0	ND	327.0	ND	96.0	ND	ND	249.0
West Branch Bull Creek																	
14-4	2.54	5.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MacDonald et al. 2000		TEC	None		108.0	150.0	240.0	170.0	240.0	166.0	33.0	423.0	77.4	200.0		204.0	195.0
		PEC	None		1050.0	1450.0	13400.0	320.0	13400.0	1290.0	135.0	2230.0	536.0	3200.0		1170.0	1520.0
NE IPS		Exc./Good	<84.25	<86.38	<239.0	<230.0	<207.0	<335.0	<520.8	<266.0	<101.0	<774.0	<84.25	<260.5	< 86.38	<243.5	<393.0
		Fair	>84.25	>86.38	>239.0	>230.0	>207.0	>335.0	>520.8	>266.0	>101.0	>774.0	>84.25	>260.5	>86.38	>243.5	>393.0
		Poor	>104.8	>103.6	>699.4	>798.3	>434.7	>792.1	>1437	>958.3	>167.3	>2432	>104.8	>623.3	>103.6	>803.3	>1570
		Very Poor	>125.3	>120.9	>1160	>1367	>662.4	>1249.0	>2354	>1651	>233.7	>4091	>125.3	>986.2	>120.9	>1363	>2747

macrophytes. Lower gradient streams may not offer such 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 the basic components of stream and riverine habitat into rankings 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 2019 Year 3 Upper Des Plaines River subwatersheds study area, QHEI scores and physical habitat attributes were recorded in conjunction with the fish sampling conducted at each site.

Based on the QHEI scores alone overall habitat quality ranged from good at four (4) sites to poor at five (5) sites with the remaining 20 sites rated fair (Table 15) based on the NE Illinois IPS (Table 9) that are more stringent than the prior usage of narrative ratings from Ohio. The numbers and ratios of good and poor habitat attributes in Table 15 (after Rankin 1989, 1995) are also important to understand in terms of the restorability of altered habitat and when seriously degraded habitat might preclude attainment of the General Use for aquatic life.

The highest scoring sites were all in the good range and included Stoneroller Creek (site 13-9) with a QHEI of 82.0, Mill Creek at RM 1.71 (site 11-2) with a QHEI of 80.0, Bull Creek at RM 0.50 (site 14-1) with a QHEI of 78.5, and Bulls Brook at RM 1.95 (site 13-15) with a QHEI of 76.5. Each of these sites had eight (8) good attributes and only one or two (1-2) poor attributes. Fair scoring sites in terms of the QHEI score that had seven (7) or eight (8) good attributes included both sites on the West Fork Belvidere Rd. Tributary (sites 13-8 and 13-14), Bull Creek at RM 1.0 (site 14-2), and the West Branch Bull Creek at RM 1.6 (site 14-3). Of these sites the lower West Fork Belvidere Rd. Tributary site (13-8) and the Bull Creek site (14-2) had six (6) and five (5) poor attributes that offset the good attributes.

Sites with poor QHEI scores included the upstream most site in Mill Creek at RM 17.2 (site 11-6) with a very poor attributes ratio of 9.0, North Mill Creek at RM 11.3 (site 10-7) also with a very poor attributes ratio of 9.0, Hastings Creek at RM 1.68 (site 10-14) with only two (2) good attributes, the Suburban Country Club Tributary (site 13-10) also with only two (2) good attributes, and the West Branch Bull Creek at RM 2.54 (site 14-4) with six (6) poor attributes. Recent and legacy channelization were associated with most if the poor and several of the fair QHEI scores. Three (3) sites had the high influence poor attribute of being channelized with no recovery evident and nine (9) sites with the moderate influence poor attribute recovering from channelization. The majority were in the upper portion of the more agricultural Year 3 study area and also towards the headwaters of the larger streams and the smaller tributaries that tend to receive the most channel modifications.

Restoring altered habitat will be essential to allowing sites with impaired biota to attain the General Use biocriteria thresholds for the fish and macroinvertebrate IBIs. This task will be more difficult at sites with higher poor to good attribute ratios and perhaps less difficult at sites with fair QHEI scores and higher numbers of good attributes. In the case of the latter eliminating poor attributes will raise the prospects for restoring to good QHEI scores. The

Table 15. *QHEI matrix of good (■) and high influence (●) and moderate influence (●) modified habitat attributes for 29 sites in the Year 3 DRWW study area during 2019. QHEI scores are shaded in accordance with IPS derived narrative ratings. Color coding and IPS thresholds are listed at the bottom of the table.*

			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	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	Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
Mill Creek																																		
11-6	17.2	40.0									■		1		●		●		2	●	●			●	●			●	●	●		7	2.00	9.00
11-5	13.8	52.8		■				■			■		3	●					1		●			●	●			●	●		●	6	0.33	2.33
11-3	7.20	62.0	■	■		■	■	■			■		6						0		●			●				●	●	●		5	0.00	0.83
11-2	1.71	80.0	■	■		■	■	■		■	■	■	8						0		●							●				2	0.00	0.25
11-1	0.70	68.5		■		■	■	■			■		5						0	●	●							●	●	●		5	0.00	1.00
North Mill Creek																																		
10-7	11.30	37.0						■					1	●	●	●		●	4		●			●				●	●		●	5	4.00	9.00
10-3	10.20	59.0					■	■			■		3	●					1		●			●				●	●	●		5	0.33	1.67
10-2	8.10	67.8		■		■	■	■			■	■	6						0	●	●							●	●			4	0.00	0.67
10-1	1.10	59.0					■	■			■		3		●				1	●	●			●				●	●	●		6	0.33	2.00
Hastings Creek																																		
10-5	3.12	60.0	■	■			■	■			■		5						0		●			●				●	●	●		5	0.00	1.00
10-4	1.68	44.5						■			■		2			●			1	●				●				●	●	●		5	0.50	2.50
Unnamed Tributary to North Mill Creek @RM 0.75																																		
10-6	0.04	53.5	■	■		■	■				■		5				●		1					●				●	●	●		4	0.20	0.80

Table 15. *QHEI matrix of good (■) and high influence (●) and moderate influence (●) modified habitat attributes for 29 sites in the Year 3 DRWW study area during 2019. QHEI scores are shaded in accordance with IPS derived narrative ratings. Color coding and IPS thresholds are listed at the bottom of the table.*

			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	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	Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
Newport Drainage Ditch																																		
12-2	3.03	45.0					■	■			■		3		●				1	●	●			●				●	●		●	6	0.33	2.33
12-1	0.70	63.0		■			■	■		■	■		5						0	●				●				●		●		4	0.00	0.80
Suburban Country Club Tributary to DPR @RM 98.4																																		
13-10	2.00	39.0						■			■		2			●	●		2		●			●				●	●		●	5	1.00	3.50
Slocum Creek																																		
13-11	1.36	63.8	■	■		■	■	■			■		6						0	●	●							●	●	●		5	0.00	0.83
Unnamed Tributary to Greenleaf Creek @RM 0.64																																		
13-13	0.40	63.8	■	■		■	■	■					5					●	1		●							●	●	●		4	0.20	0.80
Unnamed Tributary to Des Plaines River @RM 89.5																																		
13-17	0.13	62.0	■	■			■	■			■		5						0					●				●	●	●		4	0.00	0.80
West Fork Belvidere Rd. Tributary to DPR @RM 94.0																																		
13-14	0.21	68.8		■		■	■	■		■	■	■	7						0	●								●				2	0.00	0.29
13-8	0.15	70.0		■		■	■	■		■	■	■	7						0	●	●			●	●			●	●			6	0.00	0.86
Stoneroller Creek																																		
13-9	0.42	82.0	■	■		■	■	■		■	■	■	8						0									●		●		2	0.00	0.25

***Table 15**. QHEI matrix of good (■) and high influence (●) and moderate influence (●) modified habitat attributes for 29 sites in the Year 3 DRWW study area during 2019. QHEI scores are shaded in accordance with IPS derived narrative ratings. Color coding and IPS thresholds are listed at the bottom of the table.*

Site ID	River Mile	QHEI	Good Habitat Attributes											High Influence Modified Attributes						Moderate Influence Modified Attributes												Ratios	
			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	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	Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
Bulls Brook																																	
13-15	1.95	76.5	■	■		■	■	■		■	■	■	8						0								●				1	0.00	0.13
13-7	0.25	69.0	■	■		■	■	■		■	■	■	8				●		1								●	●			2	0.13	0.25
Bull Creek																																	
14-6	5.95	57.5	■	■			■	■		■			5					●	1					●				●			●	3	0.20	0.60
14-5	4.70	57.3		■			■	■		■	■		5						0	●				●				●		●		4	0.00	0.80
14-2	1.00	53.3	■	■		■	■	■			■	■	7						0					●	●			●	●			5	0.00	0.71
14-1	0.50	78.0	■	■		■	■	■		■	■	■	8						0									●				1	0.00	0.13
West Branch Bull Creek																																	
14-4	2.54	47.8	■	■			■	■			■		5						0		●			●	●			●	●		●	6	0.00	1.20
14-3	1.60	65.8	■	■		■	■	■	■		■		7						0										●	●		2	0.00	0.29
Excellent		≥84.5											≥9						0													0	0	<0.50
Good		>75.9											≥8						0													1	<0.25	<1.00
Fair		>50.1											≥5						<2													≤3	<1.00	≥1.00
Poor		≥25.0											≥2						<3													<6	≥1.00	>4.00
Very Poor		<25.0											<2						≥4													≥6	>2.00	>6.00

accounting of habitat attributes in Table 15 provides the basis to examine this on a subwatershed and site by site basis. The poor attributes spanned the entire list including channel condition and development, siltation, and substrate embeddedness. The most common poor attribute was no fast current types, but this might be the expected condition for small streams in this region of Illinois.

Biological Assemblages – Fish

Fish species were ranked by each of the four subwatershed bundles – Mill Creek, North Mill Creek, Bull Creek-Bulls Brook Des Plaines Tributaries (West), and Upper Des Plaines Tributaries (East) – that comprised the 2019 Year 3 study area (Table 16). Tolerant, moderately tolerant, and intermediate species dominated the ranking in each subwatershed. Only one intolerant species (Hornyhead Chub in Bull Creek-Bulls Brook DPR Tributaries E) was ranked in the top ten in any of the four subwatersheds. Only three intolerant species were collected in total and included Hornyhead Chub, Stonecat Madtom, and Carmine Shiner.

Species Inventory

The Mill Creek subwatershed had 29 species, 1 hybrid, and 964 total fish weighing 11.85 Kg. Bluntnose Minnow was predominant by numbers (25.8%) and White Sucker predominated the biomass (18.6%). Tolerant and moderately tolerant species numbered seven (7) by numbers and six (6) by biomass. Hornyhead Chub and Stonecat Madtom were the only intolerant species. North Mill Creek had 22 species, 1 hybrid, and 596 fish weighing 6.73 Kg. Green Sunfish predominated by numbers (30.0%) and Common Carp predominated the biomass (32.3%). Tolerant and moderately tolerant species numbered nine (9) by numbers and eight (8) by weight. Hornyhead Chub was the lone intolerant species. The Bull Creek-Bulls Brook and Des Plaines River Tributaries (West) subwatershed had 30 species, 1 hybrid, and 1585 fish weighing 3.38 Kg. Creek Chub predominated by numbers (27.7%) and White Sucker predominated the biomass (29.1%). Tolerant and moderately tolerant species numbered seven (7) by numbers and weight. Carmine Shiner was the sole intolerant species in the subwatershed. The Upper Des Plaines Tributaries (East) had 21 species, no hybrids, and 524 fish weighing 0.77 Kg. Blackstripe Topminnow predominated by numbers (26.0%) and Creek Chub predominated the biomass (26.3%). Tolerant and moderately tolerant species numbered four (4) by numbers and weight. Stonecat Madtom and Carmine Shiner were the intolerant species in the subwatershed. Several species collected are indicative of low gradient vegetated streams and include Bowfin, Central Mudminnow, Blackside Darter, and Pirate Perch. The full listing of species by subwatershed and site are included in Appendix A.

Fish Assemblage Condition

Fish IBI (fIBI) scores are from one or two sampling passes (the mean of the latter) within the summer-early fall index period. The General Use biocriterion of 41 was not met at any of the 29 sites sampled (Figure 14). The median of all fIBI scores by subwatershed bundle was in the non-supporting fair range except in North Mill Creek which consistently in the non-supporting poor range. There were no apparent differences between 2016 and 2019 even though each had

***Table 16**. Top ten fish species ranked by numbers and biomass in each of the four subwatershed bundles in the 2019 Year 3 Upper Des Plaines River subwatershed study area.*

Mill Creek

Species	Tolerance IL	Tolerance OH	No./Wt. Collected	% By Number
Species Ranks by Numbers				
Bluegill		P	249	25.8
Green Sunfish	T	T	158	16.4
Spotfin Shiner			115	11.9
Bluntnose Minnow	T	T	72	7.5
Largemouth Bass		P	43	4.5
Pumpkinseed Sunfish		P	35	3.6
Blackside Darter			31	3.2
Orangespotted Sunfish			30	3.1
Blackstripe Topminnow		P	26	2.7
Golden Shiner	T	T	26	2.7
Species Ranks by Weight (Kg)				
White Sucker	T	T	2.20	18.6
Bluegill		P	2.02	17.0
Common Carp	T	T	1.96	16.6
Channel Catfish			1.38	11.7
Largemouth Bass			0.92	7.8
Northern Pike			0.83	7.0
Green Sunfish	T	T	0.47	4.0
Yellow Bullhead	T	T	0.40	3.4
Bowfin			0.40	3.4
Pumpkinseed Sunfish		P	0.27	2.3

North Mill Creek

Species	Tolerance IL	Tolerance OH	No./Wt. Collected	% By Number
Species Ranks by Numbers				
Green Sunfish	T	T	179	30.0
Bluegill Sunfish		P	103	17.3
Bluntnose Minnow	T	T	64	10.7
Largemouth Bass			52	8.7
Central Mudminnow	T	T	39	6.5
Creek Chub	T	T	35	5.9
Yellow Bullhead	T	T	34	5.7
White Sucker	T	T	28	4.7
Fathead Minnow	T	T	19	3.2
Common Carp	T	T	13	2.2
Species Ranks by Weight (Kg)				
Common Carp	T	T	2.17	32.3
White Sucker	T	T	1.59	23.7
Northern Pike			0.80	11.9
Bluegill Sunfish	T	T	0.70	10.4
Green Sunfish	T	T	0.67	9.9
Yellow Bullhead	T	T	0.30	4.5
Black Bullhead	T	T	0.20	3.0
Central Mudminnow	T	T	0.08	1.2
Largemouth Bass			0.07	1.1
Bluntnose Minnow	T	T	0.06	2.3

Bull Creek-Bulls Brook DPR Tributaries (West)

Species	Tolerance IL	Tolerance OH	No./Wt. Collected	% By Number
Species Ranks by Numbers				
Creek Chub	T	T	439	27.7
Central Stoneroller			234	14.8
Green Sunfish	T	T	160	10.1
Bluntnose Minnow	T	T	132	8.3
White Sucker	T	T	109	6.9
Johnny Darter			72	4.5
Bluegill Sunfish		P	69	4.4
Blackside Darter			62	3.9
Fantail Darter		M	61	3.9
Hornyhead Chub		I	56	3.5
Species Ranks by Weight (Kg)				
White Sucker	T	T	0.98	29.1
Creek Chub	T	T	0.69	20.5
Green Sunfish	T	T	0.44	13.0
Northern Pike			0.30	8.9
Central Stoneroller			0.23	6.8
Largemouth Bass			0.12	3.7
Hornyhead Chub		I	0.11	3.2
Yellow Bullhead	T	T	0.10	2.9
Pumpkinseed Sunfish		P	0.09	2.7
Bluntnose Minnow	T	T	0.08	2.4

Des Plaines River Tributaries (East)

Species	Tolerance IL	Tolerance OH	No./Wt. Collected	% By Number
Species Ranks by Numbers				
Blackstripe Topminnow			136	26.0
Creek Chub	T	T	109	20.8
Green Sunfish	T	T	66	12.6
Central Mudminnow			51	9.7
White Sucker	T	T	44	8.4
Largemouth Bass			23	4.4
Bluegill Sunfish			23	4.4
Johnny Darter			20	3.8
Pumpkinseed Sunfish		P	16	3.1
Pirate Perch			13	2.5
Species Ranks by Weight (Kg)				
Creek Chub	T	T	0.20	26.3
Green Sunfish	T	T	0.17	21.6
White Sucker	T	T	0.12	15.3
Pumpkinseed Sunfish		P	0.06	8.0
Central Mudminnow			0.05	7.1
Largemouth Bass			0.05	6.1
Blackstripe Topminnow			0.03	4.4
Pirate Perch			0.03	3.5
Bluegill Sunfish			0.02	2.6
Northern Pike			0.01	1.7

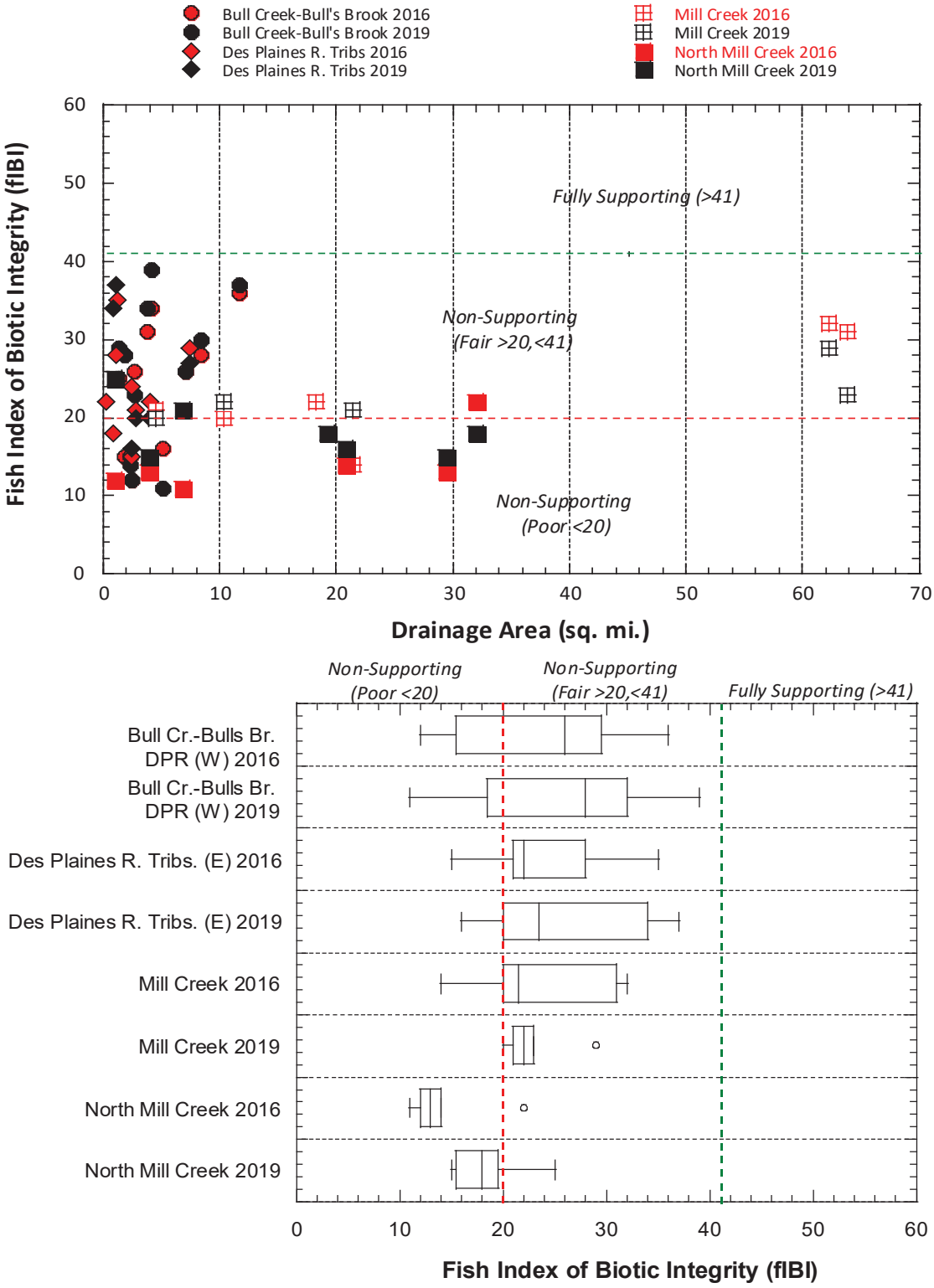

***Figure 15**. Illinois fish IBI scores by subwatershed and stream in the Year 3 2019 study area. Mean values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent full support, non-support fair, and non-support poor.*

substantially different flows nor were any drainage size differences.

Biological Assemblages – Macroinvertebrates

Macroinvertebrate taxa were likewise ranked by each of the four subwatershed bundles – Mill Creek, North Mill Creek, Bull Creek-Bulls Brook Des Plaines Tributaries (West), and Upper Des Plaines Tributaries (East) – that comprised the 2019 Year 3 study area (Table 17). Tolerant, moderately tolerant, and facultative taxa dominated the rankings in each subwatershed.

Taxa Inventory

Mill Creek had 96 taxa among 3,376 organisms collected. The scud *Gammarus sp.* comprised 20.7% of the collections followed by the Elmid beetle *Dubiraphia sp.,* Oligochaeta, the mayfly *Baetis intercalaris,* and the caddisfly genus *Cheumatopsyche sp.* North Mill Creek had 126 taxa among 4,363 organisms collected. The Planarian *Turbellaria* comprised 12.56% of the collections followed by *Oligochaeta,* the amphipod *Hyalella azteca,* the scud Gammarus sp., and the caddisfly genus *Cheumatopsyche sp.* The Bull Creek-Bulls Brook and Des Plaines Tributaries (West) had 133 taxa among 7,328 organisms collected. The Asellid crustacean *Caecidotea sp.* comprised 12.34% of the collections flowed by the scud *Gammarus sp., Oligochaeta,* the Elmid beetle *Stenelmis sp.,* and the Planarian *Turbellaria.* The Des Plaines Tributaries (East) had 97 taxa among 3,940 organisms collected. The amphipod *Hyalella azteca* comprised 15.18% of the collections followed by Asellid crustacean *Caecidotea sp., Oligochaeta,* the scud *Gammarus sp.,* and pea clams of the family Pisidiidae.

Macroinvertebrate Assemblage

Macroinvertebrate IBI (fIBI) scores are from single multihabitat collections at each of 29 sites within the summer-early fall index period. The General Use biocriterion of 41.8 was met at 10 of the 29 sites sampled and nearly so at two (2) other sites (Figure 15). Of the remaining sites 14 were in the non-support fair range and 3 barely into the non-support poor range. Full support was most frequent in the downstream reaches of major streams and the highest mIBI scores occurred in lower Mill Creek (mIBI = 58.5; site 11-1), the two lowermost sites in North Mill Creek (mIBI = 56.0 and 58.2; sites 10-1 and 10-2), and Stoneroller Creek (mIBI = 57.6; site 13-9).

Biological Assemblages – Response Signatures

Table 18 lists the fIBI score, selected fIBI metrics, mIBI score, selected mIBI metrics, and other macroinvertebrate assemblage attributes, three (3) of which are key biological response signatures associated with toxic impacts (%DELT anomalies, % toxic tolerant taxa) and organic enrichment (% organic enrichment tolerant taxa; Yoder and DeShon 2003). None of these response indicators were in the very poor range and only four (4) sites were in the poor range for organic enrichment tolerant taxa. Some of the results corresponded to stressor indicators that are relevant to the occurrence of these response signatures, but these also varied somewhat as to their degree and severity of occurrence as described below.

***Table 17**. Top forty macroinvertebrate taxa ranked by numbers in each of the four subwatershed bundles in the 2019 Year 3 Upper Des Plaines River subwatershed study area.*

Mill Creek Subwatershed

Taxa Code	Taxa Name	Tolerance	Numbers	Percent
06800	*Gammarus sp*		699	20.70%
68700	*Dubiraphia sp*		326	9.66%
03600	*Oligochaeta*		239	7.08%
11130	*Baetis intercalaris*		176	5.21%
52200	*Cheumatopsyche sp*		147	4.35%
22001	*Coenagrionidae*		143	4.24%
68708	*Dubiraphia vittata group*		138	4.09%
83040	*Dicrotendipes neomodestus*		138	4.09%
05800	*Caecidotea sp*		136	4.03%
83300	*Glyptotendipes (G.) sp*		120	3.55%
69400	*Stenelmis sp*		104	3.08%
84450	*Polypedilum (Uresipedilum) flavum*		93	2.75%
01801	*Turbellaria*		77	2.28%
84540	*Polypedilum (Tripodura) scalaenum group*		66	1.95%
98001	*Pisidiidae*		59	1.75%
68901	*Macronychus glabratus*		45	1.33%
84470	*Polypedilum (P.) illinoense*		43	1.27%
13400	*Stenacron sp*		40	1.18%
78655	*Procladius (Holotanypus) sp*		40	1.18%
82820	*Cryptochironomus sp*		35	1.04%
85625	*Rheotanytarsus sp*		32	0.95%
83158	*Endochironomus nigricans*		29	0.86%
95100	*Physella sp*		29	0.86%
17200	*Caenis sp*		28	0.83%
77750	*Hayesomyia senata or Thienemannimyia norena*		27	0.80%
82730	*Chironomus (C.) decorus group*		27	0.80%
77355	*Clinotanypus pinguis*		25	0.74%
82880	*Cryptotendipes sp*		19	0.56%
98600	*Sphaerium sp*		19	0.56%
98200	*Pisidium sp*		16	0.47%
16700	*Tricorythodes sp*		14	0.41%
68201	*Scirtidae*		14	0.41%
84520	*Polypedilum (Tripodura) halterale group*		14	0.41%
97601	*Corbicula fluminea*		14	0.41%
78600	*Pentaneura inconspicua*		12	0.36%
84210	*Paratendipes albimanus or P. duplicatus*		12	0.36%
85800	*Tanytarsus sp*		10	0.30%
06201	*Hyalella azteca*		9	0.27%
22300	*Argia sp*		9	0.27%
79000	*Tanypus sp*		9	0.27%

North Mill Creek Subwatershed

Taxa Code	Taxa Name	Tolerance	Numbers	Percent
01801	*Turbellaria*		548	12.56%
03600	*Oligochaeta*		500	11.46%
06201	*Hyalella azteca*		321	7.36%
06800	*Gammarus sp*		294	6.74%
52200	*Cheumatopsyche sp*		226	5.18%
68708	*Dubiraphia vittata group*		192	4.40%
11130	*Baetis intercalaris*		136	3.12%
83300	*Glyptotendipes (G.) sp*		135	3.09%
13400	*Stenacron sp*		115	2.64%
95100	*Physella sp*		108	2.48%
05800	*Caecidotea sp*		100	2.29%
68700	*Dubiraphia sp*		99	2.27%
17200	*Caenis sp*		93	2.13%
22001	*Coenagrionidae*		87	1.99%
78600	*Pentaneura inconspicua*		85	1.95%
84470	*Polypedilum (P.) illinoense*		85	1.95%
68201	*Scirtidae*		80	1.83%
98001	*Pisidiidae*		79	1.81%
84450	*Polypedilum (Uresipedilum) flavum*		77	1.76%
74100	*Simulium sp*		73	1.67%
78200	*Larsia sp*		65	1.49%
85625	*Rheotanytarsus sp*		55	1.26%
69400	*Stenelmis sp*		52	1.19%
94400	*Fossaria sp*		39	0.89%
84540	*Polypedilum (Tripodura) scalaenum group*		35	0.80%
52530	*Hydropsyche depravata group*		33	0.76%
77750	*Hayesomyia senata or Thienemannimyia norena*		30	0.69%
82820	*Cryptochironomus sp*		30	0.69%
21200	*Calopteryx sp*		28	0.64%
82730	*Chironomus (C.) decorus group*		27	0.62%
77500	*Conchapelopia sp*		25	0.57%
78655	*Procladius (Holotanypus) sp*		22	0.50%
68901	*Macronychus glabratus*		19	0.44%
77120	*Ablabesmyia mallochi*		17	0.39%
84520	*Polypedilum (Tripodura) halterale group*		17	0.39%
98200	*Pisidium sp*		17	0.39%
06700	*Crangonyx sp*		16	0.37%
53800	*Hydroptila sp*		16	0.37%
82880	*Cryptotendipes sp*		16	0.37%
84700	Stenochironomus sp		16	0.37%

Bull Creek- Bulls Brook DPR Tribs. (West)

Taxa Code	Taxa Name	Tolerance	Numbers	Percent
05800	*Caecidotea sp*		904	12.34%
06800	*Gammarus sp*		811	11.07%
03600	*Oligochaeta*		750	10.23%
69400	*Stenelmis sp*		676	9.22%
01801	*Turbellaria*		514	7.01%
98600	*Sphaerium sp*		332	4.53%
06201	*Hyalella azteca*		321	4.38%
98200	*Pisidium sp*		253	3.45%
52200	*Cheumatopsyche sp*		236	3.22%
04664	*Helobdella stagnalis*		228	3.11%
98001	*Pisidiidae*		161	2.20%
22001	*Coenagrionidae*		137	1.87%
84450	*Polypedilum (Uresipedilum) flavum*		125	1.71%
93200	*Hydrobiidae*		104	1.42%
68700	*Dubiraphia sp*		89	1.21%
69200	*Optioservus sp*		78	1.06%
21300	*Hetaerina sp*		76	1.04%
11130	*Baetis intercalaris*		75	1.02%
84210	*Paratendipes albimanus or P. duplicatus*		75	1.02%
83040	*Dicrotendipes neomodestus*		66	0.90%
11120	*Baetis flavistriga*		65	0.89%
06700	*Crangonyx sp*		64	0.87%
84470	*Polypedilum (P.) illinoense*		60	0.82%
95100	*Physella sp*		57	0.78%
77500	*Conchapelopia sp*		46	0.63%
74100	*Simulium sp*		45	0.61%
11200	*Callibaetis sp*		43	0.59%
85800	*Tanytarsus sp*		40	0.55%
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*		38	0.52%
84540	*Polypedilum (Tripodura) scalaenum group*		38	0.52%
85500	*Paratanytarsus sp*		37	0.50%
78200	*Larsia sp*		36	0.49%
84000	*Parachironomus sp*		36	0.49%
84750	*Stictochironomus sp*		35	0.48%
82820	*Cryptochironomus sp*		34	0.46%
68708	*Dubiraphia vittata group*		33	0.45%
78655	*Procladius (Holotanypus) sp*		29	0.40%
82730	*Chironomus (C.) decorus group*		28	0.38%
83300	*Glyptotendipes (G.) sp*		27	0.37%
85625	*Rheotanytarsus sp*		26	0.35%

Upper Des Plaines Tributaries (East)

Taxa Code	Taxa Name		Numbers	Percent
06201	*Hyalella azteca*		598	15.18%
05800	*Caecidotea sp*		501	12.72%
03600	*Oligochaeta*		475	12.06%
06800	*Gammarus sp*		453	11.50%
98001	*Pisidiidae*		345	8.76%
95100	*Physella sp*		332	8.43%
22001	*Coenagrionidae*		118	2.99%
68700	*Dubiraphia sp*		111	2.82%
01801	*Turbellaria*		106	2.69%
84750	*Stictochironomus sp*		105	2.66%
84210	*Paratendipes albimanus or P. duplicatus*		88	2.23%
94800	*Stagnicola sp*		73	1.85%
82730	*Chironomus (C.) decorus group*		42	1.07%
11200	*Callibaetis sp*		40	1.02%
17200	*Caenis sp*		34	0.86%
68708	*Dubiraphia vittata group*		32	0.81%
69400	*Stenelmis sp*		31	0.79%
98600	*Sphaerium sp*		30	0.76%
83840	*Microtendipes pedellus group*		28	0.71%
79000	*Tanypus sp*		27	0.69%
84470	*Polypedilum (P.) illinoense*		25	0.63%
83158	*Endochironomus nigricans*		18	0.46%
94400	*Fossaria sp*		17	0.43%
52200	*Cheumatopsyche sp*		16	0.41%
85500	*Paratanytarsus sp*		16	0.41%
95900	*Gyraulus sp*		16	0.41%
98200	*Pisidium sp*		16	0.41%
85800	*Tanytarsus sp*		13	0.33%
06700	*Crangonyx sp*		12	0.30%
82820	*Cryptochironomus sp*		11	0.28%
93200	*Hydrobiidae*		11	0.28%
96264	*Planorbella (Pierosoma) pilsbryi*		11	0.28%
77355	*Clinotanypus pinguis*		9	0.23%
77500	*Conchapelopia sp*		9	0.23%
80420	*Cricotopus (C.) bicinctus*		9	0.23%
52530	*Hydropsyche depravata group*		8	0.20%
72900	*Culex sp*		8	0.20%
83040	*Dicrotendipes neomodestus*		7	0.18%
83300	*Glyptotendipes (G.) sp*		7	0.18%
04664	*Helobdella stagnalis*		6	0.15%

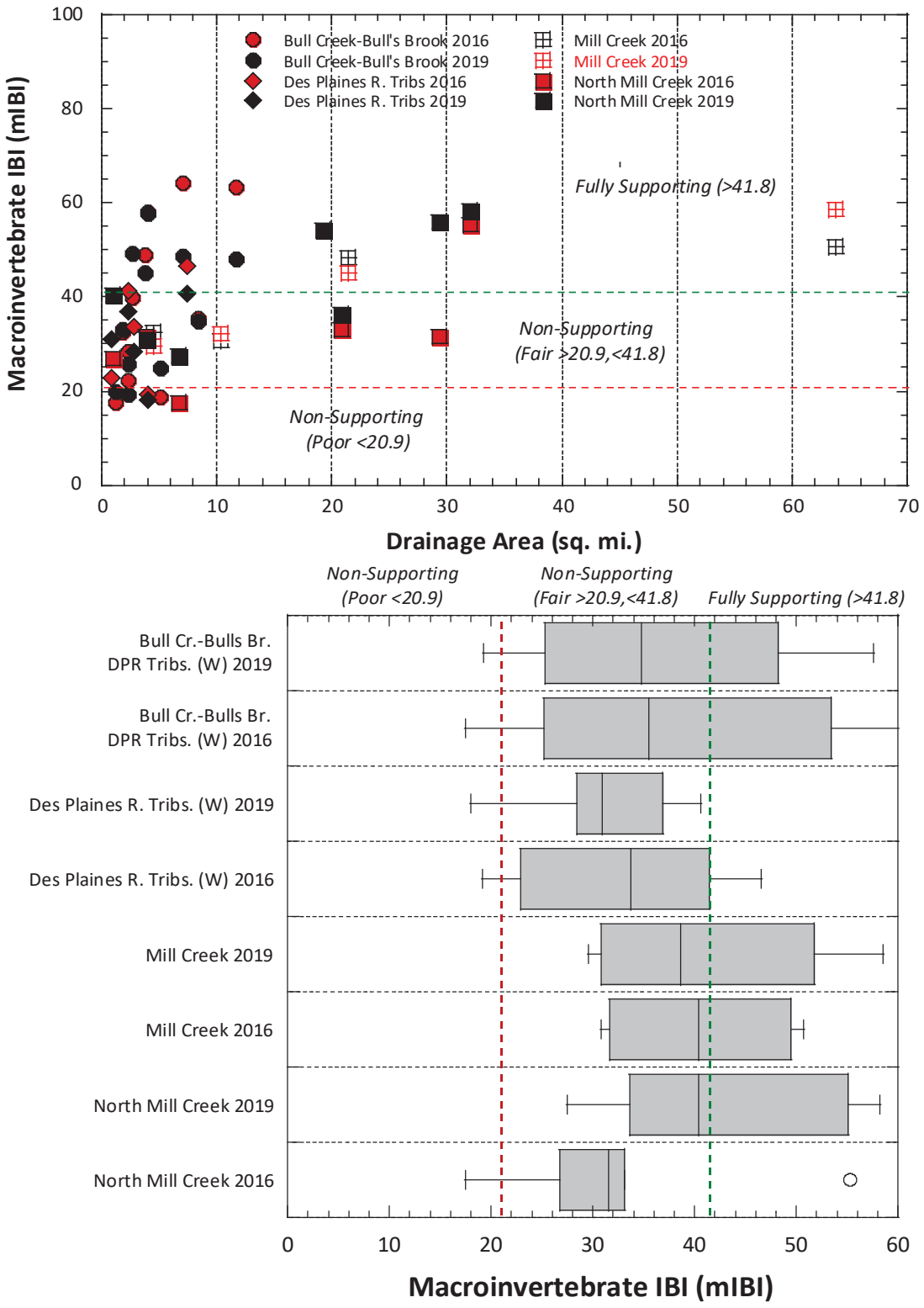

***Figure 16**. Illinois macroinvertebrate IBI scores by subwatershed and stream in the Year 3 2019 study area. Values are shown by individual site by drainage area (upper panel) in 2016 and 2019 and in tributary subwatershed bundles as box-and-whisker plots (lower panel). Dashed and solid lines represent full support, non-support fair, and non-support poor.*

***Table 18**. Selected fish and macroinvertebrate assemblage attributes for sites sampled in the 2019 Year 3 study area. Biological index scores and metrics are shaded by level of use support: Exceptional – blue; Good (fully supporting) - green; Fair (non-support) - yellow; Poor (non-support) – orange; Very Poor (non-support) - red; metrics used as signatures of toxic or organic enrichment impacts are based on Yoder and DeShon (2003).*

			Fish Assemblage Indicators							*Macroinvertebrate Assemblage Indicators*								
Site ID	River Mile	Drainage Area (mi.^{2})	fIBI	MIwb	Native Sp.	% DELT	Intolerant sp.	%Mineral Spawners	Percent Tolerant	mIBI	Total Taxa	Intolerant Taxa	%Tolerant Taxa	EPT Taxa	%EPT	MBI	%Toxic Tolerant Taxa	%Organic Enrich. Taxa
Mill Creek																		
11-6	17.20/17.20	4.5	20	NA	9	0.00	0	0.0	44.4	29.6	19	2	2.6	1	1.6	4.6	0.0	3.1
11-5	13.80/13.80	10.4	22	NA	13	1.73	0	0.0	38.5	32.1	24	2	15.9	3	4.5	5.8	2.7	26.5
11-4	10.10/10.10	18.33								43.0	27	4	7.1	5	18.4	5.5	2.4	13.8
11-3	7.20/7.20	21.4	21	6.9	13	0.00	1	2.2	38.5	45.1	27	3	6.2	4	31.4	5.3	1.4	24.8
11-2	1.71/1.71	62.3	29	8.9	21	0.25	1	4.9	28.6									
11-1	0.70/0.70	63.8	23	7.5	13	0.00	0	7.3	46.2	58.5	29	3	8.5	6	40.1	5.2	4.2	4.6
North Mill Creek																		
10-7	11.30/11.30	19.2	18	NA	9	0.00	0	0.0	33.3	54.2	36	4	4.7	6	31.1	5.4	7.2	8.9
10-3	10.20/10.20	20.8	16	6.1	9	0.00	0	0.0	44.4	36.3	30	3	7.7	4	4.4	5.3	0.0	9.2
10-2	8.10/8.10	29.5	15	5.0	10	0.00	1	1.7	70.0	56.0	28	5	2.1	6	54.4	5.3	3.1	19.8
10-1	1.10/1.10	31.9	18	6.1	12	0.00	0	0.0	50.0	58.2	30	4	9.8	5	21.2	5.4	9.8	9.5
Hastings Creek																		
10-5	3.12/3.12	3.9	15	NA	6	0.00	0	0.0	33.3	31.0	27	3	13.0	6	20.7	6.3	0.3	47.5
10-4	1.68/1.68	5.6	21	NA	8	0.00	0	0.0	25.0	27.5	19	4	2.5	1	3.3	5.4	0.7	58.5
Unnamed Tributary to North Mill Creek @RM 0.75																		
10-6	0.04/0.04	0.9	25	NA	6	0.00	0	0.0	50.0	40.4	28	4	2.0	6	25.6	4.7	1.7	11.0
Newport Drainage Ditch																		
12-2	3.03/3.03	2.8	20	NA	7	0.00	0	0.0	28.6	28.4	14	1	4.3	3	9.2	4.9	0.0	8.2
12-1	0.70/0.70	7.3	27	NA	9	0.00	0	0.0	22.2	40.6	27	3	10.3	6	4.2	5.3	2.9	18.1
Suburban Country Club Tributary to DPR @RM 98.4																		
13-10	2.00/2.00	4	20	NA	8	1.03	0	0.0	12.5	18.0	10	0	1.2	0	0.0	4.5	1.2	9.4
Slocum Creek																		
13-11	1.36/1.36	2.4	16	NA	7	0.00	0	1.4	57.1	36.9	22	3	2.2	5	3.9	4	1.3	3.5
Unnamed Tributary to Greenleaf Creek @RM 0.64																		
13-13	0.40/0.40	1.1	37	NA	9	0.00	0	0.9	44.4	21.5	9	2	6.7	0	0.0	5.7	0.0	18.5
Unnamed Tributary to Des Plaines River @RM 89.5																		
13-17	0.13/0.13	0.9	34	NA	11	0.00	0	0.0	45.5	30.9	19	1	25.8	0	0.0	7.1	0.0	44.8
West Fork Belvidere Rd. Tributary to DPR @RM 94.0																		
13-14	0.21/0.21	2.3	14	NA	6	0.00	0	0.0	66.7	25.7	18	1	2.3	1	0.9	6	0.3	18.4
13-8	0.15/0.15	3.8	34	NA	17	0.52	1	11.9	35.3	45.2	36	3	10.0	4	7.0	5.6	5.2	15.2
Stoneroller Creek																		
13-9	0.42/0.42	4.1	39	NA	16	0.74	2	50.0	37.5	57.6	27	3	24.6	7	22.8	6.1	1.0	15.5
Bulls Brook																		
13-15	1.95/1.95	1.9	28	NA	6	0.00	0	19.8	50.0	33.2	31	2	3.7	4	11.2	5.3	0.0	4.5
13-7	0.25/0.25	2.7	23	NA	9	0.00	0	4.9	33.3	49.3	24	4	4.2	4	6.0	4.1	0.3	2.6
Bull Creek																		
14-6	5.95/5.95	2.4	12	NA	1	0.00	0	0.0	0.0	19.3	17	0	7.6	0	0.0	6.3	0.3	7.9
14-5	4.70/4.70	1.3	29	NA	8	1.33	0	0.0	25.0	20.0	21	3	27.2	0	0.0	7.3	1.3	50.2
14-2	1.00/1.00	8.4	30	NA	10	0.00	0	9.1	30.0	34.8	29	1	13.0	1	6.1	6.3	1.8	25.5
14-1	0.50/0.50	11.7	37	NA	16	0.40	2	31.7	25.0	47.9	36	1	10.6	6	22.5	5.6	2.5	13.8
West Branch Bull Creek																		
14-4	2.54/2.54	5.1	11	NA	6	0.00	0	1.7	50.0	24.9	22	0	7.5	1	3.0	6.1	1.3	39.7
14-3	1.60/1.60	7.1	26	NA	6	0.00	0	46.0	50.0	48.5	27	2	11.1	5	37.1	5.8	1.6	21.8
	Exceptional		>50	>9.6	>29	0.00	≥ 5		≤16.1	>65.0							0.0	<5
	Good		≥41	>8.5	>14	≤0.10	≥4	>40.7	<30.3	≥41.8	≥23	≥3	≤7.5	≥3	>24.5	≤4.9	<5	<15
	Fair		<41.8	>5.8	>12	>0.10	<3	<40.7	<40	<41.8	≤23	≥2	≤28	2	≥7.7	>4.9	<20	≥15
	Poor		≤20	<5.8	>7	>10	≤1	<10	>50	≤20.9	<16	<2	>28.1	1	<7.7		≥35	≥35
	Very Poor		<12	<4.0	≤7	>20		<0.8	≥70			0		0			<60	>60

The %DELT anomalies on fish were in the fair range at seven (7) sites scattered throughout the 2019 Year 3 study area. While low, any detection of DELTs greater than 0.1% is noteworthy as a healthy assemblage should have very few or no DELT anomalies. The highest DELT of 1.73% occurred in Mill Creek at RM 13.8 (site 11-5) which also had a very low D.O. value of 0.16 mg/L in the Datasonde results. Low D.O. is one of the key parameters associated with elevated DELT anomalies (Yoder and Rankin 1995; Sanders et al. 1999). The second highest DELT result of 1.33% occurred in Bull Creek at RM 4.70 (site 14-5) followed by the Suburban Country Club Tributary at RM 2.0 (site 13-10) at 1.03%. The other fair DELT values were in the 0.25-0.50% range. The latter site had a high mean ammonia of 0.88 mg/L which is in the very poor range of the IPS and could be an exceedance of the water quality criteria under high pH conditions.

Five (5) sites had poor organic enrichment macroinvertebrate taxa results. Both Hastings Creek sites had 47.5% (site 10-4) and 58.5% (site 10-5) organic enrichment tolerant taxa. The upstream site was designated as likely nutrients and the downstream site as enriched by the modified SNAP procedure. Bull Creek at RM 4.7 (site 14-5) had 50.2% organic enrichment tolerant taxa, the same site that had elevated DELT anomalies on fish. The Unnamed Tributary to the Des Plaines River at RM 89.5 (site 13-17) had 44.8% organic enrichment tolerant taxa which also had a very poor TKN value, but no other chemical indicators of note. West Branch Bull Creek at RM 5.1 (site 14-4) had the remaining poor organic enrichment tolerant taxa at 39.7% which had a very low minimum D.O. value of 1.81 mg/L and was rated as likely nutrients by the modified SNAP procedure.

Synthesis

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 recently developed IPS tools and indicators (MBI 2020a) and are 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 18 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 index, new IPS chemical threshold exceedances for water and sediment, and biological response signatures for organic enrichment and toxic tolerant indicators.

The baseline biological condition of the Year 3 Upper Des Plaines subwatersheds has been shaped by the naturally low gradient and wetland origins of the region. The current condition of the biological assemblages reflects historical changes that have significantly altered these natural features, mostly through hydrological and physical alterations related to agricultural, suburban, and urban development throughout the study 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 where they are most evident have resulted in sluggish flows, excessive siltation, embedded substrates, sparse instream cover, sediments high in organic matter, and indicators of agricultural and urban runoff that are further exacerbated by the altered flows and habitat. TKN values were very poor and poor at numerous sites an indication of excessive runoff and instream algal production. Runoff containing sediments that are high in organic matter also combined with sluggish flows and stream channel alterations to exacerbate low D.O. concentrations and high to wide diel D.O. swings in several streams. Another indicator of excessive organic enrichment were the consistently high *E. coli* maximum values at the 2420 cfu/100 mL upper limit of the analytical method at all sites in North Mill Creek, Hastings Creek, Newport Drainage Ditch, Slocum Creek, Unnamed Tributary to Greenleaf Creek, West Fork Belvidere Rd. Tributary, and West Branch of Bull Creek. At sites with more "normal" mean E. coli values this is an indication of periodic spates from periods of runoff. However, some sites had elevated means indicating a more routine bacterial contamination. A higher upper limit for the analytical method could possibly better separate sites with sewage contamination versus general nonpoint source runoff. The introduction of wastewater from the Lindenhurst WWTP into Hastings Creek did not add appreciably to the existing upstream delivery of nutrients, oxygen demanding wastes, and ammonia-N. The LCDPW Mill Creek WWTP discharges to Mill Creek only one mile from the Des Plaines mainstem thus only its immediate and seemingly negligible impact could be assessed. Only four (4) sites had QHEI scores that were considered good with the majority of sites scoring in the fair range. Where habitat alteration was a factor it was severe with two (2) sites exhibiting extremely high poor to modified attribute ratios. Together these have resulted in essentially complete non-attainment of the General Use for aquatic life throughout the study area. However, the severity of the non-attainment varies at the subwatershed, reach, and site scales.

Recently 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.

A total of 16 causes associated with varying degrees of impairment of the General Use for aquatic life were determined by relating threshold exceedances of the various physical and

y chemical, physical, and biological response indicators of impairment observed at each site in the 2019 Upper Des Plaines subwatersheds study area. The causes associated with b
ents are drawn from analyses of habitat, nutrient effects, chemical IPS and other threshold exceedances, sediment chemical IPS exceedances, and biological response signatures. C
ent are classified as fair, poor, or very poor in accordance with the severity of exceedance of corresponding thresholds. See footnotes for table references and biological, physical, a
d intervals.

inage rea . mi.)	AQLU Status	fIBI	mIBI	QHEI	QHEI Modified: Good Ratio	Min. D.O. (Sonde) <WQC	Diel D.O. Swing	IPS Nutrient Index	Chemical WQC Exceed-ances	>Poor Chemical IPS Threshold	>Poor Sediment Metals Thresholds	>Poor Sediment PAH Thresholds	%Organic Enrichment Signatures	%Toxic Tolerant Signatures	2019 Causes by IPS Stressor Threshold Narrative Category			2019 Sources	IPS Restora-bility Score (0-100)
															Very Poor[1]	Poor[1]	Fair[1]		
															Mill Creek				
4.5	NON-Poor	20	29.6	40.0	9.00	5.11	1.99	9.46		TKN					QHEI Ratio;Substr;TKN	QHEI;Chan;	Min. D.O.;Ammonia;	Hydromodification; Agricultural NPS	60.1
0.4	NON-Poor	22	32.1	52.8	2.33	0.16	6.51	7.76	Min. D.O.	TKN	Cd		Macro. (26.5%)	DELT(1.73%)	Min.&Diel D.O.	Substr;Chan;TKN	QHEI&Ratio;Chloride;Ammonia;Toxicity;	Hydromodification; Agricultural NPS	49.3
8.3	[FULL]	-	43.0	-	0.83	3.38	3.08	8.98	Min. D.O.	TKN					TKN;	Min. D.O.	Chloride;Ammonia;	Agricultural NPS	-
1.4	NON-Poor	21	45.1	62.0	-	6.15	2.76	10.18		TKN					TKN;		QHEI;Substr;Chloride;	Agricultural NPS	68.1
2.3	NON-Poor	29	-	80.0	0.25	5.53	2.18	8.54		TSS,TKN			Macro. (24.8%)	DELT (0.25%)		TSS; TKN	TKN;VSS;Organic Enrich.	Agricultural NPS	73.0
3.8	NON-Poor	23	58.5	68.5	1.00	5.85	2.85	10.08		TSS,TKN					TSS;	TSS;TKN	QHEI;Substr;Chan; VSS;	Agricultural NPS; WWTP	53.8
															North Mill Creek				
9.2	NON-Poor	18	54.2	37.0	9.00	4.10	-	8.76						Macro. (7.2%)	QHEI Ratio;Substr;	QHEI; Chan; Min. D.O.	TKN;Ammonia;Organic Enrich.;	Hydromodification; Agricultural NPS	55.6
0.9	NON-Poor	16	36.3	59.0	1.67	4.23	7.50	7.58		TKN					Substr; Diel D.O.	TKN;	QHEI;Chan;	Hydromodification; Agricultural NPS	58.7
9.6	NON-Poor	15	56.0	67.8	0.67	6.51	5.33	9.18					Macro. (19.8%)			Diel D.O.	TKN;QHEI;Substr;Ammonia;Organic Enrich.	Agricultural NPS	64.5
2.0	NON-Poor	18	58.2	59.0	2.00	6.60	2.40	8.00			Cd			Macro. (9.8%)		Substr; Metals	TKN;QHEI&Ratio;Chan;Ammonia;	Agricultural NPS; Urban Stormwater	64.9
															Hastings Creek				
3.9	NON-Poor	15	31.0	60.0	1.00	4.45	2.21	7.68		TKN					TKN;	TKN;	QHEI&Ratio;Substr;Chan;Chloride;Min. D.O.	Agricultural NPS	72.6
5.6	NON-Poor	21	27.5	44.5	2.50	3.15	9.87	13.06	Min D.O.	TKN					Diel D.O.;TKN;	QHEI; Chan; Min. D.O.	Substr;Chloride;	WWTP;Agricultural NPS;Urban Stormwater	61.3
															Unnamed Tributary to North Mill Creek @RM 0.75				
.99	NON-Poor	25	40.4	53.5	0.80	-	-	7.58		TKN						TKN;	QHEI;Substr;Chan;	Urban Stormwater	67.1
															Newport Drainage Ditch				
2.8	NON-Poor	20	28.4	45.0	2.33	4.54	7.37	7.18		TKN	Al,Cd,Zn				Substr;Diel D.O.;TKN;Metals	QHEI; Chan;	Min. D.O.;QHEI Ratio;	Agricultural NPS; Hydromod.;Urban Stormwater	65.0
7.4	NON-Poor	27	40.6	63.0	0.80	-	-	6.58					Macro. (18.1%)				TKN;Max D.O.;QHEI;Substr;Chan;Amm;Org.Enrich.	Agricultural NPS	68.4
															Suburban Country Club Tributary to DPR @RM 98.4				
4.0	NON-Poor	20	18.0	39.0	3.50	-	-	6.88		Ammonia,TKN	Cd			DELT (1.03%)	Chan;Ammonia;TKN	Substr; Metals	QHEI Ratio;TKN;Toxicity;	Urban Stormwater	52.0
															Slocum Creek				
2.4	NON-Poor	16	36.9	63.8	0.83	-	-	6.68		TKN						TKN;	QHEI;Max. D.O.;Ammonia	Urban Stormwater	72.5
															Unnamed Tributary to Greenleaf Creek @RM 0.64				
1.1	NON-Poor	37	21.5	63.8	0.80	-	-	7.36		Amm.,Cond.,TKN,Chl			Macro. (18.5%)		Ammonia;TKN,Chloride		TKN; QHEI; Substr; Conduct;Organic Enrich.;	Urban Stormwater	67.4
															Unnamed Trib to Des Plaines River @RM 89.5				
.90	NON-Fair	34	30.9	62.0	0.80	-	-	8.16		TKN						TKN;	QHEI; Substr; Chan;	Urban Stormwater	82.5
															West Fork Belvidere Rd. Tributary to DPR @RM 94.0				
2.3	NON-Poor	14	25.7	68.8	0.29	-	-	6.88		TKN			Macro. (18.4%)		TKN;		TKN;QHEI;Chan;Max. D.O.;Chloride;	Urban Stormwater	62.5
3.8	PARTIAL	34	45.2	70.0	0.86	-	-	6.16		TKN			Macro. (15.2%)	DELT(0.52%);Macro. (5.2%)		TKN;	TKN;QHEI;Chan;Chloride;Org.Enrich.;Toxicity	Urban Stormwater	67.8
															Stoneroller Creek				
4.1	PARTIAL	39	57.6	82.0	0.25	-	-	5.26		Chloride	Mn		Macro. (15.5%)	DELT (0.74%)	Chloride;Metals		TKN;Conduct;Org. Enrich.;Ammonia;Toxicity	Urban Stormwater	78.0
															Bulls Brook				
1.9	NON-Poor	28	33.2	76.5	0.13	-	-	8.18		TKN					TKN;			Urban Stormwater	76.7
2.7	NON-Poor	23	49.3	69.0	0.25	-	-	7.78		TKN	Mn				TKN:	Metals	QHEI;	Urban Stormwater	85.6
															Bull Creek				
2.4	NON-Poor	12	19.3	57.5	0.60	3.50	-	8.56	Min D.O.	TKN	Mn						TKN;QHEI;Chan;Ammonia;	Urban Stormwater	79.9
1.3	NON-Fair	29	20.0	57.3	0.80	-	-	8.38		TKN				DELT (1.33%)		TKN;	QHEI; Substr; Chan;	Urban Stormwater	62.2
3.4	NON-Fair	30	34.8	53.3	0.71	-	-	7.08		Chloride		14 PAH	Macro. (25.5%)		PAH Compounds	Chloride;	TKN; QHEI; Substr; Conductivity;	Urban Stormwater	58.7
1.7	PARTIAL	37	47.9	78.0	0.13	7.02	3.75	5.86		TKN				DELT (0.40%)		TKN;	TKN;Chloride;Ammonia;Toxicity	Urban Stormwater	59.1
															West Branch Bull Creek				
5.1	NON-Poor	11	24.9	47.8	1.20	1.81	3.17	8.44	Min D.O.	TKN,Chloride					Min. D.O.;TKN;Chloride	QHEI; Substr; Metals	Substr;Chan;QHEI Ratio;Ammonia;	Urban Stormwater	63.3
7.1	NON-Poor	26	48.5	65.8	0.29	-	-	6.34					Macro. (21.8%)			Chloride;	TKN; QHEI;Organic Enrich.	Urban Stormwater	70.4
	FULL	≥50	>73	>84.5	<0.50	>6.9	< 2.0	<10											Very High
	FULL	>41-49	41.8-72.9	>75.9	<1.00	6-6.9	2.0-4.0	10-15											High
	Non-Fair	30-<41	30-41.7	<75.9	≥1.00	4.0-5.9	4.0-5.0	15-25											Moderate
	Non-Poor	>15-29	>15-29	<50.1	>4.00	2.0-3.9	5.0-6.5	25-35											Low
	Non-Poor	≤15	≤15	<25.0	>6.00	<2.0	>6.5	>35											Very Low

ir causes assigned by weighting the stressor rank * FIT factor - see Appendix D; very poor causes rank >8-10, poor causes rank >6-8, fair causes rank >4-6; other stressor rankings are in legend at bottom of table.

chemical parameters measured alongside the biological assemblages in a synthesis analysis (Table 19). These were then tallied and grouped into five (5) categories and weighted in accordance with the exceedance eclipsing a fair, poor, or very poor threshold (Table 20). Most of the thresholds are from the NE Illinois IPS (MBI 2020a), but other sources were used for parameters and indicators not directly included or yet derived in the IPS. The weighting was done as follows – 5 times for very poor, 3 times for poor, and none for fair parameter exceedances and other indicator values. This amplifies the very poor threshold exceedances as being more likely to exert a true causal influence as opposed to simply being associated with an impairment on a spatial basis. Nutrient and organic enrichment indicators included TKN, ammonia-N, and organic enrichment responses in the biota comprised 35.2% of the weighted causes (Table 19). Habitat related causes followed closely comprising 32.4% of the causes. These were followed by urban related (12.8%), D.O. related (11.5%), and toxics and toxicity (8.2%).

Restorability, Susceptibility, and Threat Factors

The NE Illinois IPS was developed to provide an organized and robust framework for determining restoration and protection priorities and options for both impaired and attaining watersheds, reaches, and sites (MBI 2020a). A Restorability factor is derived for impaired sites and Susceptibility and Threat factors are derived for attaining sites. These factors are provided in the synthesis (Table 19) and aquatic life use attainment (Table 1) tables. Five narrative ranges of Restorability from very high to very low have been established on an interim basis – these are subject to revision as these factors are applied in NE Illinois watersheds by the watershed groups. Narrative ranges for Susceptibility and Threat from very low to very high run in the reverse of the Restorability narratives.

In the 2019 Upper Des Plaines subwatersheds only one site was in full attainment and this being based on a single assemblage. This site had a moderate susceptibility and a very low threat ranking. The balance of the 30 sites were all impaired and thus were assigned Restorability scores. Two (2) sites, the Unnamed Tributary to the Des Plaines River at RM 89.5 and the downstream site on Bulls Brook had Very High Restorability scores. This means that few precluding factors that might otherwise deter recovery following a restoration project exist. The majority of the remaining sites (18) had High Restorability scores and the remaining 10 sites had Moderate scores. No sites had Low or Very Low scores. Based on the Very High and High scores much of the watershed has good potential to respond positively to restoration. However, restoration projects will need to focus on the limiting factors for each site, reach, and watershed that are available in the IPS databases and dashboard.

***Table 20**. Summary of causal agents and categories identified from the synthesis of key chemical, physical, and biological response indicators of impairment observed at each site in the 2019 Upper Des Plaines subwatersheds study area. Total and weighted observations by very poor, poor, and fair exceedances are tallied for each causal agent and category to provide a relative accounting for the Year 3 study area.*

Causal Agents	Very Poor	VP%	VP Wtd.	VP Wtd.%	Poor	Poor%	Poor Wtd.	Poor Wtd.%	Fair	Fair%	Fair Wtd.%	Total	Total%	Total Wtd.	Wtd. %
QHEI Score	0	0.0%	0	0.0%	4	2.2%	12	3.1%	20	11.1%	5.1%	4	13.3%	32	8.2%
QHEI Ratios	2	1.1%	10	2.6%	1	0.6%	3	0.8%	6	3.3%	1.5%	3	5.0%	19	4.8%
Substrate	4	2.2%	20	5.1%	4	2.2%	12	3.1%	12	6.7%	3.1%	8	11.1%	44	11.2%
Channel Condition	1	0.6%	5	1.3%	5	2.8%	15	3.8%	12	6.7%	3.1%	6	10.0%	32	8.2%
Habitat Related	**7**	**1.8%**	**35**	**8.9%**	**14**	**7.8%**	**42**	**10.7%**	**50**	**27.8%**	**12.8%**	**71**	**39.4%**	**127**	**32.4%**
TKN	11	6.1%	55	14.0%	11	6.1%	33	8.4%	13	7.2%	3.3%	22	19.4%	101	25.8%
Ammonia-N	2	1.1%	10	2.6%	2	1.1%	6	1.5%	13	7.2%	3.3%	4	9.4%	29	7.4%
Organic Enrichment	0	0.0%	0	0.0%	0	0.0%	0	0.0%	8	4.4%	2.0%	0	4.4%	8	2.0%
Nutrient_Enrichment	**13**	**3.3%**	**65**	**16.6%**	**13**	**7.2%**	**39**	**9.9%**	**34**	**18.9%**	**8.7%**	**60**	**33.3%**	**138**	**35.2%**
Minimum D.O.	2	1.1%	10	2.6%	2	1.1%	6	1.5%	3	1.7%	0.8%	4	3.9%	19	4.8%
Maximum D.O.	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	1.7%	0.8%	0	1.7%	3	0.8%
Diel D.O.	4	2.2%	20	5.1%	1	0.6%	3	0.8%	0	0.0%	0.0%	5	2.8%	23	5.9%
D.O. Related	**6**	**3.3%**	**30**	**7.7%**	**3**	**1.7%**	**9**	**2.3%**	**6**	**3.3%**	**1.5%**	**15**	**8.3%**	**45**	**11.5%**
Chlorides	3	1.7%	15	3.8%	3	1.7%	9	2.3%	8	4.4%	2.0%	6	7.8%	32	8.2%
Conductivity	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	1.7%	0.8%	0	1.7%	3	0.8%
TSS_VSS	2	1.1%	10	2.6%	1	0.6%	3	0.8%	2	1.1%	0.5%	3	2.8%	15	3.8%
Urban Related	**5**	**2.8%**	**25**	**6.4%**	**4**	**2.2%**	**12**	**3.1%**	**13**	**7.2%**	**3.3%**	**22**	**12.2%**	**50**	**12.8%**
Metals	2	1.1%	10	2.6%	4	2.2%	12	3.1%	0	0.0%	0.0%	6	3.3%	22	5.6%
PAH	1	0.6%	5	1.3%	0	0.0%	0	0.0%	0	0.0%	0.0%	1	0.6%	5	1.3%
Toxicity	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	2.8%	1.3%	0	2.8%	5	1.3%
Toxics	**3**	**1.7%**	**15**	**3.8%**	**4**	**2.2%**	**12**	**3.1%**	**5**	**2.8%**	**1.3%**	**12**	**6.7%**	**32**	**8.2%**
Total Observations	**34**	**12.9%**	**170**	**43.4%**	**38**	**21.1%**	**114**	**29.1%**	**108**	**60.0%**	**27.6%**	**180**	**100.0%**	**392**	**100.0%**

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APPENDIX A

Upper Des Plaines River Year 3 Subwatersheds 2019 Fish Assemblage Data

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

Appendix Table A-1. Fish IBI results for data collected in the upper Des Plaines River study area during 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
BULL CREEK - (95051)																			
Year: 2019																			
14-6	5.95	F	08/29/2019	2.4	11.8	3	1(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(6)	0(6)	0(0)	0 * *	12.0	0.0
14-5	4.70	F	10/13/2019	1.3	0.6X	3	8(6)	4(6)	0(0)	0(0)	0(0)	1(6)	0(0)	25(6)	65(5)	0(0)	225	29.0	5.4
14-2	1.00	F	08/28/2019	8.4	34.8	3	10(2)	3(4)	1(2)	0(0)	1(1)	3(2)	9(2)	30(5)	58(6)	28(6)	396	30.0	5.3
14-1	0.50	E	10/10/2019	11.7	40.9	3	16(3)	5(6)	0(0)	2(2)	3(2)	5(3)	32(4)	25(5)	51(6)	28(6)	498	37.0	7.5
HASTINGS CREEK - (95702)																			
Year: 2019																			
10-5	3.12	F	08/28/2019	3.9	20.7	3	6(1)	3(5)	0(0)	0(0)	0(0)	0(0)	0(0)	33(5)	70(4)	0(0)	80 *	15.0	4.7
10-4	1.68	F	08/28/2019	5.6	27.4	3	8(2)	4(6)	0(0)	0(0)	1(1)	0(0)	0(0)	25(5)	41(6)	2(1)	112 *	21.0	5.4
BULL'S BROOK - (95704)																			
Year: 2019																			
13-15	1.95	F	10/08/2019	1.9	7.5X	3	6(2)	2(6)	1(3)	0(0)	1(1)	2(2)	20(2)	50(4)	68(4)	11(4)	354	28.0	4.9
13-7	0.25	F	08/30/2019	2.7	14.0	3	9(2)	2(5)	0(0)	0(0)	2(2)	3(2)	5(1)	33(5)	78(3)	7(3)	288	23.0	3.4
NEWPORT DRAINAGE DITCH - (95708)																			
Year: 2019																			
12-2	3.03	E	10/13/2019	2.8	14.6	3	7(1)	4(6)	1(2)	0(0)	0(0)	0(0)	0(0)	29(5)	57(6)	0(0)	28 * *	20.0	4.5
12-1	0.70	F	10/13/2019	7.3	32.2	3	9(2)	2(3)	0(0)	0(0)	2(2)	2(2)	0(0)	22(6)	11(6)	19(6)	224	27.0	5.8
STONEROLLER CREEK - (95709)																			
Year: 2019																			
13-9	0.42	E	10/10/2019	4.1	21.7	3	16(4)	4(6)	1(2)	2(2)	2(2)	6(3)	50(6)	38(5)	43(6)	7(3)	540	39.0	7.7

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 A-1. Fish IBI results for data collected in the upper Des Plaines River study area during 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
SUBURBAN COUNTRY CLUB TRIB - (95710)																				
Year: 2019																				
13-10	2.00	E	10/10/2019	4.0	21.2	3	8(2)	5(6)	0(0)	0(0)	0(0)	0(0)	0(0)	13(6)	11(6)	0(0)	194	*	20.0	5.6
SLOCUM CONRNERS CREEK - (95711)																				
Year: 2019																				
13-11	1.36	E	10/13/2019	2.4	11.8	3	7(1)	1(3)	1(3)	0(0)	2(2)	2(1)	1(1)	57(3)	96(1)	3(1)	146	*	16.0	3.3
UNNAMED TRIB TO DESPLAINES RIVER - (95714)																				
Year: 2019																				
13-17	0.13	F	08/30/2019	0.9	1.1[X]	3	11(6)	4(6)	1(6)	0(0)	0(0)	2(6)	0(0)	45(4)	43(6)	0(0)	222		34.0	6.3
UT TO NORTH MILL CREEK - (95715)																				
Year: 2019																				
10-6	0.04	F	08/28/2019	0.9	1.1[X]	3	6(6)	4(6)	0(0)	0(0)	0(0)	1(6)	0(0)	50(4)	81(3)	0(0)	128	*	25.0	4.9
UT GREENLEAF CREEK - (95716)																				
Year: 2019																				
13-13	0.40	F	08/30/2019	1.1	1.1[X]	3	9(6)	2(6)	1(6)	0(0)	2(6)	4(6)	1(1)	44(4)	93(1)	1(1)	234		37.0	3.4
WEST BRANCH BULL CREEK - (95719)																				
Year: 2019																				
14-4	2.54	F	08/29/2019	5.1	25.7	3	6(1)	1(2)	0(0)	0(0)	0(0)	2(1)	2(1)	50(4)	88(2)	0(0)	120	*	11.0	2.1
14-3	1.60	F	08/29/2019	7.1	31.7	3	6(1)	3(5)	1(2)	0(0)	0(0)	2(2)	46(6)	50(4)	50(6)	0(0)	274		26.0	5.8
WEST FORK BELVIDERE RD. TRIB - (95720)																				

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 A-1. Fish IBI results for data collected in the upper Des Plaines River study area during 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
Year: 2019																				
13-14	0.21	F	10/08/2019	2.3	11.0	3	6(1)	2(5)	1(3)	0(0)	0(0)	1(1)	0(0)	67(3)	99(1)	0(0)	162	*	14.0	3.7
13-8	0.15	E	10/08/2019	3.8	20.3	3	17(4)	4(6)	1(2)	1(1)	2(2)	4(2)	12(2)	35(5)	52(6)	11(4)	388		34.0	7.1
MILL CREEK - (95995)																				
Year: 2019																				
11-6	17.20	F	08/28/2019	4.5	23.4	3	9(2)	3(5)	1(2)	0(0)	1(1)	1(1)	0(0)	44(4)	73(4)	2(1)	172	*	20.0	4.0
11-5	13.80	D	10/18/2019	10.4	38.7	3	13(3)	6(6)	1(1)	0(0)	0(0)	2(2)	0(0)	38(4)	59(6)	0(0)	260		22.0	7.8
11-3	7.20	E	08/15/2019	21.4	52.0	3	13(3)	3(4)	1(1)	1(1)	1(1)	3(2)	2(1)	38(4)	77(3)	3(1)	270		21.0	6.9
11-2	1.71	D	08/15/2019	62.3	71.6	3	21(4)	7(6)	1(1)	1(1)	3(2)	4(3)	5(1)	29(5)	72(4)	5(2)	609		29.0	8.9
11-1	0.70	D	08/15/2019	63.8	72.1	3	13(3)	4(4)	1(1)	0(0)	1(1)	3(2)	7(2)	46(4)	84(3)	7(3)	246		23.0	7.4
NORTH MILL CREEK - (95996)																				
Year: 2019																				
10-7	11.30	E	08/16/2019	19.2	50.0	3	9(2)	3(4)	1(1)	0(0)	1(1)	0(0)	0(0)	33(5)	70(4)	2(1)	132	*	18.0	5.8
10-3	10.20	E	08/16/2019	20.8	51.5	3	9(2)	4(5)	1(1)	0(0)	1(1)	0(0)	0(0)	44(4)	85(2)	1(1)	220		16.0	6.1
10-2	8.10	E	08/16/2019	29.5	57.9	3	10(2)	3(4)	1(1)	1(1)	0(0)	4(3)	2(1)	70(2)	93(1)	0(0)	344		15.0	5.0
10-1	1.10	E	08/16/2019	31.9	59.3	3	12(2)	4(5)	1(1)	0(0)	1(1)	2(2)	0(0)	50(4)	89(2)	1(1)	176	*	18.0	6.1

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 A-2: Midwest Biodiversity Institute
Fish Species List - Grand Totals

Rivers: *Mill Creek*

Years: 2019

Number of Samples: 5 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.
15-001	BOWFIN	P		C		1	0.3	0.10	399	3.37	1200.0
20-003	GIZZARD SHAD	O		M		3	1.0	0.31	9	0.08	10.0
34-001	CENTRAL MUDMINNOW	I	T	C		5	1.7	0.52	3	0.03	2.0
37-001	REDFIN PICKEREL	P	P	M		1	0.3	0.10	1	0.01	5.0
37-003	NORTHERN PIKE	P		M	F	3	1.0	0.31	832	7.03	833.3
40-016	WHITE SUCKER	O	T	S	W	22	7.3	2.28	2199	18.56	300.1
43-001	COMMON CARP	O	T	M	G	9	3.0	0.93	1964	16.58	655.5
43-003	GOLDEN SHINER	I	T	M	N	26	8.7	2.70	93	0.79	10.8
43-004	HORNYHEAD CHUB	I	I	N	N	4	1.3	0.41	49	0.42	37.5
43-013	CREEK CHUB	G	T	N	N	4	1.3	0.41	33	0.28	25.0
43-032	SPOTFIN SHINER	I		M	N	115	38.3	11.93	73	0.62	1.9
43-043	BLUNTNOSE MINNOW	O	T	C	N	72	24.0	7.47	67	0.57	2.8
47-002	CHANNEL CATFISH			C	F	23	7.7	2.39	1381	11.66	180.4
47-004	YELLOW BULLHEAD	I	T	C		18	6.0	1.87	402	3.40	67.2
47-006	BLACK BULLHEAD	I	P	C		1	0.3	0.10	5	0.04	15.0
47-008	STONECAT MADTOM	I	I	C		7	2.3	0.73	33	0.28	14.2
54-002	BLACKSTRIPE TOPMINNOW	I		M		26	8.7	2.70	9	0.08	1.1
74-006	YELLOW BASS	P	P	M		11	3.7	1.14	24	0.21	6.8
77-001	WHITE CRAPPIE	I		C	S	2	0.7	0.21	8	0.07	12.5
77-002	BLACK CRAPPIE	I		C	S	19	6.3	1.97	158	1.34	25.0
77-006	LARGEMOUTH BASS	C		C	F	43	14.3	4.46	919	7.76	64.1
77-007	WARMOUTH SUNFISH	C		C	S	8	2.7	0.83	116	0.98	43.7
77-008	GREEN SUNFISH	I	T	C	S	158	52.6	16.39	477	4.03	9.0
77-009	BLUEGILL SUNFISH	I	P	C	S	249	82.9	25.83	2017	17.03	24.3
77-010	ORANGESPOTTED SUNFISH	I		C	S	30	10.0	3.11	33	0.28	3.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	35	11.7	3.63	268	2.26	23.0
77-015	GREEN SF X BLUEGILL SF					5	1.7	0.52	58	0.49	35.0
80-003	YELLOW PERCH			M		25	8.3	2.59	168	1.42	20.2
80-005	BLACKSIDE DARTER	I		S	D	31	10.3	3.22	33	0.28	3.2
80-014	JOHNNY DARTER	I		C	D	8	2.7	0.83	2	0.02	1.0

No Species: 30 **Nat. Species:** 28 **Hybrids:** 1 **Total Counted:** 964 **Total Rel. Wt. :** 11848

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

Rivers: *Hastings Creek; Unnamed Trib to N. Mill Creek; North Mill Creek*

Years: 2019

Number of Samples: 7 Data Sources: 99 Data Types: 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.
34-001	CENTRAL MUDMINNOW	I	T	C		39	11.2	6.54	82	1.23	7.4
37-003	NORTHERN PIKE	P		M	F	5	1.4	0.84	800	11.90	560.0
40-016	WHITE SUCKER	O	T	S	W	28	8.0	4.70	1593	23.67	198.9
43-001	COMMON CARP	O	T	M	G	13	3.7	2.18	2174	32.30	584.7
43-004	HORNYHEAD CHUB	I	I	N	N	3	0.9	0.50	14	0.21	16.6
43-013	CREEK CHUB	G	T	N	N	35	10.0	5.87	28	0.42	2.8
43-042	FATHEAD MINNOW	O	T	C	N	19	5.4	3.19	9	0.14	1.6
43-043	BLUNTNOSE MINNOW	O	T	C	N	64	18.3	10.74	62	0.93	3.4
47-002	CHANNEL CATFISH			C	F	2	0.6	0.34	0	0.01	1.0
47-004	YELLOW BULLHEAD	I	T	C		34	9.7	5.70	301	4.48	31.0
47-006	BLACK BULLHEAD	I	P	C		4	1.1	0.67	200	2.97	175.0
47-013	TADPOLE MADTOM	I		C		1	0.3	0.17	1	0.02	4.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		5	1.4	0.84	1	0.02	1.0
77-002	BLACK CRAPPIE	I		C	S	1	0.3	0.17	2	0.04	10.0
77-006	LARGEMOUTH BASS	C		C	F	52	14.9	8.72	70	1.05	4.7
77-007	WARMOUTH SUNFISH	C		C	S	2	0.6	0.34	8	0.13	15.0
77-008	GREEN SUNFISH	I	T	C	S	179	51.2	30.03	667	9.92	13.0
77-009	BLUEGILL SUNFISH	I	P	C	S	103	29.5	17.28	702	10.43	23.8
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	0.3	0.17	1	0.02	4.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	0.3	0.17	1	0.02	5.0
77-015	GREEN SF X BLUEGILL SF					1	0.3	0.17	2	0.04	10.0
80-003	YELLOW PERCH			M		1	0.3	0.17	1	0.02	5.0
80-014	JOHNNY DARTER	I		C	D	3	0.9	0.50	0	0.01	1.0

No Species: 23 **Nat. Species:** 21 **Hybrids:** 1 **Total Counted:** 596 **Total Rel. Wt. :** 6730

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

Rivers: *Bull Creek; Bull's Brook; Stoneroller Creek; West Branch Bull Creek; West Fork Belvidere Rd. Trib*

Years: 2019

Number of Samples: 11 Data Sources: 99 Data Types: 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.
34-001	CENTRAL MUDMINNOW	I	T	C		21	4.0	1.32	19	0.58	4.9
37-003	NORTHERN PIKE	P		M	F	6	1.1	0.38	300	8.90	266.6
40-016	WHITE SUCKER	O	T	S	W	109	20.5	6.88	983	29.11	48.0
43-001	COMMON CARP	O	T	M	G	1	0.2	0.06	7	0.22	40.0
43-002	GOLDFISH	O	T	M	G	3	0.6	0.19	5	0.17	10.0
43-003	GOLDEN SHINER	I	T	M	N	4	0.8	0.25	1	0.04	2.0
43-004	HORNYHEAD CHUB	I	I	N	N	56	10.5	3.53	109	3.23	10.3
43-013	CREEK CHUB	G	T	N	N	439	82.5	27.70	691	20.47	8.3
43-042	FATHEAD MINNOW	O	T	C	N	3	0.6	0.19	0	0.02	1.3
43-043	BLUNTNOSE MINNOW	O	T	C	N	132	24.8	8.33	79	2.36	3.2
43-044	CENTRAL STONEROLLER	H		N	N	234	44.0	14.76	228	6.76	5.1
43-117	CARMINE SHINER	I	I	S	N	9	1.7	0.57	4	0.13	2.5
47-004	YELLOW BULLHEAD	I	T	C		19	3.6	1.20	97	2.88	27.2
47-006	BLACK BULLHEAD	I	P	C		3	0.6	0.19	21	0.63	37.6
47-008	STONECAT MADTOM	I	I	C		4	0.8	0.25	9	0.28	12.5
54-000	WESTERN BANDED KILLIFISH	I	S	M		2	0.4	0.13	0	0.01	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		22	4.1	1.39	4	0.14	1.1
68-001	PIRATE PERCH	I		C		1	0.2	0.06	5	0.17	30.0
70-001	BROOK SILVERSIDE	I	M	M		3	0.6	0.19	0	0.02	1.0
77-002	BLACK CRAPPIE	I		C	S	1	0.2	0.06	0	0.02	3.0
77-006	LARGEMOUTH BASS	C		C	F	53	10.0	3.34	124	3.67	12.4
77-007	WARMOUTH SUNFISH	C		C	S	5	0.9	0.32	13	0.39	14.0
77-008	GREEN SUNFISH	I	T	C	S	160	30.1	10.09	441	13.07	14.6
77-009	BLUEGILL SUNFISH	I	P	C	S	69	13.0	4.35	62	1.86	4.8
77-013	PUMPKINSEED SUNFISH	I	P	C	S	26	4.9	1.64	91	2.72	18.8
77-015	GREEN SF X BLUEGILL SF					3	0.6	0.19	2	0.08	5.0
80-003	YELLOW PERCH			M		2	0.4	0.13	1	0.06	5.0
80-005	BLACKSIDE DARTER	I		S	D	62	11.7	3.91	41	1.22	3.5
80-014	JOHNNY DARTER	I		C	D	72	13.5	4.54	16	0.48	1.2
80-024	FANTAIL DARTER	I		C	D	61	11.5	3.85	10	0.32	0.9
99-999	NO FISH					0	0.0	0.00	0	0.00	*****.*

No Species: 31 **Nat. Species:** 28 **Hybrids:** 1 **Total Counted:** 1585 **Total Rel. Wt. :** 3380

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

Rivers: *Newport Drainage Ditch; Suburban Country Club Tributary; Slocum Conrners Creek; Unnamed Trib to DesPlaines River; Unnamed Trib - Greenleaf Creek*

Years: 2019

Number of Samples: 6 Data Sources: 99 Data Types: 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.
20-003	GIZZARD SHAD	O		M		1	0.3	0.19	1	0.22	5.0
34-001	CENTRAL MUDMINNOW	I	T	C		51	17.0	9.73	54	7.14	3.2
37-003	NORTHERN PIKE	P		M	F	1	0.3	0.19	13	1.73	40.0
40-016	WHITE SUCKER	O	T	S	W	44	14.7	8.40	117	15.32	8.0
43-003	GOLDEN SHINER	I	T	M	N	3	1.0	0.57	1	0.13	1.0
43-013	CREEK CHUB	G	T	N	N	109	36.3	20.80	202	26.27	5.5
43-032	SPOTFIN SHINER	I		M	N	1	0.3	0.19	1	0.13	3.0
43-033	BIGMOUTH SHINER	I		M	N	1	0.3	0.19	0	0.04	1.0
43-042	FATHEAD MINNOW	O	T	C	N	4	1.3	0.76	2	0.26	1.5
43-043	BLUNTNOSE MINNOW	O	T	C	N	5	1.7	0.95	3	0.43	2.0
47-004	YELLOW BULLHEAD	I	T	C		1	0.3	0.19	0	0.09	2.0
47-013	TADPOLE MADTOM	I		C		2	0.7	0.38	1	0.17	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		136	45.3	25.95	33	4.37	0.7
68-001	PIRATE PERCH	I		C		13	4.3	2.48	26	3.46	6.1
77-006	LARGEMOUTH BASS	C		C	F	23	7.7	4.39	46	6.10	6.1
77-007	WARMOUTH SUNFISH	C		C	S	2	0.7	0.38	6	0.87	10.0
77-008	GREEN SUNFISH	I	T	C	S	66	22.0	12.60	166	21.64	7.5
77-009	BLUEGILL SUNFISH	I	P	C	S	23	7.7	4.39	19	2.60	2.6
77-013	PUMPKINSEED SUNFISH	I	P	C	S	16	5.3	3.05	61	8.01	11.5
80-005	BLACKSIDE DARTER	I		S	D	2	0.7	0.38	1	0.13	1.5
80-014	JOHNNY DARTER	I		C	D	20	6.7	3.82	6	0.91	1.0

No Species: 21 **Nat. Species:** 21 **Hybrids:** 0 **Total Counted:** 524 **Total Rel. Wt. :** 769

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

Site ID: River: 95-051 Bull Creek RM: 5.95 Date: 08/29/2019

Time Fished: 87 Distance: 0.150 Drainge (sq mi): 2.4 Depth: 0

Location: at Hazelnut Xing Lat: 42.28815 Long: -88.02155

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
99-999	NO FISH					0	0.0	***.**	0	0.00	*****.*

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

IBI: 12.0 **Mlwb:** N/A

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

Site ID: River: 95-051 Bull Creek RM: 4.70 Date: 10/13/2019

Time Fished: 616 Distance: 0.100 Drainge (sq mi): 1.3 Depth: 0

Location: at St. Mary of the Lake College Lat: 42.27954 Long: -88.00300

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	1	3.0	1.33	2100	72.99	700.0
43-003	GOLDEN SHINER	I	T	M	N	4	12.0	5.33	24	0.83	2.0
70-001	BROOK SILVERSIDE	I	M	M		3	9.0	4.00	9	0.31	1.0
77-002	BLACK CRAPPIE	I		C	S	1	3.0	1.33	9	0.31	3.0
77-006	LARGEMOUTH BASS	C		C	F	20	60.0	26.67	300	10.43	5.0
77-008	GREEN SUNFISH	I	T	C	S	3	9.0	4.00	75	2.61	8.3
77-009	BLUEGILL SUNFISH	I	P	C	S	42	126.0	56.00	345	11.99	2.7
80-003	YELLOW PERCH			M		1	3.0	1.33	15	0.52	5.0

No Species: 8 **Nat. Species:** 8 **Hybrids:** 0 **Total Counted:** 75 **Total Rel. Wt. :** 2877

IBI: 42.0 **MIwb:** N/A

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

Site ID: River: 95-051 Bull Creek RM: 1.00 Date: 08/28/2019

Time Fished: 1177 Distance: 0.150 Drainge (sq mi): 8.4 Depth: 0

Location: at Rte 137 Lat: 42.30768 Long: -87.96867

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		1	2.0	0.51	4	0.31	2.0
40-016	WHITE SUCKER	O	T	S	W	14	28.0	7.07	28	2.16	1.0
43-013	CREEK CHUB	G	T	N	N	84	168.0	42.42	880	67.90	5.2
43-043	BLUNTNOSE MINNOW	O	T	C	N	15	30.0	7.58	30	2.31	1.0
43-044	CENTRAL STONEROLLER	H		N	N	18	36.0	9.09	74	5.71	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		3	6.0	1.52	10	0.77	1.6
77-006	LARGEMOUTH BASS	C		C	F	5	10.0	2.53	40	3.09	4.0
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	1.01	80	6.17	20.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	2.0	0.51	10	0.77	5.0
80-014	JOHNNY DARTER	I		C	D	55	110.0	27.78	140	10.80	1.2

No Species: 10 **Nat. Species:** 10 **Hybrids:** 0 **Total Counted:** 198 **Total Rel. Wt. :** 1296

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

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

Site ID: River: 95-051 Bull Creek RM: 0.50 Date: 10/10/2019

Time Fished: 1086 Distance: 0.150 Drainge (sq mi): 11.7 Depth: 0

Location: Ust. IL 21 Lat: 42.31157 Long: -87.96423

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.80	1100	18.21	275.0
43-004	HORNYHEAD CHUB	I	I	N	N	18	36.0	7.23	540	8.94	15.0
43-013	CREEK CHUB	G	T	N	N	34	68.0	13.65	1000	16.55	14.7
43-043	BLUNTNOSE MINNOW	O	T	C	N	47	94.0	18.88	300	4.97	3.1
43-044	CENTRAL STONEROLLER	H		N	N	18	36.0	7.23	300	4.97	8.3
43-117	CARMINE SHINER	I	I	S	N	7	14.0	2.81	40	0.66	2.8
47-004	YELLOW BULLHEAD	I	T	C		12	24.0	4.82	1000	16.55	41.6
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	0.40	20	0.33	10.0
77-007	WARMOUTH SUNFISH	C		C	S	4	8.0	1.61	120	1.99	15.0
77-008	GREEN SUNFISH	I	T	C	S	33	66.0	13.25	1300	21.52	19.7
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.40	10	0.17	5.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	2.0	0.40	40	0.66	20.0
80-003	YELLOW PERCH			M		1	2.0	0.40	10	0.17	5.0
80-005	BLACKSIDE DARTER	I		S	D	36	72.0	14.46	200	3.31	2.7
80-014	JOHNNY DARTER	I		C	D	1	2.0	0.40	2	0.03	1.0
80-024	FANTAIL DARTER	I		C	D	33	66.0	13.25	60	0.99	0.9

No Species: 16 **Nat. Species:** 16 **Hybrids:** 0 **Total Counted:** 249 **Total Rel. Wt. :** 6042

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

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

Site ID: River: 95-702 Hastings Creek RM: 3.12 Date: 08/28/2019

Time Fished: 748 Distance: 0.150 Drainge (sq mi): 3.9 Depth: 0

Location: at Grass Lake Rd. Lat: 42.43071 Long: -88.03447

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		4	8.0	10.00	40	12.74	5.0
47-004	YELLOW BULLHEAD	I	T	C		15	30.0	37.50	30	9.55	1.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	2.50	2	0.64	1.0
77-006	LARGEMOUTH BASS	C		C	F	7	14.0	17.50	70	22.29	5.0
77-008	GREEN SUNFISH	I	T	C	S	2	4.0	5.00	22	7.01	5.5
77-009	BLUEGILL SUNFISH	I	P	C	S	11	22.0	27.50	150	47.77	6.8

No Species: 6 **Nat. Species:** 6 **Hybrids:** 0 **Total Counted:** 40 **Total Rel. Wt. :** 314

IBI: 32.0 **Mlwb:** N/A

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

Site ID: River: 95-702 Hastings Creek RM: 1.68 Date: 08/28/2019

Time Fished: 790 Distance: 0.150 Drainge (sq mi): 5.6 Depth: 0

Location: at Miller Rd. Lat: 42.44790 Long: -88.02470

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		8	16.0	14.29	80	12.74	5.0
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	3.57	220	35.03	55.0
47-013	TADPOLE MADTOM	I		C		1	2.0	1.79	8	1.27	4.0
77-006	LARGEMOUTH BASS	C		C	F	22	44.0	39.29	100	15.92	2.2
77-008	GREEN SUNFISH	I	T	C	S	6	12.0	10.71	50	7.96	4.1
77-009	BLUEGILL SUNFISH	I	P	C	S	15	30.0	26.79	150	23.89	5.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	2.0	1.79	10	1.59	5.0
80-003	YELLOW PERCH			M		1	2.0	1.79	10	1.59	5.0

No Species: 8 **Nat. Species:** 8 **Hybrids:** 0 **Total Counted:** 56 **Total Rel. Wt. :** 628

IBI: 34.0 **Mlwb:** N/A

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

Site ID: River: 95-704 Bull's Brook RM: 1.95 Date: 10/08/2019

Time Fished: 563 Distance: 0.150 Drainge (sq mi): 1.9 Depth: 0

Location: Dst. Almond Rd. Lat: 42.32563 Long: -87.97668

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	35	70.0	19.77	220	8.53	3.1
43-013	CREEK CHUB	G	T	N	N	65	130.0	36.72	1900	73.64	14.6
43-044	CENTRAL STONEROLLER	H		N	N	35	70.0	19.77	260	10.08	3.7
77-008	GREEN SUNFISH	I	T	C	S	15	30.0	8.47	90	3.49	3.0
77-009	BLUEGILL SUNFISH	I	P	C	S	5	10.0	2.82	60	2.33	6.0
77-015	GREEN SF X BLUEGILL SF					2	4.0	1.13	20	0.78	5.0
80-024	FANTAIL DARTER	I		C	D	20	40.0	11.30	30	1.16	0.7

No Species: 6 **Nat. Species:** 6 **Hybrids:** 1 **Total Counted:** 177 **Total Rel. Wt. :** 2580

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

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

Site ID: River: 95-704 Bull's Brook RM: 0.25 Date: 08/30/2019

Time Fished: 728 Distance: 0.150 Drainge (sq mi): 2.7 Depth: 0

Location: North Milwaukee Ave. Lat: 42.32570 Long: -87.97661

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		8	16.0	5.56	80	3.26	5.0
43-013	CREEK CHUB	G	T	N	N	107	214.0	74.31	2270	92.43	10.6
43-042	FATHEAD MINNOW	O	T	C	N	2	4.0	1.39	4	0.16	1.0
43-044	CENTRAL STONEROLLER	H		N	N	7	14.0	4.86	30	1.22	2.1
54-000	WESTERN BANDED KILLIFISH	I	S	M		2	4.0	1.39	4	0.16	1.0
77-006	LARGEMOUTH BASS	C		C	F	5	10.0	3.47	20	0.81	2.0
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	2.08	20	0.81	3.3
80-014	JOHNNY DARTER	I		C	D	2	4.0	1.39	4	0.16	1.0
80-024	FANTAIL DARTER	I		C	D	8	16.0	5.56	24	0.98	1.5

No Species: 9 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 144 **Total Rel. Wt. :** 2456

IBI: 28.0 **Mlwb:** N/A

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

Site ID: 12-2 River: 95-708 Newport Drainage Ditch RM: 3.03 Date: 10/13/2019

Time Fished: 693 Distance: 0.150 Drainge (sq mi): 2.8 Depth: 0

Location: dst 21st St. Lat: 42.45876 Long: -87.89665

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	1	2.0	7.14	80	13.29	40.0
40-016	WHITE SUCKER	O	T	S	W	2	4.0	14.29	310	51.50	77.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		2	4.0	14.29	2	0.33	0.5
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	7.14	10	1.66	5.0
77-008	GREEN SUNFISH	I	T	C	S	5	10.0	35.71	120	19.93	12.0
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	7.14	20	3.32	10.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	2	4.0	14.29	60	9.97	15.0

No Species: 7 **Nat. Species:** 7 **Hybrids:** 0 **Total Counted:** 14 **Total Rel. Wt. :** 602

IBI: 28.0 **Mlwb:** N/A

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

Site ID: River: 95-708 Newport Drainage Ditch RM: 0.70 Date: 10/13/2019

Time Fished: 633 Distance: 0.150 Drainge (sq mi): 7.3 Depth: 0

Location: ust. Kilbourne Rd. Lat: 42.48341 Long: -87.91242

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		14	28.0	12.50	106	28.80	3.7
43-013	CREEK CHUB	G	T	N	N	1	2.0	0.89	4	1.09	2.0
43-032	SPOTFIN SHINER	I		M	N	1	2.0	0.89	6	1.63	3.0
47-013	TADPOLE MADTOM	I		C		2	4.0	1.79	8	2.17	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		58	116.0	51.79	60	16.30	0.5
68-001	PIRATE PERCH	I		C		7	14.0	6.25	80	21.74	5.7
77-008	GREEN SUNFISH	I	T	C	S	9	18.0	8.04	60	16.30	3.3
77-009	BLUEGILL SUNFISH	I	P	C	S	1	2.0	0.89	4	1.09	2.0
80-014	JOHNNY DARTER	I		C	D	19	38.0	16.96	40	10.87	1.0

No Species: 9 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 112 **Total Rel. Wt. :** 368

IBI: 34.0 **Mlwb:** N/A

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

Site ID: River: 95-709 Stoneroller Creek RM: 0.42 Date: 10/10/2019

Time Fished: 1079 Distance: 0.150 Drainge (sq mi): 4.1 Depth: 0

Location: Dst. IL 21 Lat: 42.35290 Long: -87.93661

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	4.0	0.74	500	8.55	125.0
40-016	WHITE SUCKER	O	T	S	W	5	10.0	1.85	1300	22.23	130.0
43-004	HORNYHEAD CHUB	I	I	N	N	26	52.0	9.63	460	7.87	8.8
43-013	CREEK CHUB	G	T	N	N	36	72.0	13.33	400	6.84	5.5
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	0.37	4	0.07	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	45	90.0	16.67	400	6.84	4.4
43-044	CENTRAL STONEROLLER	H		N	N	89	178.0	32.96	1200	20.52	6.7
43-117	CARMINE SHINER	I	I	S	N	2	4.0	0.74	6	0.10	1.5
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	1.11	20	0.34	3.3
47-008	STONECAT MADTOM	I	I	C		4	8.0	1.48	100	1.71	12.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	8.0	1.48	10	0.17	1.2
77-006	LARGEMOUTH BASS	C		C	F	7	14.0	2.59	600	10.26	42.8
77-007	WARMOUTH SUNFISH	C		C	S	1	2.0	0.37	20	0.34	10.0
77-008	GREEN SUNFISH	I	T	C	S	26	52.0	9.63	600	10.26	11.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	1	2.0	0.37	8	0.14	4.0
80-005	BLACKSIDE DARTER	I		S	D	18	36.0	6.67	220	3.76	6.1

No Species: 16 **Nat. Species:** 16 **Hybrids:** 0 **Total Counted:** 270 **Total Rel. Wt. :** 5848

IBI: 34.0 **Mlwb:** N/A

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

Site ID: River: 95-710 Suburban Country Club Tributary RM: 2.00 Date: 10/10/2019

Time Fished: 778 Distance: 0.150 Drainge (sq mi): 4.0 Depth: 0

Location: Dst. North Delany Rd. Lat: 42.40424 Long: -87.90610

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	2.06	60	5.88	15.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		65	130.0	67.01	100	9.80	0.7
68-001	PIRATE PERCH	I		C		5	10.0	5.15	60	5.88	6.0
77-006	LARGEMOUTH BASS	C		C	F	1	2.0	1.03	200	19.61	100.0
77-007	WARMOUTH SUNFISH	C		C	S	2	4.0	2.06	40	3.92	10.0
77-008	GREEN SUNFISH	I	T	C	S	9	18.0	9.28	200	19.61	11.1
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	2.06	60	5.88	15.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	11	22.0	11.34	300	29.41	13.6

No Species: 8 **Nat. Species:** 8 **Hybrids:** 0 **Total Counted:** 97 **Total Rel. Wt. :** 1020

IBI: 36.0 **Mlwb:** N/A

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

Site ID: River: 95-711 Slocum Conrners Creek RM: 1.36 Date: 10/13/2019

Time Fished: 587 Distance: 0.150 Drainge (sq mi): 2.4 Depth: 0

Location: Ust. North Mill Creek Rd. Lat: 42.44442 Long: -87.95283

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	6	12.0	8.22	300	18.36	25.0
43-013	CREEK CHUB	G	T	N	N	26	52.0	35.62	700	42.84	13.4
43-042	FATHEAD MINNOW	O	T	C	N	3	6.0	4.11	8	0.49	1.3
68-001	PIRATE PERCH	I		C		1	2.0	1.37	20	1.22	10.0
77-008	GREEN SUNFISH	I	T	C	S	35	70.0	47.95	600	36.72	8.5
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	1.37	4	0.24	2.0
80-014	JOHNNY DARTER	I		C	D	1	2.0	1.37	2	0.12	1.0

No Species: 7 **Nat. Species:** 7 **Hybrids:** 0 **Total Counted:** 73 **Total Rel. Wt. :** 1634

IBI: 28.0 **Mlwb:** N/A

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

Site ID: River: 95-714 Unnamed Trib to DesPlaines River RM: 0.13 Date: 08/30/2019

Time Fished: 862 Distance: 0.150 Drainge (sq mi): 0.9 Depth: 0

Location: behind pump station off Sprucewood Lane Lat: 42.29978 Long: -87.94074

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	0.90	10	1.77	5.0
34-001	CENTRAL MUDMINNOW	I	T	C		31	62.0	27.93	130	23.05	2.1
40-016	WHITE SUCKER	O	T	S	W	14	28.0	12.61	60	10.64	2.1
43-003	GOLDEN SHINER	I	T	M	N	3	6.0	2.70	6	1.06	1.0
43-013	CREEK CHUB	G	T	N	N	5	10.0	4.50	10	1.77	1.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	0.90	4	0.71	2.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		11	22.0	9.91	40	7.09	1.8
77-006	LARGEMOUTH BASS	C		C	F	18	36.0	16.22	64	11.35	1.7
77-008	GREEN SUNFISH	I	T	C	S	8	16.0	7.21	70	12.41	4.3
77-009	BLUEGILL SUNFISH	I	P	C	S	16	32.0	14.41	140	24.82	4.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	3	6.0	2.70	30	5.32	5.0

No Species: 11 **Nat. Species:** 11 **Hybrids:** 0 **Total Counted:** 111 **Total Rel. Wt. :** 564

IBI: 38.0 **MIwb:** N/A

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

Site ID: River: 95-715 Unnamed Trib to N. Mill Creek RM: 0.04 Date: 08/28/2019

Time Fished: 428 Distance: 0.150 Drainge (sq mi): 0.9 Depth: 0

Location: at ust. of Rte 45 Lat: 42.42142 Long: -88.00465

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		1	2.0	1.56	10	2.63	5.0
43-001	COMMON CARP	O	T	M	G	1	2.0	1.56	4	1.05	2.0
43-013	CREEK CHUB	G	T	N	N	33	66.0	51.56	132	34.74	2.0
77-006	LARGEMOUTH BASS	C		C	F	9	18.0	14.06	38	10.00	2.1
77-007	WARMOUTH SUNFISH	C		C	S	2	4.0	3.13	60	15.79	15.0
77-008	GREEN SUNFISH	I	T	C	S	8	16.0	12.50	46	12.11	2.8
77-009	BLUEGILL SUNFISH	I	P	C	S	10	20.0	15.63	90	23.68	4.5

No Species: 7 **Nat. Species:** 6 **Hybrids:** 0 **Total Counted:** 64 **Total Rel. Wt. :** 380

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

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

Site ID: River: 95-716 Unnamed Trib - Greenleaf Creek RM: 0.40 Date: 08/30/2019

Time Fished: 761 Distance: 0.150 Drainge (sq mi): 1.1 Depth: 0

Location: dst. Kenwood Lat: 42.36604 Long: -87.90196

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		4	8.0	3.42	40	5.31	5.0
40-016	WHITE SUCKER	O	T	S	W	22	44.0	18.80	88	11.67	2.0
43-013	CREEK CHUB	G	T	N	N	77	154.0	65.81	580	76.92	3.7
43-033	BIGMOUTH SHINER	I		M	N	1	2.0	0.85	2	0.27	1.0
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	0.85	4	0.53	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	5	10.0	4.27	20	2.65	2.0
77-006	LARGEMOUTH BASS	C		C	F	3	6.0	2.56	12	1.59	2.0
77-009	BLUEGILL SUNFISH	I	P	C	S	3	6.0	2.56	6	0.80	1.0
80-005	BLACKSIDE DARTER	I		S	D	1	2.0	0.85	2	0.27	1.0

No Species: 9 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 117 **Total Rel. Wt. :** 754

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

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

Site ID: River: 95-719 West Branch Bull Creek RM: 2.54 Date: 08/29/2019

Time Fished: 539 Distance: 0.150 Drainge (sq mi): 5.1 Depth: 0

Location: behind World Bioproducts across field Lat: 42.30297 Long: -87.99916

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		6	12.0	10.00	24	2.26	2.0
43-013	CREEK CHUB	G	T	N	N	47	94.0	78.33	900	84.59	9.5
43-044	CENTRAL STONEROLLER	H		N	N	1	2.0	1.67	100	9.40	50.0
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	3.33	14	1.32	3.5
47-006	BLACK BULLHEAD	I	P	C		1	2.0	1.67	6	0.56	3.0
77-008	GREEN SUNFISH	I	T	C	S	3	6.0	5.00	20	1.88	3.3

No Species: 6 **Nat. Species:** 6 **Hybrids:** 0 **Total Counted:** 60 **Total Rel. Wt. :** 1064

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

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

Site ID: River: 95-719 West Branch Bull Creek RM: 1.60 Date: 08/29/2019

Time Fished: 1129 Distance: 0.150 Drainge (sq mi): 7.1 Depth: 0

Location: N. Countryside Dr. Lat: 42.31017 Long: -87.99065

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	5	10.0	3.65	1204	18.45	120.4
43-013	CREEK CHUB	G	T	N	N	40	80.0	29.20	2400	36.79	30.0
43-044	CENTRAL STONEROLLER	H		N	N	63	126.0	45.99	2106	32.28	16.7
77-006	LARGEMOUTH BASS	C		C	F	4	8.0	2.92	204	3.13	25.5
77-008	GREEN SUNFISH	I	T	C	S	11	22.0	8.03	400	6.13	18.1
77-009	BLUEGILL SUNFISH	I	P	C	S	13	26.0	9.49	200	3.07	7.6
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.73	10	0.15	5.0

No Species: 6 **Nat. Species:** 6 **Hybrids:** 1 **Total Counted:** 137 **Total Rel. Wt. :** 6524

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

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

Site ID: River: 95-720 West Fork Belvidere Rd. Trib RM: 0.21 Date: 10/08/2019

Time Fished: 639 Distance: 0.150 Drainge (sq mi): 2.3 Depth: 0

Location: Dst. Leonard Dr. Lat: 42.34737 Long: -87.95589

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	22	44.0	27.16	3420	57.08	77.7
43-002	GOLDFISH	O	T	M	G	3	6.0	3.70	60	1.00	10.0
43-013	CREEK CHUB	G	T	N	N	17	34.0	20.99	1460	24.37	42.9
47-006	BLACK BULLHEAD	I	P	C		1	2.0	1.23	20	0.33	10.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		1	2.0	1.23	2	0.03	1.0
77-008	GREEN SUNFISH	I	T	C	S	33	66.0	40.74	980	16.36	14.8
77-009	BLUEGILL SUNFISH	I	P	C	S	4	8.0	4.94	50	0.83	6.2

No Species: 7 **Nat. Species:** 6 **Hybrids:** 0 **Total Counted:** 81 **Total Rel. Wt. :** 5992

IBI: 22.0 **Mlwb:** N/A

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

Site ID: River: 95-720 West Fork Belvidere Rd. Trib RM: 0.15 Date: 10/08/2019

Time Fished: 900 Distance: 0.150 Drainge (sq mi): 3.8 Depth: 0

Location: Ust. abandoned bridge Lat: 42.34253 Long: -87.94494

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		6	12.0	3.09	100	1.06	8.3
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.52	200	2.13	100.0
40-016	WHITE SUCKER	O	T	S	W	28	56.0	14.43	5000	53.24	89.2
43-001	COMMON CARP	O	T	M	G	1	2.0	0.52	80	0.85	40.0
43-004	HORNYHEAD CHUB	I	I	N	N	12	24.0	6.19	260	2.77	10.8
43-013	CREEK CHUB	G	T	N	N	9	18.0	4.64	740	7.88	41.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	25	50.0	12.89	120	1.28	2.4
43-044	CENTRAL STONEROLLER	H		N	N	3	6.0	1.55	10	0.11	1.6
47-004	YELLOW BULLHEAD	I	T	C		2	4.0	1.03	106	1.13	26.5
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.52	200	2.13	100.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		14	28.0	7.22	28	0.30	1.0
68-001	PIRATE PERCH	I		C		1	2.0	0.52	60	0.64	30.0
77-006	LARGEMOUTH BASS	C		C	F	11	22.0	5.67	240	2.56	10.9
77-008	GREEN SUNFISH	I	T	C	S	33	66.0	17.01	1240	13.20	18.7
77-009	BLUEGILL SUNFISH	I	P	C	S	2	4.0	1.03	40	0.43	10.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	23	46.0	11.86	920	9.80	20.0
80-005	BLACKSIDE DARTER	I		S	D	8	16.0	4.12	20	0.21	1.2
80-014	JOHNNY DARTER	I		C	D	14	28.0	7.22	28	0.30	1.0

No Species: 18 **Nat. Species:** 17 **Hybrids:** 0 **Total Counted:** 194 **Total Rel. Wt. :** 9392

IBI: 34.0 **Mlwb:** N/A

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

Site ID: River: 95-995 Mill Creek RM: 17.20 Date: 08/28/2019

Time Fished: 790 Distance: 0.150 Drainge (sq mi): 4.5 Depth: 0

Location: at Wick St. Lat: 42.33642 Long: -88.03989

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		5	10.0	5.81	20	1.31	2.0
40-016	WHITE SUCKER	O	T	S	W	2	4.0	2.33	8	0.52	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	1	2.0	1.16	2	0.13	1.0
47-004	YELLOW BULLHEAD	I	T	C		1	2.0	1.16	400	26.25	200.0
77-006	LARGEMOUTH BASS	C		C	F	15	30.0	17.44	60	3.94	2.0
77-008	GREEN SUNFISH	I	T	C	S	56	112.0	65.12	1000	65.62	8.9
77-009	BLUEGILL SUNFISH	I	P	C	S	3	6.0	3.49	20	1.31	3.3
80-003	YELLOW PERCH			M		1	2.0	1.16	10	0.66	5.0
80-014	JOHNNY DARTER	I		C	D	2	4.0	2.33	4	0.26	1.0

No Species: 9 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 86 **Total Rel. Wt. :** 1524

IBI: 26.0 **Mlwb:** N/A

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

Site ID: River: 95-995 Mill Creek RM: 13.80 Date: 10/18/2019

Time Fished: 1550 Distance: 0.200 Drainge (sq mi): 10.4 Depth: 0

Location: Washington St. Lat: 42.36249 Long: -88.01576

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	3.0	1.16	2250	10.87	750.0
40-016	WHITE SUCKER	O	T	S	W	1	1.5	0.58	900	4.35	600.0
43-001	COMMON CARP	O	T	M	G	3	4.5	1.73	6165	29.79	1370.0
43-003	GOLDEN SHINER	I	T	M	N	16	24.0	9.25	315	1.52	13.1
43-043	BLUNTNOSE MINNOW	O	T	C	N	2	3.0	1.16	9	0.04	3.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	6.0	2.31	6	0.03	1.0
74-006	YELLOW BASS	P	P	M		11	16.5	6.36	112	0.54	6.8
77-001	WHITE CRAPPIE	I		C	S	2	3.0	1.16	37	0.18	12.5
77-002	BLACK CRAPPIE	I		C	S	15	22.5	8.67	487	2.36	21.6
77-006	LARGEMOUTH BASS	C		C	F	10	15.0	5.78	6960	33.64	464.0
77-008	GREEN SUNFISH	I	T	C	S	8	12.0	4.62	112	0.54	9.3
77-009	BLUEGILL SUNFISH	I	P	C	S	72	108.0	41.62	2325	11.24	21.5
77-013	PUMPKINSEED SUNFISH	I	P	C	S	6	9.0	3.47	262	1.27	29.1
77-015	GREEN SF X BLUEGILL SF					1	1.5	0.58	112	0.54	75.0
80-003	YELLOW PERCH			M		20	30.0	11.56	637	3.08	21.2

No Species: 14 **Nat. Species:** 13 **Hybrids:** 1 **Total Counted:** 173 **Total Rel. Wt. :** 20692

IBI: 32.0 **Mlwb:** N/A

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

Site ID: River: 95-995 Mill Creek RM: 7.20 Date: 08/15/2019

Time Fished: 1235 Distance: 0.150 Drainge (sq mi): 21.4 Depth: 0

Location: Dst. Stearns School Rd. Lat: 42.99890 Long: -87.98277

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	8.0	2.96	4000	32.71	500.0
43-004	HORNYHEAD CHUB	I	I	N	N	3	6.0	2.22	200	1.64	33.3
43-013	CREEK CHUB	G	T	N	N	4	8.0	2.96	250	2.04	31.2
43-043	BLUNTNOSE MINNOW	O	T	C	N	10	20.0	7.41	30	0.25	1.5
47-002	CHANNEL CATFISH			C	F	1	2.0	0.74	4000	32.71	2000.0
47-004	YELLOW BULLHEAD	I	T	C		12	24.0	8.89	1400	11.45	58.3
47-006	BLACK BULLHEAD	I	P	C		1	2.0	0.74	30	0.25	15.0
54-002	BLACKSTRIPE TOPMINNOW	I		M		5	10.0	3.70	10	0.08	1.0
77-006	LARGEMOUTH BASS	C		C	F	11	22.0	8.15	100	0.82	4.5
77-008	GREEN SUNFISH	I	T	C	S	46	92.0	34.07	800	6.54	8.7
77-009	BLUEGILL SUNFISH	I	P	C	S	26	52.0	19.26	1000	8.18	19.2
77-015	GREEN SF X BLUEGILL SF					4	8.0	2.96	200	1.64	25.0
80-003	YELLOW PERCH			M		4	8.0	2.96	200	1.64	25.0
80-014	JOHNNY DARTER	I		C	D	4	8.0	2.96	8	0.07	1.0

No Species: 13 **Nat. Species:** 13 **Hybrids:** 1 **Total Counted:** 135 **Total Rel. Wt. :** 12228

IBI: 32.0 **Mlwb:** 6.9

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

Site ID: River: 95-995 Mill Creek RM: 1.71 Date: 08/15/2019

Time Fished: 1385 Distance: 0.200 Drainge (sq mi): 62.3 Depth: 0

Location: ust. WWTP outfall Lat: 42.42095 Long: -87.95677

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
15-001	BOWFIN	P		C		1	1.5	0.25	1800	11.64	1200.0
20-003	GIZZARD SHAD	O		M		3	4.5	0.74	45	0.29	10.0
37-003	NORTHERN PIKE	P		M	F	1	1.5	0.25	1500	9.70	1000.0
40-016	WHITE SUCKER	O	T	S	W	5	7.5	1.23	1500	9.70	200.0
43-001	COMMON CARP	O	T	M	G	2	3.0	0.49	3000	19.40	1000.0
43-003	GOLDEN SHINER	I	T	M	N	9	13.5	2.22	90	0.58	6.6
43-004	HORNYHEAD CHUB	I	I	N	N	1	1.5	0.25	75	0.49	50.0
43-032	SPOTFIN SHINER	I		M	N	90	135.0	22.17	255	1.65	1.8
43-043	BLUNTNOSE MINNOW	O	T	C	N	46	69.0	11.33	225	1.46	3.2
47-002	CHANNEL CATFISH			C	F	17	25.5	4.19	975	6.31	38.2
47-004	YELLOW BULLHEAD	I	T	C		2	3.0	0.49	300	1.94	100.0
47-008	STONECAT MADTOM	I	I	C		7	10.5	1.72	150	0.97	14.2
54-002	BLACKSTRIPE TOPMINNOW	I		M		10	15.0	2.46	22	0.15	1.5
77-002	BLACK CRAPPIE	I		C	S	4	6.0	0.99	225	1.46	37.5
77-006	LARGEMOUTH BASS	C		C	F	2	3.0	0.49	90	0.58	30.0
77-007	WARMOUTH SUNFISH	C		C	S	8	12.0	1.97	525	3.40	43.7
77-008	GREEN SUNFISH	I	T	C	S	17	25.5	4.19	300	1.94	11.7
77-009	BLUEGILL SUNFISH	I	P	C	S	103	154.5	25.37	3375	21.83	21.8
77-010	ORANGESPOTTED SUNFISH	I		C	S	30	45.0	7.39	150	0.97	3.3
77-013	PUMPKINSEED SUNFISH	I	P	C	S	27	40.5	6.65	750	4.85	18.5
80-005	BLACKSIDE DARTER	I		S	D	19	28.5	4.68	105	0.68	3.6
80-014	JOHNNY DARTER	I		C	D	2	3.0	0.49	3	0.02	1.0

No Species: 22 **Nat. Species:** 21 **Hybrids:** 0 **Total Counted:** 406 **Total Rel. Wt. :** 15460

IBI: 40.0 **MIwb:** 8.9

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

Site ID: River: 95-995 Mill Creek RM: 0.70 Date: 08/15/2019

Time Fished: 1456 Distance: 0.200 Drainge (sq mi): 63.8 Depth: 0

Location: ust. Dillys Rd. Lat: 42.41830 Long: -87.94527

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-001	REDFIN PICKEREL	P	P	M		1	1.5	0.61	7	0.04	5.0
40-016	WHITE SUCKER	O	T	S	W	10	15.0	6.10	5670	29.21	378.0
43-001	COMMON CARP	O	T	M	G	4	6.0	2.44	5250	27.04	875.0
43-003	GOLDEN SHINER	I	T	M	N	1	1.5	0.61	18	0.09	12.0
43-032	SPOTFIN SHINER	I		M	N	25	37.5	15.24	75	0.39	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	13	19.5	7.93	45	0.23	2.3
47-002	CHANNEL CATFISH			C	F	5	7.5	3.05	2415	12.44	322.0
47-004	YELLOW BULLHEAD	I	T	C		3	4.5	1.83	165	0.85	36.6
54-002	BLACKSTRIPE TOPMINNOW	I		M		7	10.5	4.27	7	0.04	0.7
77-006	LARGEMOUTH BASS	C		C	F	5	7.5	3.05	2430	12.52	324.0
77-008	GREEN SUNFISH	I	T	C	S	31	46.5	18.90	390	2.01	8.3
77-009	BLUEGILL SUNFISH	I	P	C	S	45	67.5	27.44	2700	13.91	40.0
77-013	PUMPKINSEED SUNFISH	I	P	C	S	2	3.0	1.22	195	1.00	65.0
80-005	BLACKSIDE DARTER	I		S	D	12	18.0	7.32	45	0.23	2.5

No Species: 14 **Nat. Species:** 13 **Hybrids:** 0 **Total Counted:** 164 **Total Rel. Wt. :** 19413

IBI: 32.0 **Mlwb:** 7.4

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

Site ID: River: 95-996 North Mill Creek RM: 11.30 Date: 08/16/2019

Time Fished: 1273 Distance: 0.150 Drainge (sq mi): 19.2 Depth: 0

Location: Ust Edwards Rd. Lat: 42.48082 Long: -88.01196

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		14	28.0	21.21	300	6.65	10.7
37-003	NORTHERN PIKE	P		M	F	2	4.0	3.03	200	4.43	50.0
40-016	WHITE SUCKER	O	T	S	W	1	2.0	1.52	500	11.08	250.0
47-004	YELLOW BULLHEAD	I	T	C		3	6.0	4.55	400	8.86	66.6
47-006	BLACK BULLHEAD	I	P	C		4	8.0	6.06	1400	31.01	175.0
77-006	LARGEMOUTH BASS	C		C	F	3	6.0	4.55	12	0.27	2.0
77-008	GREEN SUNFISH	I	T	C	S	26	52.0	39.39	700	15.51	13.4
77-009	BLUEGILL SUNFISH	I	P	C	S	12	24.0	18.18	1000	22.15	41.6
80-014	JOHNNY DARTER	I		C	D	1	2.0	1.52	2	0.04	1.0

No Species: 9 **Nat. Species:** 9 **Hybrids:** 0 **Total Counted:** 66 **Total Rel. Wt. :** 4514

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

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

Site ID: River: 95-996 North Mill Creek RM: 10.20 Date: 08/16/2019

Time Fished: 1125 Distance: 0.150 Drainge (sq mi): 20.8 Depth: 0

Location: Dst. IL 173 Lat: 42.46497 Long: -88.00859

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		10	20.0	9.09	140	0.57	7.0
37-003	NORTHERN PIKE	P		M	F	1	2.0	0.91	2400	9.74	1200.0
40-016	WHITE SUCKER	O	T	S	W	8	16.0	7.27	6300	25.57	393.7
43-001	COMMON CARP	O	T	M	G	4	8.0	3.64	10480	42.53	1310.0
47-004	YELLOW BULLHEAD	I	T	C		4	8.0	3.64	340	1.38	42.5
77-002	BLACK CRAPPIE	I		C	S	1	2.0	0.91	20	0.08	10.0
77-006	LARGEMOUTH BASS	C		C	F	2	4.0	1.82	200	0.81	50.0
77-008	GREEN SUNFISH	I	T	C	S	45	90.0	40.91	1960	7.95	21.7
77-009	BLUEGILL SUNFISH	I	P	C	S	33	66.0	30.00	2780	11.28	42.1
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.91	20	0.08	10.0
80-014	JOHNNY DARTER	I		C	D	1	2.0	0.91	2	0.01	1.0

No Species: 10 **Nat. Species:** 9 **Hybrids:** 1 **Total Counted:** 110 **Total Rel. Wt. :** 24642

IBI: 30.0 **MIwb:** 6.1

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

Site ID: River: 95-996 North Mill Creek RM: 8.10 Date: 08/16/2019

Time Fished: 1195 Distance: 0.150 Drainge (sq mi): 29.5 Depth: 0

Location: Dst. closed bridge Lat: 42.44342 Long: -87.99981

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	1.16	10	0.16	2.5
40-016	WHITE SUCKER	O	T	S	W	7	14.0	4.07	440	6.91	31.4
43-001	COMMON CARP	O	T	M	G	1	2.0	0.58	3200	50.24	1600.0
43-004	HORNYHEAD CHUB	I	I	N	N	3	6.0	1.74	100	1.57	16.6
43-013	CREEK CHUB	G	T	N	N	2	4.0	1.16	120	1.88	30.0
43-042	FATHEAD MINNOW	O	T	C	N	18	36.0	10.47	60	0.94	1.6
43-043	BLUNTNOSE MINNOW	O	T	C	N	57	114.0	33.14	420	6.59	3.6
47-004	YELLOW BULLHEAD	I	T	C		6	12.0	3.49	440	6.91	36.6
77-006	LARGEMOUTH BASS	C		C	F	7	14.0	4.07	100	1.57	7.1
77-008	GREEN SUNFISH	I	T	C	S	64	128.0	37.21	1200	18.84	9.3
77-009	BLUEGILL SUNFISH	I	P	C	S	5	10.0	2.91	280	4.40	28.0

No Species: 11 **Nat. Species:** 10 **Hybrids:** 0 **Total Counted:** 172 **Total Rel. Wt. :** 6370

IBI: 24.0 **MIwb:** 5.0

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

Site ID: River: 95-996 North Mill Creek RM: 1.10 Date: 08/16/2019

Time Fished: 1056 Distance: 0.150 Drainge (sq mi): 31.9 Depth: 0

Location: Dst. Millburn Rd. Lat: 42.42340 Long: -87.99709

Species Code:	Species Name:	Feed Guild	Toler-ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
37-003	NORTHERN PIKE	P		M	F	2	4.0	2.27	3000	14.18	750.0
40-016	WHITE SUCKER	O	T	S	W	12	24.0	13.64	9000	42.54	375.0
43-001	COMMON CARP	O	T	M	G	7	14.0	7.95	7200	34.03	514.2
43-042	FATHEAD MINNOW	O	T	C	N	1	2.0	1.14	4	0.02	2.0
43-043	BLUNTNOSE MINNOW	O	T	C	N	7	14.0	7.95	20	0.09	1.4
47-002	CHANNEL CATFISH			C	F	2	4.0	2.27	8	0.04	2.0
47-004	YELLOW BULLHEAD	I	T	C		4	8.0	4.55	700	3.31	87.5
54-002	BLACKSTRIPE TOPMINNOW	I		M		4	8.0	4.55	8	0.04	1.0
77-006	LARGEMOUTH BASS	C		C	F	2	4.0	2.27	8	0.04	2.0
77-008	GREEN SUNFISH	I	T	C	S	28	56.0	31.82	700	3.31	12.5
77-009	BLUEGILL SUNFISH	I	P	C	S	17	34.0	19.32	500	2.36	14.7
77-010	ORANGESPOTTED SUNFISH	I		C	S	1	2.0	1.14	8	0.04	4.0
80-014	JOHNNY DARTER	I		C	D	1	2.0	1.14	2	0.01	1.0

No Species: 13 **Nat. Species:** 12 **Hybrids:** 0 **Total Counted:** 88 **Total Rel. Wt. :** 21158

IBI: 28.0 **MIwb:** 6.1

APPENDIX B

Upper Des Plaines River Year 3 Subwatersheds 2019 Macroinvertebrate Assemblage Data

B-1: Macroinvertebrate IBI Metrics and Scores
B-2: Macroinvertebrate Taxa Grand (all sites combined by four subwatershed bundles)
B-3: Macroinvertebrate Taxa by Site and Sample

Appendix Table B-1. Illinois Macroinvertebrate IBI metrics and values from the upper Des Plaines study area in 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	
Bull Creek (95-051)												
Year: 2019												
5.95	14-6	07/30/2019	2.40		17(37.0)	1(20.0)	0(0.0)	0(0.0)	6.3(77.1)	0.3(1.1)	0.0(0.0)	19.3
4.70	14-5	09/09/2019	1.30		21(46.0)	0(0.0)	0(0.0)	3(33.3)	7.3(60.7)	0.0(0.0)	0.0(0.0)	20.0
1.00	14-2	07/31/2019	8.40		29(63.0)	3(60.0)	0(0.0)	1(11.1)	6.3(77.1)	7.1(23.9)	6.1(8.3)	34.8
0.50	14-1	07/30/2019	11.70		36(78.0)	3(60.0)	2(19.6)	1(11.1)	5.6(88.5)	14.0(47.3)	22.5(30.4)	47.9
Hastings Creek (95-702)												
Year: 2019												
3.12	10-5	08/03/2019	3.90		27(59.0)	0(0.0)	1(9.8)	3(33.3)	6.3(77.1)	3.0(10.0)	20.7(27.9)	31.0
1.68	10-4	08/04/2019	5.60		19(41.0)	0(0.0)	0(0.0)	4(44.4)	5.4(91.8)	3.3(11.1)	3.3(4.5)	27.5
Bull's Brook (95-704)												
Year: 2019												
1.95	13-15	08/01/2019	1.90		31(67.0)	1(20.0)	1(9.8)	2(22.2)	5.3(93.4)	1.4(4.7)	11.2(15.1)	33.2
0.25	13-7	08/01/2019	2.70		24(52.0)	4(80.0)	1(9.8)	4(44.4)	4.1(100)	14.9(50.3)	6.0(8.1)	49.3
Newport Drainage Ditch (95-708)												
Year: 2019												
3.03	12-2	10/18/2019	2.80		14(30.0)	0(0.0)	3(29.4)	1(11.1)	4.9(100)	4.8(16.1)	9.2(12.4)	28.4
0.70	12-1	08/04/2019	7.30		27(59.0)	1(20.0)	2(19.6)	3(33.3)	5.3(93.4)	15.8(53.4)	4.2(5.7)	40.6
Stoneroller Creek (95-709)												
Year: 2019												
0.42	13-9	08/02/2019	4.10		27(59.0)	4(80.0)	2(19.6)	3(33.3)	6.1(80.3)	46.2(100)	22.8(30.8)	57.6
Suburban Country Club Tributary (95-710)												
Year: 2019												
2.00	13-10	08/02/2019	4.00		10(22.0)	0(0.0)	0(0.0)	0(0.0)	4.5(100)	1.2(4.2)	0.0(0.0)	18.0

Appendix Table B-1. Illinois Macroinvertebrate IBI metrics and values from the upper Des Plaines study area in 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
Slocum Conrners Creek (95-711)												
Year: 2019												
1.36	13-11	08/04/2019	2.40		22(48.0)	2(40.0)	2(19.6)	3(33.3)	4.0(100)	3.5(11.9)	3.9(5.2)	**36.9**
Unnamed Trib to DesPlaines River (95-714)												
Year: 2019												
0.13	13-17	07/31/2019	0.90		19(41.0)	0(0.0)	0(0.0)	1(11.1)	7.1(63.9)	40.2(100)	0.0(0.0)	**30.9**
Unnamed Trib to N. Mill Creek (95-715)												
Year: 2019												
0.04	10-6	08/03/2019	0.90		28(61.0)	1(20.0)	2(19.6)	4(44.4)	4.7(100)	1.0(3.4)	25.6(34.6)	**40.4**
Unnamed Trib - Greenleaf Creek (95-716)												
Year: 2019												
0.40	13-13	08/02/2019	1.10		9(20.0)	1(20.0)	0(0.0)	2(22.2)	5.7(86.9)	0.3(1.1)	0.0(0.0)	**21.5**
West Branch Bull Creek (95-719)												
Year: 2019												
2.54	14-4	07/31/2019	5.10		22(48.0)	2(40.0)	0(0.0)	0(0.0)	6.1(80.3)	0.7(2.2)	3.0(4.0)	**24.9**
1.60	14-3	07/31/2019	7.10		27(59.0)	2(40.0)	1(9.8)	2(22.2)	5.8(85.3)	21.6(73.0)	37.1(50.1)	**48.5**
West Fork Belvidere Rd. Trib (95-720)												
Year: 2019												
0.21	13-14	08/01/2019	2.30		18(39.0)	2(40.0)	0(0.0)	1(11.1)	6.0(82.0)	2.1(6.9)	0.9(1.2)	**25.7**
0.15	13-8	08/01/2019	3.80		36(78.0)	2(40.0)	2(19.6)	3(33.3)	5.6(88.5)	14.0(47.2)	7.0(9.5)	**45.2**
Mill Creek (95-995)												
Year: 2019												
17.20	11-6	08/03/2019	4.50		19(41.0)	2(40.0)	0(0.0)	2(22.2)	4.6(100)	0.6(2.1)	1.6(2.1)	**29.6**
13.80	11-5	08/01/2019	10.40		24(52.0)	1(20.0)	2(19.6)	2(22.2)	5.8(85.3)	5.7(19.4)	4.5(6.1)	**32.1**

Appendix Table B-1. Illinois Macroinvertebrate IBI metrics and values from the upper Des Plaines study area in 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	
10.10	11-4	08/03/2019	18.33		27(59.0)	2(40.0)	4(39.2)	4(44.4)	5.5(90.2)	1.0(3.5)	18.4(24.9)	43.0
7.20	11-3	07/30/2019	21.40		27(59.0)	3(60.0)	2(19.6)	3(33.3)	5.3(93.4)	2.4(8.1)	31.4(42.4)	45.1
0.70	11-1	08/03/2019	63.80		29(63.0)	3(60.0)	4(39.2)	3(33.3)	5.2(95.1)	19.2(64.9)	40.1(54.2)	58.5
North Mill Creek (95-996)												
Year: 2019												
11.30	10-7	08/04/2019	19.20		36(78.0)	2(40.0)	3(29.4)	4(44.4)	5.4(91.8)	15.9(53.7)	31.1(42.0)	54.2
1.10	10-1	08/03/2019	31.90		30(65.0)	4(80.0)	3(29.4)	4(44.4)	5.4(91.8)	20.1(68.0)	21.2(28.7)	58.2

***Appendix Table B-2** . Macroinvertebrate taxa collected at all sites in the Mill Creek subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
06800	*Gammarus sp*	3	356	23.06	5
68708	*Dubiraphia vittata group*	5	138	8.94	5
03600	*Oligochaeta*	10	111	7.19	5
52200	*Cheumatopsyche sp*	6	110	7.12	4
11130	*Baetis intercalaris*	4	108	6.99	3
68700	*Dubiraphia sp*	5	72	4.66	4
05800	*Caecidotea sp*	6	59	3.82	3
84450	*Polypedilum (Uresipedilum) flavum*	6	49	3.17	4
22001	*Coenagrionidae*	5.5	47	3.04	5
69400	*Stenelmis sp*	7	42	2.72	4
84540	*Polypedilum (Tripodura) scalaenum group*	6	39	2.53	4
68901	*Macronychus glabratus*	2	35	2.27	2
84470	*Polypedilum (P.) illinoense*	6	31	2.01	4
83040	*Dicrotendipes neomodestus*	6	26	1.68	4
83300	*Glyptotendipes (G.) sp*	10	23	1.49	1
13400	*Stenacron sp*	4	22	1.42	4
77750	*Hayesomyia senata or Thienemannimyia norena*	5	22	1.42	3
17200	*Caenis sp*	6	21	1.36	2
83158	*Endochironomus nigricans*	6	21	1.36	1
82820	*Cryptochironomus sp*	8	19	1.23	4
85625	*Rheotanytarsus sp*	6	18	1.17	2
95100	*Physella sp*	9	18	1.17	2
98600	*Sphaerium sp*	5	17	1.1	4
16700	*Tricorythodes sp*	5	13	0.84	1
78655	*Procladius (Holotanypus) sp*	8	11	0.71	4
22300	*Argia sp*	5	9	0.58	3
06201	*Hyalella azteca*	4	8	0.52	3
98200	*Pisidium sp*	5	8	0.52	3
52570	*Hydropsyche simulans*	5	7	0.45	1
01801	*Turbellaria*	6	5	0.32	4
68201	*Scirtidae*	7	5	0.32	3
84000	*Parachironomus sp*	8	5	0.32	1
65800	*Berosus sp*		4	0.26	1
78600	*Pentaneura inconspicua*	3	4	0.26	1
82880	*Cryptotendipes sp*	6	4	0.26	3
84520	*Polypedilum (Tripodura) halterale group*	6	4	0.26	2
08200	*Orconectes sp*	5	3	0.19	3
13000	*Leucrocuta sp*	3	3	0.19	1
21200	*Calopteryx sp*	4	3	0.19	2
44501	*Corixidae*		2	0.13	2
74100	*Simulium sp*	6	2	0.13	1

***Appendix Table B-2** . Macroinvertebrate taxa collected at all sites in the Mill Creek subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
77120	*Ablabesmyia mallochi*	6	2	0.13	2
77130	*Ablabesmyia rhamphe group*	6	2	0.13	2
78200	*Larsia sp*	6	2	0.13	1
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	3	2	0.13	2
83840	*Microtendipes pedellus group*	6	2	0.13	1
84010	*Parachironomus "abortivus" (sensu Simpson & Bode, 1980)*	8	2	0.13	1
84700	*Stenochironomus sp*	3	2	0.13	2
85265	*Cladotanytarsus vanderwulpi group sp 5*	7	2	0.13	1
85500	*Paratanytarsus sp*	6	2	0.13	2
86100	*Chrysops sp*	7	2	0.13	1
11200	*Callibaetis sp*	4	1	0.06	1
23700	*Anax sp*	5	1	0.06	1
48200	*Chauliodes sp*	4	1	0.06	1
54601	*Phryganeidae*	3.5	1	0.06	1
59100	*Ceraclea sp*	3	1	0.06	1
59570	*Oecetis nocturna*	5	1	0.06	1
59950	*Parapoynx sp*		1	0.06	1
77001	*Tanypodinae*	6	1	0.06	1
77355	*Clinotanypus pinguis*	6	1	0.06	1
77500	*Conchapelopia sp*	6	1	0.06	1
80510	*Cricotopus (Isocladius) sylvestris group*	8	1	0.06	1
81825	*Rheocricotopus (Psilocricotopus) robacki*	6	1	0.06	1
82730	*Chironomus (C.) decorus group*	11	1	0.06	1
83051	*Dicrotendipes simpsoni*	6	1	0.06	1
84400	*Polypedilum sp*	6	1	0.06	1
84460	*Polypedilum (P.) fallax group*	6	1	0.06	1
84750	*Stictochironomus sp*	5	1	0.06	1
85800	*Tanytarsus sp*	7	1	0.06	1
85821	*Tanytarsus glabrescens group sp 7*	7	1	0.06	1
89601	*Muscidae*	8	1	0.06	1
Totals(71 Taxa)			1544	100%	

Appendix Table B-3. *Macroinvertebrate taxa collected at all sites in the North Mill Creek subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
01801	*Turbellaria*	6	278	12.75	6
52200	*Cheumatopsyche sp*	6	190	8.72	6
06201	*Hyalella azteca*	4	154	7.06	6
68708	*Dubiraphia vittata group*	5	147	6.74	5
03600	*Oligochaeta*	10	122	5.6	7
11130	*Baetis intercalaris*	4	120	5.5	4
06800	*Gammarus sp*	3	114	5.23	5
13400	*Stenacron sp*	4	98	4.5	4
74100	*Simulium sp*	6	73	3.35	2
84450	*Polypedilum (Uresipedilum) flavum*	6	73	3.35	7
78600	*Pentaneura inconspicua*	3	67	3.07	5
84470	*Polypedilum (P.) illinoense*	6	66	3.03	6
68700	*Dubiraphia sp*	5	63	2.89	3
85625	*Rheotanytarsus sp*	6	52	2.39	5
05800	*Caecidotea sp*	6	42	1.93	4
17200	*Caenis sp*	6	36	1.65	2
68201	*Scirtidae*	7	33	1.51	5
52530	*Hydropsyche depravata group*	5	27	1.24	3
77500	*Conchapelopia sp*	6	24	1.1	5
84540	*Polypedilum (Tripodura) scalaenum group*	6	21	0.96	5
82820	*Cryptochironomus sp*	8	20	0.92	6
77750	*Hayesomyia senata or Thienemannimyia norena*	5	19	0.87	3
98200	*Pisidium sp*	5	17	0.78	5
06700	*Crangonyx sp*	4	16	0.73	1
53800	*Hydroptila sp*	2	16	0.73	4
68901	*Macronychus glabratus*	2	16	0.73	2
21001	*Calopterygidae*	3.5	14	0.64	3
22001	*Coenagrionidae*	5.5	14	0.64	5
69400	*Stenelmis sp*	7	14	0.64	2
84520	*Polypedilum (Tripodura) halterale group*	6	12	0.55	2
84700	*Stenochironomus sp*	3	12	0.55	4
21200	*Calopteryx sp*	4	11	0.5	1
95100	*Physella sp*	9	10	0.46	3
08200	*Orconectes sp*	5	9	0.41	3
85500	*Paratanytarsus sp*	6	9	0.41	4
22300	*Argia sp*	5	8	0.37	2
77120	*Ablabesmyia mallochi*	6	8	0.37	4
77355	*Clinotanypus pinguis*	6	7	0.32	1
78655	*Procladius (Holotanypus) sp*	8	7	0.32	4
05900	*Lirceus sp*	4	6	0.28	1
59580	*Oecetis persimilis*	5	6	0.28	3

Appendix Table B-3. *Macroinvertebrate taxa collected at all sites in the North Mill Creek subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
80420	*Cricotopus (C.) bicinctus*	8	6	0.28	1
42700	*Belostoma sp*		5	0.23	2
67700	*Paracymus sp*		5	0.23	2
82880	*Cryptotendipes sp*	6	5	0.23	2
84300	*Phaenopsectra obediens group*	4	5	0.23	1
84750	*Stictochironomus sp*	5	5	0.23	2
87540	*Hemerodromia sp*	6	5	0.23	3
44501	*Corixidae*		4	0.18	2
53501	*Hydroptilidae*	3.5	4	0.18	1
65800	*Berosus sp*		4	0.18	2
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	3	4	0.18	2
83300	*Glyptotendipes (G.) sp*	10	4	0.18	1
98600	*Sphaerium sp*	5	4	0.18	1
52430	*Ceratopsyche morosa group*	4	3	0.14	1
59550	*Oecetis inconspicua complex sp A (sensu Floyd, 1995)*	5	3	0.14	2
77001	*Tanypodinae*	6	3	0.14	2
78200	*Larsia sp*	6	3	0.14	2
80510	*Cricotopus (Isocladius) sylvestris group*	8	3	0.14	1
82730	*Chironomus (C.) decorus group*	11	3	0.14	2
84460	*Polypedilum (P.) fallax group*	6	3	0.14	3
85001	*Tanytarsini*	6	3	0.14	1
04930	*Erpobdella sp*	8	2	0.09	1
23909	*Boyeria vinosa*	3	2	0.09	2
60350	*Gyretes sinuatus*	0	2	0.09	1
71900	*Tipula sp*	4	2	0.09	2
83840	*Microtendipes pedellus group*	6	2	0.09	2
84210	*Paratendipes albimanus or P. duplicatus*	3	2	0.09	1
04666	*Helobdella papillata*	8	1	0.05	1
04901	*Erpobdellidae*	8	1	0.05	1
04935	*Erpobdella punctata punctata*	8	1	0.05	1
11120	*Baetis flavistriga*	4	1	0.05	1
12501	*Heptageniidae*	3.5	1	0.05	1
16700	*Tricorythodes sp*	5	1	0.05	1
43570	*Neoplea sp*		1	0.05	1
48200	*Chauliodes sp*	4	1	0.05	1
59500	*Oecetis sp*	5	1	0.05	1
60400	*Gyrinus sp*	4	1	0.05	1
63300	*Hydroporini*		1	0.05	1
63900	*Laccophilus sp*		1	0.05	1

Appendix Table B-3. *Macroinvertebrate taxa collected at all sites in the North Mill Creek subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
67100	*Hydrobius sp*	0	1	0.05	1
67800	*Tropisternus sp*		1	0.05	1
68601	*Ancyronyx variegata*	2	1	0.05	1
77140	*Ablabesmyia peleensis*	6	1	0.05	1
77700	*Guttipelopia guttipennis*	6	1	0.05	1
78140	*Labrundinia pilosella*	4	1	0.05	1
80410	*Cricotopus (C.) sp*	8	1	0.05	1
81825	*Rheocricotopus (Psilocricotopus) robacki*	6	1	0.05	1
82141	*Thienemanniella xena*	2	1	0.05	1
82501	*Chironomini*	6	1	0.05	1
82885	*Cryptotendipes pseudotener*	6	1	0.05	1
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	6	1	0.05	1
84000	*Parachironomus sp*	8	1	0.05	1
84601	*Saetheria species 1 (sensu Jackson, 1977)*	6	1	0.05	1
84960	*Pseudochironomus sp*	5	1	0.05	1
85615	*Rheotanytarsus pellucidus*	6	1	0.05	1
85800	*Tanytarsus sp*	7	1	0.05	1
86001	*Tabanidae*	7	1	0.05	1
94201	*Lymnaeidae*	7	1	0.05	1
95900	*Gyraulus sp*	6	1	0.05	1
96264	*Planorbella (Pierosoma) pilsbryi*	6.5	1	0.05	1
Totals(101 Taxa)			2180	100%	

Appendix Table B-4. *Macroinvertebrate taxa collected at all sites in the Bull Creek-Bulls Brook DPR Tributaries (W) subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
05800	*Caecidotea sp*	6	620	17.69	8
01801	*Turbellaria*	6	271	7.73	9
69400	*Stenelmis sp*	7	268	7.65	9
03600	*Oligochaeta*	10	265	7.56	11
06800	*Gammarus sp*	3	251	7.16	4
06201	*Hyalella azteca*	4	244	6.96	8
52200	*Cheumatopsyche sp*	6	215	6.13	9
98600	*Sphaerium sp*	5	206	5.88	8
84450	*Polypedilum (Uresipedilum) flavum*	6	108	3.08	10
22001	*Coenagrionidae*	5.5	75	2.14	8
06700	*Crangonyx sp*	4	63	1.8	3
11120	*Baetis flavistriga*	4	48	1.37	4
11130	*Baetis intercalaris*	4	45	1.28	4
74100	*Simulium sp*	6	45	1.28	7
84470	*Polypedilum (P.) illinoense*	6	42	1.2	7
98200	*Pisidium sp*	5	38	1.08	6
69200	*Optioservus sp*	4	34	0.97	5
04664	*Helobdella stagnalis*	8	33	0.94	4
68708	*Dubiraphia vittata group*	5	33	0.94	8
77500	*Conchapelopia sp*	6	29	0.83	8
85500	*Paratanytarsus sp*	6	27	0.77	6
84000	*Parachironomus sp*	8	26	0.74	2
93200	*Hydrobiidae*	6	26	0.74	3
53800	*Hydroptila sp*	2	24	0.68	4
83040	*Dicrotendipes neomodestus*	6	23	0.66	6
82820	*Cryptochironomus sp*	8	22	0.63	8
85625	*Rheotanytarsus sp*	6	22	0.63	4
95100	*Physella sp*	9	22	0.63	4
85800	*Tanytarsus sp*	7	21	0.6	5
84540	*Polypedilum (Tripodura) scalaenum group*	6	20	0.57	6
82730	*Chironomus (C.) decorus group*	11	19	0.54	7
78655	*Procladius (Holotanypus) sp*	8	18	0.51	4
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 198(*	6	18	0.51	5
84750	*Stictochironomus sp*	5	17	0.49	8
22300	*Argia sp*	5	16	0.46	3
52530	*Hydropsyche depravata group*	5	15	0.43	4
83300	*Glyptotendipes (G.) sp*	10	15	0.43	3
21001	*Calopterygidae*	3.5	14	0.4	5
84210	*Paratendipes albimanus or P. duplicatus*	3	12	0.34	6
08200	*Orconectes sp*	5	9	0.26	5
17200	*Caenis sp*	6	8	0.23	3

Appendix Table B-4. *Macroinvertebrate taxa collected at all sites in the Bull Creek-Bulls Brook DPR Tributaries (W) subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
21200	*Calopteryx sp*	4	8	0.23	2
44501	*Corixidae*	99.9	8	0.23	1
83158	*Endochironomus nigricans*	6	8	0.23	3
04935	*Erpobdella punctata punctata*	8	7	0.2	3
68901	*Macronychus glabratus*	2	7	0.2	2
83051	*Dicrotendipes simpsoni*	6	7	0.2	3
60900	*Peltodytes sp*	99.9	6	0.17	2
71900	*Tipula sp*	4	6	0.17	3
77750	*Hayesomyia senata or Thienemannimyia norena*	5	6	0.17	4
81650	*Parametriocnemus sp*	4	6	0.17	3
85001	*Tanytarsini*	6	6	0.17	1
04930	*Erpobdella sp*	8	5	0.14	1
77120	*Ablabesmyia mallochi*	6	5	0.14	3
78599	*Pentaneura sp*	3	5	0.14	1
80420	*Cricotopus (C.) bicinctus*	8	5	0.14	3
80430	*Cricotopus (C.) tremulus group*	8	5	0.14	3
83840	*Microtendipes pedellus group*	6	5	0.14	3
97601	*Corbicula fluminea*	4	5	0.14	2
98001	*Pisidiidae*	5	5	0.14	1
04901	*Erpobdellidae*	8	4	0.11	2
82880	*Cryptotendipes sp*	6	4	0.11	3
85400	*Micropsectra sp*	4	4	0.11	2
87540	*Hemerodromia sp*	6	4	0.11	2
08601	*Hydrachnidia*	99.9	3	0.09	2
29000	*Sympetrum sp*	0	3	0.09	1
82800	*Cladopelma sp*	6	3	0.09	1
58505	*Helicopsyche borealis*	2	2	0.06	1
59550	*Oecetis inconspicua complex sp A (sensu Floyd, 1995)*	5	2	0.06	2
68201	*Scirtidae*	7	2	0.06	1
68700	*Dubiraphia sp*	5	2	0.06	1
79000	*Tanypus sp*	8	2	0.06	2
80001	*Orthocladiinae*	6	2	0.06	1
84300	*Phaenopsectra obediens group*	4	2	0.06	2
94400	*Fossaria sp*	7	2	0.06	2
01900	*Nemertea*	99.9	1	0.03	1
04660	*Helobdella sp*	8	1	0.03	1
07800	*Cambarus sp*	5	1	0.03	1
13400	*Stenacron sp*	4	1	0.03	1
23700	*Anax sp*	5	1	0.03	1
28001	*Libellulidae*	4.5	1	0.03	1
42700	*Belostoma sp*	99.9	1	0.03	1

Appendix Table B-4. *Macroinvertebrate taxa collected at all sites in the Bull Creek-Bulls Brook DPR Tributaries (W) subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
57900	*Pycnopsyche sp*	3	1	0.03	1
60800	*Haliplus sp*	99.9	1	0.03	1
65800	*Berosus sp*	99.9	1	0.03	1
66500	*Enochrus sp*	99.9	1	0.03	1
78130	*Labrundinia neopilosella*	4	1	0.03	1
78450	*Nilotanypus fimbriatus*	6	1	0.03	1
80440	*Cricotopus (C.) trifascia*	6	1	0.03	1
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	3	1	0.03	1
83590	*Kiefferulus sp*	7	1	0.03	1
84400	*Polypedilum sp*	6	1	0.03	1
84460	*Polypedilum (P.) fallax group*	6	1	0.03	1
84480	*Polypedilum (P.) laetum group*	0	1	0.03	1
84800	*Tribelos jucundum*	5	1	0.03	1
95501	*Planorbidae*	6.5	1	0.03	1
96200	*Planorbella sp*	6.5	1	0.03	1
Totals(97 Taxa)			3505	100%	

Appendix Table B-5 *. Macroinvertebrate taxa collected at all sites in the Upper Des Plaines Tributaries (E) subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
06201	*Hyalella azteca*	4	394	21.78	3
06800	*Gammarus sp*	3	379	20.95	4
05800	*Caecidotea sp*	6	211	11.66	5
95100	*Physella sp*	9	166	9.18	5
03600	*Oligochaeta*	10	105	5.8	6
98001	*Pisidiidae*	5	103	5.69	1
22001	*Coenagrionidae*	5.5	45	2.49	4
84750	*Stictochironomus sp*	5	44	2.43	2
01801	*Turbellaria*	6	38	2.1	3
68708	*Dubiraphia vittata group*	5	32	1.77	2
98600	*Sphaerium sp*	5	30	1.66	3
17200	*Caenis sp*	6	27	1.49	1
84210	*Paratendipes albimanus or P. duplicatus*	3	25	1.38	4
84470	*Polypedilum (P.) illinoense*	6	16	0.88	3
98200	*Pisidium sp*	5	16	0.88	2
85500	*Paratanytarsus sp*	6	14	0.77	3
06700	*Crangonyx sp*	4	12	0.66	2
52200	*Cheumatopsyche sp*	6	12	0.66	2
68700	*Dubiraphia sp*	5	12	0.66	2
83840	*Microtendipes pedellus group*	6	11	0.61	2
80420	*Cricotopus (C.) bicinctus*	8	9	0.5	1
93200	*Hydrobiidae*	6	9	0.5	1
96264	*Planorbella (Pierosoma) pilsbryi*	6.5	9	0.5	1
82820	*Cryptochironomus sp*	8	8	0.44	4
77500	*Conchapelopia sp*	6	6	0.33	3
83002	*Dicrotendipes modestus*	6	6	0.33	1
13400	*Stenacron sp*	4	5	0.28	3
94400	*Fossaria sp*	7	5	0.28	1
04901	*Erpobdellidae*	8	4	0.22	1
21200	*Calopteryx sp*	4	4	0.22	1
69400	*Stenelmis sp*	7	4	0.22	2
04666	*Helobdella papillata*	8	3	0.17	1
52530	*Hydropsyche depravata group*	5	3	0.17	1
82880	*Cryptotendipes sp*	6	3	0.17	1
83040	*Dicrotendipes neomodestus*	6	3	0.17	1
84450	*Polypedilum (Uresipedilum) flavum*	6	3	0.17	1
84540	*Polypedilum (Tripodura) scalaenum group*	6	3	0.17	2
48200	*Chauliodes sp*	4	2	0.11	1
53800	*Hydroptila sp*	2	2	0.11	2
84315	*Phaenopsectra flavipes*	4	2	0.11	1
96002	*Helisoma anceps anceps*	7	2	0.11	1

Appendix Table B-5 *. Macroinvertebrate taxa collected at all sites in the Upper Des Plaines Tributaries (E) subwatershed, 2019.*

Taxa Code	Taxa Name	Illinois Tolerance Rating	Total Number	Percent	Samples Collected In
04664	*Helobdella stagnalis*	8	1	0.06	1
08200	*Orconectes sp*	5	1	0.06	1
11001	*Baetidae*	4	1	0.06	1
11120	*Baetis flavistriga*	4	1	0.06	1
11200	*Callibaetis sp*	4	1	0.06	1
42700	*Belostoma sp*		1	0.06	1
45900	*Notonecta sp*		1	0.06	1
52570	*Hydropsyche simulans*	5	1	0.06	1
59550	*Oecetis inconspicua complex sp A (sensu Flo*	5	1	0.06	1
60900	*Peltodytes sp*		1	0.06	1
68201	*Scirtidae*	7	1	0.06	1
77001	*Tanypodinae*	6	1	0.06	1
77355	*Clinotanypus pinguis*	6	1	0.06	1
78655	*Procladius (Holotanypus) sp*	8	1	0.06	1
79400	*Zavrelimyia sp*	8	1	0.06	1
83158	*Endochironomus nigricans*	6	1	0.06	1
83590	*Kiefferulus sp*	7	1	0.06	1
84400	*Polypedilum sp*	6	1	0.06	1
84520	*Polypedilum (Tripodura) halterale group*	6	1	0.06	1
85625	*Rheotanytarsus sp*	6	1	0.06	1
85800	*Tanytarsus sp*	7	1	0.06	1
95900	*Gyraulus sp*	6	1	0.06	1
Totals(63 Taxa)			1809	100%	

Appendix Table B-6. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: at Hazelnut Xing

Site ID: **14-6**

Subsample:

Collection Date: 07/30/2019 River Code: 95-051 River: Bull Creek RM: 5.95

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	20
04660	Helobdella sp		8.0	1
04664	Helobdella stagnalis		8.0	12
04935	Erpobdella punctata punctata		8.0	5
05800	Caecidotea sp		6.0	221
06201	Hyalella azteca		4.0	21
68708	Dubiraphia vittata group	CO	5.0	1
77500	Conchapelopia sp		6.0	1
81650	Parametriocnemus sp		4.0	1
82730	Chironomus (C.) decorus group		11.0	4
82820	Cryptochironomus sp		8.0	3
83051	Dicrotendipes simpsoni		6.0	1
83158	Endochironomus nigricans		6.0	2
83300	Glyptotendipes (G.) sp		10.0	1
83590	Kiefferulus sp		7.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	2
85400	Micropsectra sp		4.0	3
94400	Fossaria sp		7.0	1
98200	Pisidium sp		5.0	8
98600	Sphaerium sp		5.0	7

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

No. Quantitative Taxa: 20 Total Taxa: 20

Number of Organisms: 316 mIBI: 19.30

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: at St. Mary of the Lake College

Site ID: **14-5**

Subsample:

Collection Date: 09/09/2019 River Code: 95-051 River: Bull Creek RM: 4.70

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	48
03600	Oligochaeta		10.0	83
04664	Helobdella stagnalis		8.0	17
04901	Erpobdellidae		8.0	3
04935	Erpobdella punctata punctata		8.0	1
05800	Caecidotea sp		6.0	10
06700	Crangonyx sp		4.0	41
22001	Coenagrionidae		5.5	3
28001	Libellulidae		4.5	1
78599	Pentaneura sp		3.0	5
78655	Procladius (Holotanypus) sp		8.0	9
79000	Tanypus sp		8.0	1
81231	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"		3.0	1
82730	Chironomus (C.) decorus group		11.0	6
82800	Cladopelma sp		6.0	3
83040	Dicrotendipes neomodestus		6.0	7
83051	Dicrotendipes simpsoni		6.0	4
83158	Endochironomus nigricans		6.0	5
83300	Glyptotendipes (G.) sp		10.0	13
84000	Parachironomus sp		8.0	25
84210	Paratendipes albimanus or P. duplicatus		3.0	2
85001	Tanytarsini		6.0	6
85800	Tanytarsus sp		7.0	12
98200	Pisidium sp		5.0	2
98600	Sphaerium sp		5.0	5

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

No. Quantitative Taxa: 25 Total Taxa: 25

Number of Organisms: 313 mIBI: 20.00

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: at Rte 137

Site ID: 14-2

Subsample:

Collection Date: 07/31/2019 River Code: 95-051 River: Bull Creek RM: 1.00

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	1
03600	Oligochaeta		10.0	74
04664	Helobdella stagnalis		8.0	1
06201	Hyalella azteca		4.0	15
06700	Crangonyx sp		4.0	15
07800	Cambarus sp		5.0	1
08200	Orconectes sp		5.0	4
21001	Calopterygidae		3.5	2
22001	Coenagrionidae		5.5	10
52200	Cheumatopsyche sp	CA	6.0	20
68708	Dubiraphia vittata group	CO	5.0	1
69200	Optioservus sp	CO	4.0	3
69400	Stenelmis sp	CO	7.0	3
71900	Tipula sp		4.0	1
77500	Conchapelopia sp		6.0	1
80001	Orthocladiinae		6.0	2
80420	Cricotopus (C.) bicinctus		8.0	1
82820	Cryptochironomus sp		8.0	2
83040	Dicrotendipes neomodestus		6.0	2
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		6.0	1
84210	Paratendipes albimanus or P. duplicatus		3.0	2
84300	Phaenopsectra obediens group		4.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	13
84470	Polypedilum (P.) illinoense		6.0	6
84540	Polypedilum (Tripodura) scalaenum group		6.0	6
84750	Stictochironomus sp		5.0	4
85500	Paratanytarsus sp		6.0	2
85625	Rheotanytarsus sp		6.0	2
85800	Tanytarsus sp		7.0	4
93200	Hydrobiidae		6.0	16
97601	Corbicula fluminea		4.0	4
98200	Pisidium sp		5.0	20
98600	Sphaerium sp		5.0	86

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

No. Quantitative Taxa: 33 Total Taxa: 33

Number of Organisms: 326 mIBI: 34.76

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Ust. IL 21

Site ID: 14-1

Subsample:

Collection Date: 07/30/2019 River Code: 95-051 River: Bull Creek RM: 0.50

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	4
01900	Nemertea		99.9	1
03600	Oligochaeta		10.0	16
04901	Erpobdellidae		8.0	1
05800	Caecidotea sp		6.0	1
06201	Hyalella azteca		4.0	69
08601	Hydrachnidia		99.9	1
11120	Baetis flavistriga	MA	4.0	16
11130	Baetis intercalaris	MA	4.0	2
13400	Stenacron sp	MA	4.0	1
21001	Calopterygidae		3.5	1
22001	Coenagrionidae		5.5	20
22300	Argia sp		5.0	14
44501	Corixidae		99.9	8
52200	Cheumatopsyche sp	CA	6.0	37
53800	Hydroptila sp	CA	2.0	12
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)	CA	5.0	1
60800	Haliplus sp	CO	99.9	1
60900	Peltodytes sp	CO	99.9	5
65800	Berosus sp	CO	99.9	1
66500	Enochrus sp	CO	99.9	1
68708	Dubiraphia vittata group	CO	5.0	1
69200	Optioservus sp	CO	4.0	2
69400	Stenelmis sp	CO	7.0	7
74100	Simulium sp		6.0	2
77120	Ablabesmyia mallochi		6.0	2
77750	Hayesomyia senata or Thienemannimyia norena		5.0	1
78655	Procladius (Holotanypus) sp		8.0	2
80420	Cricotopus (C.) bicinctus		8.0	3
82730	Chironomus (C.) decorus group		11.0	3
82820	Cryptochironomus sp		8.0	3
82880	Cryptotendipes sp		6.0	1
83040	Dicrotendipes neomodestus		6.0	6
83300	Glyptotendipes (G.) sp		10.0	1
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		6.0	8
83840	Microtendipes pedellus group		6.0	3
84450	Polypedilum (Uresipedilum) flavum		6.0	13
84470	Polypedilum (P.) illinoense		6.0	8
84540	Polypedilum (Tripodura) scalaenum group		6.0	2
84750	Stictochironomus sp		5.0	5
84800	Tribelos jucundum		5.0	1
85500	Paratanytarsus sp		6.0	8
85800	Tanytarsus sp		7.0	2
93200	Hydrobiidae		6.0	9
95100	Physella sp		9.0	11
95501	Planorbidae		6.5	1
98600	Sphaerium sp		5.0	7

No. Quantitative Taxa: 47 Total Taxa: 47

Number of Organisms: 325 mIBI: 47.85

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: at Grass Lake Rd.

Site ID: **10-5**

Subsample:

Collection Date: 08/03/2019 River Code: 95-702 River: Hastings Creek RM: 3.12

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	72
03600	Oligochaeta		10.0	61
04935	Erpobdella punctata punctata		8.0	1
06201	Hyalella azteca		4.0	34
06700	Crangonyx sp		4.0	16
17200	Caenis sp	MA	6.0	14
22001	Coenagrionidae		5.5	3
52200	Cheumatopsyche sp	CA	6.0	38
52530	Hydropsyche depravata group	CA	5.0	3
53501	Hydroptilidae	CA	3.5	4
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)	CA	5.0	2
59580	Oecetis persimilis	CA	5.0	2
67100	Hydrobius sp		0.0	1
68201	Scirtidae		7.0	1
77001	Tanypodinae		6.0	1
77500	Conchapelopia sp		6.0	1
77700	Guttipelopia guttipennis		6.0	1
78600	Pentaneura inconspicua		3.0	20
81231	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"		3.0	3
82820	Cryptochironomus sp		8.0	4
83300	Glyptotendipes (G.) sp		10.0	4
84000	Parachironomus sp		8.0	1
84210	Paratendipes albimanus or P. duplicatus		3.0	2
84450	Polypedilum (Uresipedilum) flavum		6.0	2
84470	Polypedilum (P.) illinoense		6.0	1
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
85500	Paratanytarsus sp		6.0	1
85625	Rheotanytarsus sp		6.0	3
95100	Physella sp		9.0	7
95900	Gyraulus sp		6.0	1

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

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 305 mIBI: 31.01

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. Almond Rd.

Site ID: 13-15

Subsample:

Collection Date: 08/01/2019 River Code: 95-704 River: Bull's Brook RM: 1.95

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	8
04935	Erpobdella punctata punctata		8.0	1
05800	Caecidotea sp		6.0	73
06201	Hyalella azteca		4.0	75
06800	Gammarus sp		3.0	13
17200	Caenis sp	MA	6.0	1
21001	Calopterygidae		3.5	6
22001	Coenagrionidae		5.5	11
29000	Sympetrum sp		0.0	3
52200	Cheumatopsyche sp	CA	6.0	21
52530	Hydropsyche depravata group	CA	5.0	9
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)	CA	5.0	1
60900	Peltodytes sp	CO	99.9	1
69400	Stenelmis sp	CO	7.0	1
71900	Tipula sp		4.0	3
74100	Simulium sp		6.0	1
77500	Conchapelopia sp		6.0	7
78450	Nilotanypus fimbriatus		6.0	1
78655	Procladius (Holotanypus) sp		8.0	4
82730	Chironomus (C.) decorus group		11.0	1
82820	Cryptochironomus sp		8.0	3
82880	Cryptotendipes sp		6.0	2
84210	Paratendipes albimanus or P. duplicatus		3.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	5
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
84750	Stictochironomus sp		5.0	1
85400	Micropsectra sp		4.0	1
85500	Paratanytarsus sp		6.0	4
85625	Rheotanytarsus sp		6.0	18
87540	Hemerodromia sp		6.0	3
95100	Physella sp		9.0	2
96200	Planorbella sp		6.5	1
98001	Pisidiidae		5.0	5

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

No. Quantitative Taxa: 33 Total Taxa: 33

Number of Organisms: 288 mIBI: 33.18

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: North Milwaukee Ave.

Site ID: 13-7

Subsample:

Collection Date: 08/01/2019 River Code: 95-704 River: Bull's Brook RM: 0.25

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	4
03600	Oligochaeta		10.0	3
05800	Caecidotea sp		6.0	37
06800	Gammarus sp		3.0	200
08200	Orconectes sp		5.0	2
11120	Baetis flavistriga	MA	4.0	4
21001	Calopterygidae		3.5	3
52200	Cheumatopsyche sp	CA	6.0	13
52530	Hydropsyche depravata group	CA	5.0	3
57900	Pycnopsyche sp	CA	3.0	1
68700	Dubiraphia sp	CO	5.0	2
68708	Dubiraphia vittata group	CO	5.0	11
68901	Macronychus glabratus	CO	2.0	2
69200	Optioservus sp	CO	4.0	27
69400	Stenelmis sp	CO	7.0	25
74100	Simulium sp		6.0	1
80430	Cricotopus (C.) tremulus group		8.0	1
81650	Parametriocnemus sp		4.0	1
83040	Dicrotendipes neomodestus		6.0	1
83840	Microtendipes pedellus group		6.0	1
84210	Paratendipes albimanus or P. duplicatus		3.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	1
84460	Polypedilum (P.) fallax group		6.0	1
84750	Stictochironomus sp		5.0	2
85500	Paratanytarsus sp		6.0	1
98600	Sphaerium sp		5.0	1

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

No. Quantitative Taxa: 26 Total Taxa: 26

Number of Organisms: 349 mIBI: 49.25

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: dst 21st St.

Site ID: **12-2**

Subsample:

Collection Date: 10/18/2019 River Code: 95-708 River: Newport Drainage Ditch RM: 3.03

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	12
05800	Caecidotea sp		6.0	1
06201	Hyalella azteca		4.0	192
06700	Crangonyx sp		4.0	6
06800	Gammarus sp		3.0	1
11200	Callibaetis sp	MA	4.0	1
13400	Stenacron sp	MA	4.0	1
17200	Caenis sp	MA	6.0	27
22001	Coenagrionidae		5.5	21
42700	Belostoma sp		99.9	1
77355	Clinotanypus pinguis		6.0	1
77500	Conchapelopia sp		6.0	2
84520	Polypedilum (Tripodura) halterale group		6.0	1
95100	Physella sp		9.0	14
98200	Pisidium sp		5.0	15
98600	Sphaerium sp		5.0	21

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

No. Quantitative Taxa: 16 Total Taxa: 16

Number of Organisms: 317 mIBI: 28.43

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: ust. Kilbourne Rd.

Site ID: 12-1

Subsample:

Collection Date: 08/04/2019 River Code: 95-708 River: Newport Drainage Ditch RM: 0.70

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	1
03600	Oligochaeta		10.0	13
05800	Caecidotea sp		6.0	7
06800	Gammarus sp		3.0	102
08200	Orconectes sp		5.0	1
11001	Baetidae	MA	4.0	1
13400	Stenacron sp	MA	4.0	1
52200	Cheumatopsyche sp	CA	6.0	8
52570	Hydropsyche simulans	CA	5.0	1
53800	Hydroptila sp	CA	2.0	1
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)	CA	5.0	1
68201	Scirtidae		7.0	1
68700	Dubiraphia sp	CO	5.0	10
68708	Dubiraphia vittata group	CO	5.0	19
77500	Conchapelopia sp		6.0	2
78655	Procladius (Holotanypus) sp		8.0	1
80420	Cricotopus (C.) bicinctus		8.0	9
82820	Cryptochironomus sp		8.0	3
82880	Cryptotendipes sp		6.0	3
83040	Dicrotendipes neomodestus		6.0	3
83840	Microtendipes pedellus group		6.0	9
84210	Paratendipes albimanus or P. duplicatus		3.0	6
84450	Polypedilum (Uresipedilum) flavum		6.0	3
84470	Polypedilum (P.) illinoense		6.0	9
84540	Polypedilum (Tripodura) scalaenum group		6.0	2
84750	Stictochironomus sp		5.0	43
85500	Paratanytarsus sp		6.0	3
85625	Rheotanytarsus sp		6.0	1
93200	Hydrobiidae		6.0	9
95100	Physella sp		9.0	37

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

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 310 mIBI: 40.64

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. IL 21

Site ID: 13-9

Subsample:

Collection Date: 08/02/2019 River Code: 95-709 River: Stoneroller Creek RM: 0.42

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	30
03600	Oligochaeta		10.0	9
06201	Hyalella azteca		4.0	3
08200	Orconectes sp		5.0	1
11120	Baetis flavistriga	MA	4.0	13
11130	Baetis intercalaris	MA	4.0	32
17200	Caenis sp	MA	6.0	1
22300	Argia sp		5.0	1
52200	Cheumatopsyche sp	CA	6.0	19
52530	Hydropsyche depravata group	CA	5.0	1
53800	Hydroptila sp	CA	2.0	1
58505	Helicopsyche borealis	CA	2.0	2
68708	Dubiraphia vittata group	CO	5.0	10
68901	Macronychus glabratus	CO	2.0	5
69200	Optioservus sp	CO	4.0	1
69400	Stenelmis sp	CO	7.0	134
77120	Ablabesmyia mallochi		6.0	1
77500	Conchapelopia sp		6.0	2
77750	Hayesomyia senata or Thienemannimyia norena		5.0	2
80430	Cricotopus (C.) tremulus group		8.0	1
82730	Chironomus (C.) decorus group		11.0	1
82820	Cryptochironomus sp		8.0	2
83040	Dicrotendipes neomodestus		6.0	5
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		6.0	2
84450	Polypedilum (Uresipedilum) flavum		6.0	11
84470	Polypedilum (P.) illinoense		6.0	3
84750	Stictochironomus sp		5.0	2
85500	Paratanytarsus sp		6.0	6
95100	Physella sp		9.0	2

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

No. Quantitative Taxa: 29 Total Taxa: 29

Number of Organisms: 303 mIBI: 57.58

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. North Delany Rd.

Site ID: **13-10**

Subsample:

Collection Date: 08/02/2019 River Code: 95-710 River: Suburban Country Club Trib RM: 2.00

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	18
03600	Oligochaeta		10.0	2
05800	Caecidotea sp		6.0	1
06201	Hyalella azteca		4.0	189
22001	Coenagrionidae		5.5	19
48200	Chauliodes sp		4.0	2
60900	Peltodytes sp	CO	99.9	1
83002	Dicrotendipes modestus		6.0	6
83158	Endochironomus nigricans		6.0	1
84470	Polypedilum (P.) illinoense		6.0	3
95100	Physella sp		9.0	3

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

No. Quantitative Taxa: 11 Total Taxa: 11

Number of Organisms: 245 mIBI: 18.02

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Ust. North Mill Creek Rd.

Site ID: 13-11

Subsample:

Collection Date: 08/04/2019 River Code: 95-711 River: Slocum Conrners Creek RM: 1.36

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	6
05800	Caecidotea sp		6.0	43
06700	Crangonyx sp		4.0	6
06800	Gammarus sp		3.0	201
11120	Baetis flavistriga	MA	4.0	1
13400	Stenacron sp	MA	4.0	3
21200	Calopteryx sp		4.0	4
22001	Coenagrionidae		5.5	1
52200	Cheumatopsyche sp	CA	6.0	4
52530	Hydropsyche depravata group	CA	5.0	3
53800	Hydroptila sp	CA	2.0	1
68700	Dubiraphia sp	CO	5.0	2
68708	Dubiraphia vittata group	CO	5.0	13
69400	Stenelmis sp	CO	7.0	3
77001	Tanypodinae		6.0	1
82820	Cryptochironomus sp		8.0	1
83840	Microtendipes pedellus group		6.0	2
84210	Paratendipes albimanus or P. duplicatus		3.0	1
84470	Polypedilum (P.) illinoense		6.0	4
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
84750	Stictochironomus sp		5.0	1
85500	Paratanytarsus sp		6.0	1
95100	Physella sp		9.0	4
98200	Pisidium sp		5.0	1
98600	Sphaerium sp		5.0	4

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

No. Quantitative Taxa: 25 Total Taxa: 25

Number of Organisms: 312 mIBI: 36.87

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: behind pump station off Sprucewood Lane

Site ID: **13-17**

Subsample:

Collection Date: 07/31/2019 River Code: 95-714 River: Unnamed Trib to DesPLaines River RM: 0.13

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	34
04666	Helobdella papillata		8.0	3
04901	Erpobdellidae		8.0	4
06201	Hyalella azteca		4.0	13
22001	Coenagrionidae		5.5	4
45900	Notonecta sp		99.9	1
77500	Conchapelopia sp		6.0	2
79400	Zavrelimyia sp		8.0	1
82820	Cryptochironomus sp		8.0	3
83590	Kiefferulus sp		7.0	1
84210	Paratendipes albimanus or P. duplicatus		3.0	9
84315	Phaenopsectra flavipes		4.0	2
84400	Polypedilum sp		6.0	1
85500	Paratanytarsus sp		6.0	10
85800	Tanytarsus sp		7.0	1
94400	Fossaria sp		7.0	5
95100	Physella sp		9.0	108
95900	Gyraulus sp		6.0	1
96002	Helisoma anceps anceps		7.0	2
96264	Planorbella (Pierosoma) pilsbryi		6.5	9
98001	Pisidiidae		5.0	103

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

No. Quantitative Taxa: 21 Total Taxa: 21

Number of Organisms: 317 mIBI: 30.86

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: at ust. of Rte 45

Site ID: 10-6

Subsample:

Collection Date: 08/03/2019 River Code: 95-715 River: UT to North Mill Creek RM: 0.04

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	17
03600	Oligochaeta		10.0	6
04930	Erpobdella sp		8.0	2
05800	Caecidotea sp		6.0	27
06800	Gammarus sp		3.0	95
11130	Baetis intercalaris	MA	4.0	39
12501	Heptageniidae	MA	3.5	1
21001	Calopterygidae		3.5	11
22001	Coenagrionidae		5.5	1
23909	Boyeria vinosa		3.0	1
52200	Cheumatopsyche sp	CA	6.0	24
52530	Hydropsyche depravata group	CA	5.0	11
53800	Hydroptila sp	CA	2.0	1
59500	Oecetis sp	CA	5.0	1
68201	Scirtidae		7.0	1
68708	Dubiraphia vittata group	CO	5.0	1
71900	Tipula sp		4.0	1
74100	Simulium sp		6.0	9
77500	Conchapelopia sp		6.0	11
77750	Hayesomyia senata or Thienemannimyia norena		5.0	1
78655	Procladius (Holotanypus) sp		8.0	1
82820	Cryptochironomus sp		8.0	2
82885	Cryptotendipes pseudotener		6.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	21
84460	Polypedilum (P.) fallax group		6.0	1
84470	Polypedilum (P.) illinoense		6.0	4
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
84601	Saetheria species 1 (sensu Jackson, 1977)		6.0	1
84700	Stenochironomus sp		3.0	1
87540	Hemerodromia sp		6.0	2
98200	Pisidium sp		5.0	5

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

No. Quantitative Taxa: 31 Total Taxa: 31

Number of Organisms: 301 mIBI: 40.43

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: dst. Kenwood

Site ID: 13-12

Subsample:

Collection Date: 08/02/2019 River Code: 95-716 River: UT Greenleaf Creek RM: 0.40

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	19
03600	Oligochaeta		10.0	38
04664	Helobdella stagnalis		8.0	1
05800	Caecidotea sp		6.0	159
06800	Gammarus sp		3.0	75
69400	Stenelmis sp	CO	7.0	1
82820	Cryptochironomus sp		8.0	1
84210	Paratendipes albimanus or P. duplicatus		3.0	9
98600	Sphaerium sp		5.0	5

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

No. Quantitative Taxa: 9 Total Taxa: 9

Number of Organisms: 308 mIBI: 0.00

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: behind World Bioproducts across field

Site ID: **14-4**

Subsample:

Collection Date: 07/31/2019 River Code: 95-719 River: West Branch Bull Creek RM: 2.54

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	68
03600	Oligochaeta		10.0	27
04664	Helobdella stagnalis		8.0	3
04930	Erpobdella sp		8.0	5
05800	Caecidotea sp		6.0	16
06201	Hyalella azteca		4.0	5
22001	Coenagrionidae		5.5	8
23700	Anax sp		5.0	1
42700	Belostoma sp		99.9	1
52200	Cheumatopsyche sp	CA	6.0	9
69200	Optioservus sp	CO	4.0	1
69400	Stenelmis sp	CO	7.0	1
74100	Simulium sp		6.0	22
77500	Conchapelopia sp		6.0	2
77750	Hayesomyia senata or Thienemannimyia norena		5.0	1
78655	Procladius (Holotanypus) sp		8.0	3
79000	Tanypus sp		8.0	1
80420	Cricotopus (C.) bicinctus		8.0	1
82730	Chironomus (C.) decorus group		11.0	2
83158	Endochironomus nigricans		6.0	1
84000	Parachironomus sp		8.0	1
84400	Polypedilum sp		6.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	21
84470	Polypedilum (P.) illinoense		6.0	4
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
85625	Rheotanytarsus sp		6.0	1
98200	Pisidium sp		5.0	5
98600	Sphaerium sp		5.0	90

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

No. Quantitative Taxa: 28 Total Taxa: 28

Number of Organisms: 302 mIBI: 24.94

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: N. Countryside Dr.

Site ID: 14-3

Subsample:

Collection Date: 07/31/2019 River Code: 95-719 River: West Branch Bull Creek RM: 1.60

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	56
03600	Oligochaeta		10.0	5
06201	Hyalella azteca		4.0	1
06800	Gammarus sp		3.0	9
08601	Hydrachnidia		99.9	2
11120	Baetis flavistriga	MA	4.0	15
11130	Baetis intercalaris	MA	4.0	2
21001	Calopterygidae		3.5	2
22001	Coenagrionidae		5.5	2
52200	Cheumatopsyche sp	CA	6.0	86
52530	Hydropsyche depravata group	CA	5.0	2
53800	Hydroptila sp	CA	2.0	10
68708	Dubiraphia vittata group	CO	5.0	1
69400	Stenelmis sp	CO	7.0	56
71900	Tipula sp		4.0	2
74100	Simulium sp		6.0	7
77500	Conchapelopia sp		6.0	3
80430	Cricotopus (C.) tremulus group		8.0	3
81650	Parametriocnemus sp		4.0	4
82820	Cryptochironomus sp		8.0	1
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		6.0	6
83840	Microtendipes pedellus group		6.0	1
84300	Phaenopsectra obediens group		4.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	15
84470	Polypedilum (P.) illinoense		6.0	5
84480	Polypedilum (P.) laetum group		0.0	1
84750	Stictochironomus sp		5.0	1
85625	Rheotanytarsus sp		6.0	1
85800	Tanytarsus sp		7.0	2
87540	Hemerodromia sp		6.0	1
98600	Sphaerium sp		5.0	9

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

No. Quantitative Taxa: 31 Total Taxa: 31

Number of Organisms: 312 mIBI: 48.49

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. Leonard Dr.

Site ID: 13-14

Subsample:

Collection Date: 08/01/2019 River Code: 95-720 River: West Fork Belvidere Rd. Trib RM: 0.21

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	53
03600	Oligochaeta		10.0	7
05800	Caecidotea sp		6.0	241
08200	Orconectes sp		5.0	1
21200	Calopteryx sp		4.0	1
22001	Coenagrionidae		5.5	5
52200	Cheumatopsyche sp	CA	6.0	3
68708	Dubiraphia vittata group	CO	5.0	1
69400	Stenelmis sp	CO	7.0	6
74100	Simulium sp		6.0	2
77500	Conchapelopia sp		6.0	6
80440	Cricotopus (C.) trifascia		6.0	1
82820	Cryptochironomus sp		8.0	2
84210	Paratendipes albimanus or P. duplicatus		3.0	5
84450	Polypedilum (Uresipedilum) flavum		6.0	1
84470	Polypedilum (P.) illinoense		6.0	1
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
84750	Stictochironomus sp		5.0	1
94400	Fossaria sp		7.0	1
98200	Pisidium sp		5.0	2
98600	Sphaerium sp		5.0	1

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

No. Quantitative Taxa: 21 Total Taxa: 21

Number of Organisms: 342 mIBI: 25.74

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Ust. abandoned bridge

Site ID: 13-8

Subsample:

Collection Date: 08/01/2019 River Code: 95-720 River: West Fork Belvidere Rd Trib RM: 0.15

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	7
03600	Oligochaeta		10.0	13
05800	Caecidotea sp		6.0	21
06201	Hyalella azteca		4.0	55
06700	Crangonyx sp		4.0	7
06800	Gammarus sp		3.0	29
08200	Orconectes sp		5.0	1
11130	Baetis intercalaris	MA	4.0	9
17200	Caenis sp	MA	6.0	6
21200	Calopteryx sp		4.0	7
22001	Coenagrionidae		5.5	16
22300	Argia sp		5.0	1
52200	Cheumatopsyche sp	CA	6.0	7
53800	Hydroptila sp	CA	2.0	1
68201	Scirtidae		7.0	2
68708	Dubiraphia vittata group	CO	5.0	7
69400	Stenelmis sp	CO	7.0	35
74100	Simulium sp		6.0	10
77120	Ablabesmyia mallochi		6.0	2
77500	Conchapelopia sp		6.0	7
77750	Hayesomyia senata or Thienemannimyia norena		5.0	2
78130	Labrundinia neopilosella		4.0	1
82730	Chironomus (C.) decorus group		11.0	2
82820	Cryptochironomus sp		8.0	6
82880	Cryptotendipes sp		6.0	1
83040	Dicrotendipes neomodestus		6.0	2
83051	Dicrotendipes simpsoni		6.0	2
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		6.0	1
84210	Paratendipes albimanus or P. duplicatus		3.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	26
84470	Polypedilum (P.) illinoense		6.0	15
84540	Polypedilum (Tripodura) scalaenum group		6.0	9
84750	Stictochironomus sp		5.0	1
85500	Paratanytarsus sp		6.0	6
85800	Tanytarsus sp		7.0	1
93200	Hydrobiidae		6.0	1
95100	Physella sp		9.0	7
97601	Corbicula fluminea		4.0	1
98200	Pisidium sp		5.0	1

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

No. Quantitative Taxa:	39	Total Taxa:	39
Number of Organisms:	329	mIBI:	45.16

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: at Wick St.

Site ID: **11-6**

Subsample:

Collection Date: 08/03/2019 River Code: 95-995 River: Mill Creek RM: 17.20

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	1
03600	Oligochaeta		10.0	8
05800	Caecidotea sp		6.0	51
06201	Hyalella azteca		4.0	4
06800	Gammarus sp		3.0	130
08200	Orconectes sp		5.0	1
21200	Calopteryx sp		4.0	2
22001	Coenagrionidae		5.5	1
52200	Cheumatopsyche sp	CA	6.0	5
54601	Phryganeidae		3.5	1
68700	Dubiraphia sp	CO	5.0	9
68708	Dubiraphia vittata group	CO	5.0	86
69400	Stenelmis sp	CO	7.0	2
77001	Tanypodinae		6.0	1
78655	Procladius (Holotanypus) sp		8.0	1
82820	Cryptochironomus sp		8.0	6
84450	Polypedilum (Uresipedilum) flavum		6.0	1
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
84700	Stenochironomus sp		3.0	1
85500	Paratanytarsus sp		6.0	1
98200	Pisidium sp		5.0	4
98600	Sphaerium sp		5.0	4

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

No. Quantitative Taxa: 22 Total Taxa: 22

Number of Organisms: 321 mIBI: 29.63

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Washington St.

Site ID: 11-5

Subsample:

Collection Date: 08/01/2019 River Code: 95-995 River: Mill Creek RM: 13.80

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	1
03600	Oligochaeta		10.0	46
06201	Hyalella azteca		4.0	2
06800	Gammarus sp		3.0	125
13400	Stenacron sp	MA	4.0	1
17200	Caenis sp	MA	6.0	13
22001	Coenagrionidae		5.5	30
23700	Anax sp		5.0	1
44501	Corixidae		99.9	1
59570	Oecetis nocturna	CA	5.0	1
65800	Berosus sp	CO	99.9	4
68201	Scirtidae		7.0	1
68700	Dubiraphia sp	CO	5.0	6
68708	Dubiraphia vittata group	CO	5.0	9
77120	Ablabesmyia mallochi		6.0	1
77130	Ablabesmyia rhamphe group		6.0	1
78200	Larsia sp		6.0	2
78655	Procladius (Holotanypus) sp		8.0	6
80510	Cricotopus (Isocladius) sylvestris group		8.0	1
81231	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"		3.0	1
82880	Cryptotendipes sp		6.0	1
83040	Dicrotendipes neomodestus		6.0	2
83051	Dicrotendipes simpsoni		6.0	1
83158	Endochironomus nigricans		6.0	21
83300	Glyptotendipes (G.) sp		10.0	23
84000	Parachironomus sp		8.0	5
84010	Parachironomus "abortivus" (sensu Simpson & Bode, 1980)		8.0	2
84470	Polypedilum (P.) illinoense		6.0	8
95100	Physella sp		9.0	17
98600	Sphaerium sp		5.0	3

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

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 336 mIBI: 32.08

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. Stearns School Rd.

Site ID: 11-3

Subsample:

Collection Date: 07/30/2019 River Code: 95-995 River: Mill Creek RM: 7.20

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	20
06800	Gammarus sp		3.0	30
08200	Orconectes sp		5.0	1
11130	Baetis intercalaris	MA	4.0	72
13400	Stenacron sp	MA	4.0	2
22001	Coenagrionidae		5.5	1
22300	Argia sp		5.0	1
52200	Cheumatopsyche sp	CA	6.0	16
59100	Ceraclea sp	CA	3.0	1
68201	Scirtidae		7.0	2
68700	Dubiraphia sp	CO	5.0	3
68708	Dubiraphia vittata group	CO	5.0	1
68901	Macronychus glabratus	CO	2.0	10
69400	Stenelmis sp	CO	7.0	3
74100	Simulium sp		6.0	2
77750	Hayesomyia senata or Thienemannimyia norena		5.0	7
81825	Rheocricotopus (Psilocricotopus) robacki		6.0	1
82820	Cryptochironomus sp		8.0	6
82880	Cryptotendipes sp		6.0	2
83040	Dicrotendipes neomodestus		6.0	20
83840	Microtendipes pedellus group		6.0	2
84450	Polypedilum (Uresipedilum) flavum		6.0	29
84470	Polypedilum (P.) illinoense		6.0	4
84540	Polypedilum (Tripodura) scalaenum group		6.0	30
85500	Paratanytarsus sp		6.0	1
85625	Rheotanytarsus sp		6.0	16
85800	Tanytarsus sp		7.0	1
85821	Tanytarsus glabrescens group sp 7		7.0	1
86100	Chrysops sp		7.0	2
89601	Muscidae		8.0	1
98200	Pisidium sp		5.0	1
98600	Sphaerium sp		5.0	1

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

No. Quantitative Taxa: 32 Total Taxa: 32

Number of Organisms: 290 mIBI: 45.13

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: ust. Dillys Rd.

Site ID: 11-1

Subsample:

Collection Date: 08/03/2019 River Code: 95-995 River: Mill Creek RM: 0.70

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	1
03600	Oligochaeta		10.0	6
05800	Caecidotea sp		6.0	1
06201	Hyalella azteca		4.0	2
06800	Gammarus sp		3.0	22
11130	Baetis intercalaris	MA	4.0	30
13000	Leucrocuta sp	MA	3.0	3
13400	Stenacron sp	MA	4.0	17
16700	Tricorythodes sp	MA	5.0	13
21200	Calopteryx sp		4.0	1
22001	Coenagrionidae		5.5	2
22300	Argia sp		5.0	6
48200	Chauliodes sp		4.0	1
52200	Cheumatopsyche sp	CA	6.0	53
52570	Hydropsyche simulans	CA	5.0	7
68201	Scirtidae		7.0	2
68708	Dubiraphia vittata group	CO	5.0	5
68901	Macronychus glabratus	CO	2.0	25
69400	Stenelmis sp	CO	7.0	36
77120	Ablabesmyia mallochi		6.0	1
77130	Ablabesmyia rhamphe group		6.0	1
77750	Hayesomyia senata or Thienemannimyia norena		5.0	14
78655	Procladius (Holotanypus) sp		8.0	1
82820	Cryptochironomus sp		8.0	4
83040	Dicrotendipes neomodestus		6.0	2
84400	Polypedilum sp		6.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	14
84460	Polypedilum (P.) fallax group		6.0	1
84470	Polypedilum (P.) illinoense		6.0	12
84520	Polypedilum (Tripodura) halterale group		6.0	2
84540	Polypedilum (Tripodura) scalaenum group		6.0	4
85265	Cladotanytarsus vanderwulpi group sp 5		7.0	2
85625	Rheotanytarsus sp		6.0	2
95100	Physella sp		9.0	1
98200	Pisidium sp		5.0	3
98600	Sphaerium sp		5.0	9

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

No. Quantitative Taxa: 36 Total Taxa: 36

Number of Organisms: 307 mIBI: 58.53

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Ust Edwards Rd.

Site ID: 10-7

Subsample:

Collection Date: 08/04/2019 River Code: 95-996 River: North Mill Creek RM: 11.30

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	4
03600	Oligochaeta		10.0	9
05800	Caecidotea sp		6.0	5
05900	Lirceus sp		4.0	6
06201	Hyalella azteca		4.0	37
06800	Gammarus sp		3.0	9
08200	Orconectes sp		5.0	4
11130	Baetis intercalaris	MA	4.0	1
13400	Stenacron sp	MA	4.0	38
17200	Caenis sp	MA	6.0	22
21001	Calopterygidae		3.5	2
22001	Coenagrionidae		5.5	1
42700	Belostoma sp		99.9	4
44501	Corixidae		99.9	2
48200	Chauliodes sp		4.0	1
52200	Cheumatopsyche sp	CA	6.0	28
53800	Hydroptila sp	CA	2.0	2
59550	Oecetis inconspicua complex sp A (sensu Floyd, 1995)	CA	5.0	1
60400	Gyrinus sp	CO	4.0	1
67700	Paracymus sp	CO	99.9	1
67800	Tropisternus sp	CO	99.9	1
68700	Dubiraphia sp	CO	5.0	4
68708	Dubiraphia vittata group	CO	5.0	1
77120	Ablabesmyia mallochi		6.0	4
77355	Clinotanypus pinguis		6.0	7
77500	Conchapelopia sp		6.0	6
78600	Pentaneura inconspicua		3.0	3
78655	Procladius (Holotanypus) sp		8.0	2
82730	Chironomus (C.) decorus group		11.0	2
82820	Cryptochironomus sp		8.0	6
82880	Cryptotendipes sp		6.0	3
83840	Microtendipes pedellus group		6.0	1
84300	Phaenopsectra obediens group		4.0	5
84450	Polypedilum (Uresipedilum) flavum		6.0	12
84470	Polypedilum (P.) illinoense		6.0	22
84520	Polypedilum (Tripodura) halterale group		6.0	9
84540	Polypedilum (Tripodura) scalaenum group		6.0	2
84540	Polypedilum (Tripodura) scalaenum group		6.0	9
84700	Stenochironomus sp		3.0	1
85001	Tanytarsini		6.0	3
85500	Paratanytarsus sp		6.0	3
85625	Rheotanytarsus sp		6.0	9
95100	Physella sp		9.0	1
96264	Planorbella (Pierosoma) pilsbryi		6.5	1
98200	Pisidium sp		5.0	5
98600	Sphaerium sp		5.0	4

No. Quantitative Taxa:	46	Total Taxa:	46
Number of Organisms:	304	mIBI:	54.19

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. IL 173

Site ID: **10-3**

Subsample:

Collection Date: 08/04/2019 River Code: 95-996 River: North Mill Creek RM: 10.20

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	5
03600	Oligochaeta		10.0	22
04666	Helobdella papillata		8.0	1
05800	Caecidotea sp		6.0	6
06201	Hyalella azteca		4.0	70
06800	Gammarus sp		3.0	3
08200	Orconectes sp		5.0	1
13400	Stenacron sp	MA	4.0	7
22001	Coenagrionidae		5.5	2
44501	Corixidae		99.9	2
52200	Cheumatopsyche sp	CA	6.0	3
53800	Hydroptila sp	CA	2.0	3
59580	Oecetis persimilis	CA	5.0	1
60350	Gyretes sinuatus		0.0	2
65800	Berosus sp	CO	99.9	2
68201	Scirtidae		7.0	13
68700	Dubiraphia sp	CO	5.0	44
68708	Dubiraphia vittata group	CO	5.0	104
77120	Ablabesmyia mallochi		6.0	2
77140	Ablabesmyia peleensis		6.0	1
78200	Larsia sp		6.0	1
78600	Pentaneura inconspicua		3.0	2
78655	Procladius (Holotanypus) sp		8.0	2
82501	Chironomini		6.0	1
82730	Chironomus (C.) decorus group		11.0	1
82820	Cryptochironomus sp		8.0	3
84450	Polypedilum (Uresipedilum) flavum		6.0	1
85500	Paratanytarsus sp		6.0	4
85615	Rheotanytarsus pellucidus		6.0	1
85625	Rheotanytarsus sp		6.0	9
85800	Tanytarsus sp		7.0	1
86001	Tabanidae		7.0	1
87540	Hemerodromia sp		6.0	1
95100	Physella sp		9.0	2
98200	Pisidium sp		5.0	1

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

No. Quantitative Taxa: 35 Total Taxa: 35

Number of Organisms: 325 mIBI: 36.25

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. closed bridge

Site ID: 10-2

Subsample:

Collection Date: 08/03/2019 River Code: 95-996 River: North Mill Creek RM: 8.10

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
03600	Oligochaeta		10.0	5
04901	Erpobdellidae		8.0	1
06201	Hyalella azteca		4.0	1
06800	Gammarus sp		3.0	2
11120	Baetis flavistriga	MA	4.0	1
11130	Baetis intercalaris	MA	4.0	64
13400	Stenacron sp	MA	4.0	23
21200	Calopteryx sp		4.0	11
23909	Boyeria vinosa		3.0	1
42700	Belostoma sp		99.9	1
52200	Cheumatopsyche sp	CA	6.0	88
52430	Ceratopsyche morosa group	CA	4.0	3
52530	Hydropsyche depravata group	CA	5.0	13
68201	Scirtidae		7.0	3
68708	Dubiraphia vittata group	CO	5.0	3
68901	Macronychus glabratus	CO	2.0	4
69400	Stenelmis sp	CO	7.0	3
74100	Simulium sp		6.0	64
77120	Ablabesmyia mallochi		6.0	1
77500	Conchapelopia sp		6.0	3
77750	Hayesomyia senata or Thienemannimyia norena		5.0	2
78600	Pentaneura inconspicua		3.0	2
81825	Rheocricotopus (Psilocricotopus) robacki		6.0	1
82820	Cryptochironomus sp		8.0	1
83840	Microtendipes pedellus group		6.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	28
84460	Polypedilum (P.) fallax group		6.0	1
84470	Polypedilum (P.) illinoense		6.0	10
84540	Polypedilum (Tripodura) scalaenum group		6.0	1
84700	Stenochironomus sp		3.0	1
84750	Stictochironomus sp		5.0	4
85625	Rheotanytarsus sp		6.0	6
94201	Lymnaeidae		7.0	1

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

No. Quantitative Taxa: 33 Total Taxa: 33

Number of Organisms: 354 mIBI: 55.98

Appendix Table C-2. Macroinvertebrate taxa collected in the Upper Des Plaines River study area during 2019.

Site: Dst. Millburn Rd.

Site ID: 10-1

Subsample:

Collection Date: 08/03/2019 River Code: 95-996 River: North Mill Creek RM: 1.10

Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.
01801	Turbellaria		6.0	2
03600	Oligochaeta		10.0	18
05800	Caecidotea sp		6.0	4
06201	Hyalella azteca		4.0	1
06800	Gammarus sp		3.0	5
08200	Orconectes sp		5.0	4
11130	Baetis intercalaris	MA	4.0	16
13400	Stenacron sp	MA	4.0	30
16700	Tricorythodes sp	MA	5.0	1
21001	Calopterygidae		3.5	1
22300	Argia sp		5.0	7
43570	Neoplea sp		99.9	1
52200	Cheumatopsyche sp	CA	6.0	9
59580	Oecetis persimilis	CA	5.0	3
63300	Hydroporini	CO	99.9	1
63900	Laccophilus sp	CO	99.9	1
67700	Paracymus sp	CO	99.9	4
68201	Scirtidae		7.0	15
68601	Ancyronyx variegata	CO	2.0	1
68700	Dubiraphia sp	CO	5.0	15
68708	Dubiraphia vittata group	CO	5.0	38
68901	Macronychus glabratus	CO	2.0	12
69400	Stenelmis sp	CO	7.0	11
77120	Ablabesmyia mallochi		6.0	1
77750	Hayesomyia senata or Thienemannimyia norena		5.0	16
78140	Labrundinia pilosella		4.0	1
78200	Larsia sp		6.0	2
82820	Cryptochironomus sp		8.0	4
82880	Cryptotendipes sp		6.0	2
83820	Microtendipes "caelum" (sensu Simpson & Bode, 1980)		6.0	1
84450	Polypedilum (Uresipedilum) flavum		6.0	3
84460	Polypedilum (P.) fallax group		6.0	1
84470	Polypedilum (P.) illinoense		6.0	27
84520	Polypedilum (Tripodura) halterale group		6.0	3
84540	Polypedilum (Tripodura) scalaenum group		6.0	7
84700	Stenochironomus sp		3.0	9
84750	Stictochironomus sp		5.0	1
87540	Hemerodromia sp		6.0	2
98200	Pisidium sp		5.0	5

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

No. Quantitative Taxa:	39	Total Taxa:	39
Number of Organisms:	285	mIBI:	58.20

APPENDIX C

Upper Des Plaines River Year 3 Subwatersheds 2019 Habitat Data

C-1: QHEI Metrics and Scores
C-2: QHEI Field Sheets 2019

Appendix C-1. QHEI metric scores for sites in the upper Des Plaines River study area during 2019.

River Mile	QHEI	QHEI Metrics: Substrate	Cover	Channel	Riparian	Pool	Riffle	Gradient & Score	Narrative
(95051) Bull Creek									
Year:2019									
5.95	**57.50**	18.0	12.0	13.0	6.50	2.0	0.0	9.05 - (6)	**Fair**
4.70	**57.25**	14.0	11.0	11.5	7.75	4.0	1.0	13.95 - (8)	**Fair**
1.00	**53.25**	12.5	11.0	14.0	4.25	5.0	2.5	3.96 - (4)	**Fair**
0.50	**78.00**	18.0	16.0	15.0	5.50	8.0	5.5	6.26 - (10)	**Excellent**
(95702) Hastings Creek									
Year:2019									
3.12	**60.00**	12.0	13.0	13.0	5.50	6.0	2.5	10.50 - (8)	**Good**
1.68	**44.50**	11.0	12.0	6.0	2.50	7.0	0.0	6.86 - (6)	**Poor**
(95704) Bull's Brook									
Year:2019									
1.95	**76.50**	18.0	14.0	15.0	10.00	6.0	5.5	32.57 - (8)	**Excellent**
0.25	**69.00**	15.5	10.0	16.0	9.50	6.0	4.0	32.77 - (8)	**Good**
(95708) Newport Drainage Ditch									
Year:2019									
3.03	**45.00**	0.0	17.0	9.0	9.00	6.0	0.0	3.68 - (4)	**Fair**
0.70	**63.00**	14.0	16.0	12.0	5.00	9.0	1.0	6.65 - (6)	**Good**
(95709) Stoneroller Creek									
Year:2019									
0.42	**82.00**	18.0	12.0	16.5	10.00	9.0	6.5	19.18 - (10)	**Excellent**
(95710) Suburban Country Club Trib									
Year:2019									
2.00	**39.00**	6.0	12.0	3.0	4.00	4.0	0.0	15.72 - (10)	**Poor**
(95711) Slocum Conrners Creek									
Year:2019									
1.36	**63.75**	16.0	13.0	14.5	3.75	5.0	3.5	30.60 - (8)	**Good**
(95714) Unnamed Trib to DesPLaines River									
Year:2019									
0.13	**62.00**	13.0	11.0	13.0	10.00	4.0	1.0	26.83 - (10)	**Good**
(95715) UT to North Mill Creek									
Year:2019									
0.04	**53.50**	13.0	7.0	13.5	5.50	4.0	0.5	15.69 - (10)	**Fair**
(95716) UT Greenleaf Creek									
Year:2019									
0.40	**63.75**	14.0	10.0	18.0	6.25	4.0	1.5	26.98 - (10)	**Good**

Appendix C-1. QHEI metric scores for sites in the upper Des Plaines River study area during 2019.

River Mile	QHEI	QHEI Metrics: Substrate	Cover	Channel	Riparian	Pool	Riffle	Gradient & Score	Narrative
(95719) West Branch Bull Creek									
Year: 2019									
2.54	**47.75**	11.0	12.0	10.0	5.75	5.0	0.0	4.40 - (4)	**Fair**
1.60	**65.75**	16.5	13.0	16.0	4.25	9.0	3.0	2.85 - (4)	**Good**
(95720) West Fork Belvidere Rd. Trib									
Year: 2019									
0.21	**68.75**	18.0	14.0	13.0	6.25	5.0	4.5	36.62 - (8)	**Good**
0.15	**70.00**	17.0	14.0	11.5	6.00	9.0	4.5	33.63 - (8)	**Excellent**
(95995) Mill Creek									
Year: 2019									
17.20	**40.00**	5.0	7.0	9.0	5.00	5.0	1.0	10.78 - (8)	**Poor**
13.80	**52.75**	9.0	14.0	5.0	8.75	6.0	0.0	6.71 - (10)	**Fair**
7.20	**62.00**	13.0	14.0	14.0	9.00	5.0	1.0	5.56 - (6)	**Good**
1.71	**80.00**	16.0	17.0	15.0	10.00	8.0	6.0	7.40 - (8)	**Excellent**
0.70	**68.50**	14.0	16.0	13.5	7.00	8.0	2.0	7.30 - (8)	**Good**
(95996) North Mill Creek									
Year: 2019									
11.30	**37.00**	4.0	12.0	5.0	10.00	2.0	0.0	2.60 - (4)	**Poor**
10.20	**59.00**	2.0	16.0	10.0	9.00	8.0	4.0	7.68 - (10)	**Fair**
8.10	**67.75**	11.5	14.0	14.0	8.25	5.0	5.0	6.74 - (10)	**Good**
1.10	**59.00**	6.5	16.0	11.5	9.50	7.0	2.5	5.24 - (6)	**Fair**

Qualitative Habitat Evaluation Index Field Sheet

QHEI Score: 59

River Code: 95-996 RM: 1.10 Stream: N. Mill Creek
Site Code: 10-1 Project Code: DRW19 Location: Dst Millburn Rd
Date: 8-15-19 Scorer: MAS Latitude: 42.42340 Longitude: -87.99709

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: 6.5 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]
2 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur:
1 POOLS > 70 cm [2]
3 ROOTWADS [1]
1 BOULDERS [1]
1 OXBOWS, BACKWATERS [1]
0 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 ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 11.5 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: 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: 25 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 5.24 DRAINAGE AREA (sq.mi.): 31.97 % 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: 6 Max 10

entered 1-21-2020

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: _____

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Turbid	Normal	5

5 Subjective Rating (1-10)

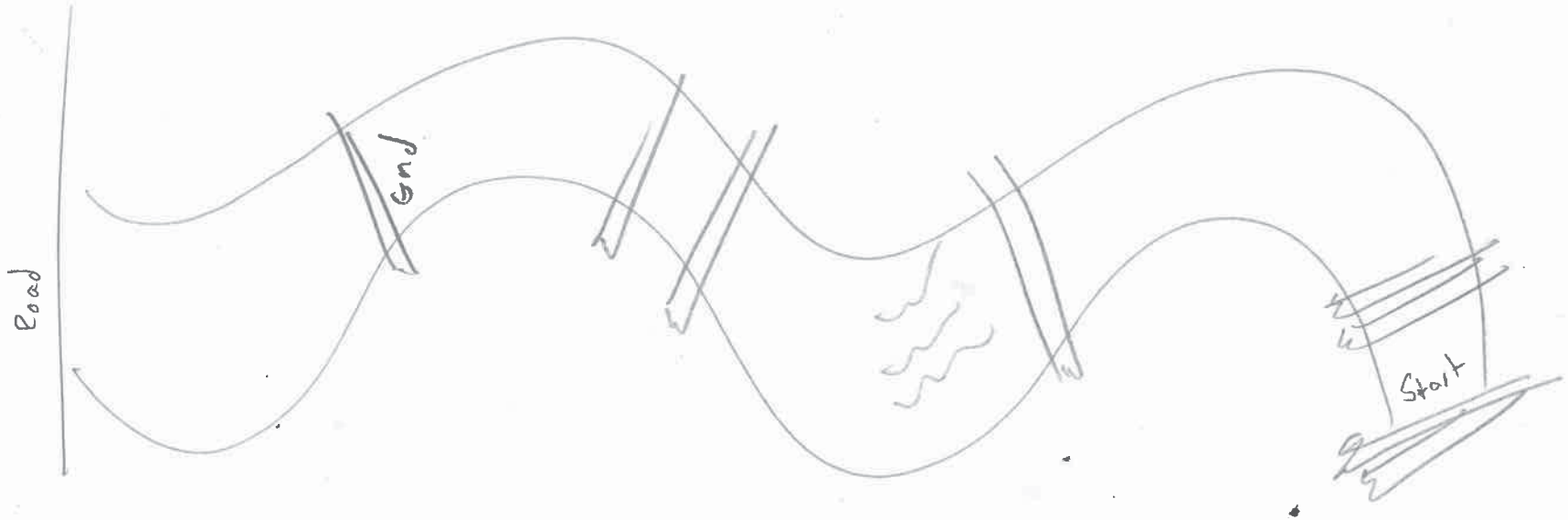
5 Aesthetic Rating (1-10)

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: 67.75

Midwest Biodiversity Institute

River Code: 95-996 RM: 8.10 Stream: N Mill Creek
Site Code: 10-2 Project Code: DRWS19 Location: Dst Closed Bridge
Date: 8-16-19 Scorer: MAS Latitude: 42.44342 Longitude: -87.99981

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]		

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: 11.5 Max 20

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

COMMENTS:

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

(Structure)
1 UNDERCUT BANKS [1]
6 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]
1 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
1 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: 14 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: 8.25 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: 5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 6.74 DRAINAGE AREA (sq.mi.): 29.57 % POOL: % GLIDE: % RIFFLE: % RUN:

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

Manual based on gradient and drainage area.

Gradient: 10 Max 10

entered 1-21-2020

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

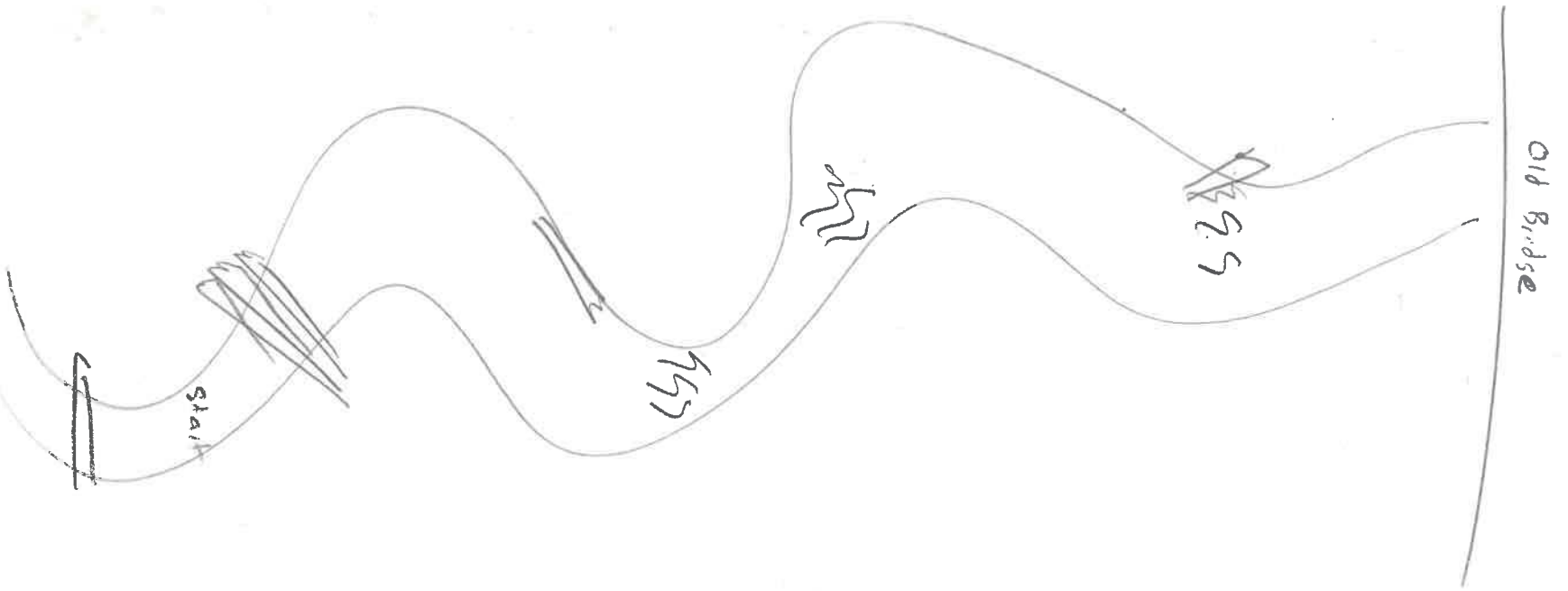
Aesthetic Rating (1-10): 5

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Turbid	Normal	10

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: 59

River Code: 95-996 RM: 10.2 Stream: N Mill Creek
Site Code: 10-3 Project Code: DRWW18 Location: Dst IL 173
Date: 8-16-19 Scorer: MAS Latitude: 42.46497 Longitude: -88.00859

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: (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: 2 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		
1 UNDERCUT BANKS [1]	3 POOLS > 70 cm [2]	0 OXBOWS, BACKWATERS [1]	
0 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	1 AQUATIC MACROPHYTES [1]	
1 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]	
2 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: 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: 9 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 Rip-Rap
☒ -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: 4 Max 8

Gradient: 10 Max 10

COMMENTS:

6.) GRADIENT (ft / mi): 7.68 DRAINAGE AREA (sq.mi.): 20.86 % 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

entered 1-21-2020

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

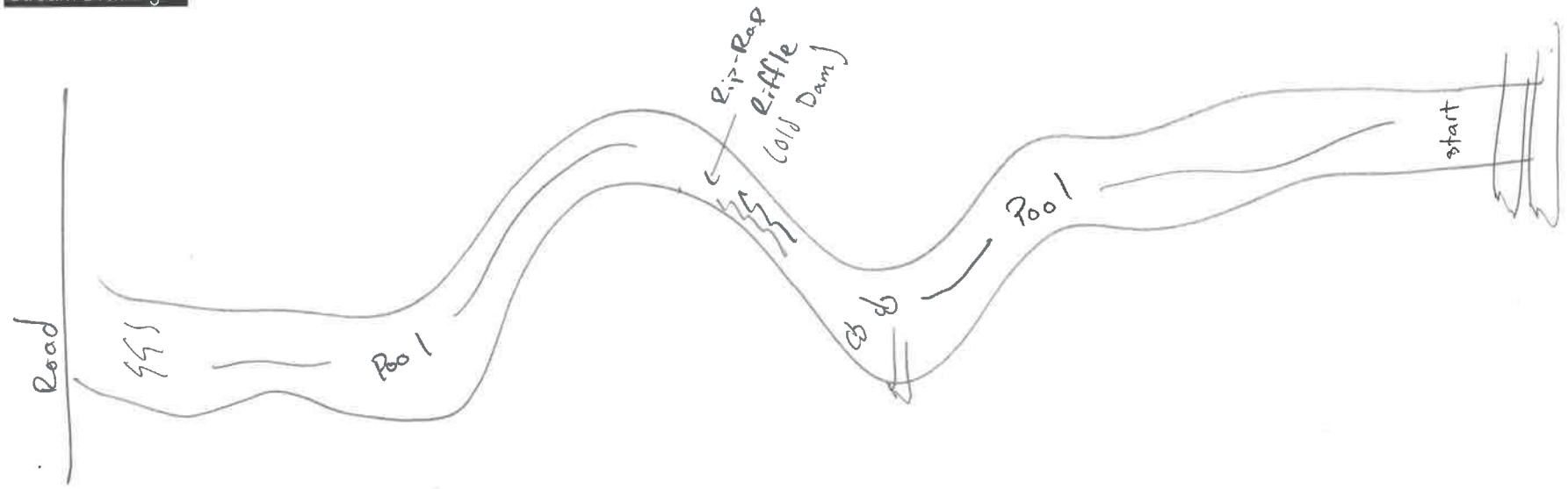
Aesthetic Rating (1-10): 4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Turbid	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: 44.5

River Code: 95-702 RM: 1.68 Stream: Hastings Creek
Site Code: 10-4 Project Code: DRWW19 Location: @ Miller Rd.
Date: 8-28-2019 Scorer: VA Latitude: 42.4479 Longitude: -88.0247

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]		

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: 11 Max 20

COMMENTS:

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

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

TYPE: Score All That Occur
_____ POOLS > 70 cm [2]
_____ ROOTWADS [1]
1 BOULDERS [1]
_____ OXBOWS, BACKWATERS [1]
3 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: 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: 2.5 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): 6.86 DRAINAGE AREA (sq.mi.): 5.6 % 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

entered 1-21-2020

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) ☐

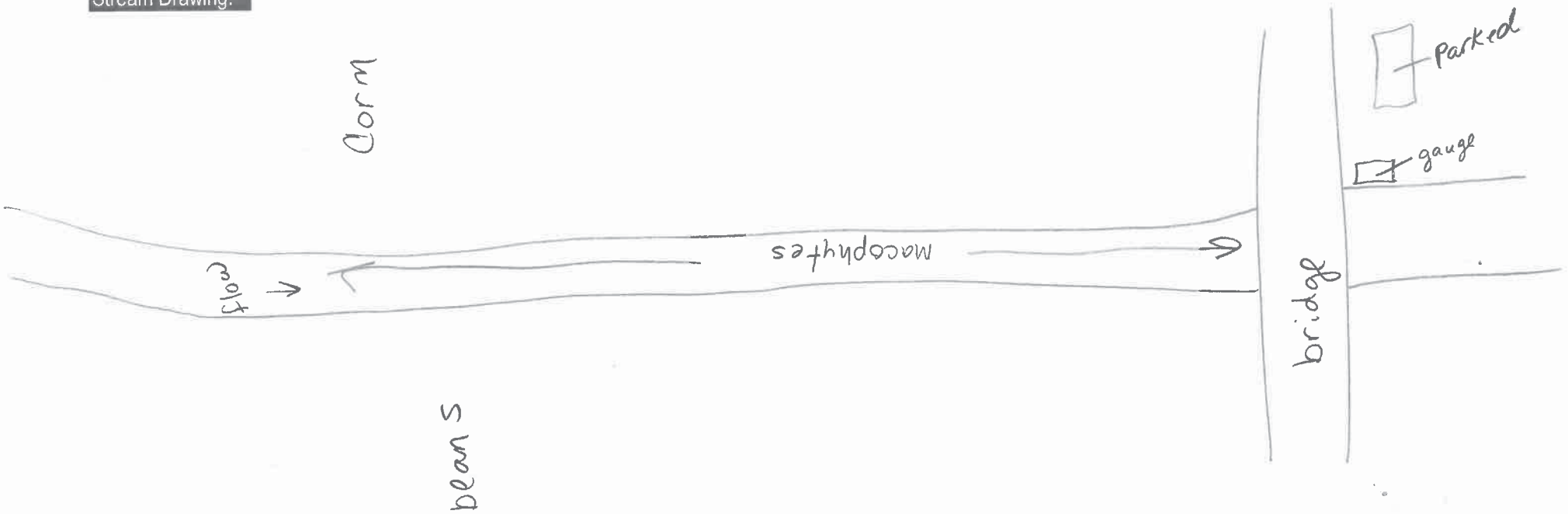
Aesthetic Rating (1-10) ☐

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 60

River Code: 95-702 RM: 3.12 Stream: Hastings Creek
Site Code: 10-5 Project Code: DRWW19- Location: @ Crast Lake Rd.
Date: 8-28-19 Scorer: VM Latitude: 42.43071 Longitude: -88.03447

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: 12 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: ____ POOLS > 70 cm [2]; ____ ROOTWADS [1]; ____ BOULDERS [1]; ____ OXBOWS, BACKWATERS [1]; 1 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: 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 ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 13 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: 5.5 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: 6 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: 2.5 Max 8

COMMENTS:

Gradient: 8 Max 10

6.) GRADIENT (ft / mi): 10.5 DRAINAGE AREA (sq.mi.): 3.91 % 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

entered 1-21-2020

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) ☐

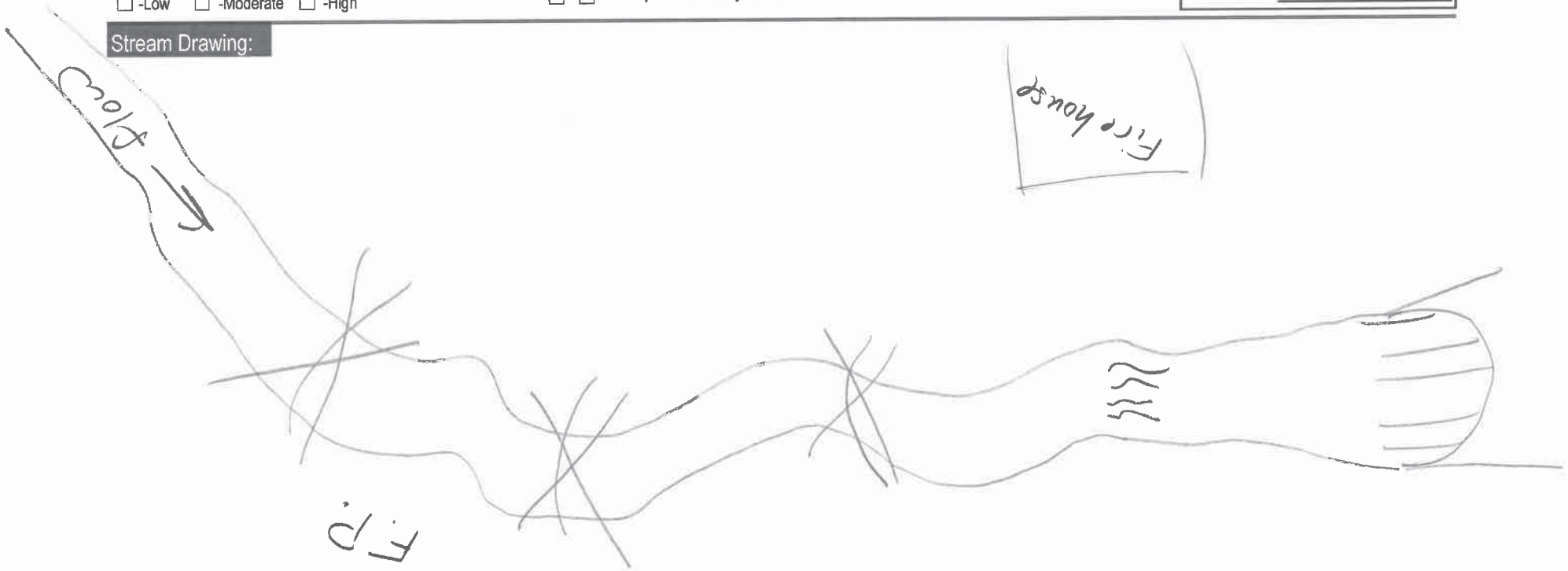
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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

Midwest Biodiversity Institute

QHEI Score: 53.5

River Code: 95-715 RM: 0.04 Stream: 1ST to North Mill Creek
Site Code: 10-6 Project Code: DRWW19- Location: 1ST. of Rte 45
Date: 8-28-19 Scorer: KA Latitude: 42.42142 Longitude: -88.00465

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: 13 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]; 2 OVERHANGING VEGETATION [1]; 2 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]; 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: 7 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: 13.5 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: 5.5 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: .5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 15.69 DRAINAGE AREA (sq.mi.): 0.99 % 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: 10 Max 10

entered 1-21-2020

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) ☐

Gradient:
☐ -Low ☐ -Moderate ☐ -High

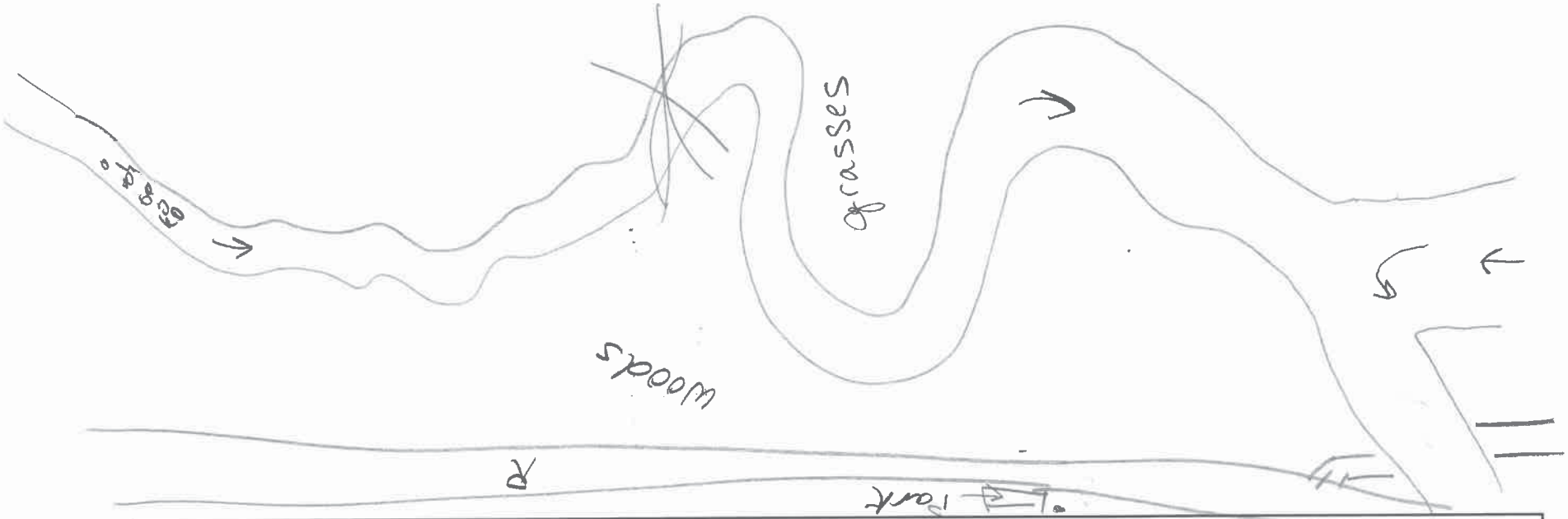
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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

QHEI Score: 68.5

River Code: 95-995 RM: 0.7 Stream: Mill Creek
Site Code: 11-1 Project Code: DEWWI8 Location: Ust Dillys Rd
Date: 8-15-19 Scorer: MAS Latitude: 42.41830 Longitude: -87.94527

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

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

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]
EMBEDDED NESS:
☐ -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)
1 UNDERCUT BANKS [1]
1 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]
1 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 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: 13.5 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: 7 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: 2 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 7.3 DRAINAGE AREA (sq.mi.): 63.8 % 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

entered 1-21-2020

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): 6

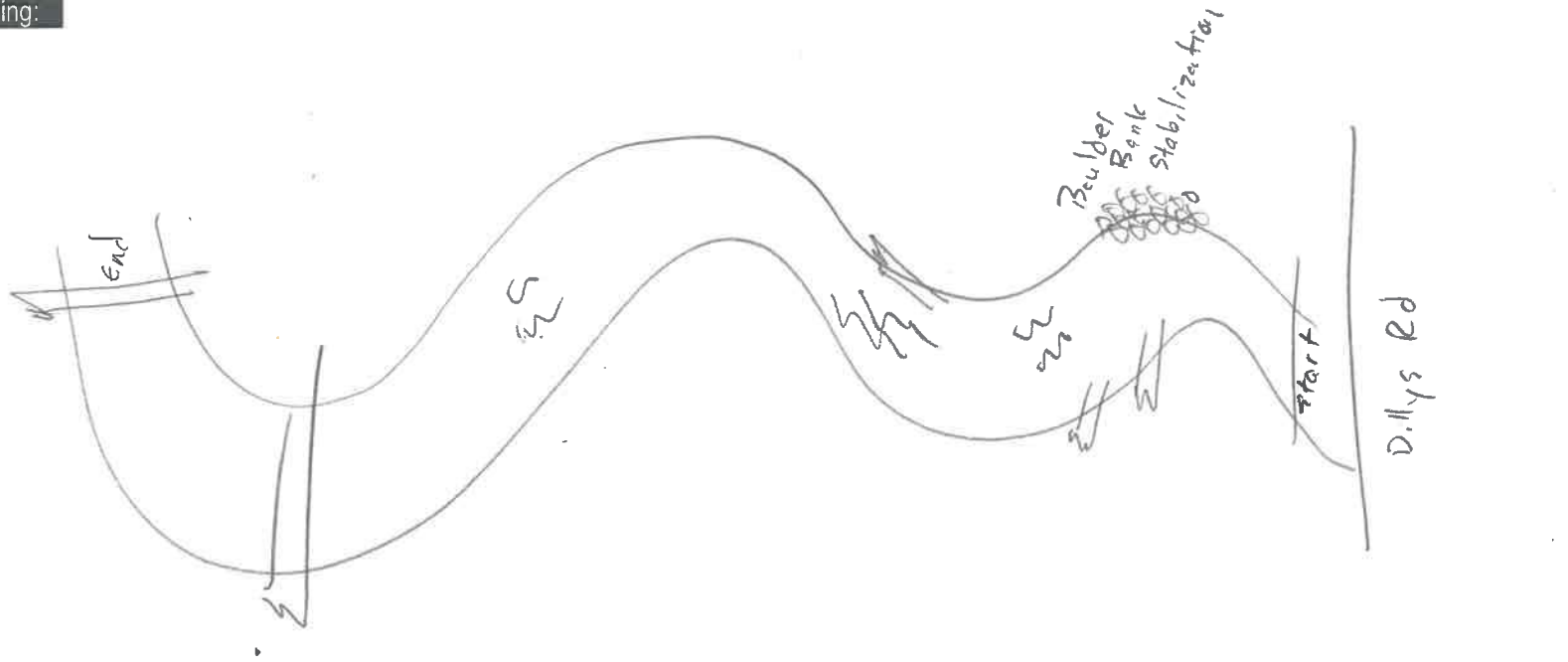
Aesthetic Rating (1-10): 5

Gradient: ☐ -Low ☐ -Moderate ☐ -High

First Sampling Pass	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
	D	200	Turbid	Normal	40

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: 80

River Code: 95-995 RM: 1.71 Stream: Mill Creek
Site Code: 11-2 Project Code: DRWW19 Location: Ust Mill Creek WWTP
Date: 8-15-19 Scorer: MAS Latitude: 42.42095 Longitude: -87.95677

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: (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: 16 (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]
10 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
1 POOLS > 70 cm [2]
1 ROOTWADS [1]
1 BOULDERS [1]
1 OXBOWS, BACKWATERS [1]
0 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: 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]

STABILITY
☐ -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: 10 (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: 6 (Max 8)

COMMENTS:

6.) GRADIENT (ft / mi): 7.4 DRAINAGE AREA (sq.mi.): 62.3 % 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)

entered VA 1-21-2020

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): 7

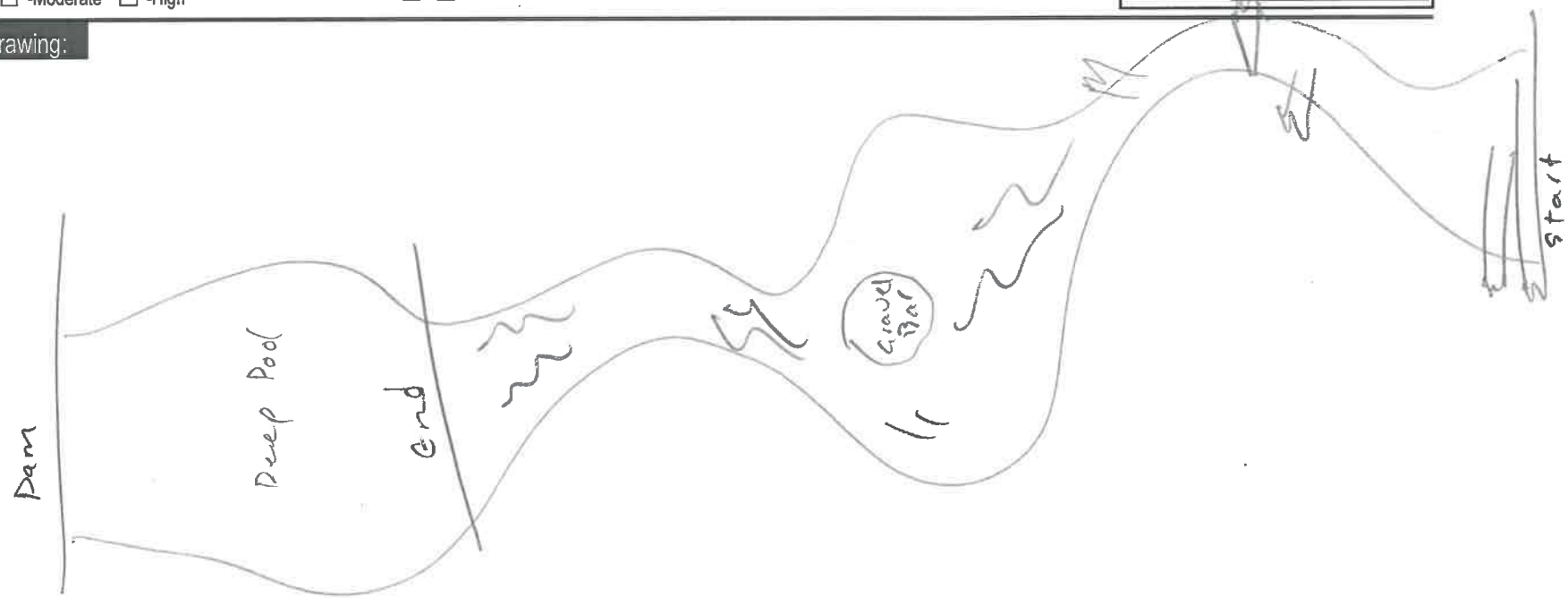
Aesthetic Rating (1-10): 7

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	D	200	Turbid	Normal	

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: 37

River Code: 95-996 RM: 11.3 Stream: N Mill Creek
Site Code: 10-7 Project Code: DRWW19 Location: Ust. Edwards Rd
Date: 8-16-19 Scorer: MAS Latitude: 42.48082 Longitude: -88.01196

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: 4 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]	2 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
1 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: 12 Max 20

COMMENTS:

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

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

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: 10 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): 2.6 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: 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)
3	3

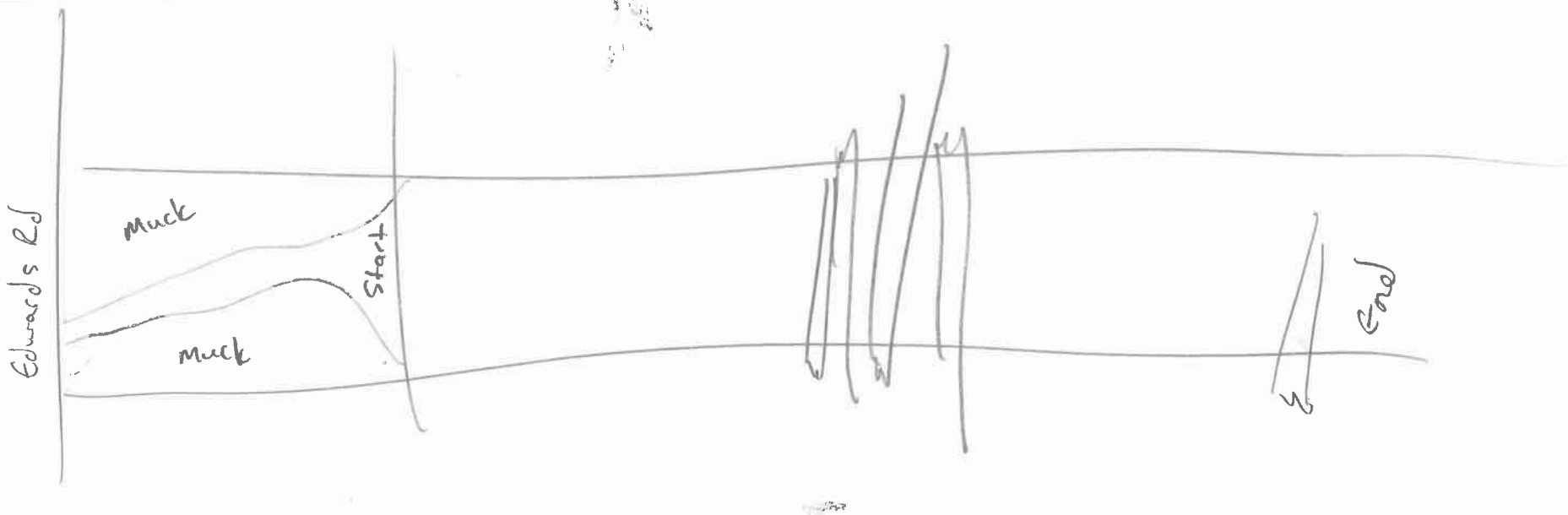
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Turbid	Normal	0

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: 62

River Code: 95-995 RM: 7.2 Stream: Mill Creek
Site Code: 11-3 Project Code: DeWitt9 Location: Dst. Stearns School Rd
Date: 8-15-19 Scorer: MAS Latitude: 42.39989 Longitude: -87.98277

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: 13 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]; 3 SHALLOWS (IN SLOW WATER) [1]; 1 ROOTMATS [1]

TYPE: Score All That Occur: 0 POOLS > 70 cm [2]; 0 ROOTWADS [1]; 1 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: 14 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 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: 1 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 5.56 DRAINAGE AREA (sq.mi.): 21.4 % 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

entered 1-21-2020

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: ____

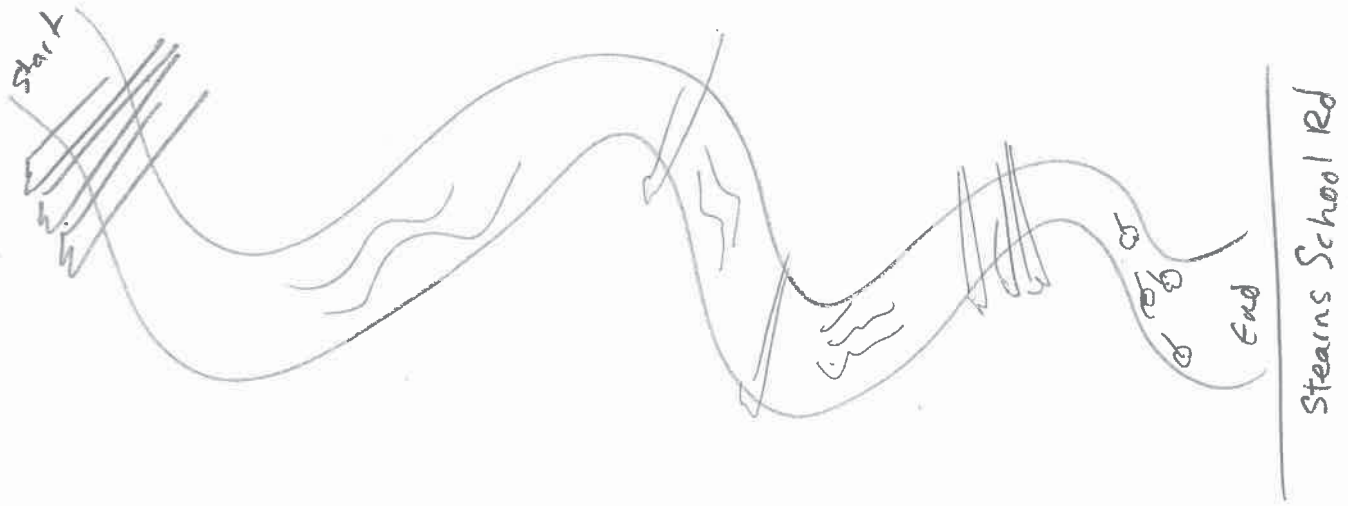
	Subjective Rating (1-10)	Aesthetic Rating (1-10)
	5	5

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

QHEI Score: 52.75

River Code: 95-995 RM: 13.8 Stream: Mill Creek
Site Code: 11-5 Project Code: DRWS19 Location: Washington St
Date: 10-18-19 Scorer: MAS Latitude: 42.36249 Longitude: -88.01574

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: 9 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	
1 UNDERCUT BANKS [1]	3 POOLS > 70 cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	3 AQUATIC MACROPHYTES [1]
0 SHALLOWS (IN SLOW WATER) [1]	0 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
1 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: 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 ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

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: 8.75 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: 6 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): 6.71 DRAINAGE AREA (sq.mi.): 10.4 % 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

entered 1-21-2020 MA

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: _____

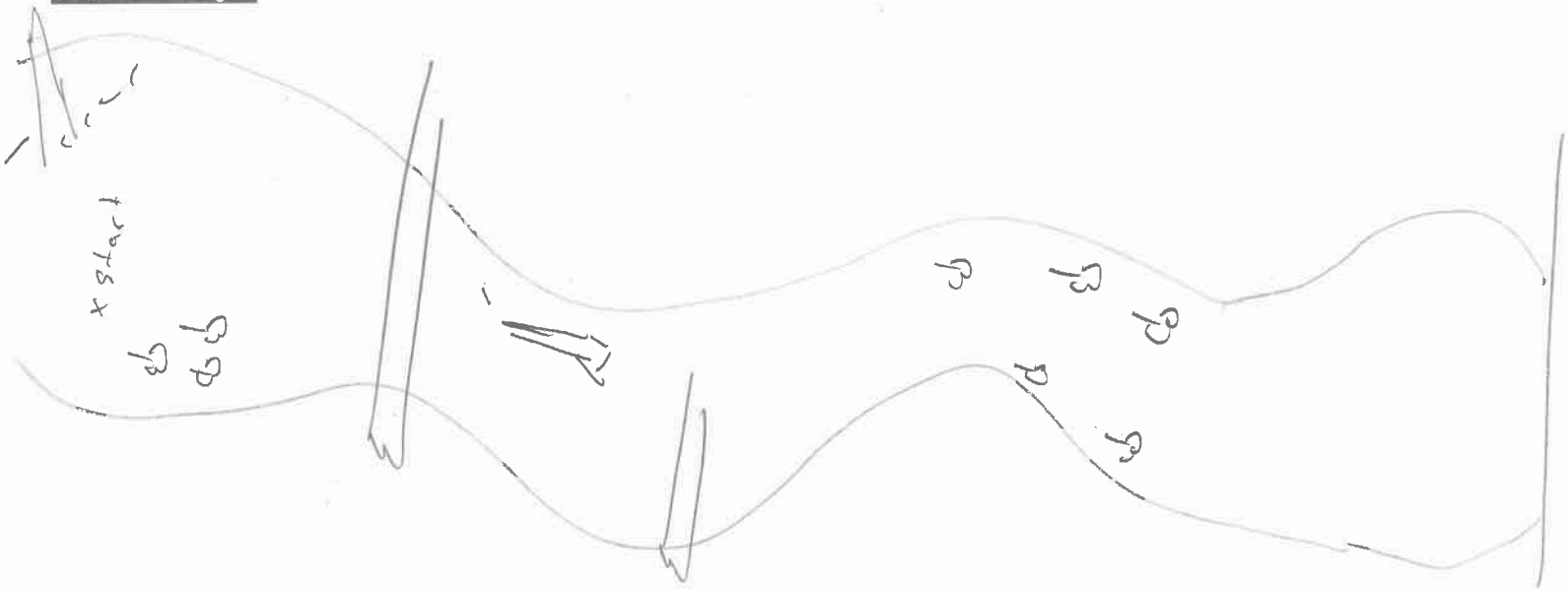
Subjective Rating (1-10)	Aesthetic Rating (1-10)
4	4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	D	200	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

Midwest Biodiversity Institute

QHEI Score: 40

River Code: 95-995 RM: 17.2 Stream: Mill Creek
Site Code: 11-6 Project Code: DRWW19- Location: @ Wick Str.
Date: 8-28-19 Scorer: KA Latitude: 42.33642 Longitude: -88.03989

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: 5 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	
2 UNDERCUT BANKS [1]	0 POOLS > 70 cm [2]	___ OXBOWS, BACKWATERS [1]
___ OVERHANGING VEGETATION [1]	___ ROOTWADS [1]	___ AQUATIC MACROPHYTES [1]
___ SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]
2 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: 7 Max 20

COMMENTS:

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

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILTIY
☐ -HIGH [4]	☐ -EXCELLENT [7]	☐ -NONE [6]	☐ -HIGH [3]
☐ -MODERATE [3]	☐ -GOOD [5]	☐ -RECOVERED [4]	☒ -MODERATE [2]
☒ -LOW [2]	☒ -FAIR [3]	☒ -RECOVERING [3]	☐ -LOW [1]
☐ -NONE [1]	☒ -POOR [1]	☐ -RECENT OR NO RECOVERY [1]	
		☐ -IMPOUNDED [-1]	

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

Channel: 9 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 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	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ -*Best Areas > 10cm [2]	☐ - MAX > 50 cm [2]	☐ -STABLE (e.g., Cobble, Boulder) [2]	☐ -NONE [2]
☒ -Best Areas 5 - 10cm [1]	☒ - MAX < 50 cm [1]	☐ -MOD. STABLE (e.g., Large Gravel) [1]	☐ -LOW [1]
☐ -Best Areas < 5cm [0]		☒ -UNSTABLE (Fine Gravel, Sand) [0]	☐ -MODERATE [0]
☐ -NO RIFFLE but RUNS present [0]			☒ -EXTENSIVE [-1]
☐ -NO RIFFLE / NO RUN [Metric = 0]			

Riffle / Run: 1 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 10.78 DRAINAGE AREA (sq.mi.): 4.5 % 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

entered 1-21-2020 KA

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) ☐

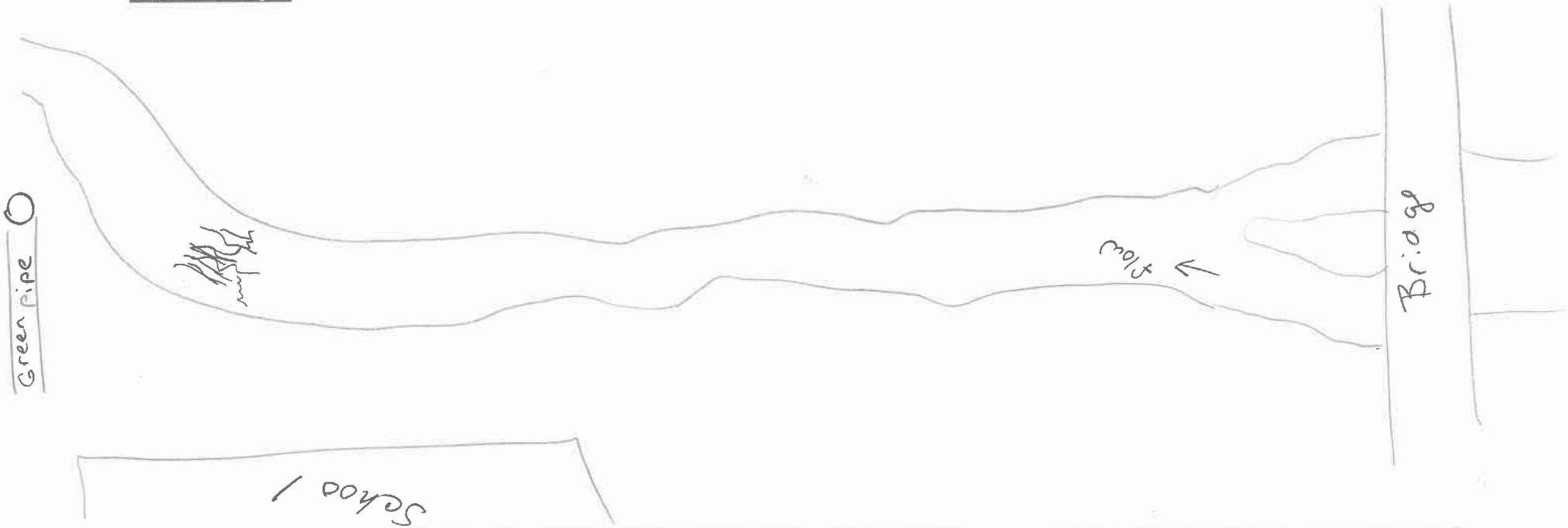
Aesthetic Rating (1-10) ☐

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 63

River Code: 95-708 RM: 0.7 Stream: Newport Drainage Ditch
Site Code: 12-1 Project Code: Drww19 Location: Ust Kilbourne Rd
Date: 10-13-19 Scorer: MAS Latitude: 42.48341 Longitude: -87.91242

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: 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]
3 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
2 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: 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 ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 12 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: 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: 1 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 6.65 DRAINAGE AREA (sq.mi.): 7.35 % 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

entered 1-21-2020 VA

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)
5	5

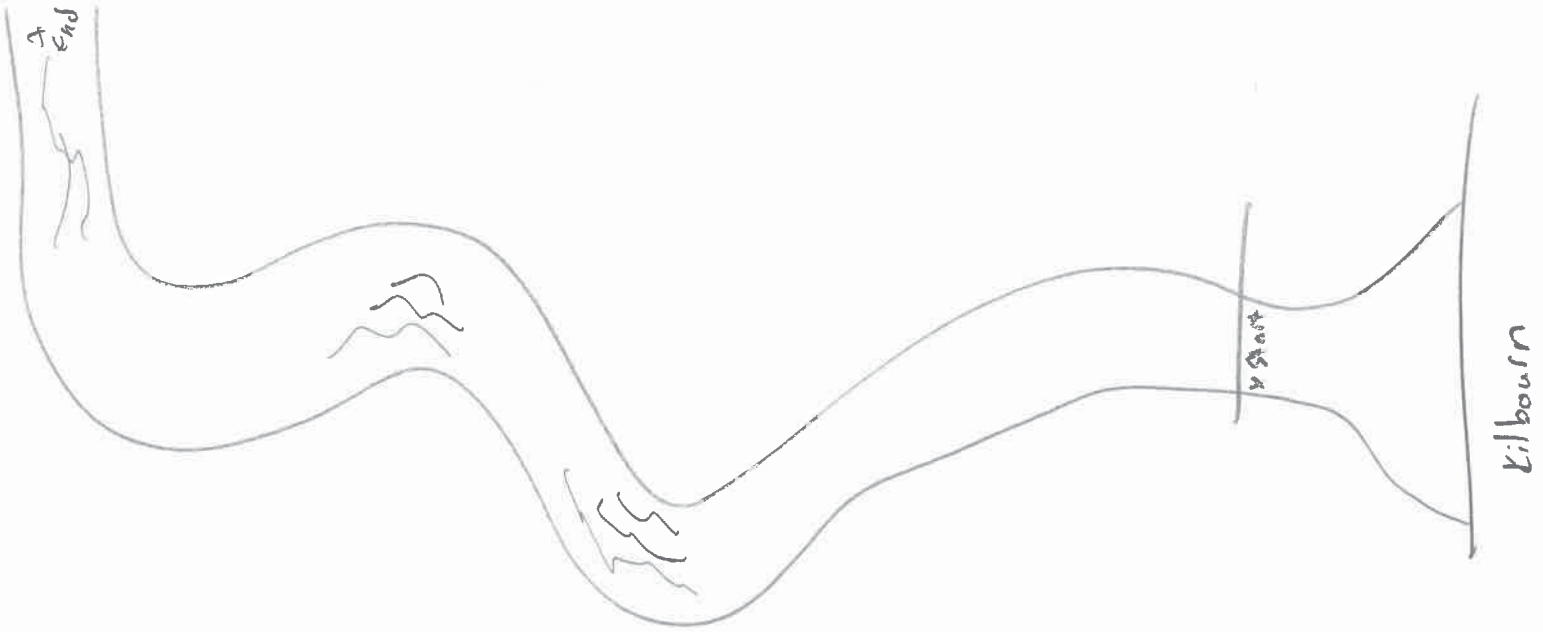
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	High	100

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: 45

River Code: 95-708 RM: 3.03 Stream: Newport Drainage Ditch
Site Code: 12-2 Project Code: DRWW19 Location: D/S 21st St
Date: 10-13-19 Scorer: MAS Latitude: 42.45876 Longitude: -87.87626 S

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: 0 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]
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]
3 OXBOWS, BACKWATERS [1]
1 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: 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: 9 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 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: 6 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): 3.68 DRAINAGE AREA (sq.mi.): 2.8 % 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

entered 1-21-2020 VH

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: _____

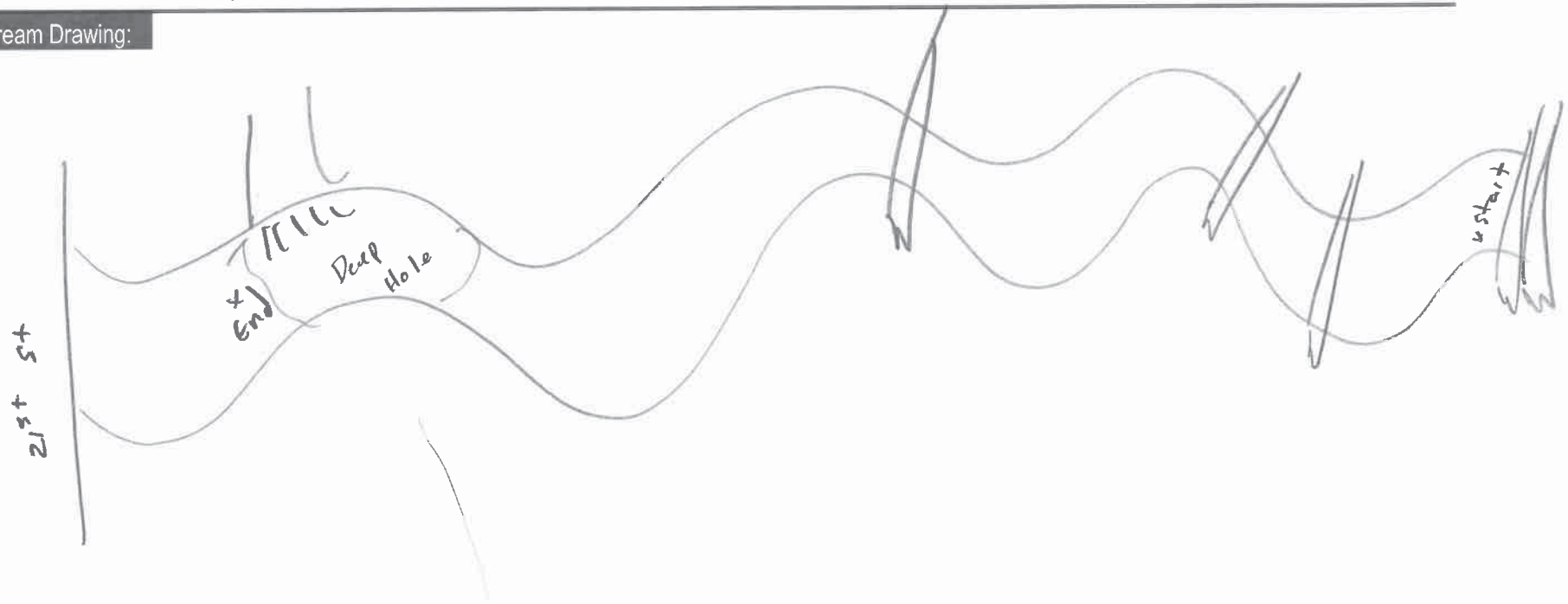
Subjective Rating (1-10)	Aesthetic Rating (1-10)
5	5

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

QHEI Score: 69

River Code: 95-704 RM: 0.25 Stream: Bull's Brook
Site Code: L3-7 Project Code: DRWW19 Location: N. Milwaukee Ave.
Date: 8-30-19 Scorer: VM Latitude: 42.32570 Longitude: -87.97661

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]		

	POOL	RIFFLE
	✓	✓
	✓	✓

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: 15.5 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]
___ OVERHANGING VEGETATION [1]
1 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
___ POOLS > 70 cm [2]
___ ROOTWADS [1]
___ BOULDERS [1]
___ OXBOWS, BACKWATERS [1]
2 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: 10 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: 16 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: 6 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: 4 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 32.77 DRAINAGE AREA (sq.mi.): 2.7 % 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

Entered 1-21-2020 VM

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) ☐

Gradient:

☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 70

River Code: 95-720 RM: 0.15 Stream: West Fork Belvidere Rd. Trib
Site Code: 13-B Project Code: DRWQIP Location: Ust Abandoned Bridge
Date: 10-8-19 Scorer: MAS Latitude: 42.34253 Longitude: -87.94494

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]		

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: 17 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
1 POOLS > 70 cm [2]
1 ROOTWADS [1]
2 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 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 ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 11.5 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: 6 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: 4.5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 33.63 DRAINAGE AREA (sq.mi.): 3.8 % 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

entered 1-21-2020 VH

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: _____

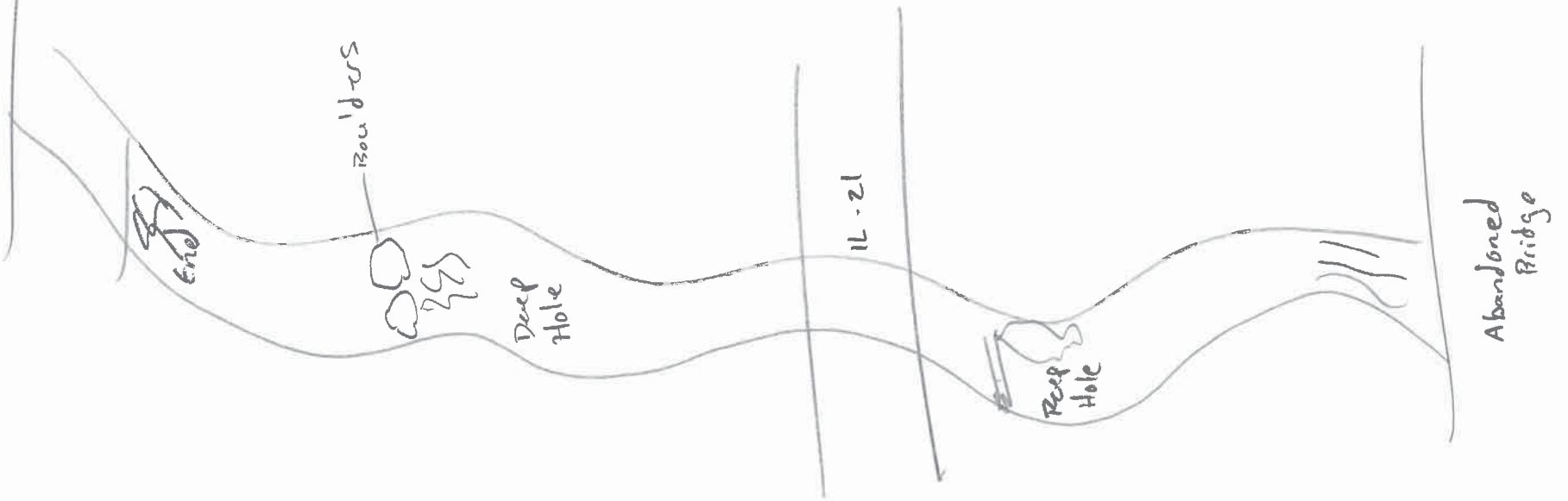
Subjective Rating (1-10) ☐ Aesthetic Rating (1-10) ☐

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 82

River Code: 95-709 **RM:** 0.42 **Stream:** Stoneroller Creek
Site Code: 13-9 **Project Code:** DEWW19 **Location:** Dst IL-21
Date: 10-10-19 **Scorer:** MAS **Latitude:** 42.35290 **Longitude:** -87.93661

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: 18 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	
3 UNDERCUT BANKS [1]	3 POOLS > 70 cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	0 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
2 SHALLOWS (IN SLOW WATER) [1]	3 BOULDERS [1]	0 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: 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: 16.5 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: 10 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: 6.5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 19.18 DRAINAGE AREA (sq.mi.): 4.1 % 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

entered 1-21-2020

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: Restoration

Subjective Rating (1-10): 6

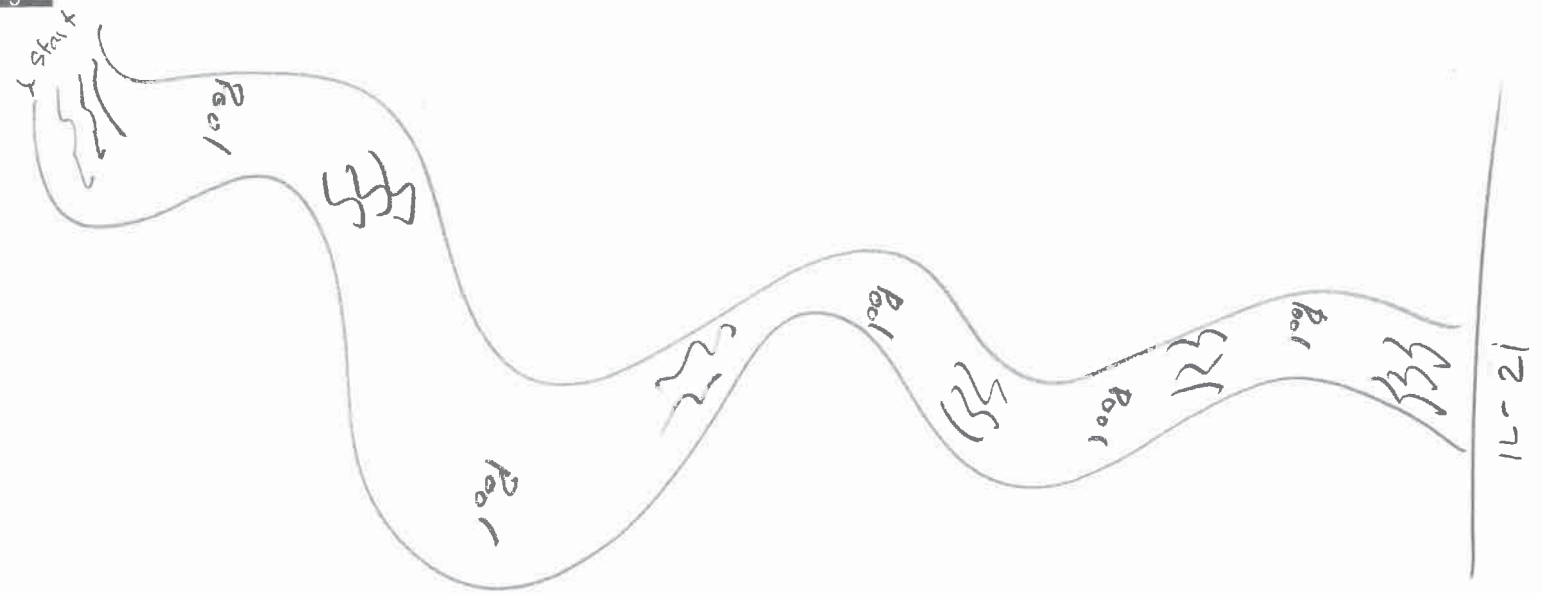
Aesthetic Rating (1-10): 6

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

QHEI Score: 39

River Code: 95-710 RM: 2.0 Stream: Suburban Country Club Trib
Site Code: 13-10 Project Code: DEWWJ19 Location: Dst N Delany Rd
Date: 10-10-19 Scorer: MAS Latitude: 42.40424 Longitude: -87.90610

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]

Substrate: 6 Max 20

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

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]
0 SHALLOWS (IN SLOW WATER) [1]
1 ROOTMATS [1]

TYPE: Score All That Occur
3 POOLS > 70 cm [2]
2 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: 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: 3 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: 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: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 15.72 DRAINAGE AREA (sq.mi.): 4.0 % 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

entered 1-22-2020

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

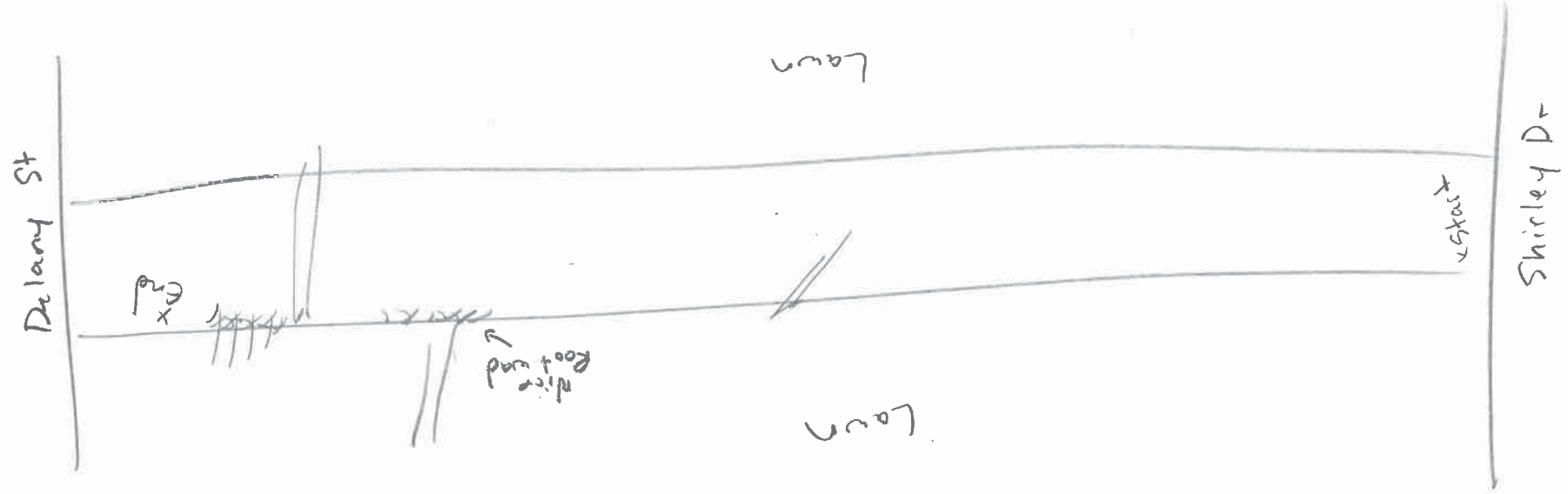
Aesthetic Rating (1-10): 4

Gradient: ☐ -Low ☐ -Moderate ☐ -High

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

Midwest Biodiversity Institute

QHEI Score: 63.75

River Code: 95-711 RM: 1.36 Stream: Slocum Coarners Creek
Site Code: 13-11 Project Code: DRww19 Location: U/S N. Mill Creek Rd.
Date: 10-13-19 Scorer: MAS Latitude: 42.44442 Longitude: -87.95283

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

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☑ ☑ -GRAVEL [7]	X	X
☐ ☐ -Lg BOULD [10]	X		☐ ☐ -SAND [6]	X	X
☐ ☐ -BOULDER [9]			☐ ☐ -BEDROCK [5]		
☐ ☑ -COBBLE [8]	X	X	☐ ☐ -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: 16 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	
1 UNDERCUT BANKS [1]	0 POOLS > 70 cm [2]	0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1]	2 ROOTWADS [1]	8 AQUATIC MACROPHYTES [1]
3 SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
3 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: 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: 14.5 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]; ☑ ☑ -OPEN PASTURE, ROWCROP [0]; ☐ ☐ -CONSERVATION TILLAGE [1]; ☐ ☐ -URBAN OR INDUSTRIAL [0]; ☐ ☐ -MINING / CONSTRUCTION [0]

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

Riparian: 3.75 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: 3.5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 30.6 DRAINAGE AREA (sq.mi.): 2.4 % 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

Gradient corrected 1-22-2020

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): 6

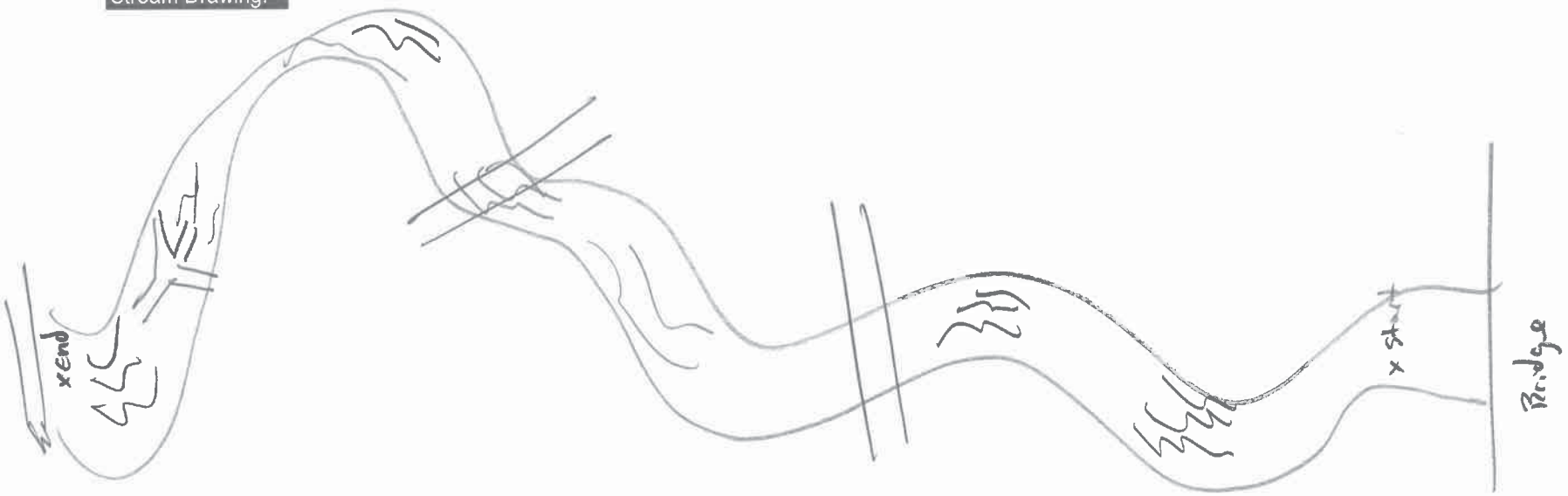
Aesthetic Rating (1-10): 5

Gradient:
☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Turbid	High	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: 63.75

River Code: 95-716 RM: 0.4 Stream: UT Greenleaf Creek
Site Code: 13-13 Project Code: DRWW19- Location: dst Kenwood
Date: 8-30-19 Scorer: VA Latitude: 42.36604 Longitude: -87.90196

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: 14 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

1 UNDERCUT BANKS [1]	___ POOLS > 70 cm [2]	___ OXBOWS, BACKWATERS [1]
___ OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	___ AQUATIC MACROPHYTES [1]
___ SHALLOWS (IN SLOW WATER) [1]	___ BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]
___ 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: 10 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: 18 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: 6.25 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: 1.5 Max 8

Gradient: 10 Max 10

COMMENTS:

6.) GRADIENT (ft / mi): 26.98 DRAINAGE AREA (sq.mi.): 1.1 % POOL: % GLIDE: % RIFFLE: % RUN:

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

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

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) ☐

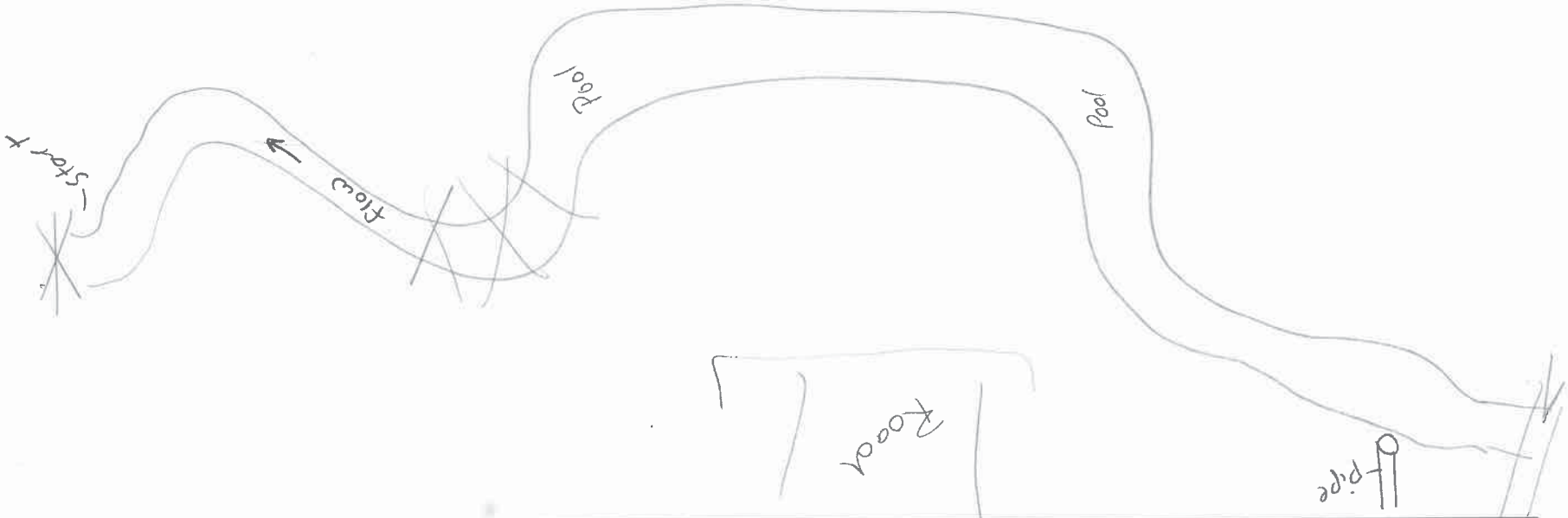
Gradient:

☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 68.75

River Code: 95-720 RM: 0.21 Stream: West Fork Belvidere Rd. Trib
Site Code: 13-14 Project Code: Dewwi9 Location: Dst Leonard Dr
Date: 10-8-19 Scorer: MAS Latitude: 42.34737 Longitude: -87.95589

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

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐ -BLDR/SLBS [10]			☐ ☑ -GRAVEL [7]	X	X
☐ ☐ -Lg BOULD [10]			☐ ☐ -SAND [6]	X	
☐ ☐ -BOULDER [9]	X	X	☐ ☐ -BEDROCK [5]		
☑ ☐ -COBBLE [8]	X	X	☐ ☐ -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: 18 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: 0 POOLS > 70 cm [2]; 1 ROOTWADS [1]; 2 BOULDERS [1]; 1 OXBOWS, BACKWATERS [1]; 0 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: 13 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	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) (Most Predominant Per Bank) L R		BANK EROSION (Per Bank) L R
☐ ☐ -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: 6.25 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: 4.5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 36.62 DRAINAGE AREA (sq.mi.): 2.3 % 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): 5

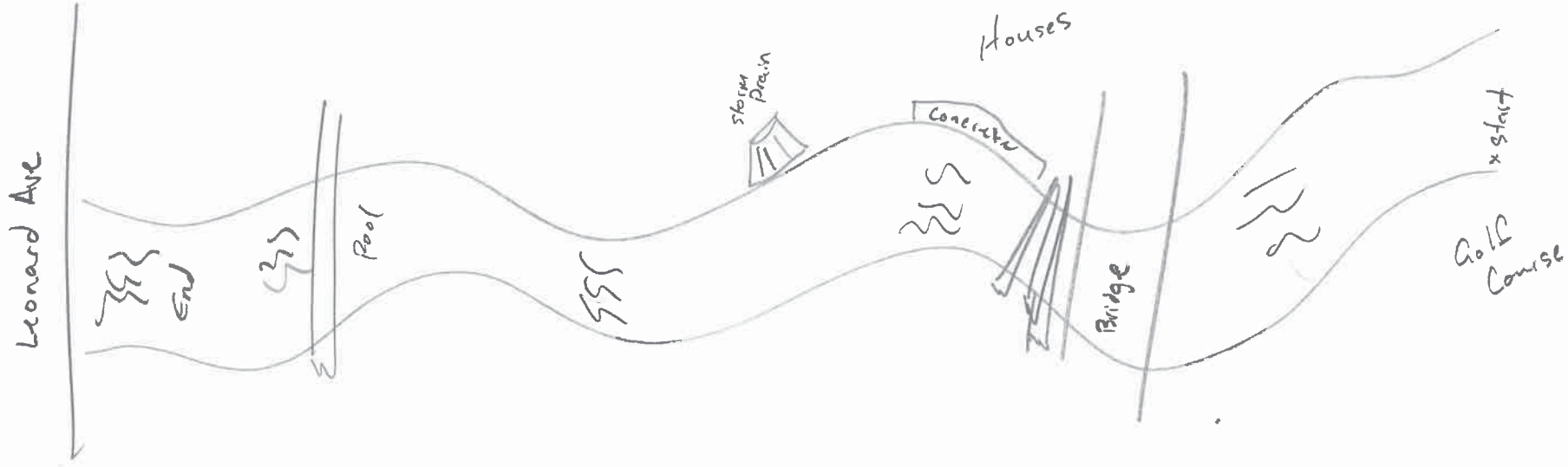
Aesthetic Rating (1-10): 5

Gradient: ☐ -Low ☐ -Moderate ☐ -High

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

QHEI Score: 46.5

River Code: 95-704 RM: 1.95 Stream: Bull's Brook
Site Code: 13-15 Project Code: DRWW19 Location: Dst Almond Rd
Date: 10-8-15 Scorer: MAS Latitude: 42.32563 Longitude: -87.97668

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: 18 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]
0 OVERHANGING VEGETATION [1]
3 SHALLOWS (IN SLOW WATER) [1]
3 ROOTMATS [1]

TYPE: Score All That Occur
0 POOLS > 70 cm [2]
2 ROOTWADS [1]
1 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: 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 ☐ -IMPOUNDMENT ☐ -RELOCATION ☐ -ISLAND ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -DREDGING ☐ -BANK SHAPING ☐ -ONE SIDE CHANNEL MODIFICATIONS

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: 10 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: 10 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: 5.5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 32.57 DRAINAGE AREA (sq.mi.): 1.9 % POOL: % GLIDE: % RIFFLE: % RUN:

Gradient: 8 Max 10

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

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

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): 7

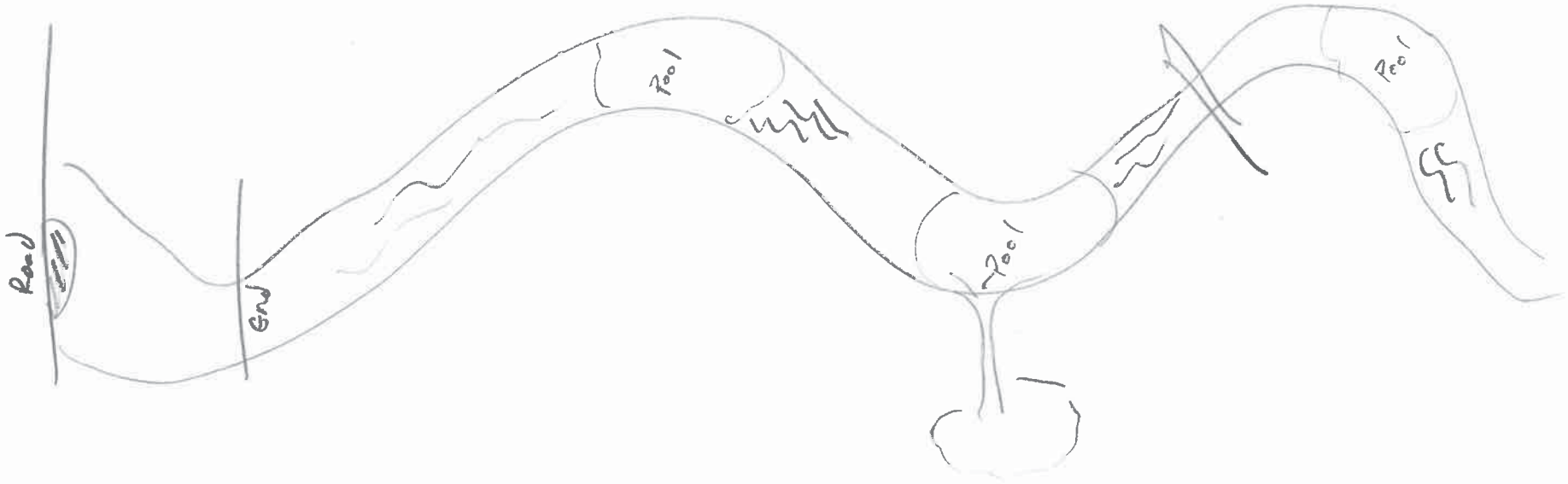
Aesthetic Rating (1-10): 7

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	150	Clear	Normal	10

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: 62

River Code: 95-714 RM: 0.13 Stream: Unnamed Trib to Des Plaines River
Site Code: 13-17 Project Code: DRWW19- Location: behind pump station off Sprucewood Lane
Date: 8-30-19 Scorer: KA Latitude: 42.29978 Longitude: -87.94074

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: 13 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]; ___ 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]; 2 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: 13 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)		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: 10 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): 26.83 DRAINAGE AREA (sq.mi.): 0.9 % 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) ☐

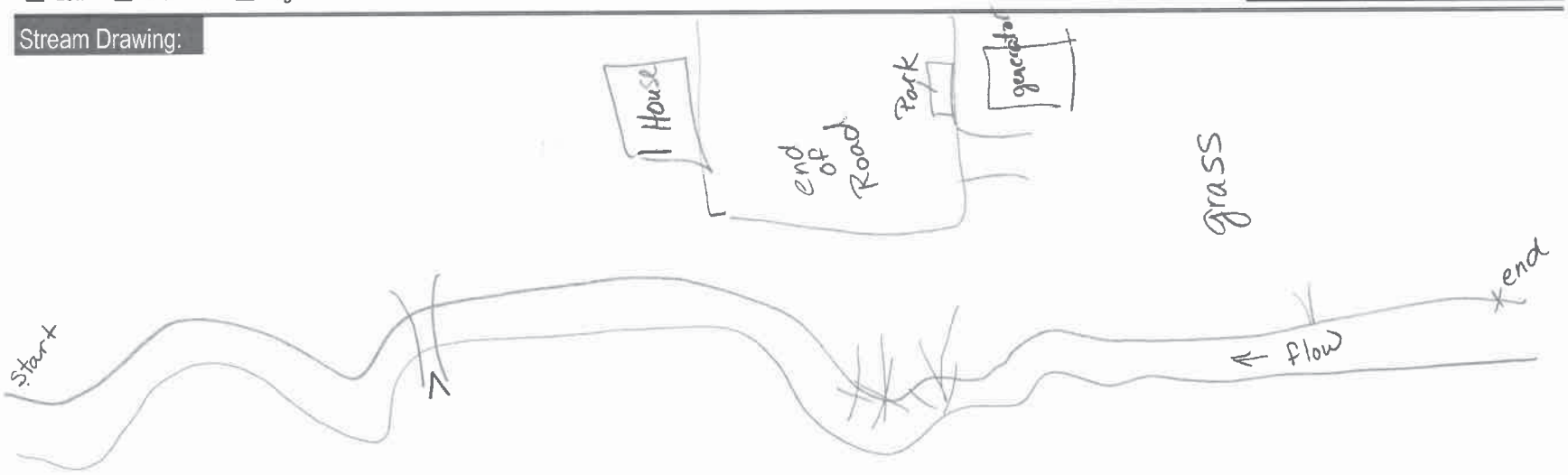
Aesthetic Rating (1-10) ☐

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 78

River Code: 95-051 RM: 0.5 Stream: Bull Creek
Site Code: 14-1 Project Code: ORWW19 Location: IL-21
Date: 10-10-19 Scorer: MAS Latitude: 42.31157 Longitude: -87.96423

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: 18 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
3 POOLS > 70 cm [2]
2 ROOTWADS [1]
2 BOULDERS [1]
1 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: 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: 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: 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: 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: 5.5 Max 8

COMMENTS:

Gradient: 10 Max 10

6.) GRADIENT (ft / mi): 6.26 DRAINAGE AREA (sq.mi.): 11.7 % 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

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): 7

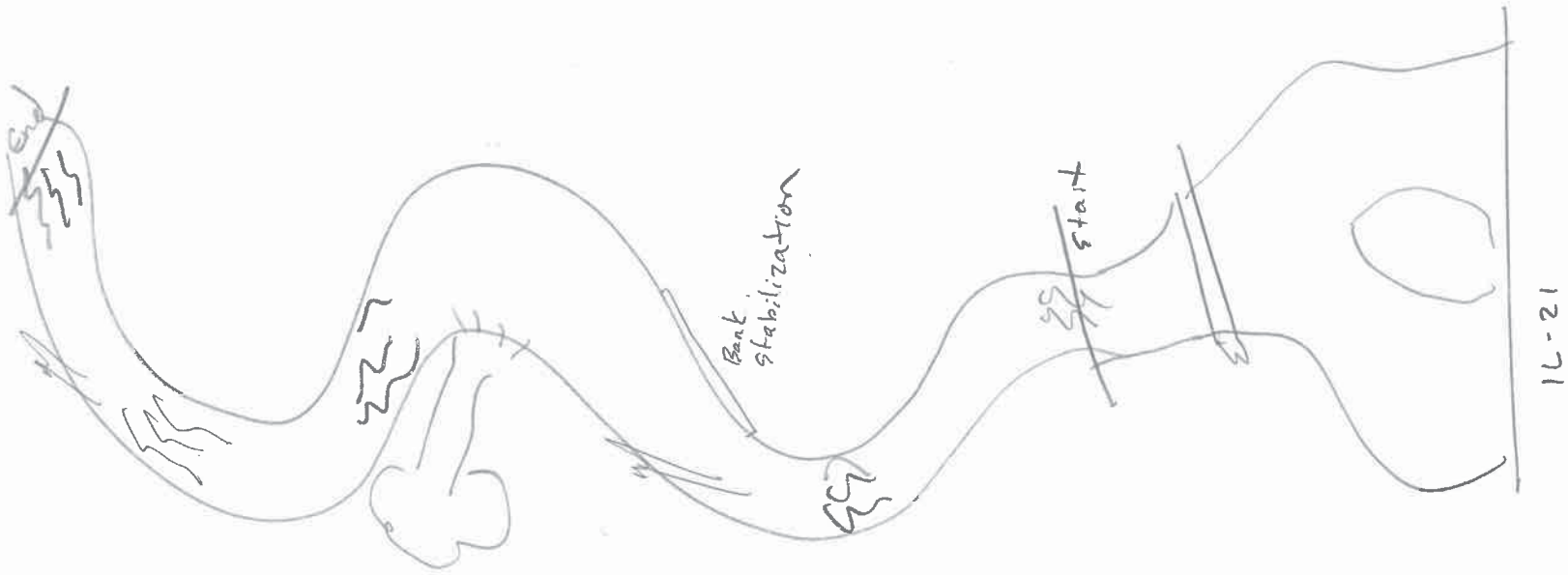
Aesthetic Rating (1-10): 7

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	E	150	Clear	normal - High	60

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: 53.25

River Code: 95-051 RM: 1.0 Stream: Bull Creek
Site Code: 14-2 Project Code: DRWW19 Location: @ Route 137
Date: 8-28-19 Scorer: VH Latitude: 42.30768 Longitude: -87.96867

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: (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: 12.5 Max 20

COMMENTS:

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

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

TYPE: Score All That Occur
_____ POOLS > 70 cm [2]
_____ ROOTWADS [1]
_____ BOULDERS [1]

_____ OXBOWS, BACKWATERS [1]
2 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: 14 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: 4.25 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: 2.5 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 3.96 DRAINAGE AREA (sq.mi.): 8.4 % 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) ☐

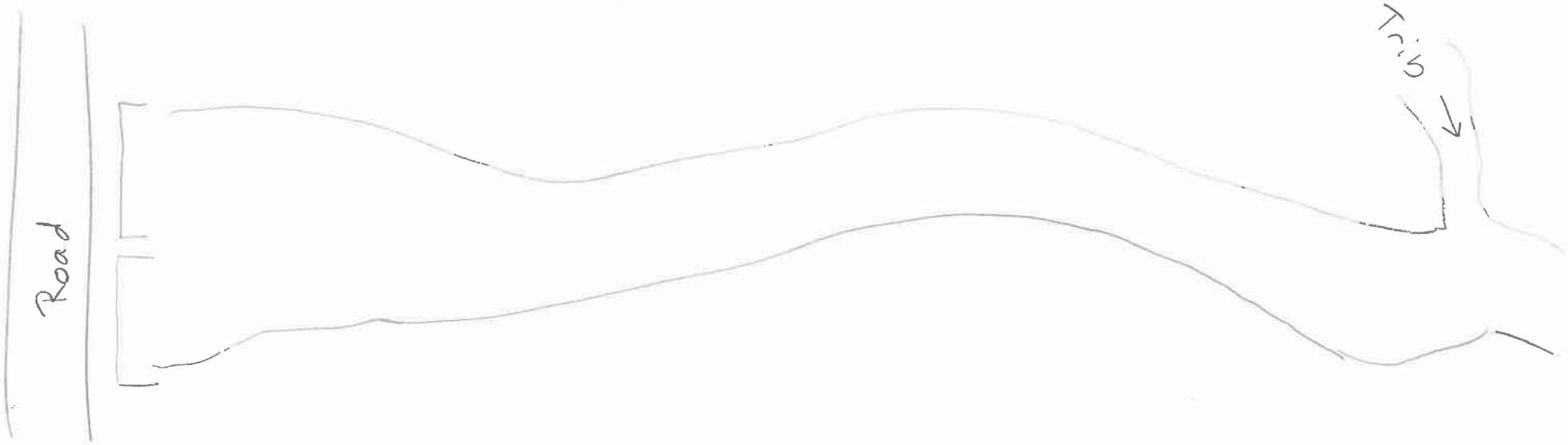
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 65.75

River Code: 95-719 RM: 1.6 Stream: Bull Creek (West Branch)
Site Code: 14-3 Project Code: DRWW19 Location: N. Countryside Drive
Date: 8-29-19 Scorer: VM Latitude: 42.31017 Longitude: -87.99065

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: 16.5 Max 20

COMMENTS:

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

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

TYPE: Score All That Occur: 1 POOLS > 70 cm [2]; ___ ROOTWADS [1]; 3 BOULDERS [1]; ___ 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: 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; ☐ -IMPOUNDMENT; ☐ -RELOCATION; ☐ -ISLAND; ☐ -CANOPY REMOVAL; ☐ -LEVEED; ☐ -DREDGING; ☐ -BANK SHAPING; ☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 16 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: 4.25 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: 3 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 2.85 DRAINAGE AREA (sq.mi.): 7.1 % 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

entered 1-22-2020

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) ☐

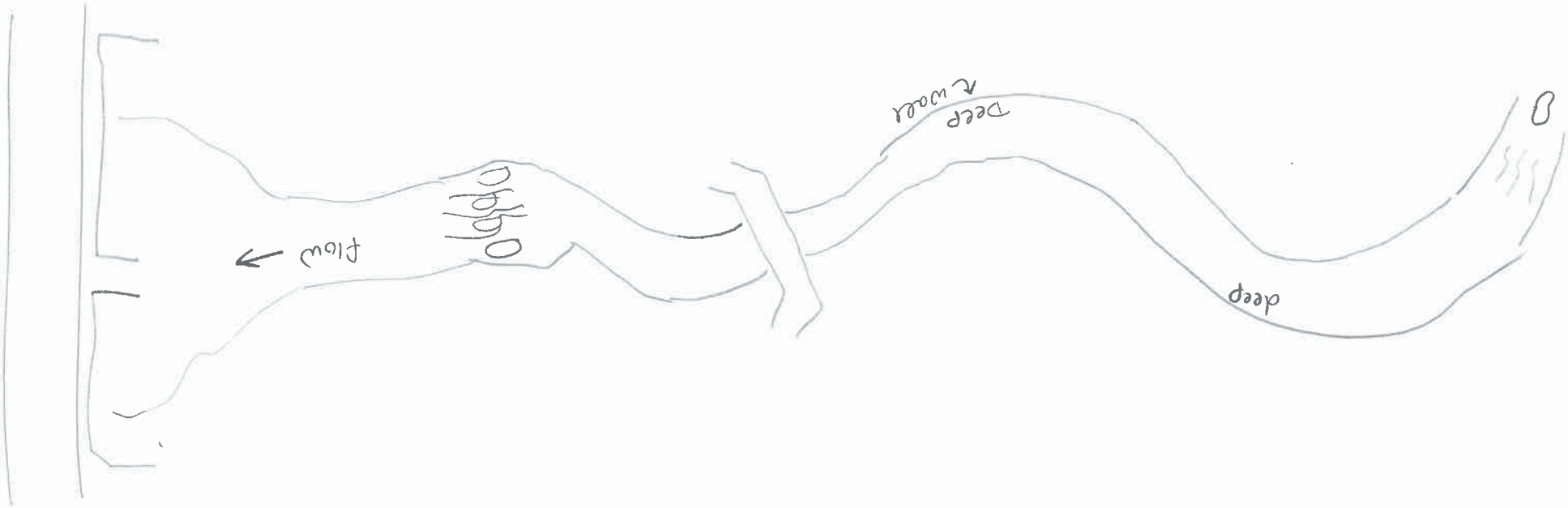
Gradient:

☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 47.75

River Code: 95-719 RM: 2.54 Stream: W. Branch Bull Creek
Site Code: 14-4 Project Code: DRWW19- Location: behind World Bioproducts (Across field)
Date: 8-29-19 Scorer: VA Latitude: 42.30297 Longitude: -87.99916

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]

Substrate: 11 Max 20

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

COMMENTS:

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

(Structure)	TYPE: Score All That Occur		
1 UNDERCUT BANKS [1]	____ POOLS > 70 cm [2]	____ OXBOWS, BACKWATERS [1]	
1 OVERHANGING VEGETATION [1]	____ ROOTWADS [1]	____ AQUATIC MACROPHYTES [1]	
____ SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]	
2 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: 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: 16 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: 3.75 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: 0 Max 8

COMMENTS:

6.) GRADIENT (ft / mi): 4.4 DRAINAGE AREA (sq.mi.): 5.1 % 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) ☐

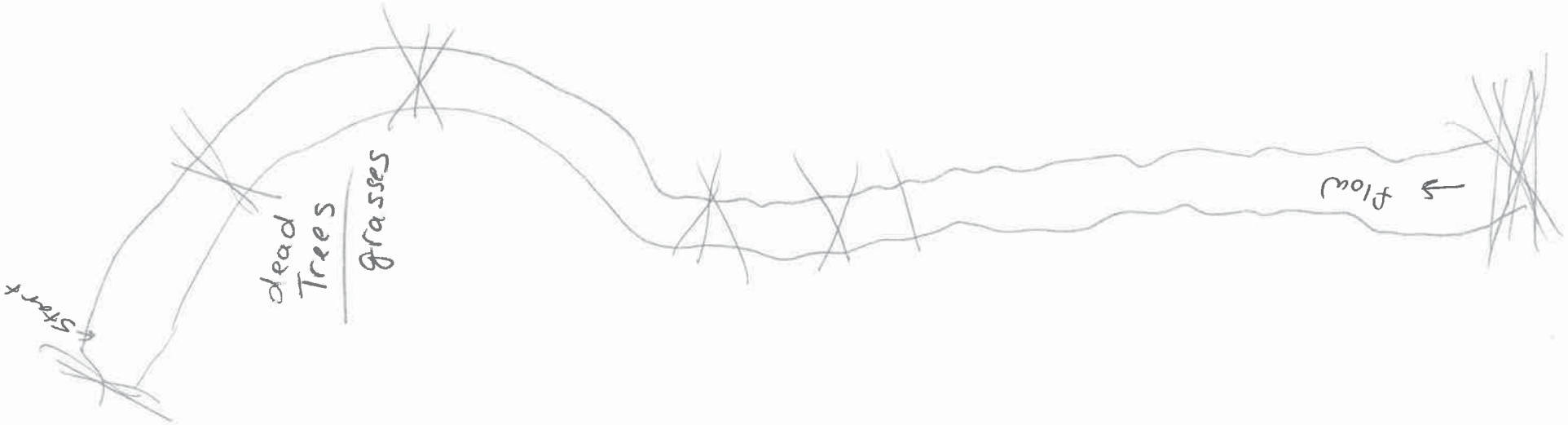
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass					

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: 57.25

River Code: 95-051 RM: 4.7 Stream: Bull Creek
Site Code: 14-S Project Code: DRWW19 Location: E St. Mary of the Lake College
Date: 10-13-19 Scorer: MAS Latitude: 42.27954 Longitude: -88.00300

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: 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]
1 ROOTMATS [1]

TYPE: Score All That Occur
0 POOLS > 70 cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 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: 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: 11.5 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: 7.75 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): 13.95 DRAINAGE AREA (sq.mi.): 1.3 % 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): 6

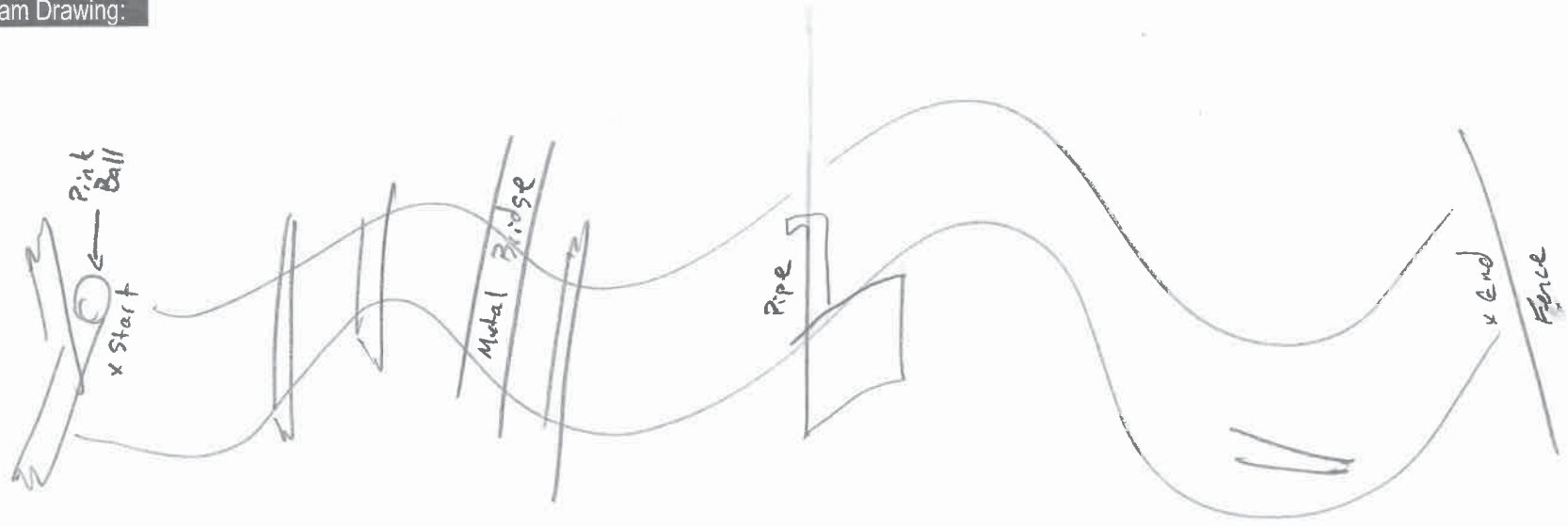
Aesthetic Rating (1-10): 6

Gradient: ☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	F	100	Clear	High	20

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: 57.5

River Code: 95-051 RM: 5.95 Stream: Bull Creek
Site Code: 14-6 Project Code: DRW19 Location: @ Hazelnut Xing
Date: 8-29-19 Scorer: VA Latitude: 42.28815 Longitude: -88.02155

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]		

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)) POOL RIFFLE
☐ -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: 18 Max 20

COMMENTS:

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

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

TYPE: Score All That Occur
_____ POOLS > 70 cm [2]
_____ ROOTWADS [1]
1 BOULDERS [1]

_____ OXBOWS, BACKWATERS [1]
_____ 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: 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 ☐ -IMPOUNDMENT
☐ -RELOCATION ☐ -ISLAND
☐ -CANOPY REMOVAL ☐ -LEVEED
☐ -DREDGING ☑ -BANK SHAPING
☐ -ONE SIDE CHANNEL MODIFICATIONS

Channel: 13 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 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: 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): 9.05 DRAINAGE AREA (sq.mi.): 2.4 % 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: Mostly dry with pools.

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) _____

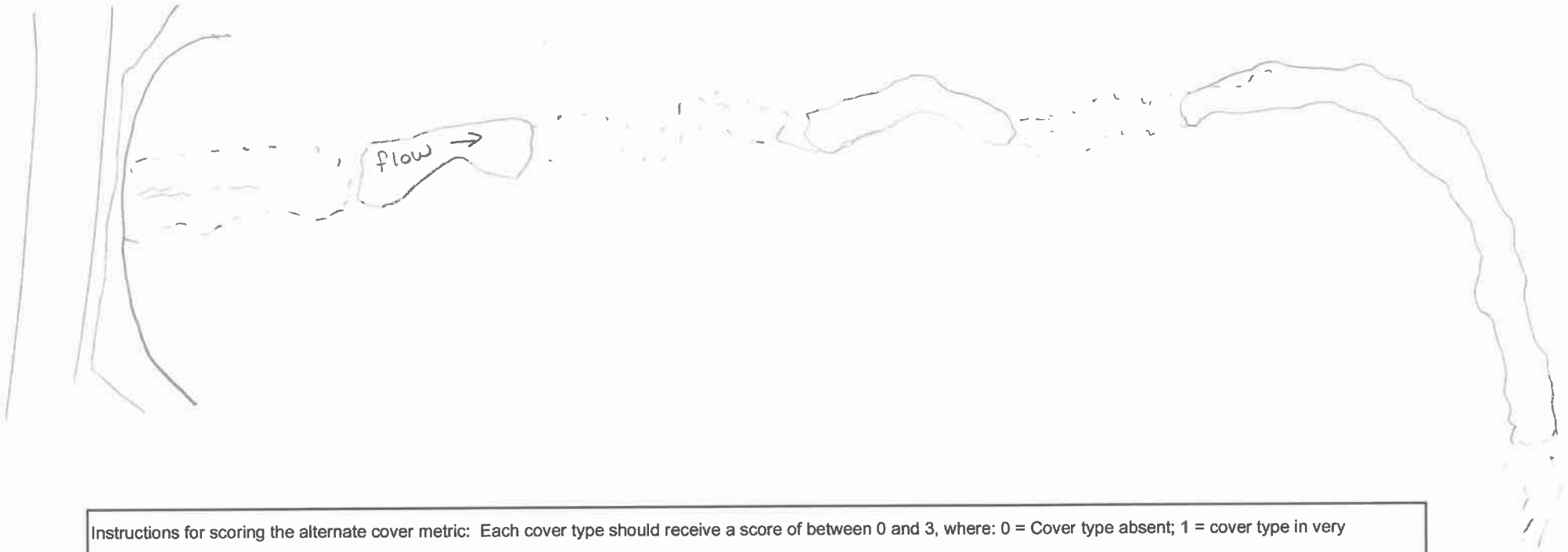
Gradient:

☐ -Low ☐ -Moderate ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy- % open:
First Sampling Pass	FT	150	good	low	2%

Yes	No	
☐	☑	Is Stream Ephemeral (no pools, totally dry of only damp spots)?
☑	☐	Is there water upstream? How far: 15m.
☑	☐	Is there water close downstream? How far: 2m
☑	☐	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.

APPENDIX D

D-1: FIT Factors for Deriving Primary, Secondary, and Tertiary Causes of Impairment
D-2: Northeast Illinois IPS Nutrient Ranking Index

Appendix D-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 Appendix Table D-1). 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 D-2.

Appendix Table D-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 D-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 D-2: Northeast Illinois IPS Nutrient Ranking Index

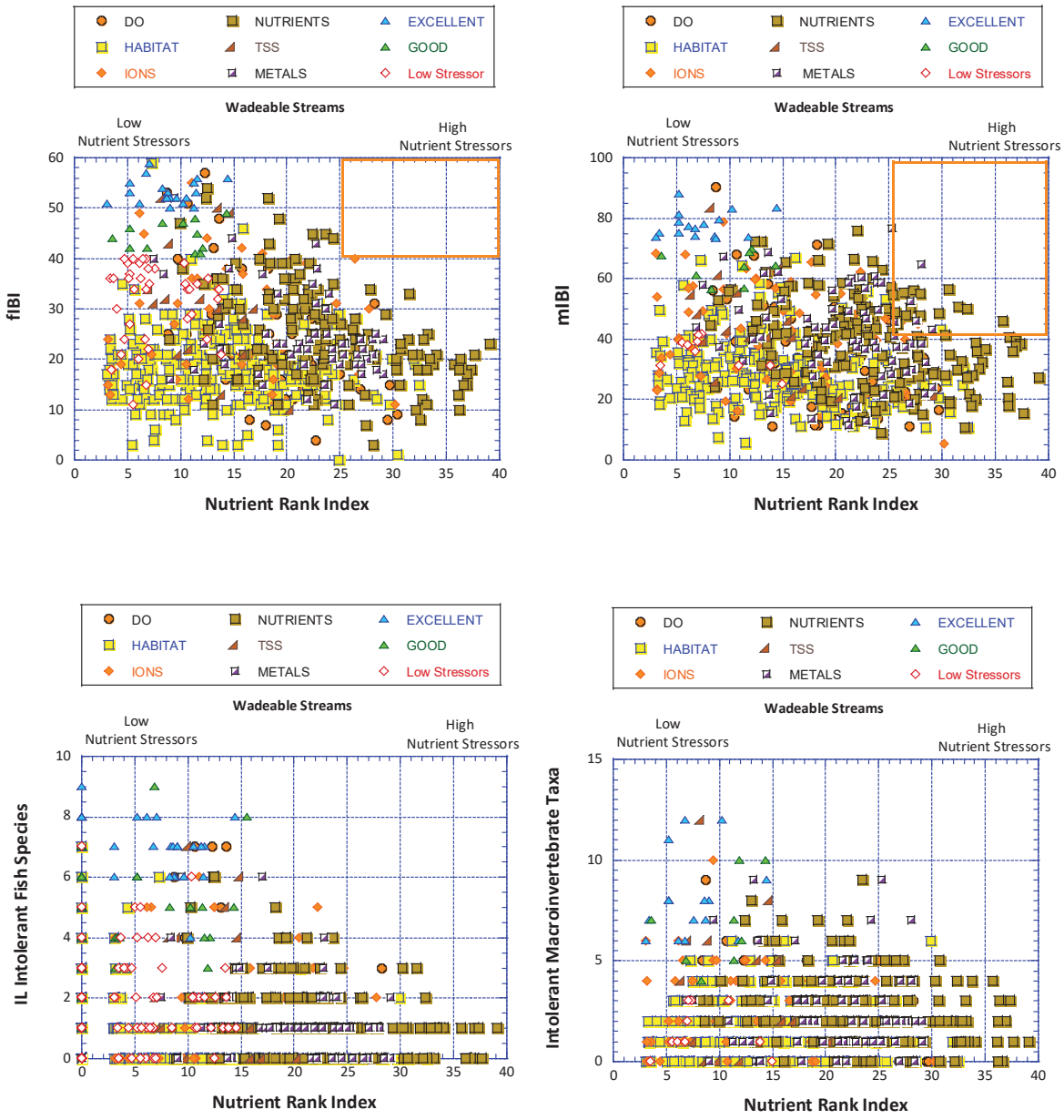
With the emphasis on nutrients in NE Illinois a Nutrient Ranking Index (NRI) was developed by summing the ranking of each of the individual primary nutrient or nutrient-related parameters with each weighted based on the FIT coefficient (Appendix Table E-2). The equation is as follows:

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 D-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 D-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 D-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).*