BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the	e Matter of:)				
SIERRA CLUB, ENVIRONMENTAL LAW AND POLICY CENTER, PRAIRIE RIVERS NETWORK, and CITIZENS AGAINST RUINING THE ENVIRONMENT))))) PCB 2013-015				
	Complainants,	(Enforcement – Water)				
	v.))				
MID	WEST GENERATION, LLC,)				
	Respondent.)				
	NOTIO	CE OF FILING				
TO:	Don Brown, Clerk Illinois Pollution Control Board 60 E. Van Buren St., Ste. 630 Chicago, Illinois 60605	Attached Service List				
PLEASE TAKE NOTICE that I have filed today with the Illinois Pollution Control Board, Midwest Generation, LLC's Motion to Incorporate the Pre-filed Testimony of G. Allen Burton into the PCB 13-15 Docket, a copy of which is hereby served upon you.						
		MIDWEST GENERATION, LLC				
		By: /s/ Jennifer T. Nijman				
Dated	l: April 20, 2023					
Susan Kriste NIJM 10 So Chica	fer T. Nijman M. Franzetti en L. Gale AN FRANZETTI LLP uth LaSalle Street, Suite 3400 (please note 190, IL 60603 251-5255	change of suite no.)				

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CERTIFICATE OF SERVICE

The undersigned, an attorney, certifies that a true copy of the foregoing Notice of Filing, Certificate of Service for Midwest Generation, LLC's Motion to Incorporate the Pre-filed Testimony of G. Allen Burton into the PCB 13-15 Docket, a copy of which is hereby served upon you and filed on April 20, 2023 with the following:

Don Brown, Clerk Illinois Pollution Control Board James R. Thompson Center 60 E. Van Buren St., Ste. 630 Chicago, Illinois 60605

and that true copies of the pleading were emailed on April 20, 2023 to the parties listed on the foregoing Service List.



BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:)	
SIERRA CLUB, ENVIRONMENTAL LAW)	
AND POLICY CENTER, PRAIRIE RIVERS)	
NETWORK, and CITIZENS AGAINST)	
RUINING THE ENVIRONMENT		
)	PCB 2013-015
Complainants,)	(Enforcement – Water)
)	
v.)	
)	
MIDWEST GENERATION, LLC,)	
)	
Respondent.)	

MIDWEST GENERATION, LLC'S MOTION TO INCORPORATE THE PRE-FILED TESTIMONY OF G. ALLEN BURTON INTO THE PCB 13-15 DOCKET

Pursuant to 35 Ill. Admin. Code § 101.500 and § 101.306, Midwest Generation, LLC's ("MWG") request that the Hearing Officer enter an Order granting their Motion to Incorporate the Pre-filed Testimony of G. Allen Burton and the exhibits attached because these documents are authentic, credible, and relevant to this proceeding. In support of this Motion, MWG states as follows:

1. Board Rule 101.306(a) provides:

Upon the separate written request of any person or on its own initiative, the Board or hearing officer may incorporate materials from the record of another Board docket into any proceeding. The person seeking incorporation must file the material to be incorporated with the Board in accordance with Section 101.302(h). The person seeking incorporation must demonstrate to the Board or the hearing officer that the material to be incorporated is authentic, credible, and relevant to the proceeding. Notice of the request must be given to all identified participants or parties by the person seeking incorporation. 35 Ill. Adm. Code 101.302(a).

¹ MWG requested Complainants agree to admission of the Pre-filed Testimony of G. Allen Burton, and Complainants requested that MWG file a motion to incorporate under Rule 101.302(a).

- 2. On October 26, 2007, the Illinois Environmental Protection Agency ("IEPA") initiated a rulemaking before the Illinois Pollution Control Board (the "Board"). The IEPA proposed a rule of general applicability to update "both the designation of uses for specified waters and establishment of numeric and narrative criteria intended to protect these designated uses." *In the Matter of Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303 and 304*, R08-09, Statement of Reasons at 3, October 26, 2007 (the "Rulemaking"). The Rulemaking focused on the Use Attainability Analysis factors and the numeric criteria intended to protect the designated uses for the Chicago Area Waterway System and the Lower Des Plaines River, collectively referred to as the Upper Illinois Waterway ("UIW"). *Id.* at 16-17. MWG's Stations, including the Joliet 29 Station, are on the UIW. *In the Matter of Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303 and 304, R08-09, Pre-filed Testimony of G. Allen Burton, p. 8, September 8, 2008.*
- 3. Dr. G. Allen Burton submitted pre-filed testimony in the Rulemaking on behalf of MWG. His testimony focused on the chemical, biological, and physical stressors in the UIW, the role of these stressors in biological impairment, and the interrelationship with other key watershed factors that affect heavily human-dominated, effluent dominant waterway such as the UIW. *Id.* at 2. In support of his testimony, he relied upon and incorporated a Sediment Chemistry Study of the Upper Illinois Waterway, Dresden and Lower Brandon Pools prepared by EA Engineering, Science, and Technology. *Id.* Appen. C.

- 4. Dr. Burton's pre-filed testimony and the attachments are authentic. MWG retrieved the Pre-filed Testimony of G. Allen Burton from the Board website.²
- 5. Dr. Burton's pre-filed testimony and the attachments are credible. Dr. Burton was the Director of NOAA's Cooperative Institute for Limnology and Ecosystems Research and a Professor in the School of Natural Resources and Environment at the University of Michigan at the time of his testimony. Pre-filed Testimony of G. Allen Burton, p. 1. The Sediment Chemistry Survey was an extensive physical and chemical survey, including 35 sediment samples that were analyzed for grain size, metals, and PAHs. *Id.* at 7. The Hearing Officer in the Rulemaking admitted Dr. Burton's testimony as Exhibit 369, and also admitted an enlarged Figure 2 of the Sediment Chemistry Study as Exhibit 378. *See* List of Exhibits #369 through 381 from Hearings Held January 13 and 14, 2010, attached as Exhibit A.
- 6. Parties to the Rulemaking, including one of the Complainants in this matter, the Environmental Law and Policy represented by Albert Ettinger, cross-examined Dr. Burton on his pre-filed testimony by answers to pre-filed questions and oral examination.³
- 7. Dr. Burton's pre-filed testimony and the attachments are relevant. Two of the factors the Board considers when determining a remedy are "the character and degree of injury to, or interference with the protection of the health, general welfare and physical property of the people" and "the technical practicability and economic reasonableness of reducing or eliminating the emissions, discharges or deposits resulting from such pollution source." 415 ILCS 5/33(c)(i) and (iv). Dr. Burton's discussion about the analysis of the sediments in the Des Plaines River near the

² In the Matter of Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303 and 304, R08-09, Prefiled Testimony of G. Allen Burton, September 8, 2008, at https://pcb.illinois.gov/documents/dsweb/Get/Document-62432.

³ In the Matter of Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303 and 304, R08-09, Transcripts of January 13, 2010 hearings, a.m and p.m.

Joliet Generating Station is directly relevant to whether there is interference with the "protection of the health, general welfare and physical property of the people" and the "technical practicability and economic reasonableness of reducing" the pollutants.

- 8. When material from another docket is relevant, a motion to incorporate should be granted. *ExxonMobil Oil Corp. v. IEPA*, 2011 WL 4615015, PCB 11-86, at *1 (Sept. 29, 2011). The Hearing Officer has previously granted the Complainants' Motion to Incorporate Certain Documents from a rulemaking because the Board "may find that the rulemaking . . . assists them in determining a remedy." *Sierra Club, et. al. v. Midwest Generation, LLC*, PCB 13-15, H. O. Order, p. 20 (July 13, 2022). Here, the Pre-Filed Testimony of G. Allen Burton, that was subject to cross examination, will assist the Board in determining a potential remedy.
 - 9. MWG has included a copy of the Pre-Filed Testimony of G. Allen Burton as Exhibit B.

WHEREFORE, Midwest Generation, LLC respectfully requests the Hearing Officer order the Pre-filed Testimony of G. Allen Burton filed in *In the Matter of Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303 and 304*, R08-09 on September 8, 2008 to be incorporated into the docket for this matter.

Respectfully submitted,

MIDWEST GENERATION, LLC.

By ______/s/ Jennifer T. Nijman_ One of Its Attorneys

Jennifer T. Nijman Susan M. Franzetti Kristen L. Gale NIJMAN FRANZETTI LLP 10 South LaSalle Street, Suite 3400 (please note change of suite no.) Chicago, IL 60603 312-251-5255

EXHIBIT A

	Electronic Filing: Received Ligher's Statione 04/20/2023
R08-9	JAN 1 4 2010 Exhibit List
Exhibit 369	STATE OF ILLINOIS Pollution Control Board Prefiled testimony and attachments of Dr. G. Allen Burton
Exhibit 370	Two CD ROMs, CD #1 Titled "Final Report Aquatic Ecological Study of the Upper Illinois Waterway" CD #2 untitled
Exhibit 371	Index of Exhibits [Exhibit 370] for G. Allen Burton Testimony
Exhibit 372	"The Upper Illinois Waterway Study Summary Report Sediment Contamination Assessment" Prepared for Commonwealth Edison Company, Prepared by G. Allen Burton, Jr. The Institute for Environmental Quality Wright State University December 18, 1995
Exhibit 373	"Reviews of the Literature Concerning: 1. Effects of Temperature on Freshwater Fish, 2. Effects on Freshwater Biota from Interactions of Temperature and Chemicals, and 3. Effects of Turbidity and Barge-Traffic on Aquatic Ecosystems" Prepared for Commonwealth Edison Company, Prepared by Institute for Environmental Quality Wright State University December 18, 1995
Exhibit 374	"Illinois Integrated Water Quality Report and Section 303(d) List -2008" Illinois Environmental Protection Agency August 2008
Exhibit 375	Printed pages from USEPA web site with "Section 303(d) List Fact sheet for Watershed Des Plaines" in bold at top
Exhibit 376	Printed pages from USEPA web site with "Total Maximum Daily Loads" "Listed Water Information Cycle: 2006"
Exhibit 377	Oversized Map identified at bottom as EA Figure 3 "Concentrations of Total PAHs and Total PCBs that Exceed Sediment Quality Guidelines"
Exhibit 378	Oversized Map identified at bottom as EA Figure 2 "Concentrations of Metals that Exceed Sediment Quality Guidelines"
Exhibit 379	Picture of Barge on River with tanks along river
Exhibit 380	Photograph Depicting Dense Mat of Algae/Duckweed at Midwest Generation Fish Sampling Location 408 (mouth of Jackson Creek embayment, RM 278.3) Located just upstream of the I-55 Bridge September 10, 2008
Exhibit 381	Figure 2a Des Plaines River Watershed 303d Listed Waters (2002)

EXHIBIT B

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)	
)	
WATER QUALITY STANDARDS AND)	R08-9
EFFLUENT LIMITATIONS FOR THE)	(Rulemaking – Water)
CHICAGO AREA WATERWAY SYSTEM)	
AND LOWER DES PLAINES RIVER)	
PROPOSED AMENDMENTS TO 35 ILL.)	
ADM. CODE 301, 302, 303, and 304)	

NOTICE OF FILING

TO:

John Therriault, Clerk Illinois Pollution Control Board James R. Thompson Center 100 West Randolph Street, Suite 11-500 Chicago, IL 60601

Deborah J. Williams, Assistant Counsel Stefanie N. Diers, Assistant Counsel Illinois Environmental Protection Agency 1021 North Grand Avenue East P.O. Box 19276 Springfield, IL 62794-9276 Marie Tipsord, Hearing Officer Illinois Pollution Control Board James R. Thompson Center 100 West Randolph Street, Suite 11-500 Chicago, IL 60601

Persons included on the attached SERVICE LIST

PLEASE TAKE NOTICE that I have electronically filed today with the Office of the Clerk of the Pollution Control Board <u>PRE-FILED TESTIMONY OF G. ALLEN BURTON</u>

<u>AND GREG SEEGERT</u>, by Midwest Generation, a copy of which is herewith served upon you.

MIDWEST GENERATION, L.L.C.

Susan M. Franzetti

Date: September 8, 2008

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Susan M. Franzetti Nijman Franzetti LLP 10 S. LaSalle St., Suite 3600 Chicago, IL 60603 (312) 251-5590 (phone) (312) 251-4610 (fax)

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CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 8th day of September, 2008, have caused to be filed electronically the attached <u>PRE-FILED TESTIMONY OF G. ALLEN BURTON AND GREG SEEGERT</u>, by Midwest Generation, and NOTICE OF FILING upon the following person:

John Therriault, Clerk Illinois Pollution Control Board James R. Thompson Center 100 West Randolph Street, Suite 11-500 Chicago, IL 60601

by personal delivery to the following person:

Marie Tipsord, Hearing Officer Illinois Pollution Control Board James R. Thompson Center 100 West Randolph Street, Suite 11-500 Chicago, IL 60601

by U.S. Mail, first class postage prepaid, to the following persons:

Deborah J. Williams, Assistant Counsel Stefanie N. Diers, Assistant Counsel Illinois Environmental Protection Agency 1021 North Grand Avenue East P.O. Box 19276 Springfield, IL 62794-9276

AND the participants listed on the attached SERVICE LIST via CD Disc.

Susan M. Franzelli

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
WATER QUALITY STANDARDS AND)
EFFLUENT LIMITATIONS FOR THE) R08-9
CHICAGO AREA WATERWAY SYSTEM) (Rulemaking - Water)
AND THE LOWER DES PLAINES RIVER:)
PROPOSED AMENDMENTS TO 35 III.)
Adm. Code Parts 301, 302, 303 and 304)

PRE-FILED TESTIMONY OF G. ALLEN BURTON

Good morning, my name is Allen Burton. I currently serve as the Director of NOAA's Cooperative Institute for Limnology and Ecosystems Research and a Professor in the School of Natural Resources and Environment at the University of Michigan. Prior to joining the University of Michigan in August of this year, I was a Professor and Chair of the Department of Earth and Environmental Sciences at Wright State University in Columbus, Ohio. Over the past 30 years, my research has focused on developing effective methods for identifying significant effects and stressors in aquatic systems where sediment and storm water contamination is a concern. I serve on the U.S. EPA Science Advisory Board committees, a National Research Council committee (in 2007), and am the "Immediate Past President" of the Society of Environmental Toxicology & Chemistry, and have served on numerous national and international scientific committees, review panels, councils and editorial boards with more than 200 publications. I have an M.S. and Ph.D. from the University of Texas, where I focused on aquatic toxicology. My resume can be found at Attachment 1, Appendix A.

I have been retained by Midwest Generation ("MWGen") to provide technical support in the evaluation of the Illinois EPA Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303 and 304 (the "Proposed UAA Rules") and supporting

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documentation provided to the Illinois Pollution Control Board (the "Board") in the rule-making docketed as R08-09. The focus of my testimony is contained in my written report and assessment of the Illinois EPA's Proposed UAA Rules attached hereto as Attachment 1, which includes supporting tables, citations, and appendices.

My area of expertise is in the evaluation of freshwater ecosystem stressor effects, particularly focusing on the role of sediment and storm water quality. In the mid-1990's, on behalf of Commonwealth Edison (the former owner of the MWGen electric generating stations), I was asked to lead an evaluation of sediment quality on the Des Plaines River in support of the Upper Illinois Waterway ("UIW") Task Force process. My work entailed, among other things, an evaluation of sediment contamination and toxicity, review of the literature on temperature, turbidity and barge traffic effects, *in situ* toxicity evaluations around MWGen's Joliet generating stations, and laboratory evaluations of temperature effects.

My testimony will focus on the chemical, biological, and physical stressors in the UIW, the role of these stressors in biological impairment, and the interrelationship with other key watershed factors that affect heavily human-dominated, effluent dominant waterway such as the UIW. My testimony will also identify what I consider to be fundament flaws relating to the Illinois Environmental Protection Agency's ("Illinois EPA") overall approach to the Proposed UAA Rules, including the Agency's failure to consider the dominant physical, chemical, and biological factors affecting the UIW and the interplay of those stressors with indigenous populations, and the Agency's failure to rely upon peer-reviewed and quantitative approaches that would support the proposal. Unfortunately, as I have concluded, and as set forth more fully below and in my detailed report, it is my position that these flaws are fatal to certain aspects of the aquatic life use designations in the Illinois EPA's Proposed UAA Rules, particularly for the

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proposed Upper Dresden Island Pool aquatic life use designation, which are not supported by the facts or weight of evidence in this proceeding.

1. The Des Plaines Watershed Is One Of The Most Heavily Urbanized And Polluted Rivers In The State And, Due To The Many Significant Stressors, Certain Segments Will Not Achieve CWA Aquatic Life Goals.

The Des Plaines River is like many watersheds in highly urbanized areas in that it is heavily dominated by human activities that result in significant stressors on the aquatic ecosystem. The river flow itself is dominated by discharges of municipal wastewater, which account for more than 70% of the flow during low flow periods. As documented by the Illinois EPA in its recent integrated water quality assessment reports submitted to the U.S. Environmental Protection Action ("U.S. EPA"), the Des Plaines River is heavily polluted and ranks among the most impaired water bodies in Illinois. Pollutants such as organic chemicals, nutrients, metals, pathogens, ammonia, sedimentation/siltation, total dissolved and suspended solids, chlorides, and dissolved oxygen, are ubiquitous. In 2004, Illinois EPA identified more than 800 causes and sources of impairments. The most common sources of impairment are municipal point source discharges, combined sewer overflows ("CSO"), urban runoff/storm sewers, contaminated sediments, channelization, flow regulation, hydro-modification, and habitat alteration. Importantly, thermal modification has never been identified by the Illinois EPA as a cause of impairment.

The upper part of the UIW, known as the Chicago Area Waterway System ("CAWS"), consists of 78 miles of engineered canals and modified river channels, and flow has been significantly altered by a series of regulated locks and dams. The CAWS was created to drain urban runoff, treated wastewater and support commercial navigation. The heavily human-

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dominated nature of this waterway and the attendant stressors that shape the aquatic ecosystem will not change. Until the stressors causing the beneficial use impairments are reduced significantly, there will be ongoing risks to the aquatic biota and to humans that consume fish in the CAWS and Des Plaines River.

The Upper Dresden Pool ("UDP") area just like many areas in the Des Plaines watershed has multiple causes and sources of use impairment. Dominant stressors for the UDP include contaminated sediments, metals, nutrients, synthetic organics (e.g., pesticides, carcinogenic polycyclic aromatic hydrocarbons ("PAHs"), pharmaceuticals and personal care products ("PPCPs")), and flow regime alteration and degraded habitats. The lower area of Hickory Creek, nearest to the Brandon tailwaters, does not support aquatic life or primary recreation uses due to impairments such as fecal coliforms, chloride, alteration to streamside or littoral vegetation, flow alterations, sedimentation/siltation, total dissolved and suspended solids, zinc, nitrogen, phosphorus and algae. It is important to understand that with many urbanized watersheds, such as the Des Plaines, the removal of one stressor alone will not be sufficient to restore a watershed to beneficial use attainment.

2. Wet Weather Impacts In The UIW Are Significant And Will Continue To Cause Significant Loadings From Sewage And Other Contaminants.

Although water quality in the UIW has improved somewhat since the 1970s, there is no documented evidence of significant improvement in beneficial use attainment. Despite reductions of untreated discharges of sewage from the Metropolitan Water Reclamation District of Greater Chicago's ("MWRDGC") tunnel and reservoir plan ("TARP"), significant loadings of raw sewage with associated solids, nutrients and chemical contaminants will continue into the foreseeable future. In addition, significant loadings and associated pollutants from both urban

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characterization. The extensive EA 2008 Sediment Survey conducted this past May (2008) documented exceedances of sediment guidelines for metals, PAHs and PCBs at almost every sample location. Table 11 of the 2008 Sediment Survey provides a comparison of sediment concentrations for organics and metals for samples collected this year with those collected by me in 1994 and 1995. The organic contaminants for the vast majority of sediments sampled between 1994 and 2008 in the UIW (CSSC to the Dresden Pool) exceed sediment quality guidelines ("SQGs") for probable adverse biological effects. The fact that both the Upper Dresden and the Lower Brandon Pools had high concentrations of both metals and organic constituents indicates that large portions of these pools are of poor sediment quality and include the higher quality habitats of the Brandon Lock & Dam tailwaters.

Although some of the sediment contamination of the Des Plaines River is attributable to historical discharges and human activities, much of it is on-going and will continue to persist due to the existing point and nonpoint sources discussed above. There are no known plans to remove contaminated sediments in the UDP area. Such a removal would be one of the largest in the United States, likely costing hundreds of millions of dollars due to the spatial extent of the extreme contamination. However, even the removal of significantly contaminated and acutely toxic sediments from depositional areas identified would only provide temporary improvement, as the continued loadings of a broad array of chemicals from point and nonpoint sources would result in the re-accumulation of contaminated sediments. Further, the fact that the 2008 Sediment Survey reveals highly contaminated sediments similar to what I observed in the mid-90's, strongly suggests that depositional sediments remain significantly degraded and are not

¹ SQGs are commonly accepted benchmarks and have been widely used in the U.S. for many years to establish "clean-up" levels for federal and state remediation activities and to determine which sediments are toxic and thus represent a threat to aquatic biota.

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being reduced, contrary to the Illinois EPA's assumption that sediment quality in the CSSC and UDP is improving.

Based on my experience, most depositional sediments that are acutely toxic are located in areas suitable as fish habitat, not in high current areas, such as the main channel. Indeed, the prime habitat for spawning in this study area are the shallow waters below Brandon Lock & Dam where sediments are contaminated and exceed sediment quality guidelines. Shallow waters, including those throughout the UIW, are prone to a phenomenon known as photoinduced-toxicity due to the presence of even ug/L (ppb) levels of PAHs, which is toxic to zooplankton, benthic macroinvertebrates, fish and amphibians in surficial layers of waters. In addition to photoinduced PAH toxicity in overlying waters, the concentrations of PAHs found in the sediments (parts per million) are high enough to cause acute toxicity without UV stimulation and exceed Probable Effect Concentrations ("PECs") by up to 30-fold.

A recent study by the U.S. Geological Survey ("USGS") found that total PAHs in the sediments of the Upper Illinois River Basin are among the highest for sites nationwide, and nearby sites in Western Springs and Riverside, tributaries upstream from the UDP, are among the highest 5% in the nation, exceeding probable effect levels for adverse effects on aquatic life. The USGS study also revealed that concentrations of DDT, PCBs, methyl mercury, and dieldrin in fish and sediments in the Upper Des Plaines and its tributaries are among the highest concentrations observed nationwide. The USGS findings are consisting with the results of the 2008 Sediment Survey, which revealed significant concentrations of PAHs throughout the Dresden and Lower Brandon Pools. *See* Tables 7 – 10, 2008 Sediment Survey.

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4. Suspended Sediments And Turbidity Are Significant Stressors.

Studies have shown that turbidity is a major stressor in both the CSSC and the UDP. Turbidity is due to eroded soils and resuspended sediments, both of which contribute during high flow events. Turbidity during low flow events is primarily a result of resuspension of bedded sediments, which in the UIW often occurs from barge traffic. A study that I conducted in 1998 showed that *Ceriodaphnia dubia* survival was affected by turbidity. As well, filter feeding zooplankton are known to be sensitive to suspended solids at levels of 50-100 mg/L (*e.g.*, IEQ 1995). This dominant stressor of the UIW, aggravated by barge and navigation traffic, is likely to impact zooplankton populations throughout the waterway.

5. Nutrient Enrichment And Ammonia Are Significant Stressors.

Nutrients, such as nitrogen and phosphorus, are a common pollutant of human dominated watersheds, disrupting aquatic ecosystems by increasing biological productivity, leading to increased bacterial respiration (and thus anoxia), increased algae and nuisance weeds, and thus a switch to less desirable fish and invertebrate species. Nutrient loading from sources such as municipal sewage and agricultural runoff contribute to eutrophic conditions, impair beneficial uses, and reduce oxygen levels that favor pollution tolerant species. As documented in the Lower Des Plaines UAA Report and elsewhere, the waters of the UIW from above Chicago through the Dresden Pool exhibit high levels of nitrogen and phosphorus. When nitrogen is elevated, another stressor of particular concern is ammonia, which can be particularly toxic to certain aquatic species. In fact, studies have found ammonia to be a primary sediment stressor in the UIW and Brandon Pool area, and it is significantly correlated with sediment acute toxicity, particle size and organic contaminants.

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Recent USGS studies have documented phosphorus concentrations exceeding U.S. EPA desired goals to prevent excessive growth of algae and other nuisance plants in every water sample collected from urban or mixed land-use watersheds in the UIW. These studies have also found the concentration of ammonia in the CSSC at Romeoville as the highest measured in the Upper Illinois River Basin, the fourth highest of 109 streams and rivers measured nationwide by the USGS, and among the highest in the Mississippi River basin. The USGS has attributed the primary degradation of the UIW to elevated concentrations of ammonia and phosphorus, and the presence of organic wastewater contaminants such as disinfectants, pharmaceuticals and steroids, insecticides, and organochlorines. These USGS studies also found that water quality conditions in the UIW have resulted in decreased numbers and diversity of pollution-sensitive species of fish and benthic invertebrates.

6. Municipal Wastewater Plants Will Continue To Discharge Endocrine Disruptors And Other Emerging Contaminants.

The UIW and the UDP are also adversely impacted by organic compounds collectively referred to as "emerging contaminants," which include endocrine-disrupting compounds (EDCs) found in many pharmaceutical and personal care products (PPCPs) and veterinarian and livestock operations. Numerous studies have found that fish downstream of municipal wastewaters suffer from exposures to estrogenic chemicals with extreme reproductive disruption and feminization.

Recent studies by U.S. EPA of effluent dominated streams and other water bodies, including the North Shore Channel in Chicago, identified numerous pharmaceutical compounds in fish tissues, of which antihistamines and antidepressants were most frequent. A recent lake study conducted in Canada found that fish exposed to levels commonly found in both untreated

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and treated municipal wastewaters (5-6 ng/L) resulted in feminization of males and ultimately a near extinction of the fathead minnow species from the lake. Other studies, including segments of the Potomac River Basin, where 80 to 100% of the male smallmouth bass are intersex, have identified EDCs at concentrations significantly in excess of those that can result in male feminization. These finding are of serious concern for the sustainability of wild fish populations in waterways receiving municipal wastewaters, such as the UIW.

7. The Illinois EPA Has Never Identified Temperature As A Limiting Factor To Attainment of Beneficial Uses.

As noted earlier, despite the many causes of impairment to the Des Plaines River, thermal modification has never been identified by the Illinois EPA as a cause of impairment. While temperature in some cases can be a stressor, studies have shown that warm and cold temperatures can be both advantageous and detrimental to aquatic biota. Although it was not discussed in the Lower Des Plaines River UAA Report (hereafter referred to as the "LDR UAA Report"), another concern regarding temperature is that there are winter maximum temperatures which are impacted by municipal wastewater effluents and may impede some fish reproductive processes. The sections of the LDR UAA Report titled "Selection of the Temperature Standard" and "Critique of the Current Secondary Contact and Indigenous Aquatic Life Standard" contain inaccurate statements regarding temperature effects on riverine species and ecosystem processes. High and low temperatures may or may not be detrimental to aquatic life that reside in the UIW. The authors of the LDR UAA Report incorrectly imply and over-generalize that high temperatures are always detrimental. Moreover, as discussed below, the LDR UAA Report inaccurately presents my prior work on the UIW in several ways. Contrary to the LDR UAA Report, there is no simple relationship between temperature and aquatic toxicity. Both low and

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high temperatures can increase and decrease toxicity due to exposures from other chemical stressors, such as those found in the UIW. Toxicity is dependent upon species, presence of other toxicants, toxicant type and concentration. The LDR UAA Report's over-simplification that high temperatures increase toxicity is simply incorrect and misleading. Nitrification is also inhibited by cold temperatures and ammonia is not always consumed in the upper sediment layers. Nitrification, which is the biological oxidation of ammonia, is very sensitive to toxicants, which abound in the UIW's depositional sediments.

The former study that I directed while at Wright State University (the "Wright State Study") did not attempt to establish temperature limits for the UIW. The LDR UAA Report's discussion of the Wright State Study is misleading, leaving out key portions of the conclusions and misinterpreting others. The Wright State Study findings substantiated previous studies by my laboratory and others. These key findings documented that acute toxicity exists in short-term exposures for multiple species in waters and sediments of the UIW without any water temperature elevation. Toxic sediments abound in most tributary mouth, tailwater, and pool depositional areas, which generally provide better habitats for fish. These same habitats are typically shallow waters which are subject to rapid mortality as a result of photoinduced toxicity of PAHs, as discussed above. Both cold and hot temperatures accentuate toxicity originating from UIW waters and sediments. Statistically significant correlations between sediment ammonia and fluorene concentrations and toxicity were also observed. Ammonia was also significantly correlated to depositional sediments and the presence of high concentrations of organics. These correlations were based on sediment data collected from throughout the UIW. Outside the thermal discharge plume, temperature was not observed as a factor of in situ toxicity.

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The laboratory toxicity test results produced by the Wright State Study further document the role of sediment toxicity and how it increases in the presence of temperature extremes. The Toxicity Identification Evaluation Phase I experiments further substantiate the findings of the Chemical Screening Risk Assessment and the ammonia correlations with toxicity, suggesting that ammonia is a primary system stressor to benthic and epibenthic species. However, these seven day, static renewal experiments do not adequately mimic dynamic, *in situ* conditions where light, temperature, turbidity, water quality and food conditions change over minutes to hours. The most reliable indicator of *in situ* conditions are the indigenous communities actually present in the waterway. These are the most reliable data for evaluations of thermal impacts.

8. Several UAA Factors Are Met, Based On Severity And Prevalence Of Sediment Contamination And Continued Chemical And Biological Stressors From Human Dominated Activities.

Based on my professional opinion, at least three of the six UAA Factors set forth at 40 C.F.R. 131.10 apply in the present case, demonstrating that the UIW (including the CSSC and UDP) does not meet CWA aquatic life goals. I did not evalute UAA Factor 2, as flow alterations were not part of my evaluation. Moreover, it is my opinion that it is not feasible to correct these factors or limitations sufficient to attain CWA goals.² The application of these three UAA Factors does not support the upgrading of use designations under the Proposed UAA Rules. Moreover, under U.S. EPA's rules, a determination that any one of these Factors applies would support the downgrading of the use designations. The UAA factors that apply include:

<u>Factor 3</u>. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave

² An evaluation of the potential applicability of the other UAA Factors, such as Factor 2 related to flow conditions, was outside the scope of my review.

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in place. Human caused conditions or sources of pollution prevent both the CSSC and the Lower Des Plaines River from attaining the Clean Water Act's aquatic life goals. It is the primary reason supporting not upgrading the use designation for either waterway to Clean Water Act "fishable" use designations. The evidence of excessive impairments is clear from the results of sediment surveys, including the 2008 Sediment Survey. A multitude of physical and chemical impairment causes and sources exist throughout the watershed as discussed and documented above. The sources will not be removed due to the human dominated nature of the watershed and the connectivity between the UDP and the UIW. In-situ remediation of contaminated sediments would likely cost hundreds of millions of dollars or more based on the costs of remediating other similar systems.

Factor 4. Dams, diversions or other hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original conditions or to operate such modifications in a way that would result in the attainment of the use. The UIW habitat is heavily and permanently modified. Barge traffic is a major protected use and will continue to result in degraded habitat and resuspended contaminated sediments.

Factor 5. Physical conditions associated with the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to quality preclude attainment of aquatic life protection uses. The rationale for Factor 4 above applies here as well. Due to the many stressors, habitat is of poor quality throughout most of the UIW and cannot be feasibly corrected.

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Conclusion

The rationales used and conclusions reached by the Illinois EPA to support its Proposed UAA Rules are in my view detrimentally flawed. Illinois EPA's presentation of data, data interpretation, and supporting statements are often biased, and fail to provide a scientificallybalanced representation of previous UIW studies, peer-reviewed literature, and accepted approaches that reflect state-of-the-science. Multiple lines of evidence clearly establish that the CSSC, as well as the UDP, is a highly modified, effluent-dominated waterway that receives massive amounts of pollutants from various regulated and unregulated discharges and is generally poor habitat. Acute toxicity of water and sediments, unrelated to temperature, is and will remain a major limitation on the potential of this water body to achieve CWA aquatic life goals. Major nonpoint source loadings of solids, nutrients, metals, and organics will continue from growing urban areas, sewers, construction, and agriculture in this human-dominated watershed and therefore will continue to contaminate waters, sediments, and the food of aquatic biota throughout the UIW. Modified and limited habitats (channelization, barge traffic, lock and dams), extreme turbidity and siltation, and stressor loadings will not improve in the foreseeable future and will continue to dominate water quality conditions and use impairments. Consequently, development of new, modified standards, including thermal standards, will not address the key issue of excessive and pervasive pollution sources, excessive use impairments and limited habitats in this watershed.

Thank for the opportunity to testify before the Board.

BY: _____

G. Allen Burton, Ph.D.

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Attachment 1

Review of the Illinois EPA Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code Parts 301, 302, 303, and 304

Review of the Illinois EPA Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm.Code Parts 301, 302, 303 and 304.

by

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September 4, 2008

Table of Contents

	<u>Section</u>	<u>Page</u>
1.	Introduction	
2.	Overview of The Des Plaines Watershed	2
3.	Wet Weather Impacts	5
4.	Sediment Quality	7
	Suspended Sediments	
6.	Nutrients	14
	Emerging Contaminants	
8.	Temperature	16
9.	UAA Factors	17
10.	Conclusions	18
11.	References Cited	

Appendices

Appendix A: Resume

Appendix B: Land use and recent development in

the Des Plaines watershed

Appendix C: EA Engineering, Science, and Technology

Report on sediment chemistry

I. Introduction

I have been asked by Midwest Generation to review and comment on the Illinois EPA Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35Ill. Adm. Code Parts 301, 302, 303 and 304 (the "Proposed UAA Rules") and supporting documentation provided to the Illinois Pollution Control Board (the "IPCB") in the rule-making docketed as R08-09.

In the mid-1990's, I lead evaluations of sediment quality on the Des Plaines River for Commonwealth Edison in support of the Upper Illinois Waterway (UIW) Task Force process (Burton, 1995, 1998; Burton and Brown 1995). These studies involved evaluations of sediment contamination and toxicity on the upper ~55 miles of the UIW, reviews of the literature on temperature, turbidity and barge traffic effects, in situ toxicity evaluations around the Joliet power stations, and laboratory evaluations of temperature effects. My area of expertise is in the evaluation of freshwater ecosystem stressor effects, particularly focusing on the role of sediment and storm water quality (Appendix A). Therefore, this review deals with the stressors in the UIW, their role in biological impairment, and interrelationships with other key watershed factors.

Effective management of aquatic ecosystem quality requires a comprehensive, watershed based framework, because upstream inputs affect downstream ecosystems. This process is well understood and was the foundation for the U.S. EPA's TMDL approach. Each aquatic ecosystem is both unique and complex. Protective management approaches such as NPDES permit limits, water and sediment quality standards, and Best Management Practices have numerous assumptions and uncertainties that confound the ability to ensure they are effective. Determining what will be effective requires an interdisciplinary approach and understanding of how dominant physical, chemical and biological factors interact. This dictates that state-of-thescience approaches be used that generate an adequate level of quality data and that the associated uncertainties and assumptions be clearly understood and stated. The current consensus is that reliable "weight-of-evidence" based approaches are necessary in environmental quality assessments, providing for sound decision-making (e.g., Burton et al. 2002ab; Wenning et al. 2005, USEPA 2000). These approaches should characterize and link the key "exposure" (i.e., stressor) components with indigenous biological "effect" components using reliable, peerreviewed, and quantitative approaches where reference conditions, dominant stressors (including their spatial and temporal patterns), and, finally, associated risk is clearly defined. Unfortunately, this important process has not been followed in the supporting documentation for the Proposed UAA Rules, as explained below.

II. Overview of the Des Plaines Watershed and its Impairments

A wealth of information exists on the Des Plaines River and its watershed. It is clearly a watershed that is heavily dominated by human activities, with no pristine waters. It drains nearly 855,000 acres in Lake, Cook, DuPage and Will counties (Appendix B). The majority of Chicago's metropolitan area drains into the Des Plaines River and its tributaries. Much of the current data has been summarized by the Illinois EPA (IEPA 2004, 2008). This humandominated watershed is characterized primarily by urban and agricultural land uses (AquaNova

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& Hey 2003; CDM 2007; Groschen et al. 2004). The river is effluent dominated, receiving municipal wastewaters from many cities, including the 3rd largest in the nation. Municipal wastewater constitutes more than 70% of the flow during low flow periods (CDM 2007 -Attachment B to Illinois EPA Statement of Reasons). The Illinois EPA 2004 303(d) List report on Illinois water quality for 2004 identified a large number of possible causes of beneficial use impairment in this system (IEPA 2004). The 2004 303(d) List included the following list of causes of impairments: organic chemicals, nutrients, metals, pathogens, ammonia, sedimentation/siltation, total dissolved and suspended solids, chlorides, flow alterations, dissolved oxygen, flow and habitat alteration, combined sewer overflow, urban runoff/storm sewers, and fish consumption advisories. Surprisingly, in the Illinois EPA 2008 Integrated Water Quality Report and Section 303(d) List, Final Draft dated June 30, 2008, many of the 2004 303(d) List causes and sources of impairment were deleted from this most recent Illinois EPA report (IEPA 2008). While the Illinois EPA's reasons for deleting certain of the 2004-listed causes and sources of impairments are not explained in the 2008 Final Draft Integrated Report, some of its reasons are provided and show that the deletion of the causes and sources of impairments is not due to their having ceased being impairments to the system. Rather, these deletions are due to changes in the "criteria" that the Illinois EPA uses to identify such impairments. For example, with respect to total nitrogen and dissolved oxygen causes of impairments, the Illinois EPA states:

We have stopped using total nitrogen, as a cause of impairment for aquatic life use. Total nitrogen appeared as nitrogen (total) on previous 303(d) lists. We do not have a standard for total nitrogen related to aquatic life. In streams, we typically do not have total nitrogen data. The methods, criteria and the manner in which nitrogen was reported as a cause of impairment of aquatic life use have changed many times over previous assessment cycles. These criteria had never been shown to be related to aquatic life use impairment in any scientific study and had never been used or proposed as water quality standards. Illinois now believes that the criteria by which it placed total nitrogen on previous 303(d) lists were not scientifically valid. Illinois does not believe that a scientifically valid criterion currently exists for determining when nitrogen is causing an impairment of aquatic life use in this state.

Dissolved oxygen (which is a cause of impairment used to indicate low dissolved oxygen) has been changed from a pollutant to a nonpollutant cause of impairment. Although low dissolved oxygen may be caused by pollutants, the impairment does not result from the discharge of dissolved oxygen into the water. Furthermore, federal regulations in CWA Section 502(6) do not define dissolved oxygen or low dissolved oxygen as a pollutant. Because only pollutant causes of impairment appear on the 303(d) List this means that all entries of dissolved oxygen have been delisted.

Thus, while the Illinois EPA's 2008 draft list of causes and sources of impairments may be shorter than the UIW 2004 list of impairments, it does not appear to reflect any real improvements in the quality of the subject waterway.

The quality of the Des Plaines River ranks among the worst in the state (and likely the nation), in number of impaired reaches (USEPA 303d Fact Sheet). Every reach of the Des Plaines River reported in the Illinois EPA 2008 Integrated Report had multiple causes (i.e., stressors) and sources that contributed to non-attainment of beneficial uses. (In the 2004 303(d) List, a total of more than 800 causes and sources of impairments were identified). Of the Illinois EPAidentified impairments, the most common sources of impairment on many reaches are municipal point sources, contaminated sediments, channelization, flow regulation, hydro-modification, combined sewer overflow (CSO), and urban runoff/storm sewers. In the Illinois EPA 2002 305b Report, "thermal modification" was listed as a possible cause of impairment, although it was not identified as a stressor for the Des Plaines River in 2002. The more recent Illinois EPA 2004, 2006 and 2008, Integrated 305b/303d reports do not list thermal modification as a possible cause of impairment in the Des Plaines River. The Upper Dresden Pool (UDP) area has multiple causes and sources of use impairment identified by the Illinois EPA (Appendix B-1 of IEPA 2006 305(b) Report). The causes include: DDT, flow regime alterations, phosphorus, mercury, PCBs, total suspended solids, and sedimentation/siltation. The sources of impairment identified include: urban runoff, municipal point sources, contaminated sediments, and impacts from hydrostructure/flow regulation/modification.

The upper part of the UIW is known as the Chicago Area Waterway System (CAWS) consisting of 78 miles of man-made canals and modified river channels. These were created to drain urban runoff, treated wastewater and support commercial navigation (CDM 2007). All of this artificial and modified system is further altered by five structures (i.e., engineered locks) that control flow. With no high quality habitat and the continual presence of contaminants that spike to high levels during periodic events, no pollution sensitive aquatic life is expected. Unfortunately, water flows downstream and the contaminants identified as causes of impairment also travel great distances affecting downstream areas. Indeed, the growing incidence of hypoxia in the Gulf of Mexico is largely due to nitrogen inputs from agricultural runoff in the upper Midwest (e.g., Scavia and Donnelly 2007), while the UDP area is only a few miles downstream of the CAWS. The Illinois EPA has found the Chicago Sanitary and Ship Canal (CSSC) has 7 causes of impairments originating from 8 major source categories (IEPA 2006, 2008). Because most of the water (approximately 70%) is municipal wastewater effluent (with additional contributions from urban runoff) it contains significant loadings of stressors that will impact the lower reaches. In addition, the flow alterations upstream will impact downstream flows. Some of the stressors are more likely to be transported long distances downstream, such as fine solids, metals, and the more problematic organic chemicals (such as, larger polycyclic aromatic hydrocarbons, pyrethroid and chlorinated pesticides). This is evidenced by the high levels of contaminants in depositional sediments in the UDP, as discussed further below.

Further downstream from the CSSC, there are four significant tributaries that empty into the upper Des Plaines River. Each of these key tributaries provide the potential for a refuge for fish from the Des Plaines, a source of aquatic life, and correspondingly a source of pollution. Unfortunately, these waterways have several causes and sources of impairment. Hickory Creek

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discharges directly into the Brandon Road Lock & Dam tailwaters which have good quality habitat. However, according to the Illinois EPA's Integrated Reports, the lower areas nearest to the Brandon tailwaters (GG02 and 06) do not support aquatic life or primary recreation uses due to the following impairments: fecal coliforms, chloride, alteration to streamside or littoral vegetation, flow alterations, sedimentation/siltation, total dissolved and suspended solids, zinc, nitrogen, phosphorus and algae. The sources of these 11 causes of impairments are thought to be combined sewer overflows, municipal point source discharges, urban runoff, channelization, flow regulation structures and land development (IEPA 2006, 2008). Grant Creek does not support aquatic life due to unknown impairment sources (IEAP 2006, 2008). Jackson Creek does not support aquatic life due to altered flow, phosphorus and aquatic plants (IEPA 2006, 2008). Finally, DuPage River segments do not support aquatic life, fish consumption and primary contact beneficial uses due to altered flow, sedimentation/siltation, silver, phosphorus, aquatic plants, PCBs, chloride, DDT, hexachlorobenzene, nitrogen, fecal coliforms, and dissolved oxygen. These 12 causes of impairment were stated to originate from 6 sources, including hydrostructures, land development, upstream impoundments, urban runoff, municipal point sources, and contaminated sediments (IEPA 2006, 2008) which are documented to be accumulating at the mouth of the DuPage River in the Des Plaines River (see below).

The high degree of impairment and the multiple causes and sources are to be expected, based on the dominance of human activities and the limited nonpoint source runoff controls in the watershed. In fact, these dominant stressors and the resulting biological impairments are similar to other waterways that are human dominated (e.g., Burton et al. 2000; Burton and Pitt 2001).

The unique, human-dominated nature of this watershed makes the critically important issue of reference waterway selection difficult. The reality is that the Des Plaines watershed is one of the most heavily human-dominated waterways in the nation. This will not change. While the quality of the Des Plaines can be improved via a comprehensive watershed management program, it will always be a heavily modified waterway. Until the stressors that dominate as causes of the beneficial use impairments (identified above) are reduced significantly, there will be risks to the aquatic biota and to humans that consume fish and recreate in the UDP.

In the following discussion, evidence will be presented that supports the findings of the recent Illinois EPA 305(b) Reports on the primary causes of beneficial use impairments in the UDP and why these stressors and impairments will persist in the foreseeable future. These dominant stressors include: contaminated sediments, metals, synthetic organic chemicals (including pesticides, PAHs and pharmaceuticals and personal care products (PPCPs), nutrients, flow regime alteration and degraded habitats. Unless the great majority of these stressors (and their sources) are removed, the CSSC and UDP will continue to be impaired.

III. Wet Weather Impacts in the UIW

While water quality in the UIW has improved since the 1970s, the recent Illinois EPA 305(b) Reports found no significant changes in beneficial use attainment. This is despite the MWRDGC improvements (including TARP) to reduce the impacts from wet weather events to the waterway. The lack of improvement is likely the result of two key factors. First, there will

be continuing, significant inputs from many large CSOs (Appendix B) that provide large loadings of raw sewage with associated solids, nutrients and chemical contaminants. Based on MWRDGC data, during the period from January 1, 2007 through August 6, 2008, there were 117 CSO events at 4 major CSO stations (www.mwrdgc.dst.il.us/CSO/display only.aspx). Second, there will continue to be significant nonpoint source inputs from both urban and, to a lesser extent, agricultural runoff given the nature of the watershed and its continued development (Appendix B). A press release by the University of Illinois –Urbana Champaign (August 1, 2007) reported that "flood peaks in the Chicago metropolitan area are higher than they used to be, and they are also higher than estimates currently used by water managers, according to an Illinois-Indiana Sea Grant study....the steady increase in flood discharges in small streams over the past 100 years is due to increases in urbanization and precipitation, with urbanization playing the major role...Between 1954 and 1999, urbanization, on average, increased from about 11 percent to 52 percent in the 12 Chicago watersheds... the 10 largest historical storms have occurred since 1950, and these storms were much larger than any in the previous 50 years." These urbanization trends are also reflected in data through 2006 shown in Appendix B, showing changes in land use, development, population, and housing from the USGS, Chicago Metropolitan Agency for Planning, and U.S. Census Bureau. It is apparent that the Des Plaines watershed's trait of being human dominated is increasing steadily with time and will likely continue long-term, despite the recent economic slow-down. This finding is also reflected in the recent comprehensive USGS study and US Census Bureau data (Groschen et al 2004). Growth has been greatest in the counties surrounding Chicago (ranging from 14 to 42 percent: Du Page 16%, Grundy 25%, Lake 25%, Kane 27%, Kendall 38%, McHenry 42%, Will 41%).

Agricultural runoff is contributing four groups of stressors: clay/silt sediments, nutrients (from fertilizers and livestock), metals (a common contaminant of fertilizers), pathogens (from livestock), pesticides, and pharmaceuticals (from livestock). The recently banned insecticide Diazinon (toxic in the part per trillion range) is still being marketed and used. It was frequently found in the Des Plaines River watershed (93% of samples). In agricultural parts of the watershed, Atrazine was found in every sample (Groschen *et al.* 2004).

While the recent and near-future improvements from TARP are noteworthy, this will continue to be a highly impacted waterway, being effluent-dominated and receiving large amounts of untreated nonpoint source (NPS) runoff containing a wide range of nutrients, pathogens, metals, petroleum products, "new-age" pesticides and pharmaceutical and personal care products (PPCP) which are often referred to as emerging contaminants. Many of these chemicals are known to be toxic at the part-per-trillion level and/or hormone disruptors (Burton and Pitt 2001; Burton et al. 2000). Urban and agricultural storm waters in streams are often acutely toxic (Burton et al. 2000; Burton and Pitt 2001; Hatch and Burton 1999; Tucker and Burton 1999). In addition to the chemicals, solids erode from urban, construction and agricultural lands and constitute the number one pollutant of river systems (USEPA 2002; Burton and Pitt 2001). Many of the above stressors have been identified by the Illinois EPA as the primary causes of impairment on the Des Plaines (IEPA 2004, 2006, 2008); the others are known to be common in human-dominated waterways as discussed above and below.

The above NPS inputs will continue for many years, likely decades, and will continue to adversely impact the downstream ecosystems. The sheer magnitude of urbanization and

agriculture in the watershed (Appendix B) and lack of effective NPS controls dictates that NPS-related degradation will be the dominant source of impairment for the foreseeable future. This is not surprising, because NPS runoff is the leading cause of water quality problems in the U.S. (USEPA 2002).

IV. Sediment Quality

It is well known that chemicals (nutrients, synthetic organics and metals) and pathogens tend to associate with solids due to polar and non-polar binding affinities (Burton 1992). Therefore, those sediments that have greatest surface areas (clays, silts, colloids) will accumulate the greatest concentrations, and thus serve as both a sink and a source of contamination. Indeed, contaminated sediments are the cause of use impairment of 41 of 42 Great Lakes Areas of Concern and the dominant cause for Superfund site designation in our waterways. Depositional sediments are not stationary and continue to contaminate resident organisms and downstream waters via common fate processes, such as resuspension, advection, bioturbation and diffusion. All of these fate processes exist on the Des Plaines River and vary spatially and temporally. In cases, for example, where overlying water quality may be relatively good (i.e., meet water quality standards), contaminant concentrations will steadily increase in depositional sediments and provide an environment for bioaccumulation in benthic organisms (e.g., Burton et al. 1992; Wenning et al. 2005). The U.S. Environmental Protection Agency (USEPA) has shown dramatic correlations between fish tissue consumption advisories and the levels of sediment contamination. On the Des Plaines, most of the reaches assessed in the Illinois EPA 305(b) Reports have fish consumption advisories and the levels of mercury and PCBs found in sediments suggest a substantial risk exists to those consuming fish from the Des Plaines River.

There have been several studies of sediment chemical contamination and toxicity in the UIW, from the CSSC downstream through the Dresden Pool since the 1990s (Burton *et al.* 1995; Groschen *et al.* 2004; MWRDGC 2008, EA Engineering, Science, and Technology 2008). The most recent study by EA (2008) was conducted in the Dresden Pool and the lower portion of the Brandon Pool between May 6 -9, 2008. This extensive physical and chemical survey included 35 sediment samples (31 in the Dresden Pool and four in the Lower Brandon Pool). Analyses included total organic carbon, total solids (percent moisture), grain size (sieve and hydrometer), arsenic, silver, cadmium, chromium, copper, lead, mercury, nickel, zinc, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCB congeners).

These studies have documented that the depositional sediments (clays and silts) have been and continue to be severely contaminated with metals, synthetic organics and nutrients throughout the UIW (from northern Chicago to the Dresden Island Lock and Dam). The depositional sediments are often acutely or chronically toxic to benthic invertebrates (Table 1 below; Tables 9-11 Appendix C). All have shown typical high degrees of riverine spatial heterogeneity (*i.e.*, natural variation across the river and longitudinally). This high degree of spatial heterogeneity makes determinations of improvement through time extremely difficult. Indeed, high levels of sediment contamination and exceedances of internationally accepted sediment quality guidelines (SQGs) are as common now as in the early 1990s.

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Contamination of the Des Plaines River sediments is not only historical but is on-going due to the point and nonpoint sources discussed above. Nutrients, metals, pathogens and synthetic organics (primarily polycyclic aromatic hydrocarbons (PAHs) and new age pesticides such as pyrethroids) are common constituents today of both point and nonpoint source loadings in waterways such as the Des Plaines (Burton and Pitt 2002; USGS 1999). Although there are no known plans to dredge sediment locations in the UPD area, even the removal of significantly contaminated and acutely toxic sediments from depositional areas identified throughout the UIW (Burton 1995) would provide but a temporary improvement. The hydrologic conditions and continued point and nonpoint source loadings would eventually result in contaminated sediments re-accumulating because the myriad of sources will not be removed. The Illinois EPA-identified problems associated with TSS, siltation and contaminated sediments (IEPA 2004, 2008) suggest widespread watershed sources of these major stressors.

Indeed, sediment sampling in the UIW (CSSC to Dresden Island Lock and Dam) between 1994 and 2008 showed that the concentrations of organic contaminants in the depositional sediments of the UIW exceed widely used sediment quality guidelines (SQGs) for probable adverse biological effects (Appendix C) (Burton 1995, USEPA 2001, MWRDGC 2008, EA Engineering, Science, and Technology 2008). SQGs are widely used to determine which sediments are toxic and thus represent a threat to the aquatic biota (Wenning et al. 2005). They have been used in Superfund, RCRA and State investigations for many years and are frequently used to establish "clean-up" levels for remediation activities (Wenning et al. 2005). One of the biological-effects approaches that has been widely used to assess sediment quality relative to the potential for adverse effects on benthic organisms in freshwater ecosystems is the Threshold Effects Concentration (TEC)/Probable Effects Concentration (PEC) (MacDonald et al. 1996) approach. TECs typically represent concentrations below which adverse biological effects are not expected to occur, while PECs typically represent concentrations in the middle of the effects range and above which effects are expected to occur more often than not. (MacDonald et al. 2000).

Comparing the analytical results of sediment sampling to the SQGs, the Burton, U.S. EPA, and MWRDGC surveys all document that these sediments are highly contaminated and are likely to cause adverse biological effects (e.g., Buchman 1999; McDonald et al. 2000ab, Wenning et al. 2005). Recent studies by the MWRDGC (2007) and EA Engineering, Science, and Technology (2008) found that Brandon Road and both upper and lower Dresden Pool sediments continue to be highly contaminated with nutrients, cyanide, metals, and synthetic organic chemicals. Sediments from a majority of the sampling locations had both an odor and a sheen indicative of petroleum products.

A sediment survey was conducted in the Upper Dresden Pool and the lower portion of the Brandon Pool between May 6-9, 2008 by EA Engineering, Science & Technology ("EA 2008 Sediment Survey"). A copy of the report prepared by EA on the EA 2008 Sediment Survey is attached as Appendix C. In the EA 2008 Sediment Survey, 35 sediment samples, 31 in the Upper Dresden Pool and four in the Lower Brandon Pool, were collected for physical and chemical characterization. The physical composition of the sediment was determined by total organic carbon, total solids (percent moisture) and grain size (sieve and hydrometer) analysis.

The target analytes for identifying the chemical composition of the sediments included arsenic, silver, cadmium, chromium, copper, lead, mercury, nickel, zinc, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCB congeners). The extensive EA 2008 Sediment Survey conducted this past May (2008) documented exceedances of sediment guidelines for metals, PAHs and PCBs at almost every sample location (Tables 9 and 10, Appendix C). A majority of the sampling locations had both an odor and a sheen, both of which are indications of sediment contamination. (Appendix C at p. 10).

As explained in the EA 2008 Sediment Survey report (Appendix C at p. 9), one of the biological effects approaches that have been used to assess sediment quality relative to the potential for adverse effects on benthic organisms in freshwater ecosystems is the Threshold Effects Concentration (TEC)/Probable Effects Concentration (PEC) (MacDonald et al. 1996) approach. The TEC and PEC concentrations are sediment guidelines used to identify potential adverse biological effects associated with contaminated sediments. TECs typically represent concentrations below which adverse biological effects are not expected to occur, while PECs typically represent concentrations in the middle of the effects range and above which effects are expected to occur more often than not. (MacDonald et. al. 2000)

In the Lower Brandon Pool, metals concentrations of the sediments, with limited exceptions, exceeded the PEC values. The total PAH and PCB concentrations exceeded the PEC values in all four samples (Appendix C at p.11). In the UDP, concentrations of metals, PAHs and PCB congeners were elevated. Metals concentrations exceeded the PEC values at several locations. Total PAH concentrations exceeded PEC concentrations at 61% of the locations sampled (19 locations) and total PCB concentrations exceeded PEC values at 29% of the locations sampled (8 locations). (Figures 2 and 3, Appendix C). The fact that both the Upper Dresden and the Lower Brandon Pools had high concentrations of both metals and organic constituents indicates that large portions of these pools are of poor sediment quality. This includes the higher quality habitats of the Brandon Road Lock & Dam tailwaters.

Many of these areas had extremely high levels of sediment contamination, greatly exceeding SQGs. For example, at the lower end of the Dresden Pool, near Bay Hill Marina, 96% of the metal and organic SQGs were exceeded with 75% exceeding the PECs (Appendix C, Table 9); while upstream near the DuPage River, I-55 and Jackson Creek Dam (stations DR-13, 15, and 16) between 79 and 100% of the PECs were exceeded. Remarkably at DR-13 the PAH PEC was exceeded by nearly 30 fold and Benzo-a-pyrene (a potent human carcinogen) exceeded the PEC by 50-fold. All 35 stations exceeded the SQGs for total PAHs, showing pervasive and extreme sediment contamination indicative of urban-dominated watersheds. Of the 35 stations, 80% exceeded the PECs (up to 30-fold).

Because the U.S. EPA's 2001 sediment survey and recent surveys by MWRDGC (2007) and the EA 2008 Sediment Survey all found highly contaminated depositional sediments similar to the levels we found in the mid-90's UIW work (Burton 1995), it is likely that depositional sediments are not being cleaned out, capped, or significantly degraded. Further, contrary to statements made by Illinois EPA that sediment quality is improving, there are no reliable data establishing a trend of improving sediment quality. In fact, it appears that there has been no improvement in sediment contaminant levels, as evidenced by the recent 2008 EA Sediment Survey (Appendix

C). The 2008 EA Sediment Survey results were compared to the results of sediment sampling from the same study area in 1994-1995 (Burton 1995) and to metals data compiled previously by the MWRDGC (2007). Eighteen of the 1994-95 sediment study locations were re-sampled in the EA 2008 Sediment Survey. For the detected metals, the majority of the detected concentrations from the 2008 EA Sediment Survey are either higher or within a factor of two or less, indicating that overall, the sediment quality has remained the same or has degraded in several areas (see Table 11 to EA 2008 Sediment Study Report). A comparison of the results for PAHs and PCBs was more difficult because the 1994-95 study generally had higher detection limits than did the EA 2008 study. However, concentrations of both total PAHs and total PCBs were elevated in both studies, indicating no basis to support the Illinois EPA opinion that sediment quality is improving. The results indicate that sediment quality remains poor in both the Dresden and Brandon Pools.

As discussed above, surficial sediments are being routinely contaminated from urban, residential, transportation and agricultural runoff and a wide variety of small to large point sources. These sources will continue to contaminate the depositional sediments and, as these sediments are resuspended, they will continue to contaminate the more biologically sensitive and productive lower reaches of the UIW system along with the Brandon tailwaters and UDP.

The main channel of the UDP, a relatively well scoured area, contains large grained sediments that are non-toxic (Burton 1995). However, most depositional sediments showed acute toxicity and lie in the limited habitat areas for fish (Burton 1995). The main channel is not primary habitat and not suitable for spawning. Indeed, one of the prime habitat for spawning in this study area is the tail waters below Brandon Road Lock & Dam where sediments are contaminated (Burton 1995, EA 2008). PAH SQGs were exceeded and greatly exceed levels known to be acutely toxic to aquatic life, particularly in the presence of sunlight. These shallow areas allow for photoinduced-toxicity of low ug/L (ppb) levels of PAHs. The photoinduced PAHs will be toxic to zooplankton, benthic macroinvertebrates, fish and amphibians in surficial layers of waters throughout the UIW. This phenomenon is well established in the peer-reviewed literature (e.g., Hatch and Burton 1998, 1999; Ireland et al. 1996). Portions of the UIW have significant areas that are shallow (<1m depth) and thus subject to photoinduced PAH toxicity. In addition, the levels found in the sediments (parts per million) are high enough to cause acute toxicity without UV stimulation, with or without carbon loadings, based on accepted SQGs (EA 2008). Station DR-29 at the end of the tailwaters even exceeded the PEC guidelines.

A recent USGS study (Groschen et al. 2004) did an extensive water quality evaluation of the Upper Illinois River Basin. It found that total PAHs in the sediments of the upper Illinois River Basin were among the highest 25% of all sites nationwide and sites in Western Springs and Riverside were among the highest 5% of the nation, exceeding probable effect levels for adverse effects on aquatic life. The lowest concentrations at Milford were still ranked in the top 55% of the nation (Groschen et al. 2004). These PAH loadings originate from nonpoint sources and will not decline as there are no management practices in place to reduce these nonpoint source loadings. Sediment concentrations of total DDT, PAHs and PCBs were related to urban sources in the Chicago metropolitan area. Concentrations of DDD and DDT in Western Springs were among the top 3% nationwide and concentrations in fish increase being among the highest concentrations found nationwide. Methyl mercury concentrations in fish and sediment were also

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the highest nationwide on the Des Plaines at Russell. Fish in this system also have exceedingly high levels of PCBs, DDT and dieldrin in fish tissue. Cadmium and nickel have also been implicated as causing fish impairment. (See Groschen et al. 2004 for additional information.) These recent findings soundly document that this is one of the most (if not the most) impaired watersheds in the nation. The Illinois EPA has not considered the important results and findings of the USGS Study. These study results demonstrate that the Illinois EPA has ignored these multiple chemical stressors that should be taken into account in determining the use designations for the CSSC and the UDP.

11

TABLE 1. Sediment Quality Guideline Exceedances in Des Plaines River (Brandon Road Pool to Dresden Pool) in 2006 (MWRDGC 2007)

Station 2

Brandon Road Pool 290.5							
	Cd		Cu	Pb	Hg	Ni	Zn
Date	mg/Kg	Cr mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Oct-84	27	263	226	299	4.9	216	1595
Oct-85	NA	NA	NA	NA	NA	NA	NA
Oct-86	3	18	35	127	<0.1	65	246
Oct-87	NA	NA	NA	NA	NA	NA	NA
Oct-88	NA	NA	NA	NA	NA	NA	NA
Oct-89	17	185	192	290	1	80	870
Oct-90	5	50	78	254	0.03	52	340
Oct-91	38	323	234	336	2.3	86	1196
Oct-92	5.1	75	79	205	0.6	32	383
Oct-93	2	20	42	170	0.02	23	168
Oct-94	4	36	62	292	<0.1	40	190
Oct-95	3	40	71	280	0.2	34	280
Oct-96	3.6	146	60	223	0.5	39	290
Oct-99	2.5	65	66	236	<0.1	45	242
Oct-00	2	26	57	106	0.3	19	178
Oct-02	11.6	180	161	536	0.64	214	719
Oct-03	23.6	234	233	465	1.78	258	1124
Oct-04	16.7	189	313	439	0.93	221	961
Oct-05	10.4	155	213	469	0.21	184	902
Oct-06	1.3	26	21	211	0.71	420	166
Oct-07	1.1	24	78	295	0.11	46	138

Upper Dresden Island Station 5

Des Plaines River		Upper Dresden Island Pool		RM 285			
Sep-83	2.8	16	25	49	0.6	47	163
Oct-84	4	23	37	66	<0.1	66	199
Oct-85	7	37	39	100	0.2	66	311
Oct-86	1	NA S	NA	NA	<0.1	NA	NA
Oct-87	29	321	307	306	0.2	110	990
Oct-88	2	433	27	23	<0.1	40	170
Oct-89	10	93	81	154	0.6	70	540
Oct-90	4	55	19	51	<0.1	28	135
Oct-91	1	19	27	94	0.2	21	162
Oct-92	0.9	11	37	33	<0.1	18	107
Oct-93	2	15	14	28	<0.1	28	138
Oct-94	3	35	47	137	<0.1	40	200
Oct-95	5	72	74	101	0.3	36	383
Oct-96	2.2	106	51	77	0.4	28	215
Oct-99	1.1	31	27	70	0.5	27	149

Oct-00	0.5	19	23	180	<0.1	22	75
7-Oct-02	0.3	27	10	275	0.1	99	86
6-Oct-03	1.8	37	92	333	0.12	78	206
4-Oct-04	4.2	133	58	284	0.35	65	278
3-Oct-05	1.2	30	29	285	0.62	60	151
2-Oct-06	2.3	41	48	295	0.83	124	237
1-Oct-07	1.8	30	26	231	0.16	31	148

Station 8

		Dresden					
Des Plaines		Island Pool (to		RM			
River		Lock)		278			
Sep-83	5.1	32	46	67	3.4	63	309
Oct-84	4	28	38	38	0.1	73	262
Oct-85	3	23	20	32	0.2	53	253
Oct-86	5	41	69	132	0.3	42	300
Oct-87	3	25	21	45	0.1	50	220
Oct-88	48	10	430	15	6.9	110	1680
Oct-89	3	24	16	20	0.1	40	160
Oct-90	30	384	478	249	2.4	113	1747
Oct-91	1	29	91	284	2.6	26	375
Oct-92	7.6	90	99	101	0.7	36	494
Oct-93	5	61	66	226	0.5	42	474
Oct-94	6	60	84	102	0.1	40	380
Oct-95	3	49	62	74	0.2	46	399
Oct-96	17	211	158	217	3	44	784
Oct-99	2.5	41	44	82	0.7	40	322
Oct-00	5	65	82	105	0.5	30	407
7-Oct-02	1.4	50	38	361	0.39	47	219
6-Oct-03	1.5	30	20	290	0.19	34	201
4-Oct-04	0.8	28	37	226	0.13	22	110
3-Oct-05	6.3	98	135	546	0.67	118	555
2-Oct-06	2.2	35	38	385	1.97	64	222
1-Oct-07	5.7	84	104	530	0.85	103	474

	Cd	Cr	Cu	Pb	Hg	Ni	Zn	
Yellow = Threshold Effects Concentration	0.99	43.4	31.6	35.8	0.18	22.7	121	
Red =	WATER TO THE REAL PROPERTY.	Wardle/Clinating						
Probable		生力的是形态等。						
Effects								1
Concentration	5	111	149	128	1.1	49	459	100

V. Suspended Sediments in the CSSC and UDP

Prior studies have shown that turbidity has and continues to be a stressor in both the CSSC and the UDP. Turbidity is due to eroded soils and resuspended sediments, both of which contribute during high flow events. Turbidity during low flow events is primarily a result of resuspension of bedded sediments, which in the UIW often occurs from barge traffic. *Ceriodaphnia dubia* survival was adversely affected by turbidity (86-100% mortality) as would be expected (Burton 1995). Filter feeding zooplankton are known to be sensitive to suspended solids at levels of 50-100 mg/L (e.g., IEQ 1995). This dominant stressor of the UIW likely impacts zooplankton populations throughout the waterway and is aggravated by barge and navigation traffic.

VI. Nutrients

Nutrients are a common contaminant of human-dominated watersheds, disrupting aquatic ecosystems by increasing biological productivity, leading to increased bacterial respiration (thus anoxia), increased algae and nuisance weeds, and thus a switch to less desirable fish and invertebrate species. Nutrient rich waters become eutrophic, impair beneficial uses, and experience oxygen declines that favor pollution tolerant species. The waters of the UIW from above Chicago through the Dresden Pool have high levels of nitrogen and phosphorus (MWRDGC 2007). It is not until below Dresden Pool that levels drop significantly for nitrogen, ammonia, phosphorus and fecal coliforms. When nitrogen is elevated, a stressor of particular concern is ammonia. Ammonium is typically considered to be the ionic form, while the term ammonia is inclusive of both the ionic (dominant form) and unionized (NH₄OH) forms. The unionized form is more toxic to some species, such as rainbow trout, but not others (e.g., Hyalella azteca). The U.S. EPA is currently considering revising their ammonia criteria as recent evidence has found it is not protective of freshwater mussels and snails. Criteria continuous concentrations for chronic protection of unionid mussels were 0.3 to 1.0 mg/L (Augspurger et al. 2003). More than half the nearly 300 species of mussels are in decline in North America. These findings suggest that levels commonly found in the UIW are toxic and may explain their absence from the UDP.

Previous studies found ammonia to be a primary sediment stressor in the UIW and Brandon Pool area. It was significantly correlated with sediment acute toxicity, particle size and organic contaminants (Burton 1995; Groschen et al. 2004). The 1999-2001 USGS study found phosphorus concentrations exceeded U.S. EPA desired goals to prevent excessive growth of algae and other nuisance plants in every water sample collected from urban or mixed land-use watersheds in the UIW (Groschen et al. 2004). In the recent USGS study (Groschen et al. 2004) of the Upper Illinois River Basin, the flow-weighted mean of ammonia in the Chicago Sanitary and Ship Canal (CSSC) at Romeoville was the highest measured in the Upper Illinois River Basin, the fourth highest of 109 streams and rivers measured nationwide by the USGS, and among the highest in the Mississippi River basin. The USGS study findings state that the primary causes of degradation of the UIW are elevated concentrations of ammonia and phosphorus and the presence of organic wastewater contaminants such as disinfectants, pharmaceuticals and steroids, insecticides, and organochlorines. The USGS Study also found that these water quality conditions have resulted in decreased numbers and diversity of pollution-sensitive species of fish and benthic invertebrates.

Recently, environmental groups from states bordering the Mississippi River have filed a petition with the U.S. EPA to take aggressive action (including numeric nutrient limits) to address the growing problem of hypoxia in the Gulf of Mexico that originates from nutrient loadings. It is believed that nitrogen and phosphorus pollution alone prevents waters from attaining "fishable-swimmable" goals. Illinois is the largest contributor to the Gulf dead zone with 16.8% of the total nitrogen and 12.9% of the phosphorus. "Toxic algal blooms in Illinois have closed lakes to swimming and fishing and burdened water suppliers

14

with increased treatment costs. These blooms have killed livestock, pets and, tragically, a teenager in Wisconsin in 2002." (Environmental Lay & Policy Center 2008; National Research Council 2008). Despite the removal of nutrients by the Illinois EPA as a cause of impairment in its 2008 Integrated Report – it is obviously a major cause based on the above studies, and is not surprising given the high loadings from both point and nonpoint sources.

Toxicity Identification Evaluation (TIE) results (Lower Brandon Pool and Tailwaters) also suggested ammonia and PAHs as primary toxicants (Burton 1998). While ammonia is reduced by nitrification, this microbial process is greatly inhibited in undisturbed sediments because oxygen is typically low or absent (Wetzel 1983). So as long as there continues to be high loadings of natural organic compounds and suspended solids, there will be ideal environments in the UIW for ammonia production by heterotrophic bacteria. There are at least 3 lines of evidence (chemistry, TIE testing, laboratory toxicity tests) showing ammonia is a major stressor throughout the UIW.

VII. Emerging Contaminants

The term "emerging contaminants" has become common and refers to more recently identified organic compounds that have been found to be relatively common in the environment and are of concern because they accumulate in wildlife and humans, cause endocrine-hormone disruption resulting in loss of male species and population collapses (Ankley *et al.* 2007). Examples of these compounds include endocrine disrupting compounds (EDCs, such as 17 alpha-ethymylestradiol (EES) found in birth control pills), many pharmaceutical and personal care products (PPCPs) which have been identified often in waters below municipal wastewater outfalls and livestock operations, and some of the newer pesticides that have replaced banned pesticides in recent years. Numerous European and US studies have found that fish downstream of municipal wastewater plants suffer from exposures to estrogenic chemicals with extreme reproductive disruption and feminization (Vajda *et al.* 2008; http://toxics.usgs.gov/regional/emc/estrogenicity.html and http://toxics.usgs.gov/highlights/wastewater-fish.html).

A 1999-2000 nationwide survey (139 streams in 30 states) by the USGS of pharmaceuticals, hormones, and other organic wastewater contaminants focused on streams downstream of intense urbanization and livestock production. These compounds were found in 80% of the streams. The compounds originate from a wide range of residential, industrial and agricultural sources with 82 of the 95 analyzed being detected. The most frequently detected were coprostanol (fecal steroid), cholesterol (plant and animal steroid), N,N-diethytoluamide (insect repellant), caffeine, triclosan (antimicrobial disinfectant), tri(20chloroethyl) phosphate (fire retardant), and 4-nonylphenol (nonionic detergent metabolite) (Kolpin et al. 2002). Some of these compounds are noted EDCs. A survey was also conducted by the U.S. EPA in 2006 of 5 states in effluent dominated streams (Stahl et al. 2007). Eight of 24 pharmaceutical compounds were detected in fish tissues, of which antihistamines and antidepressants were most frequent. One of these sites was the North Shore Channel in Chicago where 24 largemouth bass were sampled

A more recent similar study was conducted by the USGS in the UIW. It found 5 of 45 compounds typically found in domestic and industrial wastewater in waters that drained more than 25% urban areas (Groschen *et al.* 2004).

A recent 7 year whole lake study in Canada exposed fish to levels commonly found in both untreated and treated municipal wastewaters (5-6 ng/L). The chronic exposure resulted in feminization of males and ultimately a near extinction of the fathead minnow species from the lake. This finding is of grave concern for the sustainability of wild fish populations in waterways receiving municipal wastewaters. Levels in the Potomac Basin stormwaters of 90-370 ng estradiol/L have been detected from agricultural areas.

Levels as low a 1 ng/L can result in male feminization (Jobling et al. 2006). In the Potomac Basin 80 to 100% of the male smallmouth bass are intersex (www.mawaterquality.org).

For purposes of the UAA waterways at issue, these studies have shown that urban waters, like the Chicago Area Waterway System and the Lower Des Plaines River, are impacted by these "emerging contaminants." This is particularly true of highly urbanized waters, like the Chicago Sanitary and Ship Canal and the Upper Dresden Pool, which are effluent-dominated. The presence of these emerging contaminants is another stressor that will adversely affect the aquatic community.

VIII. Temperature

It is noteworthy that thermal modifications have not been identified as one of the 23 impairment causes on the Des Plaines River (IEPA 2002, 2006, 2008). While temperature can certainly be a stressor, a literature review found that warm temperatures can be both advantageous and detrimental to aquatic biota (IEO 1995). Another concern not discussed in the Lower Des Plaines River UAA Report is that there are winter maximum temperatures which are impacted by municipal wastewater effluents and may impede some fish reproductive processes. The "Selection of the Temperature Standard" and "Critique of the Current Secondary Contact and Indigenous Aquatic Life Standard" sections have inaccurate statements regarding temperature effects on riverine species and ecosystem processes. High and low temperatures may or may not be detrimental to aquatic life that resides in the UIW. There is not a simple relationship, as noted from many past studies (e.g., Cairns et al. 1973; Cairns et al. 1978; review by Burton and Brown 1995). Both low and high temperatures can increase and decrease toxicity due to exposures from other chemical stressors, such as found in the UIW, and these relationships are both species and toxicant type and concentration dependent. The Lower Des Plaines River UAA Report's over-simplification that high temperatures increase toxicity is simply incorrect. Nitrification is also inhibited by cold temperatures and ammonia is not always consumed in the upper sediment layers. Nitrification is very sensitive to toxicants, which abound in the UIW's depositional sediments. As further discussed below, the authors of the Lower Des Plaines River UAA Report incorrectly imply and over-generalize that high temperatures are always detrimental.

One of the negative effects of high temperatures cited in the Lower Des Plaines River Report is the creation of blue green algae blooms in waterways. However, the authors fail to note that blue green algae are not a concern on the UIW due to its flow conditions. Toxic cyanobacterial blooms do not apply to the UIW, yet their presentation in the Lower Des Plaines River UAA Report implies that they do.

Similarly, the Lower Des Plaines River UAA Report also inaccurately presents my prior work on the UIW. On p. 2-97 of the Report, the subsection title is "Experiments by Wright University to Establish Temperature Limits". This study, which I directed while at Wright State University, did not attempt to establish temperature limits for the UIW (the "Wright State Study"). The UAA Report's discussion of the Wright State Study is misleading, leaving out key portions of the conclusions and misinterpreting others. The Wright State Study findings substantiated previous studies by my laboratory and others. The key findings documented that acute toxicity exists in short-term exposures for multiple species in waters and sediments of the UIW without any water temperature elevation. Toxic sediments abound in most tributary mouth, tailwater, and pool depositional areas, which include the better (but limited) habitats for fish. These same habitats are typically shallow waters which are subject to rapid mortality as a result of photoinduced toxicity of PAHs, as discussed above. Both cold and hot temperatures accentuated toxicity originating from UIW waters and sediments. Statistically significant correlations between sediment ammonia and fluorene concentrations and toxicity were observed. Ammonia was also significantly correlated to depositional sediments and the presence of high concentrations of organics. These

correlations were based on sediment data collected from throughout the UIW. *In situ* toxicity was not observed due to temperature outside the thermal discharge plume.

The laboratory toxicity test results produced by the Wright State Study further document the role of sediment toxicity and how it is increased in the presence of temperature extremes. The Toxicity Identification Evaluation Phase I experiments further substantiate the findings of the Chemical Screening Risk Assessment and the ammonia correlations with toxicity, suggesting that ammonia is a primary system stressor to benthic and epibenthic species. However, these 7 day, static renewal experiments do not adequately mimic dynamic, *in situ* conditions where light, temperature, turbidity, water quality and food conditions change over minutes to hours. The most reliable indicator of *in situ* conditions are the indigenous communities present in the waterway. These are the most reliable data to use for evaluations of thermal impacts.

IX. Review of the UAA Factors¹

The current and future status of this watershed and the relevant data clearly show that several UAA factors are met in the CSSC and UDP. The rationale supporting the statements below are provided in the text above and literature citations; and through a weight-of-evidence based, decision-making process involving the following 12 lines-of-evidence: magnitude of SQG exceedances, prevalence of sediment contamination, likelihood of continuing sediment contamination, extreme degraded status of waterway compared to others in the nation, human dominance of watershed, profuse NPS inputs, excessive habitat modification and degradation, human risk from pathogens and fish consumption, toxicity levels in water and sediment, correlations of toxicity with chemical stressors, indigenous biotic indices, and excessive numbers of use impairments throughout the watershed.

A. UAA Factor 3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place:

Human caused conditions or sources of pollution prevent both the CSSC and the Upper Dresden Island Pool from attaining the Clean Water Act's aquatic life goals. It is the primary reason that upgrading the use designation for either waterway to Clean Water Act "fishable" use designations is not appropriate. The evidence of excessive impairments is clear from the results of recent Illinois EPA efforts (IEPA 305(b) and 303(d) reports) and surveys by the MWRDGC. A multitude of physical and chemical impairment causes and sources exist throughout the watershed as discussed and documented above. The sources will not be removed due to the human-dominated nature of the watershed and the connectivity between the UDP and the UIW. In-situ remediation of contaminated sediments would likely take hundreds of millions of dollars based on the costs of remediating other similar systems (NRC 2007).

B. UAA Factor 4. Dams, diversions or other hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original conditions or to operate such modifications in a way that would result in the attainment of the use.

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¹ UAA Factor 2 not considered as the impacts of altered regimes were not part of this review.

The CSSC and UDP habitat is heavily and permanently modified. Barge traffic will continue to be a protected use and will continue to result in degraded habitat, resuspended contaminated sediments and a physical hazard to recreational users.

C. UAA Factor 5. Physical conditions associated with the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to quality preclude attainment of aquatic life protection uses.

See rationale for Factor 4 above. Habitat is of poor quality through most of the UIW and cannot be feasibly corrected.

Conclusions

An extensive database exists on the UIW (including the CSSC and UDP) concerning its physical, chemical, biological and toxicity characteristics. These multiple lines-of-evidence clearly establish this is a highly modified waterway that has poor riverine habitat, is effluent dominated and receives significant amounts of untreated, nonpoint source runoff. Primary stressors to the aquatic biota in the CSSC and the UDP are: metal and synthetic organic chemical contaminated sediments, elevated nutrients and ammonia, pharmaceuticals and personal care products, unnaturally altered flow regimes, lack of pools and riffles and generally poor substrates and habitat conditions. These stressors have been documented via multiple studies that quantitatively measured their presence recently and showed adverse biological effects result through on-site studies and peer-reviewed literature. This included studies that documented acute toxicity of waters and sediments in the UDP unrelated to temperature. Other research by Cairns et al., (1973, 1978) showed the complexity of temperature and chemical interactions in organisms which refute the simplistic conclusions of the UAA report. Laboratory-based results require extrapolation to field conditions and indigenous benthic and fish communities, which have been thoroughly characterized in the UIW and are the most important line-of-evidence. Depositional sediments throughout the UIW are contaminated with levels of multiple contaminants that, in many locations, pose a hazard to aquatic biota, wildlife and humans. Major nonpoint source loadings of solids, nutrients, metals, and organics will continue from small to major urban areas, sewers, construction, and agriculture in this human-dominated watershed and therefore will continue to contaminate waters, sediments and the food of aquatic biota throughout the UIW. Modified and limited habitats (channelization, barge traffic, lock and dams), extreme turbidity and siltation, and stressor loadings will not improve in the foreseeable future and will continue to dominate water quality conditions and use impairments. Development of new, modified standards will not address the key issue of excessive and pervasive pollution sources, excessive use impairments and limited habitats in this watershed.

The conclusions and the rationales used by Illinois EPA (*i.e.*, proposed Illinois EPA Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and the Lower Des Plaines River: Proposed Amendments to 35Ill. Adm. Code Parts 301, 302, 303 and 304) are flawed. The presentation of data, data interpretation, and supporting statements are often biased, and fail to provide a scientifically-balanced representation of previous Upper Illinois Waterway studies, peer-reviewed literature and accepted approaches that are the state-of-the-science.

References Cited

Ankley GT, Brooks BW, Huggett DB, Sumpter JP. 2007. Repeating history: pharmaceuticals in the environment. Environ. Sci. Technol. 8211-8217.

Augspurger T, Keller AE, Black MC, Cope WG, Dwyer FJ. 2003. Water quality guidance for protection of freshwater mussels (unionidae) from ammonia exposure. Environ. Toxicol. Chem. 22:2569-2575.

Booth DB, Karr JR, Schauman S, Konrad CP, Morley SA, Larson MG, Burges SJ. 2004. Reviving urban streams: land use, hydrology, biology, and human behavior. J Am Water Resources Assoc. no. 03187.

Brix KV, DeForest DK, Adams WJ. 2001. Assessing acute and chronic copper risks to freshwater aquatic life using species sensitivity distributions for different taxonomic groups. Environ Toxicol Chem 20:1846-1856.

Buchman MF. 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1. Seattle WA.

Burton, G.A., Jr., D. Gunnison and G.R. Lanza. 1987. Survival of enteric pathogens in freshwater sediments. Appl. Environ. Microbiol. 53: 633-638.

Burton, G.A., Jr. 1991. Assessing freshwater sediment toxicity. Environ. Toxicol. Chem. 10: 1585-1627.

Burton, G.A., Jr. 1992. Sediment Toxicity Assessment. Lewis Publishers. Boca Raton, FL. 457 p

Burton, G.A., Jr. 1992. Sediment collection and processing: factors affecting realism. In, Sediment Toxicity Assessment. Lewis Publishers. Boca Raton, FL. pp. 37-66.

Burton, G.A., Jr. 1992. Assessing contaminated aquatic sediments (a two part feature series - Special Editor). Environ. Sci. Technol. Vol. 26:1862-1863.

Burton, G.A., Jr. 1995. The Upper Illinois Waterway Study, 1994-1995 Sediment Contamination Assessment Final Report. Commonwealth Edison, Co., Chicago, IL.

Burton, G.A. Jr. 1998. The Upper Illinois Waterway Ecological Survey: Continuous *In Situ* Toxicity Monitoring and Thermal Effect Characterization Tasks. Commonwealth Edison Corp. Chicago, IL.

Burton, G.A., Jr. 2002. Sediment quality criteria in use around the world. Limnology 3:65-76.

Burton, G.A., Jr. and H. Brown. 1995. Reviews of the Literature Concerning: 1) Effects of Temperature on Freshwater Fish, 2) Effects on Freshwater Biota from Interactions of Temperature and Chemicals, and 3) Effects of Turbidity and Barge-Traffic on Aquatic Ecosystems. Commonwealth Edison, Co. Chicago, IL.

Burton, G.A., Jr., and R. Pitt. 2001. Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists and Engineers. CRC/Lewis Publishers, Boca Raton, FL, 924 pp.

Burton, G.A., Jr., R. Pitt, and S. Clark. 2000. The role of whole effluent toxicity test methods in assessing stormwater and sediment contamination. CRC Critical Reviews in Environmental Science & Technology 30: 413-447.

Burton, G.A., Jr., P. Chapman, and E. Smith. 2002. Weight of Evidence Approaches for Assessing Ecosystem Impairment. Human and Ecological Risk Assessment 8:1657-1673.

Burton, G.A., Jr., G. E. Batley, P.M. Chapman, V.E. Forbes, E.P. Smith, T. Reynoldson, C.E. Schlekat, P.J. den Besten, A.J. Bailer, A.S. Green and R.L. Dwyer. 2002. A Weight-of-Evidence Framework for

Assessing Sediment (Or Other) Contamination: Improving Certainty in the Decision-Making Process. Human and Ecological Risk Assessment 8:1675-1696.

Burton GA, Jr., Rowland CD, Greenberg MS, Lavoie DR, Nordstrom JF, Eggert LM. 2003. A tiered, weight-of-evidence approach for evaluating aquatic ecosystems, in, M. Munawar (ed.), Sediment Quality Assessment and Management: Insight and Progress, 2003 Ecovision World Monograph Series, Aquatic Ecosystem Health and Management Society Publ., Hamilton, Ontario. pp. 3-21.

Cairns JJ Jr, Buikema AL Jr, Heath AG, Parker BC. 1978. Effects of temperature on aquatic organism sensitivity to selected chemicals. Virginia Water Resources Research Center. Bulletin 106. Blacksburg, VA.

Cairns JJ Jr, Heath AG, Parker BC. 1973. The effects of temperature upon the toxicity of chemicals to aquatic organisms. Report to Congress by the Environmental Protection Agency. Part 3. Serial No. 93-14. Washington DC.

CDM. 2007. Chicago Area Waterway System Use Attainability Analysis--Final Report prepared for the Illinois Environmental Protection Agency by CDM. (211 pp.) August, 2007.

ComEd. 1996. Aquatic Ecological Study of the Upper Illinois Waterway. Final Report. Chicago, IL.

EA Engineering, Science and Technology. 2008. Sediment Chemistry Study Upper Illinois Waterway, Upper Dresden and Lower Brandon Pools. August 2008 report to Nijman Franzetti LLP. Chicago IL.

Greenberg, M.S., G.A. Burton, Jr., P.B. Duncan. 2000. Considering Groundwater-Surface Water Interactions in Sediment Toxicity Assessment. SETAC Globe. March, April, pp. 42-44.

Groschen GE, Arnold TL, Harris MA, Dupre DH, Fitzpatrich FA, Scudder BC, Morrow WS, Terrio PJ, Warner KL, Murphy EA. 2004. Water quality in the upper Illinois River basin, Illinois, Indiana and Wisconsin, 1999-2001. Resont VA, US Geological Survey Circular 1230. http://il.water.usgs.lgov/nawqa/uirb.

Gutreuter S, Dettmers JM, Wahl DH. 2003. Estimating mortality rates of adult fishes from entrainment through the propellers of river towboats. Trans Am Fisheries Soc 132:646-661.

Hart DD, Finelli CM. 1999. Physical-biological coupling in streams: the pervasive effects of flow on benthic organisms. Annu Rev Ecol Syst 30:363-395.

Hart DD, Clark BD, Jasentuliyana A. 1996. Fine-scale field measurement of benthic flow environments inhabited by stream invertebrates. Limnol. Oceanogr. 41:297-308.

Hart DD, Johnson TE, Bushaw-Newton KL, Horwitz RJ, Bednarek AT, Charles DF, Kreeger DA, Velinsky DJ. 2002. BioScience 52:669-681.

Hatch, A.C. and G.A. Burton, Jr. 1998. Effects of photoinduced toxicity of fluoranthene on amphibian embryos and larvae. Environ. Toxicol. Chem. 17:1777-1785.

Hatch, A.C. and G.A. Burton, Jr. 1999. Sediment toxicity and stormwater runoff in a contaminated receiving system: Consideration of different bioassays in the laboratory and field. Chemosphere 39:1001-1017.

Hatch, A.C. and G.A. Burton, Jr. 1999. Photoinduced toxicity of PAHs to *Hyalella azteca* and *Chironomus tentans*: Effects of mixtures and behavior. Environmental Pollution106:157-167.

IEQ (Institute for Environmental Quality) 1995. Reviews of the literature concerning: 1) Effects of temperature on freshwater fish, 2) Effects on freshwater biota from interactions of temperature and chemicals, and 3) Effects of turbidty and barge-traffic on aquatic ecosystems. Final report for Commonwealth Edison Co. Chicago, IL.

Illinois Environmental Protection Agency. 2002. Illinois Water Quality Report 2002. Bureau of Water. Springfield, IL.

Ireland, D.S., G.A. Burton, Jr., and G.G. Hess. 1996. *In Situ* toxicity evaluations of turbidity and photoinduction of polycyclic aromatic hydrocarbons. Environ. Toxicol. Chem. 15:574-581.

Kidd KA, Blanchfield PJ, Mills KH, Palace VP, Evans RE, Lazorchak JM, Flick RW. 2007. Collapse of a fish population after exposure to a synthetic estrogen. Proc. Nat. Acad. Sci. 104:8897-8901.

Kolpin DA, Furlong ET, Meyer MT, Thurman EM, Zaugg SD, Barber LB, Buxton HT. 2002. Pharmaceuticals, hormones, and other organic wasterwater contaminants in U.S. streams, 1999-2000: A national reconnaissance. Environ. Sci. Technol 32:1201-1211.

Lowery DDR, Pasch RW, Scott EM. 1987. Hydroacoustic survey of fish populations of the lower Cumberland River. US Amrmy Eng Distr, Nashville TN.

MacDonald DD, CG Ingersoll and TA Berger. 2000a. Development and evaluation of consensus based sediment quality guidelines for freshwater ecosystems. Arch Environ Contam Toxicol. 39:20-31.

MacDonald DD, LM DiPinto, J Field, CG Ingersoll, ER Long and RC Swartz. 2000b. Development and Evaluation of consensus-based sediment effect concentrations for polychlorinated biphenyls. Environ. Toxicol Chem. 19:1403-1413.

MWRDGC (Metropolitan Water Reclamation District of Great Chicago). 2007. Water and sediment quality along the Illinois waterway from the Lockport Lock to the Peoria Lock during 2006. Report No. 07-39. January 2008.

MWRDGC (Metropolitan Water Reclamation District of Great Chicago). 2008 Ambient water quality monitoring in the Chicago area waterway system: A summary of biological, habitat, and sediment quality data between 2001 and 2004. Report No. 08-2. January 2008.

National Research Council. 2007. Sediment dredging at Superfund megasites. National Academy of Science. Washington DC.

National Research Council. 2008. Mississippi River water quality and the Clean Water Act: Progress, Challenges and opportunities. National Academy of Science, Washington, DC.

Poff NL, Allen JD, Bain MB, Karr JR, Prestegaard KL, Richter BD, Sparks RE, Stromberg JC. 1997. The natural flow regime. BioScience 47:769-784

Santucci VJ, Gephard SR, Pescitelli SM. 2005. Effects of multiple low-head dams on fish, macroinvertebrates, habitat, and water quality in the Fox River, Illinois. N Am J Fisheries Mgmt 25:975-992.

Scavia D, Donnelly KA. 2007. Reassessing hypoxia forecasts for the Gulf of Mexico. Environ Sci Technol 41:8111-8117.

Stahl L, Wathen J, Snyder B, O'Donnel J, Pitt J. 2007. EPA pilot study of PPCPs in fish tissue. Abstr. Annu. Meeting Soc Environ Toxicol Chem. Milwaukee WI.

Todd BL, Rabeni CF. 1989. Movement and habitat use by stream-dwelling smallmouth bass. Trans Am Fish Soc 118:229-242.

Tucker, K.A. and G.A. Burton, Jr. 1999. Assessment of nonpoint source runoff in a stream using *in situ* and laboratory approaches. Environ. Toxicol. Chem. 18:2797-2803.

U.S. Environmental Protection Agency. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. 2nd Edition. EPA/600/R-99/064. Office of Research and Development and Office of Water. Washington, DC.

U.S. Environmental Protection Agency. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. Office of Water. EPA-823-B-01-002. Washington, DC.

U.S. Environmental Protection Agency 2002. National Water Quality Inventory 2000 Report. Office of Water. Washington DC. EPA-841-R-02-001.

U.S. Environmental Protection Agency. 2000. Stressor Identification Guidance Document. Office of Water and Office of Research & Development. EPA/822/B-OO/025. Washington, DC.

U.S. Geological Survey. 1999. The Quality of Our Nation's Waters. Nutrients and Pesticides. USGS Circular 1225. Reston, VA.

Vajda AM, Barber LB, Gray JL, Lopez EM, Woodling JD, and Norris DO. 2008. Reproductive disruption in fish downstream from an estogenic wastewater effluent. Environ. Sci Technol. 42:3407-3414.

Wenning RJ, Batley GE, Ingersoll CG, Moore DW. 2005. Use of sediment quality guidelines and related tools for the assessment of contaminated sediments. Society of Environmental Toxicology and Chemistry. Pensacola, FL.

Wetzel RG. 1983. Limnology, 2nd ed. Saunders College Publ., Philadelphia.

Wolter C, Arlinghaus R. 2003. Navigation impacts on freshwater fish assemblages: the ecological relevance of swimming performance. Rev Fish Biol Fisheries 13:63-89.

APPENDIX A

Resume G. Allen Burton

Dr. Burton recently began as Director of NOAA's Cooperative Institute of Limnology and Ecosystem Research, and is a Professor in the School of Natural Resources and Environment at the University of Michigan. Previously, he was Professor and Chair of the Earth & Environmental Sciences Department at Wright State University, in Dayton, Ohio. While at WSU he directed the Institute for Environmental Quality, started the PhD program in Environmental Sciences, and was the Brage Golding Distinguished Professor of Research. His research on aquatic ecosystem stressors has taken him to all seven continents and Visiting Scientist positions in New Zealand, Italy and Portugal. Recently he was the President of the international Society of Environmental Toxicology & Chemistry and served on National Research Council and U.S. EPA Science Advisory Board committees. He has served on numerous national and international boards and panels with over 200 publications.

Education

Ouachita Baptist University	B.S.	1976	Biology & Chemistry
Auburn University	M.S.	1978	Microbiology
University of Texas @ Dallas	M.S.	1981	Environmental Sciences
University of Texas @ Dallas	Ph.D.	1984	Env. Sci. (Aquatic Toxicology)

Professional Positions:

1980-1984. Life Scientist. U.S. Environmental Protection Agency, Dallas, Texas

1984-1985. Visiting Fellow. NOAA's Cooperative Institute for Research in Environmental Sciences, University of Colorado.

1985-1990. Assistant Professor, Dept. of Biological Sciences, Wright St. Univ.

1990-1996. Associate Professor, Dept. of Biological Sciences, Wright St. Univ.

1985-present. Coordinator, Environmental Health Sciences Program, WSU.

1994-2006, Director, Institute for Environmental Quality, WSU.

1996-present. Professor. Dept. of Biological Sciences, Wright St. Univ.

2000-2003. Brage Golding Distinguished Professor of Research, WSU.

2002-2003. Director, Environmental Sciences Ph.D. Program, WSU.

2003-2005. Associate Director, Environmental Sci. Ph.D. Program, WSU.

2005. Interim Chair, Geological Sciences Department, WSU.

2006-2008. Chair, Department of Earth & Environmental Sciences, WSU.

2008-present. Professor, School of Natural Resources & Environment, University of Michigan Director, Cooperative Institute of Limnology & Ecosystem Research

Awards and Other Professional Activities (Select):

1992-1999. U.S. EPA National Freshwater Sediment Toxicity Methods Committee

1994, 2001. Visiting Senior Scientist, Italian Institute for Hydrobiology.

1994, 1995, 1998, 1999. External Review Panel. Environmental Biology Research Program. Exploratory Research. Office of Research and Development, U.S. EPA.

1996. Visiting Senior Scientist, New Zealand Inst. of Water and Atmospheric Research.

1994-1997, NATO Senior Research Fellow, University of Coimbra, Portugal.

1993-1996. Board of Directors, Soc. of Environmental Toxicology and Chemistry

2002. Meeting Chair. 5th International Symposium on Sediment Quality Assessment.

1999-2001. U.S. EPA Scientific Advisory Panel, Office of Pesticide Programs

2001-2004, Editorial Board, Aquatic Ecosystem Health & Management and Chemosphere.

2000-2003. Brage Golding Distinguished Professor of Research.

2003-2006. World Council, Society of Environmental Toxicology & Chemistry (SETAC)

2006. Vice President, World Council, SETAC

2007. President. Society of Environmental Toxicology & Chemistry

2005-2009. U.S. EPA Science Advisory Board Committees (2).

2006-2007. National Research Council Committee on Sediment Dredging at Superfund Megasites.

2008. Past President, Society of Environmental Toxicology and Chemistry.

Recent Research Projects (\$7,655,912 total; Select since 2005):

- U.S. Environmental Protection Agency STAR Grant Program. Defining and Predicting PCB Fluxes and Their Ecological Effects in River Systems for Risk Characterizations. March 2005- February 2008. \$325,000.
- 2. City of Dayton. Great Miami River Water Quality vs. Stormwater Inputs. 2005. \$56,382.
- 3. U.S. Environmental Protection Agency, Cooperative Research and Development Agreement. Toxicity Evaluation of Ground Water/Surface Water Interactions. EPA No. 304-04. 2005-2006. \$56,090.
- Bayer CropScience and BASF. An Assessment of Fipronil Effects on Benthic Invertebrates in Freshwater Ecosystems. 2005-2006. \$325,295.
- 5. Copper Development Association, RioTinto, and International Copper Association. An Assessment of Copper Effects on Benthic Invertebrates in Freshwater Ecosystems. 2005-2007. \$80,884.
- RIVM, the Netherlands. Weight-of-Evidence based GIS System for Stressor Detection. QERAS Project. \$10,000. 2006.
- 7. European Copper Association. 2006. An Assessment of Copper Effects on Benthic Invertebrates in Freshwater Ecosystems, Project Amendment. \$36,575.
- 8. Nickel Producers Environmental Research Association. Comparison of Nickel Sensitivity in Cultured and Field Collected *Ceriodaphnia* spp. 2006-2007. \$27,122.
- Strategic Environmental Restoration and Demonstration Program (SERDP). USDOD, USDOE, USEPA.
 Sediment Ecosystem Assessment Protocol (SEAP): An Accurate and Integrated Weight-of-Evidence Based System. Feb 2007-Jan 2010. \$903,000.
- Copper Development Association. Copper and Sediments: Defining the State-of-the-Science and Key Data Gaps. \$36,000. 2007.
- International Copper Association, Dissolved Organic Carbon Dynamics in Brandenberg Pond, Ohio. \$2,700. 2007.
- 12. International Zinc Association. Zinc and Sediments: Defining the State-of-the-Science and Key Data Gaps. \$12,000. 2007.
- 13. City of Dayton. Stormwater Effects on the Mad River, Ohio. \$66,997 (\$50,000 to WSU). 2007.
- 14. Nickel Producers Environmental Research Association. Determining Realistic Sediment Toxicity Threshold Effect Levels for Freshwater Species. \$131,206. 2007-2008
- 15. Wright State University Research Challenge. Seed grant for Center of Excellence: Nanoscale Science & Engineering of Multi-functional Materials. (Co-PI) 2007-2008. \$60,000 (AB \$30,000)
- International Copper Association and Copper Development Association. An Assessment of Copper Effects on Benthic Invertebrates in Freshwater Ecosystems, Project Amendment. \$19,278. 2007-2008.
- Environment Agency United Kingdom. A Quantitative Approach for Scientifically-Based Decision Making: Linking Physical and Chemical Factors with Ecosystem Responses. \$20,900. 2007-2008.

Publications (144 excluding technical reports; Select since 2005):

- 1. Burton GA Jr., Greenberg MS, Rowland CD, Irvine CA, Lavoie DR, Brooker JA, Eggert LM, Raymer DFN, McWilliam RA. 2005. *In situ* exposures using caged organisms: a multi-compartment approach to detect aquatic toxicity and bioaccumulation. Environ. Pollut. 134:133-144.
- 2. Burton GA Jr, Nguyen LTH, Janssen C, Baudo R, McWilliam R, Bossuyt B, Beltrami M, Green A. 2005. Field validation of sediment zinc toxicity. Environ Toxicol. Chem 24:541-553.
- 3. Kapo, K., Burton GA. 2006. A GIS based weight of evidence approach for identifying aquatic impairment. Environ. Toxicol. Chem. 25:2237-2249.
- 4. Custer KW, Burton GA, Coleho R, Smith P. 2006. Determining stressor presence in streams receiving urban and agriculture runoff: development of a benthic in situ toxicity identification evaluation (BiTIE) Method. Environ Toxicol Chem 25:2299-2305

- 5. Burton, GA, Green A, Baudo R, Forbes V, Nguyen LTH, Janssen CR, Kukkonen J, Leppanen M, Maltby L, Soares A, Kapo K, Smith P, Dunning J. 2007. Characterizing sediment acid volatile sulfide concentrations in European stream. Environ Toxicol Chem 26:1-12.
- 6. Baird, DJ, Burton GA, Culp JM, Maltby L. 2007. Summary and recommendations from a SETAC Pellston Workshop on in situ measures of ecological effects. Integr Environ Asseess Mgmt 3:275-278.
- 7. Crane M, G. Allen Burton, Joseph Culp, Marc S. Greenberg, Kelly R. Munkittrick, Rui G.L.G. Ribeiro, Michael H. Salazar and Sylvie D. St-Jean. 2007. Review of In Situ Approaches for Stressor and Effect Diagnosis. Integr Environ Assess Mgmt. 3:234-245.
- 8. Custer KW, Burton GA Jr. 2007. *Isonychia* spp. and macroinvertebrate community responses to stressors in streams utilizing the benthic in situ toxicity identification evaluation (BiTIE) method. Environ Pollut. 151:101-109.
- 9. National Research Council (A. Burton coauthor). 2007. Sediment Dredging at Superfund Megasites: Assessing the Effectiveness. National Academies Press. Washington DC.

APPENDIX B

Land Use and Recent Development in the Des Plaines Watershed

Area Converted to Urban Land Use 1992-2001

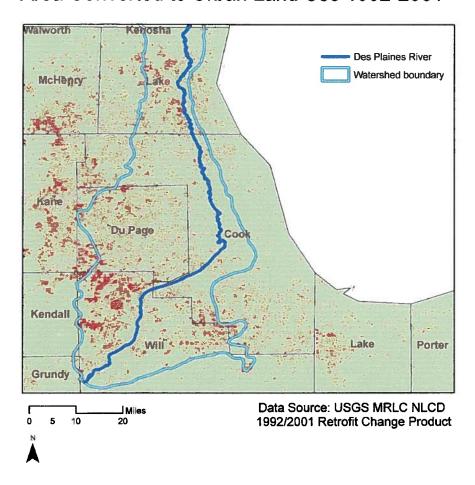


Figure B-1. Estimated land converted to urban land use between 1992 and 2001 based on a comparison of the NLCD 1992 and 2001 datasets (USGS, MRLC NLCD 1992/2001 Retrofit Change Product).

Urban Area Boundary Expansion 1990-2000 Cook, Dupage, Lake and Will Counties (IL)

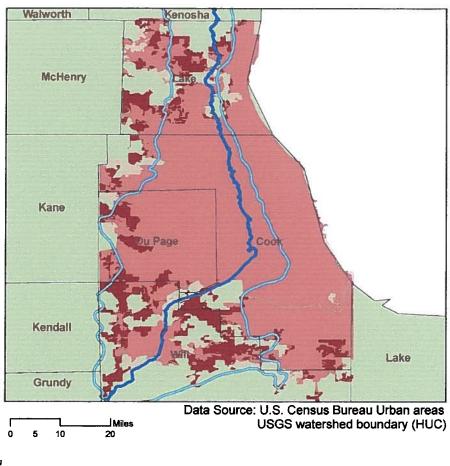


Figure B-2. U.S. Census urban boundary change between 1990 and 2000 census for Cook, Du Page, Lake, and Will counties in Illinois.

The following three figures are from the Chicago Metropolitan Agency for Planning (CMAP) Data Bulletin: 2001 Land Use Inventory for Northeastern Illinois, September 2006 (www.cmap.illinois.gov).

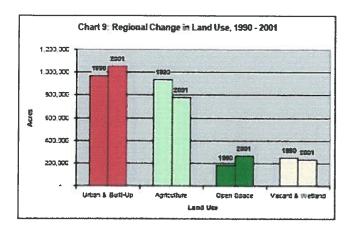


Figure B-3. Regional change in land use from 1990-2001.

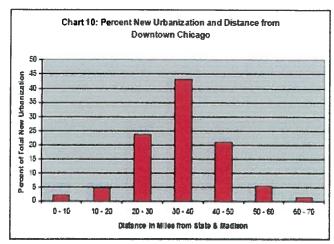
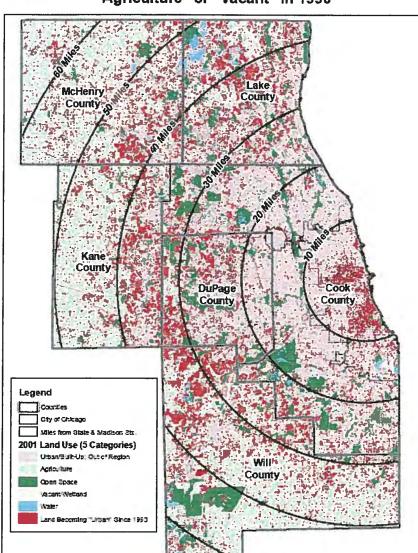


Figure B-4. Percent new urbanization and distance from downtown Chicago.



Map 10: "Urbanized" Lands (2001) Classified as "Agriculture" or "Vacant" in 1990

Figure B-5. Urban lands in 2001 that were agricultural or vacant in 1990. The 2001 land use data was compiled from interpretation of aerial photography and other sources).

% Population Increase in Municipalities 2000-2006

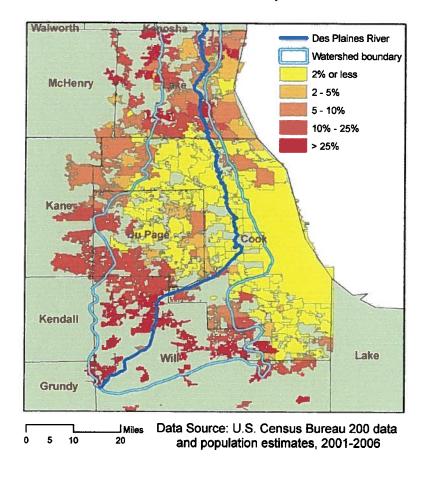
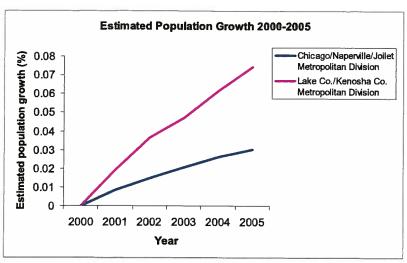




Figure B-6. U.S. Census estimated population increase (%) in municipalities from year 2000 to 2006.



^{*} See metropolitan divisions in figure below

Metropolitan Division Areas

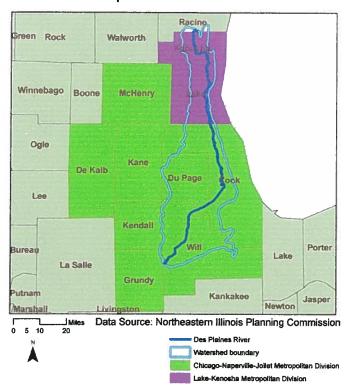


Figure B-7 (a+b). Estimated population growth (2000-2005, U.S. Census Bureau) by Metropolitan Division (Northeastern Illinois Planning Commission).

Change in Annual Building Permit Numbers by Municipality or Chicago Community Area (Year 2000 versus 2003)

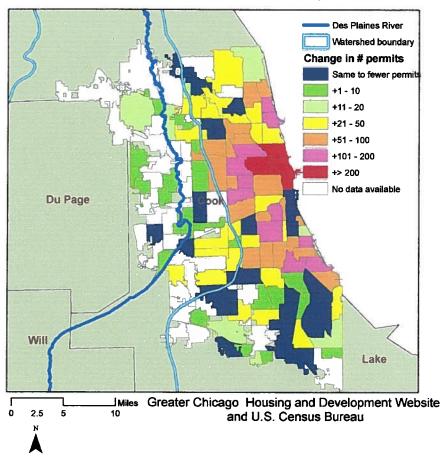


Figure B-8. Change in number of annual building permits (year 2000 versus 2003) for municipalities and communities of the Greater Chicago area.

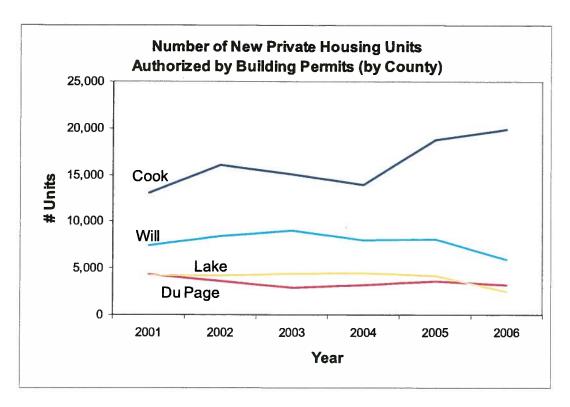


Figure B-9. Number of new private housing units authorized by building permits (2001-2006) for Cook, Du Page, Lake, and Will Counties (U.S. Census Bureau).

Combined Sewer Overflow Figures:

According to the Metropolitan Water Reclamation District of Greater Chicago, from January 1, 2006 to June 13, 2008 (latest MWRD data update), there were a combined total of 117 combined sewer overflows reported at the four major pumping stations of North Branch, Racine Ave., Westchester, and 125th St. There have been 17 system-wide CSO events (multiple stations per event) this summer (June 3 – August 6, 2008).

Individual maps of reaches with CSO events by date for 2008 to the present can be accessed at www.mwrdgc.dst.il.us/CSO/display_only.aspx These maps are updated the day following an overflow event. The seven most current daily maps are retained online with the oldest being deleted when a new map is added.

APPENDIX C

EA Engineering, Science, and Technology Report on Sediment Chemistry



SEDIMENT CHEMISTRY STUDY

UPPER ILLINOIS WATERWAY, DRESDEN AND LOWER BRANDON POOLS

Prepared for

Nijman Franzetti LLP 10 S. LaSalle St. Suite 3600 Chicago, IL 60603

Prepared by

EA Engineering, Science, and Technology 444 Lake Cook Rd. Suite 18 Deerfield, IL 60015 (847) 945-8010

September 2008

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TABLE OF CONTENTS

			rage
LIST	T OF F	IGURES	ii
LIST	r of T	ABLES	ii
1.	FIEI	LD SAMPLING	1
2.	ANA	ALYTICAL TESTING PROGRAM	6
	2.1	Laboratory Control Samples	7
	2.2	Detection Limits	8
3.	DAT	ΓA ANALYSIS	9
	3.1	Calculation of Total PCBs and Total PAHs	9
	3.2	Comparison to Sediment Benchmarks	
4.	VISU	UAL OBSERVATIONS OF SEDIMENT	9
5.	SED	IMENT CHEMISTRY RESULTS	11
6.	COM	MPARISON TO HISTORICAL DATA	12
7.	REF	ERENCES	13

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LIST OF FIGURES AND TABLES

Number	<u>Title</u>
Figure 1	Sediment Sampling Locations in the Dresden and Lower Brandon Pools
Figure 2	Concentrations of Metals that Exceed Sediment Quality Guidelines
Figure 3	Concentrations of Total PAHs and Total PCBs that Exceed Sediment Quality Guidelines
Number	<u>Title</u>
Table 1	Sediment Sampling Locations in the Dresden and Lower Brandon Pools
Table 2	Required Containers, Preservation Techniques, and Holding Times For Sediment Samples
Table 3	Required Containers, Preservation Techniques, and Holding Times For Aqueous Samples (Equipment Blanks)
Table 4	Analytical Methods for Sediment Analysis
Table 5	Laboratory QC Samples
Table 6	Summary of Field Observations of Sediment from the Dresden and Lower Brandon Pools
Table 7	Concentrations of Target Analytes in Sediment, Dresden Pool, May 2008
Table 8	Concentrations of Target Analytes in Sediment, Lower Brandon Pool, May 2008
Table 9	Concentrations of Target Analytes that Exceeded Sediment Quality Guidelines, Dresden Pool, May 2008
Table 10	Concentrations of Target Analytes that Exceeded Sediment Quality Guidelines, Dresden Pool, May 2008
Table 11	Comparisons of Sediment Concentrations to Historical Data, Dresden and Lower Brandon Pools, May 2008

SEDIMENT CHEMISTRY STUDY

UPPER ILLINOIS WATERWAY, DRESDEN AND LOWER BRANDON POOLS

EA Engineering, Science, and Technology conducted a sediment study in Dresden Pool and the lower portion of Brandon Pool, which includes the Des Plaines, Kankakee, and Illinois Rivers (i.e., the study area) (Figure 1). The purpose of this project was to determine if the sediment chemistry of the study area may preclude the attainment of a higher aquatic life use. Results of this sediment analysis were compared to sediment benchmarks and previous sediment sampling efforts in the same study area. Sampling locations were targeted in areas adjacent to the main channel of the river that would potentially provide suitable aquatic habitat. Therefore, sampling locations tended to be in shallow areas with lower water velocities and the potential for higher rates of fine-grained sediment deposition.

Thirty-five (35) sediment samples — 31 in the Dresden Pool and four in the Lower Brandon Pool — were collected for physical and chemical characterization (**Figure 1**). The physical composition of the sediment was described by total organic carbon, total solids (percent moisture), and grain size (sieve and hydrometer). The target analytes for the chemical determination of the sediment were: arsenic, silver, cadmium, chromium, copper, lead, mercury, nickel, zinc, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCB congeners).

1. FIELD SAMPLING

Sediment samples were collected using a petite, stainless steel Ponar grab sampler. At each location, five discrete grab samples were collected, combined in a stainless steel container, and gently homogenized using a stainless steel spoon/spatula. General observations of the sediment, including color and odor, were noted in the field log book (Appendix A), and digital photographs (Appendix B) and GPS coordinates (Table 1) were collected at each location.

Sediment samples were collected from 31 sites in the Dresden Pool and four in the Lower Brandon Pool between 6 May and 9 May 2008. Two field duplicate samples were collected – one from location DR08-11 and one from location DR08-28 – and submitted for chemical analysis. Multiple grabs (five) were collected at each location and homogenized to form one sample for each site. Each sample was homogenized in a stainless steel bowl using a stainless steel spoon until the sediment was thoroughly mixed and of uniform consistency. When compositing was completed, sub-samples of sediment were removed for bulk chemistry testing.

The homogenized material was transferred into appropriate labeled containers and each container was sealed with a custody seal. Once sealed, the sample containers were placed in a cooler on wet ice and documented on a chain of custody form. All equipment that came in contact with the sediment was decontaminated between each location (see **Section 2.4**). Sediment samples were kept in a cooled, insulated cooler onboard the workboat during each work day. At the end of each day, coolers were appropriately packed, iced, and shipped by overnight courier to the laboratory with chain of custody (COC) documentation.

Upper Illinois Waterway

Sediment samples were shipped via overnight delivery to the analytical laboratory, TestAmerica—Pittsburgh, on the day of collection. The sample containers, preservatives, and holding time requirements for sediment samples are provided in **Table 2-1**. Holding times for the sediment samples began when the sediment was collected, homogenized, and placed in the appropriate sample containers.

Sample Documentation

A log of field activities, sampling location coordinates, site observations, and sediment recoveries were recorded in a permanently bound, dedicated field logbook (**Appendix A**). Personnel names, local weather conditions, and other information that may impact the field sampling program were also recorded. Each page of the logbook was numbered and dated by the personnel entering information.

A sample numbering system was used to communicate between the field crew and the analytical laboratory. Sampling locations and samples were numbered as follows:

Example: DR08-01

The first two letters denote the site designation (DR=Dresden Reach; BR=Brandon Reach), the next two digits denote the sampling year (08=year 2008), and the last two digits indicate the sampling location number.

Table 1. Sediment Sampling Locations in the Dresden and Lower Brandon Pools

		Northing (m)	Easting (m)
Sample ID	Date Sampled		ast NAD83
DRESDEN PO	OL		
DR08-01	5/6/2008	525571.56	304526.11
DR08-02	5/6/2008	525297.55	305069.83
DR08-03	5/6/2008	524167.37	306199.93
DR08-04	5/6/2008	523905.67	307041.08
DR08-05	5/6/2008	524149.62	307200.08
DR08-06	5/6/2008	524200.28	308708.26
DR08-07	5/6/2008	524024.17	308799.00
DR08-08	5/6/2008	525951.89	309184.50
DR08-09	5/6/2008	525848.05	309429.79
DR08-10	5/6/2008	525895.80	309742.74
DR08-11	5/6/2008	527391.25	310137.04
DR08-12	5/6/2008	527559.48	310717.80
DR08-13	5/6/2008	527437.18	311063.46
DR08-14	5/7/2008	527750.97	311542.61
DR08-15	5/7/2008	528202.60	312423.72
DR08-16	5/7/2008	528301.38	312425.35
DR08-17	5/7/2008	529093.41	313371.70
DR08-18	5/7/2008	529752.25	314044.20
DR08-19	5/7/2008	530313.47	314050.10
DR08-20	5/7/2008	530791.69	313816.52
DR08-21	5/7/2008	530828.70	314066.66
DR08-22	5/7/2008	532283.21	313855.07
DR08-23	5/7/2008	533534.28	314667.19
DR08-24	5/7/2008	533613.87	315436.00
DR08-25	5/8/2008	534546.85	316278.60
DR08-26	5/8/2008	534824.74	316663.47
DR08-27	5/8/2008	535537.06	317628.58
DR08-28	5/8/2008	536176.57	318479.56
DR08-29	5/9/2008	536667.62	319046.21
DR08-30	5/9/2008	536568.31	319522.71
DR08-31	5/9/2008	536567.16	319485.10
LOWER BRA	NDON POOL		
BR08-01	5/8/2008	537485.12	320111.97
BR08-02	5/8/2008	537246.47	319934.34
BR08-03	5/8/2008	537195.15	319237.12
BR08-04	5/8/2008	537352.76	319435.33

Equipment Blanks

Equipment blanks were collected to determine the extent of contamination, if any, from the sampling equipment used as part of the project. Four equipment blanks were collected for the project, one during each day of the sampling. Equipment blanks are collected by pouring deionized water, which was provided by EA's Ecotoxicology Laboratory, over the petit Ponar grab sampler that was decontaminated using the procedure outlined in **Section 2.4**. The rinsate water was placed in laboratory-prepared containers, submitted to TestAmerica-Pittsburgh via overnight delivery, and tested for the same chemical parameters as the sediments.

Equipment Decontamination Procedures

Equipment that came into direct contact with sediment during sampling was decontaminated prior to deployment in the field to minimize cross-contamination. This included the petit Ponar sampler and stainless steel processing equipment (spoons, knives, and bowls). Any equipment that was reused in the field was decontaminated on-board the sampling boat between sample locations. While performing the decontamination procedure, phthalate-free nitrile gloves were used to prevent phthalate contamination of the sampling equipment or the samples.

The decontamination procedure utilized is described below:

- Rinse equipment using site water
- Rinse with 10 percent nitric acid (HNO₃)
- Rinse with distilled or de-ionized water
- Rinse with methanol followed by hexane
- Rinse with distilled or de-ionized water
- Air dry (in area not adjacent to the decontamination area)

Waste liquids produced during decontamination procedures were contained at the areas of decontamination. Decontamination waste liquid produced on-board the boat were collected in 5-gallon buckets with lids and returned to EA's warehouse facility for proper disposal.

Table 2. Required Containers, Preservation Techniques, and Holding Times for Sediment Samples (a)

Parameter	Volume Required ^(b)	Container ^(c)	Preservative	Holding Time
Inorganics				
Metals (including Mercury)	8 oz.	G	4°C	6 months (28 days for Hg)
Physical Parameters				
Grain Size and Total Solids	32 oz	P,G	4°C	6 months
Organics				
Total Organic Carbon	(d)	G	4°C	14 days
PCB Congeners	4 oz.	G	4°C	14 days until extraction, 40 days from extraction to analysis
PAHs	(d)	G	4°C	14 days until extraction, 40 days from extraction to analysis

Source: USEPA/USACE 1995

- (a) From time of sample collection.
- (b) Additional volume will be provided for samples designated as MS/MSDs.
- (c) P = plastic; G = glass.
- (d) Sufficient volume is provided from the 8 oz noted under Metals.

Table 3. Required Containers, Preservation Techniques, and Holding Times for Aqueous Samples (Equipment Blanks) (a)

Parameter	Volume Required ^(b)	Container ^(c)	Preservative	Holding Time
Inorganics				
Metals (including Mercury)	1 Liter	P	pH<2 with HNO3 Cool, 4°C	6 months (28 days for Hg)
Organics		200		
Total Organic Carbon	3- 40mLs	G, teflon lined, speta cap	H₂SO₄ or HCl to pH<2; Cool, 4°C	28 days
PAHs and PCB Congeners	4 Liters	G, Teflon lined cap	Cool, 4°C	7 days until extraction, 40 days from extraction to analysis

Source: USEPA/USACE 1995

- (a) From time of sample collection.
- (b) Additional volume will need to be provided for samples designated as MS/MSD/MDs
- (c) P = plastic; G = glass.

2. ANALYTICAL TESTING PROGRAM

Samples collected during the field effort were tested for target analytes using analytical methods listed in **Table 4** as described in the laboratory's analytical standard operating procedures (SOP). Sediment samples were tested for the following analytes:

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc)
- PAHs,
- PCB congeners,
- total organic carbon (TOC),
- grain size, and
- total solids.

Table 4. Analytical Methods for Sediment Analysis

Analyte	Analytical Method
Sediment	
Metals	SW846 6020
Mercury	SW846 7471A
Polynuclear Aromatic	SW846 8270C SIM
Hydrocarbons (PAHs)	3 W 640 6270C SIWI
Polychlorinated Biphenyls	SW846 8082
(PCB) Congeners	3 W 840 8082
Total Organic Carbon	Lloyd Khan
Grain Size	ASTM D422
Total Solids	SM 2540B

To meet program-specific regulatory requirements for chemicals of concern, all methods/SOPs were followed as stated with some specific requirements noted below:

PCB Congeners

PCBs for this project were analyzed and quantified as individual congeners by SW846 Method 8082. Twenty-six (26) PCB congeners were determined in the various matrices. These 26 congeners include all of the "summation" and "highest priority" congeners, plus several of the "secondary priority" congeners.

Total Organic Carbon (TOC)

TOC in sediments was determined using the 1988 EPA Region II combustion oxidation procedure (referred to as the Lloyd Kahn procedure).

Polynuclear Aromatic Hydrocarbons - PAHs

To achieve the target detection limits (TDLs) referenced in QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations - Chemical Evaluations (EPA 823-B-95-001, April 1995), the PAHs were determined utilizing SW846 Method 8270C using Selective Ion Monitoring (SIM).

Metals

Metals were determined utilizing Inductively Coupled Plasma (ICP) or Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) according to the SW846 Method 6020, with the exception of mercury. For mercury, samples will be analyzed by Cold Vapor Atomic Absorption (CVAA) method [SW846 7470A (aqueous) or 7471A (sediment)].

2.1 Laboratory Quality Control Samples

Project specific [matrix spike (MS) / matrix spike duplicates (MSD)] and internal laboratory QA/QC samples (including method blanks, laboratory control samples, and surrogates) were analyzed. Quality control samples were analyzed at the frequency stated in **Table 5**. Standard Reference Materials (SRMs) were obtained from the National Institute of Standards and Technology (NIST) or a comparable source, if available.

QC Sample	Frequency
Standard Reference Material	1 per analytical batch of 1-20 samples, where available
Method Blanks	1 per analytical batch of 1-20 samples
Laboratory Control Sample	1 per analytical batch of 1-20 samples
Surrogates	Spiked into all field and QC samples (Organic Analyses)
Sample Duplicates	1 per analytical batch of 1-20 samples (Inorganic Analyses)
Matrix Spike/Matrix Spike Duplicate	1 per analytical batch of 1-20 samples

Table 5. Laboratory QC Samples

The following internal laboratory QA/QC samples were analyzed for this project:

- Standard reference materials (SRMs) represent performance-based QA/QC. A standard reference material is a soil/solution with a certified concentration that is analyzed as a sample and is used to monitor analytical accuracy. SRMs were analyzed for the PCB congeners and PAHs in sediment. Control criteria apply only to those analytes having SRM true values greater than 10 times the MDL established for the method.
- The **method** (**reagent**) **blank** was used to monitor laboratory contamination. The method blank is usually a sample of laboratory reagent water processed through the same analytical procedure as the sample (i.e., digested, extracted, distilled). One method blank was analyzed at a frequency of one per every analytical preparation batch of 20 or fewer samples.
- The Laboratory Control Sample (LCS) is a fortified method blank consisting of reagent water or solid fortified with the analytes of interest for single-analyte methods or selected analytes for multi-analyte methods according to the appropriate analytical

method. LCS's were prepared and analyzed with each analytical batch, and analyte recoveries were used to monitor analytical accuracy and precision.

- A **sample duplicate** is a second aliquot of a field sample that is analyzed to monitor analytical precision associated with that particular sample. Sample duplicates were performed for every batch of 20 or fewer samples.
- Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. These compounds were spiked into all blanks, standards, samples, and spiked samples prior to analysis for organic parameters. Generally, surrogates are not used for inorganic analyses. Percent recoveries were calculated for each surrogate. Surrogates were spiked into samples according to the requirements of the reference analytical method. Surrogate spike recoveries were evaluated against the standard laboratory acceptance criteria limits, and were used to assess method performance and sample measurement bias. If sample dilution caused the surrogate concentration to fall below the quantitation limit, surrogate recoveries were not calculated.

2.2 Detection Limits

The detection limit is a statistical concept that corresponds to the minimum concentration of an analyte above which the net analyte signal can be distinguished with a specified probability from the signal because of the noise inherent in the analytical system. The method detection limit (MDL) was developed by USEPA and is defined as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero" (40 CFR 136, Appendix B). The reporting limit (RL) is the lowest concentration at which an analyte can be detected in a sample and its concentration can be reported with a reasonable degree of accuracy and precision. The RL is typically three to five times higher than the MDL and is determined based on corrections necessary for sample dilutions, percent moisture in the sample (for sediments), and sample weight.

Samples collected during the field effort were tested for target analytes using analytical methods and target detection limits (TDLs) for sediment and water (equipment blanks) listed in in the QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations - Chemical Evaluations (EPA 823-B-95-001, April 1995). All analytical parameters, except total organic carbon (TOC), were quantified to the MDL. All detected values greater than or equal to the MDL, but less than the laboratory RL, were qualified as estimated. TOC samples were quantified to the laboratory RL. For sediment analyses, sample weights were adjusted for percent moisture (up to 50% moisture), where appropriate, prior to analysis to achieve the lowest possible reporting limits.

Upper Illinois Waterway Sediment Sampling
September 2008

3. DATA ANALYSIS

3.1 Calculation of Total PCBs and Total PAHs

For each sample, total PCB concentrations were determined by summing the concentrations of the 18 summation congeners and multiplying the total by a factor of two. Multiplying by a factor of two estimated the total PCB concentration and accounted for additional congeners that were not tested as part of this program. These determinations were based upon testing of specific congeners recommended in the Inland Testing Manual (ITM) (USEPA/USACE 1998) and upon the National Oceanic and Atmospheric Administration (NOAA 1993) approach for total PCB determinations.

Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. For both the total PCB and total PAH concentrations, two values were reported, each representing the following methods for treating concentrations below the analytical detection limit:

- Non-detects = 0 (ND=0)
- Non-detects = 1/2 of the method detection limit (ND=½MDL)

Substituting one-half the method detection limit for non-detects (ND=½MDL) provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing the calculated total values to criteria values.

3.2 Comparison to Sediment Benchmarks

Sediment quality guidelines are numerical chemical concentrations intended to either be protective of biological resources or predictive of adverse effects to those resources, or both (Wenning and Ingersoll 2002). The SQGs were developed as informal (non-regulatory) guidelines for use in interpreting chemical data from analyses of sediments. One of the biological-effects approaches that have been used to assess sediment quality relative to the potential for adverse effects on benthic organisms in freshwater ecosystems is the Threshold Effects Concentration (TEC) / Probable Effects Concentration (PEC) approach (MacDonald et al. 1996). These sediment quality guidelines were used to identify potential adverse biological effects associated with contaminated sediments. TECs typically represent concentrations below which adverse biological effects are not expected to occur, while PECs typically represent concentrations in the middle of the effects range and above which effects are expected to occur more often than not (Macdonald et al. 2000). Concentrations that are between the TEC and PEC represent the concentrations at which adverse biological effects occasionally occur.

4. VISUAL OBSERVATIONS OF SEDIMENT

At each sampling location, the sediment was photograph and described, and any noticeable petroleum odors or sheens in the sediment were recorded in the logbook (Appendix A). The

results of the field observations indicated that the sediments were comprised of a mixture of fine grained sands, silts, and clays. Sediment from the majority of the sampling locations had both sheen and an odor, as summarized in **Table 6**.

Table 6. Summary of field observations of the sediment in the Dresden and Lower Brandon Pools.

DR08-01 4.9 Dark brown to gray silt X X DR08-02 4.1 Dark to light gray silt with sand and clay X DR08-03 2.8 Light gray sand with silt DR08-04 3.9 Light gray silt with sand X X DR08-05 2.6 Light gray silt with sand X X DR08-05 2.6 Light gray silt with sand X X DR08-05 2.6 Light gray silt with sand X X DR08-06 4.8 Light gray silt with sand X X DR08-06 4.8 Light gray silt with sand X X DR08-07 4.8 Dark gray tolayey silt X X DR08-08 3.3 Light gray silt with fine-grained sand DR08-09 6.2 Gray silt with fine-grained sand DR08-10 2.3 Dark gray silt ysown sandy silt X X X	LOCATION
DR08-03 2.8 Light gray sand with silt DR08-04 3.9 Light gray silt with sand X X DR08-05 2.6 Light gray with fine-grained sands X X DR08-06 4.8 Light gray clayey silt X DR08-07 4.8 Dark gray to black fine grained silt with clay DR08-08 3.3 Light gray fine-grained silt DR08-09 6.2 Gray silt with fine-grained sand DR08-10 2.3 Dark brown sandy silt X X DR08-11 3.8 Dark brown sandy silt X X DR08-12 1.7 Dark gray silty sand X DR08-13 4.2 Dark gray clayey silt X X DR08-14 3.1 Dark gray sandy silt X X DR08-15 5.7 Gray clayey silt X X DR08-16 3.8 Dark gray silt with fine grained sands X	DR08-01
DR08-04 3.9 Light gray silt with sand X X DR08-05 2.6 Light gray with fine-grained sands X X DR08-06 4.8 Light gray clayey silt	DR08-02
DR08-05 2.6 Light gray with fine-grained sands X X DR08-06 4.8 Light gray clayey silt X DR08-07 4.8 Dark gray to black fine grained silt with clay DR08-08 3.3 Light gray fine-grained silt DR08-09 6.2 Gray silt with fine-grained sand DR08-10 2.3 Dark brown sandy silt X X DR08-11 3.8 Dark brown sandy silt X X DR08-12 1.7 Dark gray silty sand X DR08-13 4.2 Dark gray clayey silt X X DR08-14 3.1 Dark gray sandy silt X X DR08-15 5.7 Gray clayey silt X X DR08-16 3.8 Dark gray to black clayey silt X X DR08-17 3.4 Dark gray silt with fine grained sands X X DR08-18 4.1 Black silt X	DR08-03
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DR08-12 1.7 Dark gray silty sand X DR08-13 4.2 Dark gray clayey silt X X DR08-14 3.1 Dark gray sandy silt X X DR08-15 5.7 Gray clayey silt X X DR08-16 3.8 Dark gray to black clayey silt X X DR08-17 3.4 Dark gray silt with fine grained sands X X DR08-18 4.1 Black silt X X DR08-19 3.1 Dark brown silt with medium grained sands DR08-20 1.1 Dark gray sandy silt X X DR08-21 2.1 Dark brown to gray sandy silt X X	DR08-10
DR08-13 4.2 Dark gray clayey silt X X DR08-14 3.1 Dark gray sandy silt X X DR08-15 5.7 Gray clayey silt X X DR08-16 3.8 Dark gray to black clayey silt X X DR08-17 3.4 Dark gray silt with fine grained sands X X DR08-18 4.1 Black silt X X DR08-19 3.1 Dark brown silt with medium grained sands DR08-20 1.1 Dark gray sandy silt X X DR08-21 2.1 Dark brown to gray sandy silt X X	DR08-11
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DR08-19 3.1 Dark brown silt with medium grained sands DR08-20 1.1 Dark gray sandy silt X X DR08-21 2.1 Dark brown to gray sandy silt X X	DR08-17
DR08-20 1.1 Dark gray sandy silt X X DR08-21 2.1 Dark brown to gray sandy silt X X	DR08-18
DR08-21 2.1 Dark brown to gray sandy silt X X	DR08-19
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DR08-22 2.3 Dark brown sandy silt X X	DR08-21
	DR08-22
DR08-23 5.2 Dark brown sandy silt X X	DR08-23
DR08-24 2.8 Dark brown sandy silt X X	DR08-24
DR08-25 1.8 Dark brown sandy silt X X	DR08-25
DR08-26 2.0 Dark brown sandy silt X X	DR08-26
DR08-27 2.3 Dark brown sandy silt X X	DR08-27
DR08-28 1.9 Dark gray sandy silt X X	DR08-28
DR08-29 0.8 Dark gray sandy silt X X	DR08-29
DR08-30 2.2 Dark gray sandy silt X X	DR08-30
DR08-31 0.9 Dark gray sandy silt X	DR08-31
BR08-01 3.6 Dark gray silt with fine-grained sands X X	BR08-01
BR08-02 4.7 Dark gray silt X X	
BR08-03 1.6 Dark gray silt X X	
BR08-04 2.1 Dark gray silt with fine-grained sands X X	

5. SEDIMENT CHEMISTRY RESULTS

The results of the physical and chemical analysis of samples from Dresden pool are summarized in **Table 7**, and the results for samples from the Lower Brandon pool are summarized in **Table 8**. The target analytes for the physical and chemical description of the sediment were total organic carbon, total solids (percent moisture), grain size, metals (arsenic, silver, cadmium, chromium, copper, lead, mercury, nickel, and zinc), PAHs, and PCB congeners. Sample weights were adjusted for percent moisture (up to 50 percent moisture) prior to analysis to achieve the lowest possible detection limits. Analytical results are reported on a dry weight basis.

Analytical results and definitions of organic and inorganic data qualifiers are provided in **Tables 7 and 8**. Values for detected chemical constituents are shaded and bolded in the data tables, and RLs/MDLs are presented for non-detected chemical constituents. Analytical narratives that included an evaluation of laboratory quality assurance/quality control results and copies of final raw data sheets (Form I's) were provided by the laboratory. TestAmerica—Pittsburgh will retain and archive the results of these analyses for seven years from the date of issuance of the final results.

Concentrations of tested metals, PAHs, and PCB congeners were elevated in the sediments collected in both the Dresden and the Lower Brandon pools, and comparisons to TECs and PECs indicated that detected concentrations of metals, PAHs, and total PCBs had concentrations between the TEC and the PEC at almost every sampling location (**Tables 9 and 10**). In the Dresden pool, detected concentrations for the metals exceeded PEC values at several locations (**Table 9**): cadmium – 12 locations (39 percent); chromium – 6 locations (19 percent); copper – 4 locations (13 percent); lead – 9 locations (29 percent); mercury - 4 locations (13 percent); nickel – 9 locations (29 percent); and zinc – 9 locations (29 percent). For the tested organic constituents in the Dresden pool, total PAH concentrations (ND=1/2MDL) exceeded PEC concentrations at a total of 19 locations (61 percent) and total PCB concentrations (ND=1/2MDL) exceeded PEC concentrations at a total of 19 locations at a total of 8 locations (26 percent) (**Table 9**).

In the Lower Brandon pool, detected concentrations of each of the metals, with the exception of arsenic, copper, and mercury, and the total PAH and total PCB concentrations (ND=1/2MDL) exceeded PEC values in each of the four samples (**Table 10**).

The sediment chemical analysis indicated that both the Dresden and the Lower Brandon pools had high concentrations of metals (Figure 2) and tested organic constituents (Figure 3), indicating that large portions of the Dresden and Lower Brandon Pools are of poor sediment quality. Detected concentrations were frequently higher than the PEC value, which is the concentration above which adverse biological effects are expected to occur more often than not (MacDonald et al. 2000). These data indicate that the sediment quality in this portion of the Dresden Pool and the lower portion of Brandon Pool would overall be characterized as poor.

For metals (**Figure 2**), only two sampling locations did not exceed the TEC for the suit of eight metals evaluated (DR08-02 and DR08-03). All other sample locations exceeded at least the TEC for a minimum of five metals and many exceeded the PEC for a majority of the eight metals evaluated (**Tables 9 and 10**). There is a clustering of sediments with elevated metal

concentrations (concentrations that exceed the PEC) at three groups of locations - locations BR08-01 through BR08-04; locations DR08-13, DR08-15, and DR08-16; and locations DR08-24 through DR08-26 (**Figure 2**).

Lower quality sediments as determined by exceeding the TECs and PECs for total PAHs and total PCBs were observed at all sample locations for PAHs and all but one sample location (DR08-03) for PCBs (**Figure 3**). Similar to the metals data, a clustering of the sample locations with the poorest sediment quality (concentrations that exceed the PEC for both PAHs and PCBs) were observed at three groups of locations — locations BR08-01 through BR08-04; locations DR08-04, DR08-15, and DR08-16; and locations DR08-18, DR08-20 and DR08-21 (**Figure 3**).

6. COMPARISON TO HISTORICAL DATA

Data from this study was compared to the results of sediment sampling conducted in the same study area in 1994-1995 (Burton 1995) and metals data from three locations as compiled by MWRDGC (2007). Sampling locations in this study were targeted in areas adjacent to the main channel of the river that would potentially provide suitable aquatic habitat. Therefore, sampling locations tended to be in shallow areas with lower water velocities and higher rates of fine-grained sediment deposition. Most chemicals in the environment, including metals, PAHs, and PCBs, tend to be particle reactive, binding to sediment particles in the water column and are subsequently deposited along with the sediment particles, predominately in areas where water velocities decrease, allowing for increased rates of deposition and organic matter accumulation.

Similar to previous studies (Burton et al. 1995, MWRDGC 2007), this study also indicates that the sediments in the Dresden and the Lower Brandon pools have poor sediment quality. To determine whether the sediment quality at specific locations has improved since the 1994-1995, 18 of those locations were re-sampled in this study, and the detected concentrations of metals and PAHs were compared (**Table 11**). Sediment samples in most riverine systems have a high degree of spatial heterogeneity, making it often difficult to make absolute determinations of sediment quality improvement over time when comparing samples from different sampling events. The results of the sampling effort during the 2008 study in comparison to the 1994-1995 study are provided as a weight of evidence type approach and should be considered as the total system rather than simply focusing on specific sampling locations.

For the detected metals, the majority of the detected concentrations from the 2008 study are either higher or within a factor of two or less, indicating that overall, the sediment quality has essentially remained the same or has degraded in several areas (**Table 11**). When environmental samples are compared using the weight of evidence approach, a factor of two is a general rule of thumb to determine if sample concentrations are similar when compared. For sediment samples with metal concentrations that exceeded either the TEC or the PEC, the concentrations in the 2008 study were often less than a factor of two compared to the results of the 1994-1995 study.

A direct comparison of the PAH and PCB data between the 2008 study and the 1994-1995 study is complicated by the vast improvements in instrumentation commercially available and techniques for detecting specific PAHs and PCBs. Many of the individual organic parameters had considerably higher detection limits in the 1994-1995 study than in the 2008 study. Based

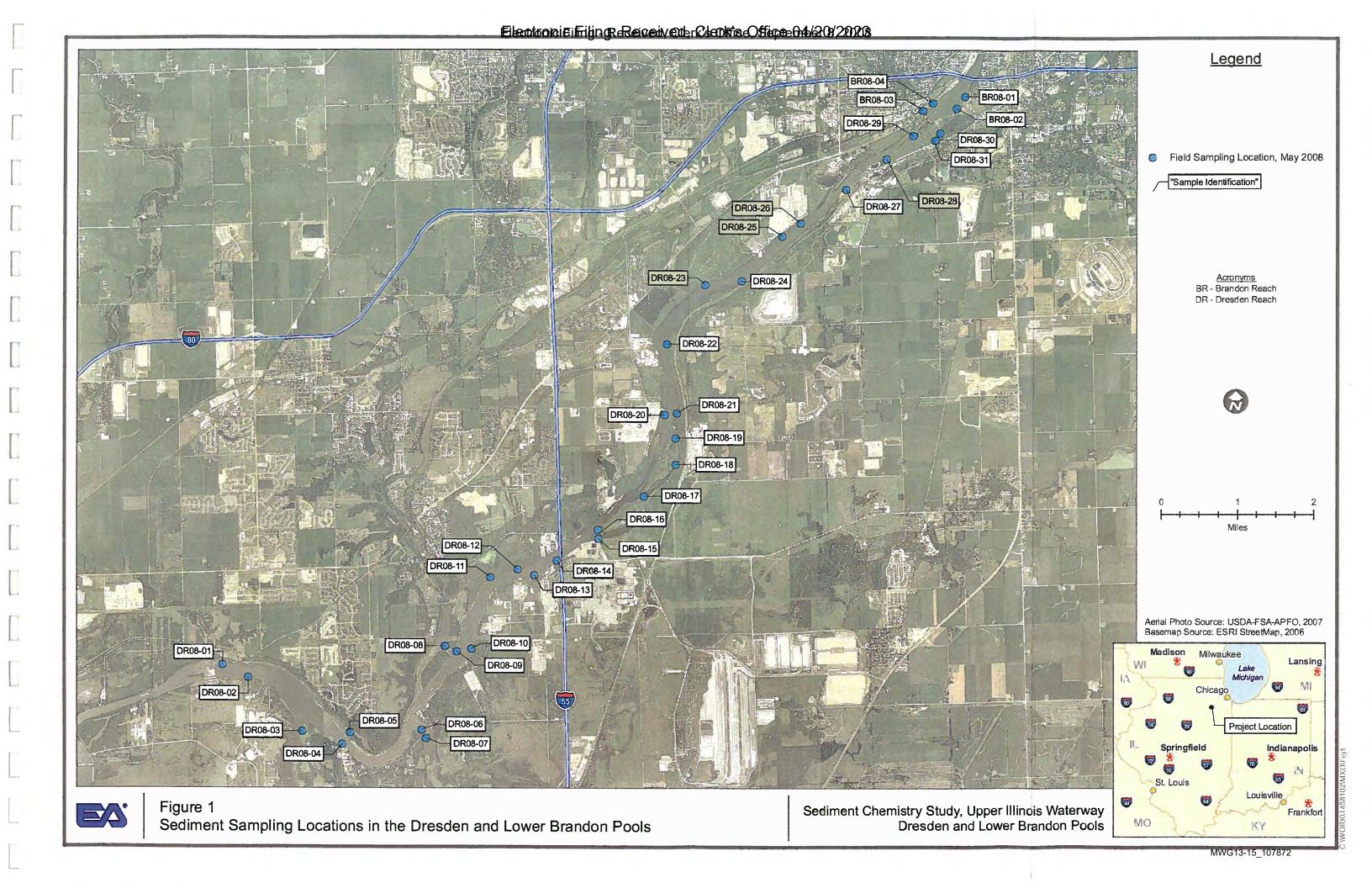
on the results in **Table 11**, it is our opinion that the differences are not improvement of the sediment quality, but rather improvements in detection limits and are most likely similar between the two sampling periods. Regardless of this discrepancy, concentrations of total PAHs and total PCBs were elevated in both studies, with concentrations that commonly exceeded TEC and PEC values, further evidence that the overall sediment quality in the Dresden and the Lower Brandon pools is poor.

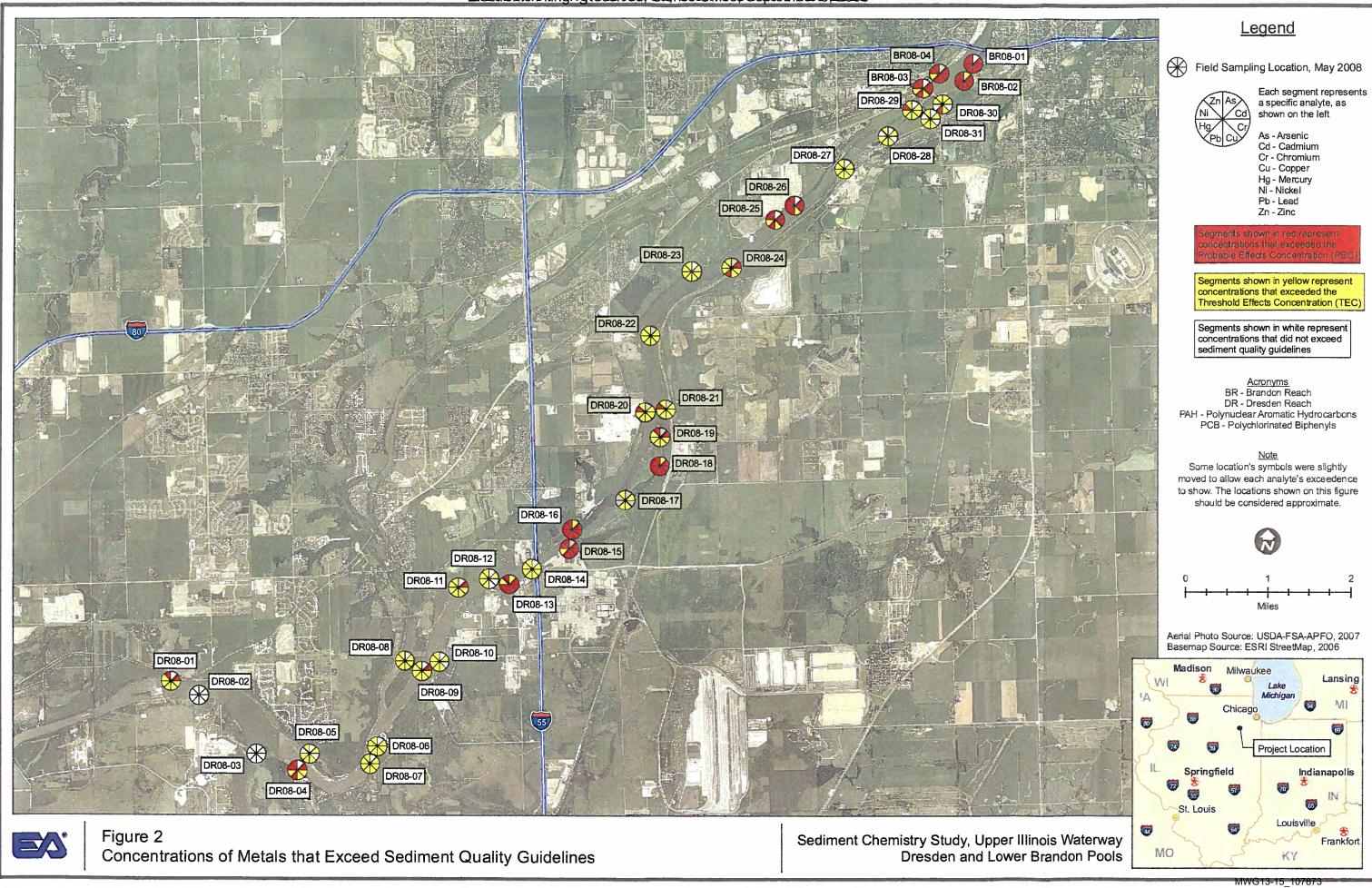
This comparison indicates that, overall, the metals concentrations were generally comparable between the two sampling efforts, and concentrations of total PAHs and total PCBs were elevated in both years. While given the fact that the sampling efforts for both the 1994-1995 and 2008 studies were not set up with an experimental design to allow trend analysis or statistical analysis, there was no clear trend to indicate that the sediment quality of the Dresden and Lower Brandon pools was either greatly improving or degrading between the 1994-1995 study and the 2008 study. However, the results do indicate that the sediment quality remains poor, as evidenced by the high number of sampling locations that exceeded the PECs for many of the metals (**Figure 2**), and total PAHs and total PCBs (**Figure 3**); and that almost all sampling locations had concentrations that were between the TEC and the PEC. It is our opinion that the system has not substantially improved with regards to sediment quality over the last 13 years.

7. REFERENCES

- Burton, G.A. 1995. The Upper Illinois Waterway Study, 1994-1995 Sediment Contamination Assessment. Prepared for the Commonwealth Edison Company, Chicago, Illinois. Final.
- MacDonald, D.D., R.S. Carr, F.D. Calder, E.R. Long, and C.G. Ingersoll. 1996. Development and Evaluation of Sediment Quality Guidelines for Florida Coastal Waters. *Ecotoxicology* 5:253-278.
- MacDonald D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.
- Metropolitan Water Reclaimation District of Great Chicago (MWRDGC). 2007. Water and sediment quality along the Illinois Waterway from the Lockport Lock to the Peoria Lock during 2006. Report No. 07-39. January 2008.
- National Oceanic and Atmospheric Administration (NOAA). 1993. Sampling and Analytical Methods of the National Status and Trends Program: National Benthic Surveillance and Mussel Watch Projects 1984-1992. Vol 1: Overview and Summary of Methods. NOAA Tech. Memo. NOS ORCA 71. Silver Spring, MD.
- U.S. Environmental Protection Agency (USEPA). 2001 Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. Office of Water. EPA-823-B-01-002. October.

- U.S. Environmental Protection Agency (USEPA). 1997. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. 3rd Edition, including final update III. EPA SW-846, Washington D.C.
- U.S. Environmental Protection Agency (USEPA) / U.S. Army Corps of Engineers (USACE). 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.-Testing Manual (Inland Testing Manual). EPA-823-B-98-004.
- U.S. Environmental Protection Agency (USEPA) / U.S. Army Corps Engineers (USACE). 1995. QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations. EPA-823-B-95-001.
- Wenning, R.J. and C.G. Ingersoll. 2002. Summary of the SETAC Pellston Workshop on Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments; 17-22 August 2002. Fairmount, Montana, USA. Society of Toxicology and Chemistry (SETAC). Pensacola, FL, USA.





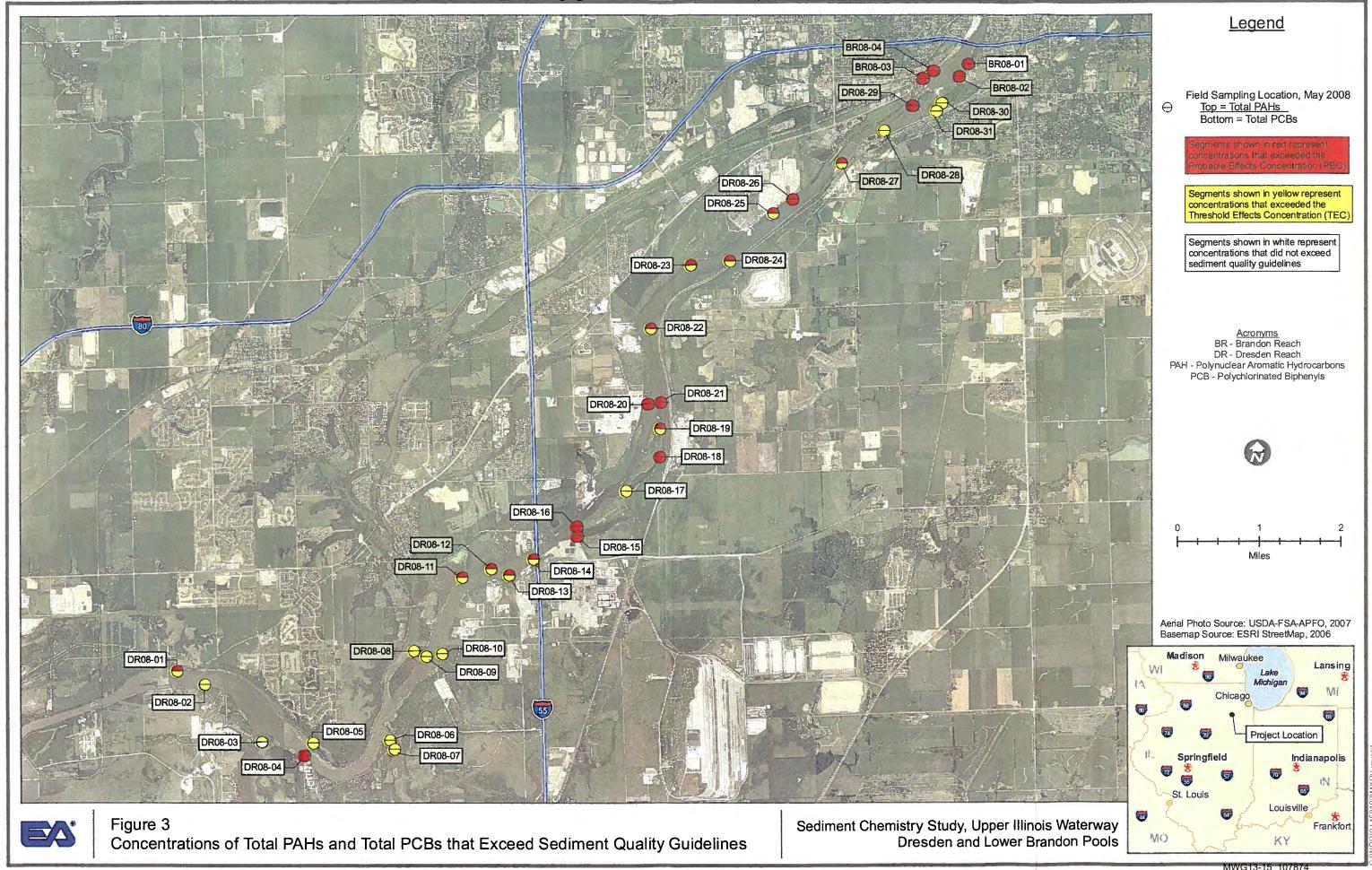


TABLE 7A. CONCENTRATIONS OF TARGET ANALYTES IN SEDIMENT DRESDEN POOL, MAY 2008

					DR08-01	DR08-02	DR08-03	DR08-04	DR08-05	DR08-06	DR08-07	DR08-08	DR08-09	DR08-10	DR08-11	DR08-11FD	DR08-12	DR08-13	DR08-14	DR08-15	DR08-16
ANALYTE	UNITS	RL	TEC*	PEC*																	
TOTAL ORGANIC CARBON	MG/KG	0.90		_	41,400	24,400	6,700	28,700	21,800	26,500	33,200	15,700	23,700	14,500	23,600	16,600	13,200	29,400	13,300	26,300	28,300
PERCENT SOLIDS	%				32.8	45.9	66.9	39	54.6	31.1	32.7	41.3	46.2	57.5	53.5	53.1	66.9	43.3	54.8	35.9	36.4
GRAVEL	96		T	-																	
SAND	96				0.0	0.0	0.0	0.7	0.7	0.0	0.0	0.0	0.4	0.1	0.1	0.7	0.0	2.9	1.5	0.0	0.8
COARSE SAND	— ·		-		16.3	50.3	73.1	25.1	51.1	2.2	4.3	6.2	49.5	67.4	62.3	60.1	88.2	39.9	61.7	9.9	21.0
MEDIUM SAND	į.	_			0.2	0.3	0.1	1.0	2.2	0.0	0.0	0.1	0.3	0.3	3.1	2.8	1.0	0.4	1.4	0.0	1.8
FINE SAND				l _	0.6 15.5	2.7 47.3	3.5 69.5	4.0	4.4	0.1	0.2	0.5	3.8	3.3	11.7	11.3	14.4	6.5	9.1	1.7	6.0
SILT	%			_	64.4	27.4	21.0	20.1 58.4	44.5 38.6	2.1 69.8	73.3	5.6 75.1	45.4 36.0	63.8	47.5	46.0	72.8	33.0	51.2	8.2	13.2
CLAY	%				19.2	22.3	6.0	15.8	9.6	28.1	22.4	18.7	14.0	22.8 9.7	28.7 8.9	28.7 10.6	6.6 5.2	30.2 27.1	26.4 10.4	61.8 28.3	47.2 31.0
SILT+CLAY	%		-		83.6	49.7	27.0	74.2	48.2	97.9	95.7	93.8	50.0	32.5	37.6	39.3	11.8	57.3	36.8	90.1	78.2
ARSENIC	MG/KG	0.11	9.79	22	1. 58 × 3	4					THE PERSON NAMED IN COLUMN				Parameter States						Color and the second
CADMIUM	MG/KG MG/KG	0.11	0.99	4.98			2	6	3	3	4	4	5	3	5	5	3	26	4	6	13
CHROMIUM	MG/KG	0.11	43.4	111	7.5 93.4 J	0.91 16.6 J	0.49	7.4	2.9	4.5	2.8	3.6	5.2	3	9.1	4.1	1.3	17.3	3.1	12.7	29.3
COPPER	MG/KG	0.22	31.6	149	112	19.1	7.5 J	106 J 123	34.6 J 43.8	59.2 J	45.9 J 52	46.4 J 62.3	59.5 J	34 J	56.2 J	54.5 J	27.2]	196 J	51.9 J	158 J	301 J
LEAD	MG/KG	0.11	35.8	128	125	22.2	10.1	143	54.A	67.8 85.7	72.3	65.8	72.9 97.8	42.5	56.9	60	28.7	185	64	161	214
MERCURY	MG/KG	0.05	0.18	1.06	0.72	0.12	0.031	0.63	0.24	0.56	0.27	0.29	0.45	67.3 0.44	90.5	90.8	46.8	311	110 0.3	176	312
NICKEL	MG/KG	0.11	22.7	48.6	37:2	12.2	7.5	50.5	22.7	24.3	29.3	29	37.5	23.8	0.56 41.1	0.45 45	0.72 27.2	36.3	25	0.79	1.5 106
SILVER	MG/KG	0.11			2.3	0.35	0.062	2.7	0.97	2.1	1.2	1.3	1.3	0.82	0.94	0.83	0.36	4.5	1.1	4.3	7
ZINC	MG/KG	0.54	121	459	519 J	84.7 1	44 J	611 J	213]	264 J	225 J	296 J	455 J	267 J	354 J	356 J	204 J	836 J	314 3	655 J	1280 J
ACENAPHTHENE	UG/KG	204			300	130 J	130 U	320	220	210 J	160 J	160	250	210	490	400	250	3,000	390	220	800
ACENAPHTHYLENE	UG/KG	204			700	360	140	770	340	380	240	290	710	710	1,700	1,400	840	7,900	2,400	830	1,200
ANTHRACENE	UG/KG	204	57	845	820	390	140	870	410	440	270	320	650	650	1,500	1,300	740	14,000	2,300	910	1,700
BENZO(A)ANTHRACENE	UG/KG	204	108	1,050	2,000	1,900	57 J	2,300	1,000	770	210	740	1,900	1,800	5,300	5,300	3,200	84,000	9,500	2,600	6,300
BENZO(A)PYRENE	UG/KG	204	150	1,450	2,700	1,900	130	2,900	1,200	1,000	360	1,100	2,500	2,400	7,000	6,300	3,900	73,000	11,000	3,400	4,900
BENZO(B)FLUORANTHENE	UG/KG	204			3,100	2,200	210	3,500	1,400	1,400	560	1,400	2,700	2,700	6,500	6,500	4,000	74,000	16,000	5,200	7,800
BENZO(GHI)PERYLENE	UG/KG	204			2,100	1,200	61 J	2,200	840	840	220	880	1,900	1,800	4,700	4,300	2,600	36,000	8,900	3,000	4,300
BENZO(K)FLUORANTHENE	UG/KG	204			1,300	770	41 J	1,200	550	430	140 J	510	1,100	820	3,400	2,700	1,300	35,000	130 U	47 U	92 U
CHRYSENE	UG/KG	204	166	1,290	2,700	2,200	70 J	2,800	1,300	920	280	1,100	2,300	2,300	6,100	5,600	3,900	83,000	11,900	3,600	7,200
DIBENZO(A,H)ANTHRACENE	UG/KG	204	33		620	410	130 U	650	250	230	77 J	210	550	500	1,300	1,200	680	9,000	2,400	590	950
FLUORANTHENE	UG/KG	204	423	2,230	3,100	1,500	340	3,300	1,800	1,400	720	1,400	2,500	2,300	5,200	4,900	2,600	110,000	9,800	5,100	15,000
FLUORENE INDENO(1,2,3-CD)PYRENE	UG/KG UG/KG	204	77	536	680	390	130 U	590	400	560	200 U	430	490	460	750	620	430	5,800	620	340	1,100
			176		1,900	1,200	70 J	1,900	790	740	250	820	1,600	1,600	4,200	3,900	2,400	35,000	7,600	2,500	3,200
NAPHTHALENE PHENANTHRENE	UG/KG UG/KG	204	176 204	561 1,170	240 1,200	38 J 410	130 U	200	89 J	87 J	200 U	69 J	130 J	140	370	370	110 J	990 J	470	380	390
PYRENE	UG/KG UG/KG	204	195	1,170	2,900	1,200	100 J 98 J	1,300 3,100	470 1,700	520 1,200	330	1,400	2,200	810 2,000	2,000 4,400	1,700 3,900	690 2,100	12,000	3,000 7,200	1,600 3,800	1,400
TOTAL PAHs (ND=0)	UG/KG		1.610		111000000000000000000000000000000000000		Name and Address of the Owner,					A CONTROL OF	No. of the last of				2000	90,000	An example of		11,000
TOTAL PAHS (ND=0) TOTAL PAHS (ND=1/2RL)	UG/KG		1,610	22,800	26,360	16,198	1,457	27,900	12,759	11,127	4,017	11,319	22,360	21,200	54,910	50,390	29,740	672,690	92,580	34,070	67,240
TOTAL PAHS (ND=1/2RL) TOTAL PAHS (ND=RL)	UG/KG UG/KG		1,610	22,800 22,800	26,360 26,360	16,198 16,198	1,717 1,977	27,900 27,900	12,759	11,127	4,217 4,417	11,319	22,360	21,200	54,910	50,390	29,740	672,690	92,645	34,094	67,286
TOTAL FAIR (ND-KL)	JOWG		1,010	22,800	20,500	10,170	1,7//	47,500	12,759	11,127	4,417	11,319	22,360	21,200	54,910	50,390	29,740	672,690	92,710	34,117	67,332

^{*}Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

Physical parameters (ie., grain size and TOC) are reported as percent total sample.

B (organic) = detected in the laboratory method blank

RL = average reporting limit
TEC = Threshold Effect Concentration J (organic) = compound was detected, but below the reporting limit (value is estimated)

PEC = Probable Effect Concentration J (inorganic) = detected in the laboratory method blank

FD = field duplicate U = compound was analyzed, but not detected

COL = more than 40% difference between initial and confirmation results; the lower result is reported

NOTE: Shaded and bold values indicate parameters for detected constituents. Values not shaded or bold represent non-detected concentrations reported at the RL/MDL.

TABLE 7A. CONCENTRATIONS OF TARGET ANALYTES IN SEDIMENT DRESDEN POOL, MAY 2008

					DR08-17	DR08-18	DR08-19	DR08-20	DR08-21	DR08-22	DR08-23	DR08-24	DR08-25	DR08-26	DR08-27	DR08-28	DR08-28FD	DR08-29	DR08-30	DR08-31
ANALYTE	UNITS	RL	TEC*	PEC*	2100 11	2200 10	2400-15		DR00-21	DR00-22	D100-25	DR00-24	DR00-23	DR00-20	DR00-27	DR00-20	DRUG-ZGFD	DR00-29	DRUG-30	DR00-31
TOTAL ORGANIC CARBON	MG/KG	0.90			15,100	43,900	25,600	70,800	15,100	47,400	37,000	37,500	33,500	73,000	24,800	21,400	26,300	83,500	45,000	21,500
PERCENT SOLIDS	%		-		47.7	39.8	40.1	61.3	58.6	58.3	57.7	49.4	57	50.6	57.3	67.3	66.2	54	57.8	59.7
	٠		1	7				<u> </u>												#==
GRAVEL	%	-			5.3	0.0	1.7	0.6	0.0	1.0	0.4	0.0	0.0	0.0	2.8	1.1	1.3	0.6	0.0	0.2
SAND	%			-	28.4	32.5	53.2	85.2	80.9	74.4	71.9	55.6	62.7	44.9	67.2	80.8	79.4	63.3	41.5	41.9
COARSE SAND	l .	-	-	-	0.6	0.6	1.9	1.8	1.1	2.3	3.3	0.5	0.8	0.2	2.3	3.7	5.6	3.6	1.1	4.1
MEDIUM SAND	i	-	-	<u> </u>	3.0	2.4	8.4	14.8	9.0	16.9	15.8	2.8	4.6	2.4	11.0	21.2	20.0	18.1	7.9	11.3
FINE SAND		-			24.8	29.5	42.9	68.6	70.8	55.2	52.8	52.3	57.3	42.3	53.9	55.9	53.8	41.6	32.5	26.5
SILT	%	-			50.6	44.3	34.3	10.0	13.4	16.8	21.8	34.5	32.5	48.1	24.9	14.8	15.5	22.8	43.0	40.1
CLAY	%		-		15.6	23.2	10.9	4.2	5.7	7.7	5.9	10.0	4.7	7.1	5.1	3.3	3.9	13.3	15.4_	17.8
SILT+CLAY	%		-		66.2	67.5	45.2	14.2	19.1	24.5	27.7	44.5	37.2	55.2	30.0	18.1	19.4	36.1	58.4	57.9
ARSENIC	MG/KG	0.11	9.79	33	4	17	6	5	4	4	3	8 4	4	6	4	3	3	6	10	9
CADMIUM	MG/KG	0.11	0.99	4.98	1.5	41.3	5	4.9	3.9	3.4	3.7	7.3	5.5	7.9	4.4	1.7	1.7	3.7	2.2	2
CHROMIUM	MG/KG	0.22	43.4	111	28 J	355 J	77.3 J	79.1 J	55.3 J	47.4 J	57.3 J	71.3 J	125 J	147 J	56.5 J	34.1 J	33.1 J	57.2 J	19.8 J	33.2 J
COPPER	MG/KG	0.22	31.6	149	37.A	284	87	57.7	58.5	48.5	73.1	81.7	97.5	140	68.4	38.2	32.7	49.6	103	47.2
LEAD	MG/KG	0.11	35.8	128	39.8	366	127	100	92.3	83.9	86.9	138	222	215	89.9	51.1	56.7	98.7	241	105
MERCURY	MG/KG	0.05	0.18	1.06	0.13	3.3	0.58	0.48	0.66	0.51	0.32	0.87	0.97	2.6	0.3	0.24	0.13	0,29	0.15	0.24
NICKEL	MG/KG	0.11	22.7	48.6	18.2	90.6	38	77.2	49.4	45.7	35.3	29.1	57.2	56.4	34.1	21.5	21.7	55.1	32.1	22.7
SILVER	MG/KG	0.11		-	0.6	8.4	1.5	0.97	0.81	0.79	1.1	2.2	1.3	2.1	0.96	0.46	0.41	0.64	0.38	0.61
ZINC	MG/KG	0.54	121	459	145 J	1450 J	491 J	342 J	374 J	312 J	335 J	305 J	547 J	757 J	330 J	158 J	172 J	429 J	333 J	383 J
ACENAPHTHENE	UG/KG	204		-	51	2,600	340	1,700	910	1.600	580	670	1,600	910	410	130	130	620	47	36
ACENAPHTHYLENE	UG/KG	204	-		130	3,000	1.500	10,000	4.000	12,000	3,500	1,400	1,900	2,700	1,300	250	340	3,200	37	160
ANTHRACENE	UG/KG	204	57	845	140	6,600	1,300	5,800	4,200	11,000	6,900	1,400	4,000	3,000	1,200	590	420	3,000	140	130
BENZO(A)ANTHRACENE	UG/KG	204	108	1.050	500	18,000	4.600	43,000	13,000	93,000	25,000	5,200	16,000	12,000	5,800	1,900	1,200	12,000	590	570
BENZO(A)PYRENE	UG/KG	204	150	1,450	580	15,000	5,400	45,000	15,000	86,000	22,000	4,800	18,000	15,000	7,200	1,400	1,300	12,000	590	600
BENZO(B)FLUORANTHENE	UG/KG	204			720	17,000	8,000	45,000	19,000	92,000	22,000	6,100	25,000	13,000	9,600	2,100	1,900	16,000	880	820
BENZO(GHI)PERYLENE	UG/KG	204			520	11,000	3,000	31,000	12,000	55,000	14,000	3,700	13,000	11,000	4,500	730	510	9,300	360	380
BENZO(K)FLUORANTHENE	UG/KG	204	-		320	5,300	42 U	17,000	130 U	34,000	13,000	68 U	320 U	10,000	64 U	32 U	33 U	310 U	32 U	34 U
CHRYSENE	UG/KG	204	166	1,290	610	21,000	5,700	41,000	14,000	94,000	25,000	6,600	18.000	14,000	7.100	1.700	1,500	12.000	570	590
DIBENZO(A,H)ANTHRACENE	UG/KG	204	33	-	90	2,900	1,300	2,700	4,300	5,500	3,500	1,000	2,500	3,100	1.500	190	170	2,700	89	120
FLUORANTHENE	UG/KG	204	423	2,230	960	45,000	6,700	43,000	21,000	130,000	43,000	10,000	44,000	23,000	9,100	4,400	2,600	16,000	1,500	1,000
FLUORENE	UG/KG	204	77	536	64	4,800	430	1,500	1,100	2,000	940	920	1,800	1,200	460	210	160	570	51	57
INDENO(1,2,3-CD)PYRENE	UG/KG	204		-	450	8,400	3,000	27,000	11,000	50,000	13,000	3,000	12,000	10.000	4,600	730	550	8,200	360	340
NAPHTHALENE	UG/KG	204	176	561	50	1,100	390	1,100	870	1,400	570	270	970	1,300	460	94	120	720	29 J	38
PHENANTHRENE	UG/KG	204	204	1,170	300	10,000	2,000	3,900	5,600	7,700	11,000	1,500	19,000	8,100	2,200	1,600	760	2,900	510	400
PYRENE	UG/KG	204	195	1,520	700	32,000	4,200	32,000	12,000	85,000	28,000	6,300	24,000	13,000	5,000	2,200	1,400	8,900	710	640
TOTAL PAHs (ND=0)	UG/KG		1,610	22,800	6,185	203,700	47,860	350,700	137,980	760,200	231,990	52,860	201,770	141,310	60,430	18,224	13,060	108,110	6,463	5,881
TOTAL PAHs (ND=1/2RL)	UG/KG		1,610	22,800	6,185	203,700	47,881	350,700	138,045	760,200	231,990	52,894	201,930	141,310	60,462	18,240	13,077	108,265	6,479	5,898
TOTAL PAHs (ND=RL)	UG/KG		1,610	22,800	6,185	203,700	47,902	350,700	138,110	760,200	231,990	52,928	202,090	141,310	60,494	18,256	13,093	108,420	6,495	5,915

^{*}Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

Physical parameters (ie., grain size and TOC) are reported as percent total sample.

RL = average reporting limit
TEC = Threshold Effect Concentration **B** (organic) = detected in the laboratory method blank

J (organic) = compound was detected, but below the reporting limit (value is estimated)

PEC = Probable Effect Concentration J (inorganic) = detected in the laboratory method blank

FD = field duplicate U = compound was analyzed, but not detected

COL = more than 40% difference between initial and confirmation results; the lower result is reported

NOTE: Shaded and bold values represent detected concentrations.

TABLE 7B. CONCENTRATIONS OF TARGET ANALYTES IN SEDIMENT DRESDEN POOL, MAY 2008

					DR08-01	DR08-02	DR08-03	DR08-04	DR08-05	DR08-06	DR08-07	DR08-08	DR08-09	DR08-10	DR08-11	DR08-11FD	DR08-12	DR08-13	DR08-14	DR08-15	DR08-16
ANALYTE	UNITS	RL	TEC*	PEC*							•							•			
PCB 8 *	UG/KG	1.42			3.9	1.1 U	0.97 U	5.5 COL	1.9	2.2 EST	1.5 U	1.6 COL	2.5 COL	2.9	4.4 EST	4.9	2.3	1.8	3.7 EST	5.5 COL	2.8 COL
PCB 18 *	UG/KG	1.42			13	1.6	0.97 U	23	8.1	7	2.6	6.6	10	11	18	18	8.5	6.8	11	26	25 COL
PCB 28 *	UG/KG	14.18			28	3.2 J	0.7 J	38	16	19	6.8 J	14	19	21	29	29	16	9.6 J	23	51	38
PCB 44 *	UG/KG	1.42			27	2.8	0.81 J	37	15	17	6.3	15	19	19	26	25	14	9.8	19	49	53
PCB 49	UG/KG	1.42			25	2.8 COL	0.87 J	33	12	17	6.1	13	16	16	21	20	11	11	17	46	46
PCB 52 *	UG/KG	1.42			33	3.4	0.86 J	43	17	21	7.7	17	23	21	29	27	15	13	23	58	73
PCB 66 *	UG/KG	1.42			26	2.7	0.71 J	30	13	17	6.7	13	16	16	22	21	12	7.5	17	41	48
PCB 77 *	UG/KG	1.42			4.6	0.36 J COL	0.97 U	5.3	2.1 COL	2.9 COL	1.1 J COL	2.4 COL	2.9 COL	2.6	0.93 U	3.2	1.6	1.5 COL	2.8 COL	6.6 COL	7.4 COL
PCB 87	UG/KG	1.42			11 COL	1.3 COL	0.36 J COL	12 COL	5.5 COL	7.9 COL	3.1 COL	6.1 COL	7.9 COL	6.2 COL	7.9 COL	7.4 COL	4.3 COL	5.4 COL	6.7 COL	19 COL	33 COL
PCB 90	UG/KG	1.42			1.5 U	1.1 U	0.97 U	1.3 U	1 U	1.6 U	1.5 U	1.2 U	1.1 U	0.96 U	0.93 U	0.94 U	0.97 U	1.2 U	1 U	1.4 U	2.8 U
PCB 101 *	UG/KG	1.42			33 EST	3.4 EST	0.86 J EST	37 EST	15 EST	23 EST	8.4 EST	18 EST	23 EST	18 EST	22 COL	21 COL	11 EST	14 EST	19 COL	56 COL	86 EST
PCB 105 *	UG/KG	1.42			9.2	1.1	0.97 U	9.4	4.5	6.6	2.6	4.5	6.5	5.4	6.6	6.5	3.8	4.3	5.5	14	23
PCB 118 *	UG/KG	1.42			22	2.3	0.64 J	25	10	16	6	11	16	12	15	15	8.2	10	13	36	65
PCB 126 *	UG/KG	1.42			1.5 U	1.1 U	0.97 U	1.3 U	1 U	1.6 U	1.5 U	1.2 U	1.1 U	0.96 U	0.93 U	0.94 U	0.97 U	1.2 U	1 U	1.4 U	2.8 U
PCB 128 *	UG/KG	1.42			4.6	0.61 J	0.2 J	4.9	1.9	3.6	1.5	2.4	3.3	2.4	2.4	2.4	1.2	2.3	2.3	8.4	15
PCB 138 *	UG/KG	1.42			23	2.6 EST	0.65 J EST	23	9.3	17	6.7 EST	11	16	11	12	12	6.3	10	13	36	66
PCB 153 *	UG/KG	1.42			24	2.7	0.65 J COL	24	9.4	19	6.7	12	16	12	11	12	6.1	9.2	14	40	68
PCB 156	UG/KG	1.42			2.4	0.27 J	0.97 U	2,5	0.98 J	1.9	0.73 J	1.2	1.7	1.2	1.3	1.3	0.74 J	1.2	1.2	3.7	7.4
PCB 169 *	UG/KG	1.42			1.5 U	1.1 U	0.97 U	1.3 U	1 U	1.6 U	1.5 U	1.2 U	1.1 U	0.96 U	0.93 U	0.94 U	0.97 U	1.2 U	1 U	1.4 U	2.8 U
PCB 170 *	UG/KG	1.42			9.2 EST	1.1 EST	0.3 JEST	8.6 EST	3.2 EST	7.1 EST	2.6 EST	4.4 EST	6 EST	4.2 EST	3.8 EST	3.9 EST	1.9 EST	3.2 EST	5 EST	14 EST	22 EST
PCB 180 *	UG/KG	1.42			17	1.7	0.97 U	16	5.5	13	4.7	7.6	10	7.2	6.2	6.4	3.1	5.5	8.4	25	42
PCB 183	UG/KG	1.42			4.5	0.47 J	0.97 U	4.3	1.5	3.5	1.2 J	2.1	2.8	2.1	1.8	1.9	0.9 J	1.5	2.4	7	11
PCB 184	UG/KG	1.42			0.75 J COL	1.1 U	0.97 U	1.3 U	1 U	0.54 J COL	1.5 U	1.2 U	1.1 U	0.39 J COL	0.93 U	0.94 U	0.97 U	1.2 U	COL	1.1 J COL	2.8 U
PCB 187 *	UG/KG	1.42			9.6	1.2	0.26 J	9.3	3.4	7.8	2.8	4.8	6.3	4.6	* 4.1	4.3	2	3.8	5.4	15	23
PCB 195	UG/KG	1.42			2.2 EST	0.31 T COL	0.97 U	1.9	0.75 J EST	1.7 EST	0.62 J EST	0.97 J	1.2	0.95 J EST	0.88 COL	0.9 COL	0.41 J EST	1.2 COL	1.2	2.9 T COL	
PCB 206	UG/KG	1.42			3.3	0.54 J	0.15 J	3.1	0.86 J	2.7	0.88 J	1.3	2.1	1.6	3	2.6	0.38 J	15	1.2	3.8	8.2
PCB 209	UG/KG	1.42			3.8	0.6 J	0.97 U	2.9	0.79 J	2.5	0.85 J	1.3	1.8	1.5	2.8	2.5	0.97 U	16	1	Biol. 4	10
TOTAL PCBs (ND=0)	UG/KG		59.8	676	574.2	61.54	13.28	678	270.6	398.4	146.4	290.6	391	340.6	423	423.2	226	224.6	370.2	963	1314,4
TOTAL PCBs (ND=1/2RL)	UG/KG		59.8	676	577.2	64.84	20.07	680.6	272.6	401.6	150.9	293	393.2	342.52	425.79	425.08	227.94	227	372.2	965.8	1320
TOTAL PCBs (ND=RL)	UG/KG		59.8	676	580.2	68.14	26.86	683.2	274.6	404.8	155.4	295.4	395.4	344.44	428.58	426.96	229.88	229.4	374.2	968.6	1325.6

^{*}Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

B (organic) = detected in the laboratory method blank

TEC = Threshold Effect Concentration

J (organic) = compound was detected, but below the reporting limit (value is estimated)

PEC = Probable Effect Concentration

J (inorganic) = detected in the laboratory method blank

FD = field duplicate

U = compound was analyzed, but not detected COL = more than 40% difference between initial and confirmation results; the lower result is reported

NOTE: Shaded and bold values indicate detected concentrations. Values not shaed or bold indicated non-detected concentrations represented by the average RL.

RL = average reporting limit

TABLE 7B. CONCENTRATIONS OF TARGET ANALYTES IN SEDIMENT DRESDEN POOL, MAY 2008

					DR08-17	DR08-18	DR08-19	DR08-20	DR08-21	DR08-22	DR08-23	DR08-24	DR08-25	DR08-26	DR08-27	DR08-28	DR08-28FD	DR08-29	DR08-30	DR08-31
ANALYTE	UNITS	RL	TEC*	PEC*																
PCB 8 *	UG/KG	1.42			1 U	3.1 J COL	4.9 EST	19	6.6 EST	7 EST	6	3	7	14 EST	7	5.9	4.7	8.7 EST	0.95 U	1 U
PCB 18 *	UG/KG	1.42	-		2.8	19	16	97	31	26	18	8.9	20	35	19	25	20	39	0.95 U	1.5
PCB 28 *	UG/KG	14.18	-	·	6.4 J	26 J	32	120	56	39	31	15	35	70	31	28	23	51	15	2.7 J COL
PCB 44 *	UG/KG	1.42			6.6	65	27	110	45	30	24	12	25	49	24	29	24	51	15	3
PCB 49	UG/KG	1.42			6 COL	52	25	85	36	24	21	9.6 COL	22	41	20 COL	23	19	41	13	3 COL
PCB 52 *	UG/KG	1.42			8	110	32	120	49	34	27	13	29	52	27	33	26	53	19	4.1
PCB 66 *	UG/KG	1.42	-		5.7	51	23	87	38	23	21	10	22	48	20	17	14	39	5.5	3.1
PCB 77 *	UG/KG	1.42	-		1.1 COL	3.8 U	4.2	9.6	5.3	3.7	3.2 COL	1.3 COL	4	7.2	3.2 COL	3.1	2.4	1.9 U	0.95 U	1 U
PCB 87	UG/KG	1.42			3.1 COL	68 COL	9.6 COL	26 COL	13 COL	8.1 COL	7.8 COL	4.2 COL	9.7 COL	15 COL	7.6 COL	8.4 COL	7.1 COL	12 COL	8.5 COL	2.9 COL
PCB 90	UG/KG	1.42			1 U	3.8 U	1.2 U	2.9 U	2.8 U	0.94 U	0.95 U	1 U	0.96 U	3 U	0.96 U	0.97 U	0.98 U	1.9 U	0.95 U	1 U
PCB 101 *	UG/KG	1.42			8.1 EST	140 COL	28 COL	74 EST	32 EST	21 COL	22 COL	11 COL	26 COL	39 COL	21 COL	25 EST	21 EST	33 EST	18 EST	6 EST
PCB 105 *	UG/KG	1.42			2.5 COL	45	8	21	10	6.3	6.4	3.4	8.8	13	6.2	6.1	4.8	10	6	2.1
PCB 118 *	UG/KG	1.42			5	130	18	49	22	14	15	7.5	20	27	14	15	12	22	15	4.7
PCB 126 *	UG/KG	1.42	-		1 U	3.8 U	1.2 U	2.9 U	2.8 U	0.94 U	0.95 U	1 U	0.96 U	3 U	0.96 U	0.97 U	0.98 U	1.9 U	0.95 U	1 U
PCB 128 *	UG/KG	1.42			1.2	30	3.5	6.8	3.2	1.7 COL	2.7	1.5	4.9 B	4.8 B	2.5 B	2.9 B	2.3 B	3.2 B	5.1 B	3 B
PCB 138 *	UG/KG	1.42	-		6.2	110	18	30	17	11	14	6.7	21	24	13	13	11	17	19	11
PCB 153 *	UG/KG	1.42	-		6.4	110	19	29	17	11	14	6.6	21	23	13	14	11	18	18	10
PCB 156	UG/KG	1.42		-	0.61 J	15	1.8	3.3	1.7 J	1.2	1.5	0.75 J	2.5	2.6 J	1.3	1.4	1.1	1.8 J	2	0.77 J
PCB 169 *	UG/KG	1.42			1 U	3.8 U	1.2 U	2.9 U	2.8 U	0.94 U	0.95 U	1 U	0.96 U	3 U	0.96 U	0.97 U	0.98 U	1.9 U	0.95 U	1 U
PCB 170 *	UG/KG	1.42			2.6 EST	30 EST	6.7 EST	8.9 EST	5.7 EST	3.4 EST	5.1 EST	2.5 EST	8.6 EST	9.1 EST	4.5 EST	4.8 EST	3.3 EST	5.9 EST	6.1 EST	4.5 EST
PCB 180 *	UG/KG	1.42			4.5	51	12	15	9.1	5.2	8.5	3.7	14	14	7.6	9.2	6	9.4	13	7.9
PCB 183	UG/KG	1.42			1.1	14	3.3	4.1	2.6 J	1.7	2.5	1.1	3.7	4	2.2	2,4	1.7	2.7	3.6	2.2
PCB 184	UG/KG	1.42			1 U	3.8 U	1.2 U	2.9 U	2.8 U	0.94 U	0.95 U	1 U	0.96 U	3 U	1.2	0.97 U	0.98 U	1.9 U	0.95 U	1 U
PCB 187 *	UG/KG	1.42			2.8	27	7.1	9.6	5.9	3.7	5.5	2.4	7.9	9.1	4.8	5.6	3.7	6.4	8.5	4.7
PCB 195	UG/KG	1.42			0.57 COL	6.3	1.5 EST	1.8 J EST	1.2 J	0.95 EST	1.1 EST	0.68 J EST	1.7	3 U	0.97 EST	0.97 U	0.76 T COL	1.1 T COL	1.9	0.94 J EST
PCB 206	UG/KG	1.42			0.59 J	13	1.7	2.1 J	1 J	0.59 J	1.1	1.7	1.5	1.8 J	0.94 J	1.9	1.1	1.3 J	5.3	1.7 COL
PCB 209	UG/KG	1.42	- "		0.54 J	18	1.5	1.9 J PE	1.2 J PE	0.94 U	0.7 J COL	1.9	2.1	1.6 J	1.2 PE	0.47 J	0.7 J	1.1 J	2.3	1.7
TOTAL PCBs (ND=0)	UG/KG		59.8	676	139.8	1894.2	518.8	1611.8	705.6	480	446.8	217	548.4	876.4	435.6	473.2	378.4	733.2	326.4	136.6
TOTAL PCBs (ND=1/2RL)	UG/KG		59.8	676	142.8	1905.6	521.2	1617.6	711.2	481.88	448.7	219	550.32	882.4	437.52	475.14	380.36	738.9	331.15	140.6
TOTAL PCBs (ND=RL)	UG/KG		59.8	676	145.8	1917	523.6	1623.4	716.8	483.76	450.6	221	552.24	888.4	439.44	477.08	382.32	744.6	335.9	144.6

^{*}Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

 \mathbf{B} (organic) = detected in the laboratory method blank

TEC = Threshold Effect Concentration

J (organic) = compound was detected, but below the reporting limit (value is estimated)

PEC = Probable Effect Concentration

J (inorganic) = detected in the laboratory method blank

FD = field duplicate

U = compound was analyzed, but not detected

COL = more than 40% difference between initial and confirmation results; the lower result is reported

NOTE: Shaded and bold values indicate detected concentrations. Values not shaed or bold indicated non-detected concentrations represented by the average RL.

RL = average reporting limit

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TABLE 8. CONCENTRATIONS OF TARGET ANALYTES IN SEDIMENT LOWER BRANDON POOL, MAY 2008

					BR08-01	BR08-02	BR08-03	BR08-04
ANALYTE	UNITS	RL	TEC**	PEC**		137		
TOTAL ORGANIC CARBON	96				4.23 53.9	6.61 39.5	5.28 45.2	4.80 50.3
PERCENT SOLIDS	%	-			33.9	39.3	43.2	30.3
GRAVEL	96			_	3.5	0.0	0.0	0.5
SAND	%				54.7	19.2	19.4	58.0
COARSE SAND	%				2.2	0.1	0.0	4.4
MEDIUM SAND	%	_			4.6	0.7	0.8	12.6
FINE SAND	96				47.9	18.4	18.6	41.0
SILT	%		-	ļ	29.2	64.4	68.6	24.0
CLAY	%				12.5	16.4	11.9	17.5
SILT+CLAY	%			-	41.7	80.8	80.5	41.5
			0.50					
SILVER	MG/KG	0.11	9.79	33	9 21	23.3	6 8.4	8
CADMIUM	MG/KG	0.11	0.99 43.4	4.98	274 J	282 J	125 J	18.4 244 J
CHROMIUM COPPER	MG/KG MG/KG	0.22	31.6	149	235	264	146	177
LEAD	MG/KG	0.11	35.8	128	456	322	196	315
MERCURY	MG/KG	0.04	0.18	1.06	1.4	2	0.84	0.83
NICKEL	MG/KG	0.11	22.7	48.6	163	109	50.3	129
SILVER	MG/KG	0.11			6.8	6.8	3	5.2
ZINC	MG/KG	0.54	121	459	933 J	1,170 J	642 J	800 J
ACENAPHTHENE	UG/KG	361			3,000	2,000	520	2,400
ACENAPHTHYLENE	UG/KG	361		-	10,000	5,300	1,500	8,200
ANTHRACENE	UG/KG	361	57.2	845	7,100	6,300	1,800	10,000
BENZO(A)ANTHRACENE	UG/KG	361	108_	1,050	35,000	16,000	6,100	40,000
BENZO(A)PYRENE	UG/KG	361	150	1,450	35,000	21,000	6,900	38,000
BENZO(B)FLUORANTHENE	UG/KG	361			47,000	27,000	9,500	53,000
BENZO(CHI)PERYLENE	UG/KG	361 361	-	_	29,000 620 U	15,000 420 U	3,900 74 U	18,000 330 U
BENZO(K)FLUORANTHENE CHRYSENE	UG/KG UG/KG	361	166	1,290	38,000	26,008	6,400	47,000
DIBENZO(A,H)ANTHRACENE	UG/KG	361	33.0	1,290	9,500	4,600	990	6,700
FLUORANTHENE	UG/KG	361	423	2,230	45.000	36,000	11,000	65,000
FLUORENE	UG/KG	361	77.4	536	2,900	2,800	720	2,800
INDENO(1,2,3-CD)PYRENE	UG/KG	361		_	26,000	14,000	3,900	21,000
NAPHTHALENE	UG/KG	361	176	561	1,900	6,600	840	3,700
PHENANTHRENE	UG/KG	361	204	1,170	6,600	11,000	3,300	12,000
PYRENE	UG/KG	361	195	1,520	26,000	23,000	6,790	32,000
TOTAL PAHs (ND=0)	UG/KG		1,610	22,800	322,000	216,600	64,070	359,800
TOTAL PAHs (ND=1/2RL)	UG/KG		1,610	22,800	322,310	216,810	64,107	359,965
TOTAL PAHs (ND=RL)	UG/KG		1,610	22,800	322,620	217,020	64,144	360,130
707 0 t	******	6.00			60	24 001	11 700	AT COL
PCB 8 * PCB 18 *	UG/KG UG/KG	6.93		-	240	24 COL 120	11 EST 38	47 COL
PCB 28 *	UG/KG	69.3	-		290	160	76	270
PCB 44 *	UG/KG	6.93	-	=	280	190	59	240
PCB 49	UG/KG	6.93		_	210	140	52	190
PCB 52 *	UG/KG	6.93		_	300	210	66	270
PCB 66 *	UG/KG	6.93		-	200	140	52	190
PCB 77 *	UG/KG	6.93			23 COL	18 COL	8.9	21 COL
PCB 87	UG/KG	6.93		-	80 COL	72 COL	20 COL	65 COL
PCB 90	UG/KG	6.93			9.3 U	6.3 U	2.2 U	9.9 U
PCB 101 *	UG/KG	6.93			COL	190 EST	57 EST	190 EST
PCB 105 *	UG/KG	6.93			56	53	16	48
PCB 118 *	UG/KG	6.93		-	140	120	39	130
PCB 126 *	UG/KG	6.93			9.3 U	6.3 U	2.2 U	9.9 U
PCB 128 *	UG/KG	6.93	-	- -	23 B	23 B	7.2 B	20 B
PCB 138 *	UG/KG	6.93			110	110 110	36 38	93
PCB 153 * PCB 156	UG/KG UG/KG	6.93		-	12	12	3.8	10
PCB 169 *	UG/KG	6.93		-	9.3 U	6.3 U	2.2 U	9.9 U
PCB 170 *	UG/KG	6.93			31 EST	39 EST	14 EST	29 EST
PCB 180 *	UG/KG	6.93	-		55	72	26	49
PCB 183	UG/KG	6.93		_	16	19	6.8	14
PCB 184	UG/KG	6.93		-	9.3 U	6.3 U	1J COL	9.9 U
PCB 187 *	UG/KG	6.93		-	34	40	15	29
PCB 195	UG/KG	6.93			5.4 J EST	8.3 EST	2.7 EST	9.9 U
PCB 206	UG/KG	6.93		_	6.6	8	2.9	59 J
PCB 209	UG/KG	6.93			8.7 J	11	211	9.3 J
TOTAL PCBs (ND=0)	UG/KG		59.8	676	4,324	3,238	1,118	3,832
TOTAL PCBs (ND=1/2RL)	UG/KG		59.8	676	4,343	3,251	1,123	3,852
TOTAL PCBs (ND=RL)	UG/KG		59.8	676	4,361	3,263	1,127	3,872

Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

NOTE: Shaded and bold values indicate detected concentrations. Values not shaed or bold indicated non-detected concentrations.

represented by the average RL.

RL = average reporting limit

TEC = Threshold Effect Concentration $\begin{array}{l} B \ (organic) = \ detected \ in \ the \ laboratory \ method \ blank \\ J \ (organic) = compound \ was \ detected, \ but \ below \ the \ reporting \ limit \ (value \ is \ estimated) \\ J \ (inorganic) = \ detected \ in \ the \ laboratory \ method \ blank \\ \end{array}$

PEC = Probable Effect Concentration

COL = more than 40% difference between initial and confirmation results; the lower result is reported

EST = estimated value

U = compound was analyzed, but not detected

^{*} PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998)

**Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater

TABLE 9. CONCENTRATIONS OF TARGET ANALYTES THAT EXCEEDED SEDIMENT QUALITY GUIDELINES DRESDEN POOL, MAY 2008

					DR08-01	DR08-02	DR08-03	DR08-04	DR08-05	DR08-06	DR08-07	DR08-08	DR08-09	DR08-10	DR08-11	DR08-11FD	DD08-12	DB08-13	DP08-14	DR08-15	DR08-16
ANALYTE	UNITS	RL	TEC*	PEC*					21.00 00	21100 00	DAVO-07	DRVO-VO	DR00-07	DIVO-10	DX00-11	DR00-111D	DR00-12	DK00-13	DR00-14	DK00-13	DK00-10
ARSENIC	MG/KG	0.109	9.79	33										T				26			13
CADMIUM	MG/KG	0.109	0.99	4.98	7.5			7.4	2,9	4.5	2.8	3.6	5.2	3.0	9.1	4.1	1.3	17.3	3.1	12.7	29.3
CHROMIUM	MG/KG	0.218	43.4	111	93.4 J			106 J		59.2 J	45.9 J	46.4 J	59.5 J		56.2 J	54.5 J		196.I	51.9 J	158 J	301.I
COPPER	MG/KG	0.218	31.6	149	112			123	44	68	52	62	73	43	57	60		185	64	161	214
LEAD	MG/KG	0.109	35.8	128	125			143	54	86	72	66	98	67	91	91	47	311	110	176	312
MERCURY	MG/KG	0.050	0.18	1.06	0.72			0.63	0.24	0.56	0.27	0.29	0.45	0.44	0.56	0.45	0.72	3.10	0.30	0.79	1.50
NICKEL	MG/KG	0.109	22.7	48.6	37			51		24	29	29	38	24	41	45	27	36	25	65	106
ZINC	MG/KG	0.544	121	459	519 J		-	611 J	213 J	264 J	225 J	296 J	455 J	267 J	354 J	356 J	204 J	836.1	314 J	655.1	1280 J
			-300											1		550		02.0	02.0		
ANTHRACENE	UG/KG	204	57.2	845	820	390	140	870	410	440	270	320	650	650	1,500	1.300	740	14.000	2,300	910	1,700
BENZO(A)ANTHRACENE	UG/KG	204	108	1,050	2,000	1,900		2,300	1,000	770	210	740	1,900	1.800	5,300	5,300	3,200	84,000	9,500	2,600	6,300
BENZO(A)PYRENE	UG/KG	204	150	1,450	2,700	1,900		2,900	1,200	1.000	360	1,100	2,500	2.400	7,000	6,300	3.900	73,000	11,000	3,400	4,900
CHRYSENE	UG/KG	204	166	1,290	2,700	2,200		2,800	1,300	920	280	1,100	2,300	2,300	6.100	5,600	3.900	83,000	11,000	3,600	7,200
DIBENZO(A,H)ANTHRACENE	UG/KG	204	33		620	410		650	250	230	77 J	210	550	500	1,300	1,200	680	9,000	2,400	590	950
FLUORANTHENE	UG/KG	204	423	2,230	3,100	1,500		3,300	1,800	1,400	720	1,400	2,500	2,300	5,200	4,900	2,600	110,000	9,800	5,100	15,000
FLUORENE	UG/KG	204	77.4	536	680	390		590	400	560		430	490	460	750	620	430	5,800	620	340	1,100
NAPHTHALENE	UG/KG	204	176	561	240			200							370	370		990 J	470	380	390
PHENANTHRENE	UG/KG	204	204	1,170	1,200	410		1.300	470	520		490	880	810	2,000	1,700	690	12,000	3,000	1,600	1,400
PYRENE	UG/KG	204	195	1,520	2,900	1,200		3,100	1.700	1,200	330	1,400	2,200	2,000	4,400	3,900	2.100	90,000	7,200	3,800	11,000
TOTAL PAHs (ND=0)	UG/KG		1,610	22,800	26,360	16,198		27,900	12,759	11,127	4.017	11,319	22,360	21,200	54,910	50,390	29,740	672,690	92,580	34,070	67,240
TOTAL PAHs (ND=1/2RL)	UG/KG		1,610	22,800	26,360	16,198	1,717	27,900	12,759	11,127	4,217	11,319	22,360	21,200	54,910	50,390	29,740	672,690	92,645	34.094	67,286
TOTAL PAHs (ND=RL)	UG/KG		1,610	22,800	26,360	16,198	1,977	27,900	12,759	11,127	4,417	11,319	22,360	21,200	54,910	50,390	29,740	672,690	92,710	34,117	67,332
										,	1,14	229027	22,000	-1,200			401130	EVEN V	75010	24,111	01,000
TOTAL PCBs (ND=0)	UG/KG		59.8	676	574	62		678	271	398	146	291	391	341	423	423	226	225	370	963	1,314
TOTAL PCBs (ND=1/2RL)	UG/KG		59.8	676	577	65		681	273	402	151	293	393	343	426	425	228	227	372	966	1,320
TOTAL PCBs (ND=RL)	UG/KG		59.8	676	580	68		683	275	405	155	295	395	344	429	427	230	229	374	969	1,326

*Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

RL = average reporting limit

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

FD = field duplicate

J (inorganic) = detected in the laboratory method blank

concentration exceeds TEC

TABLE 9. CONCENTRATIONS OF TARGET ANALYTES THAT EXCEED SEDIMENT QUALITY GUIDELINES DRESDEN POOL, MAY 2008

						_														
					DR08-17	DR08-18	DR08-19	DR08-20	DR08-21	DR08-22	DR08-23	DR08-24	DR08-25	DR08-26	DR08-27	DR08-28	DR08-28FD	DR08-29	DR08-30	DR08-31
ANALYTE	UNITS	RL	TEC*	PEC*										a. 27	537 50					
ARSENIC	MG/KG	0.109	9.79	33		17						T						T	10	
CADMIUM	MG/KG	0.109	0.99	4.98	1.5	41.3	6.0	4.9	3.9	3.4	3.7	7.3	5.5	7.9	4.4	1.7	1.7	3.7	2.2	2.0
CHROMIUM	MG/KG	0.218	43.4	111		355 J	77.3 J	79.1 J	55.3 J	47.4 J	57.3 J	71.3 J	125 J	147.1	56.5 J			57.2 J		
COPPER	MG/KG	0.218	31.6	149	37	284	87	58	59	49	73	82	98	140	68	38	33	50	103	47
LEAD	MG/KG	0.109	35.8	128	40	366	127	100	92	84	87	138	222	215	90	51	57	99	241	105
MERCURY	MG/KG	0.050	0.18	1.06		3.30	0.58	0.48	0.66	0.51	0.32	0.87	0.97	2.60	0.30	0.24		0.29		0.24
NICKEL	MG/KG	0.109	22.7	48.6		91	38	77	49	46	35	29	57	56	34			55	32	
ZINC	MG/KG	0.544	121	459	145 J	1450 J	491 J	342 J	374 J	312 J	335 J	305 J	547.1	757.1	330 J	158 J	172 J	429 J	333 J	383 J
															2200	1000	1.20	1270		1000
ANTHRACENE	UG/KG	204	57.2	845	140	6,600	1,300	5,800	4,200	11,000	6.900	1,400	4.000	3,000	1,200	590	420	3,000	140	130
BENZO(A)ANTHRACENE	UG/KG	204	108	1,050	500	18,000	4,600	43,000	13,000	93,000	25,000	5,200	16,000	12,000	5,800	1.900	1,200	12,000	590	570
BENZO(A)PYRENE	UG/KG	204	150	1,450	580	15,000	5,400	45,000	15,000	86,000	22,000	4.800	18,000	15,000	7,200	1,400	1,300	12,000	590	600
CHRYSENE	UG/KG	204	166	1,290	610	21,000	5,700	41,000	14,000	94,000	25,000	6,600	18,000	14,000	7,100	1,700	1.500	12,000	570	590
DIBENZO(A,H)ANTHRACENE	UG/KG	204	33		90	2,900	1,300	2,700	4,300	5,500	3,500	1,000	2,500	3,100	1,500	190	170	2,700	89	120
FLUORANTHENE	UG/KG	204	423	2,230	960	45,000	6,700	43,000	21,000	130,000	43,000	10.000	44,000	23,000	9,100	4.400	2,600	16,000	1,500	1,000
FLUORENE	UG/KG	204	77.4	536		4,800	430	1,500	1.100	2,000	940	920	1.800	1,200	460	210	160	570		
NAPHTHALENE	UG/KG	204	176	561		1,100	390	1,100	870	1,400	570	270	970	1,300	460			720		
PHENANTHRENE	UG/KG	204	204	1,170	300	10,000	2.000	3,900	5,600	7,700	11,000	1,500	19,000	8,100	2,200	1.600	760	2,900	510	400
PYRENE	UG/KG	204	195	1,520	700	32,000	4.200	32,000	12,000	85,000	28.000	6,300	24,000	13,000	5,000	2.200	1,400	8,900	710	640
TOTAL PAHs (ND=0)	UG/KG		1,610	22,800	6,185	203,700	47,860	350,700	137 980	760,200	231,990	52,860	201 770	141,310	60.430	18,224	13,060	108,110	6,463	5,881
TOTAL PAHs (ND=1/2RL)	UG/KG		1,610	22,800	6,185	203,700	47,881	350,700	138,045	760,200	231,990	52,894	201.930	141,310	60.462	18,240	13,077	108,265	6,479	5,898
TOTAL PAHs (ND=RL)	UG/KG		1,610	22,800	6,185	203,700	47,902	350,700	138 110	760,200	231,990	52,928	202,090	141,310	60,494	18,256	13,077	108,420	6,495	5,915
		<u>-</u>	1,010	22,000	0,100	F #AET(BA 1	1,1702	220,790	100/110	100,200	201,000	2m,/m0	494,979	1415710	00.674	10,430	13,073	100,4=0	0,475	3,913
TOTAL PCBs (ND=0)	UG/KG		59.8	676	140	1.894	519	1.612	706	480	447	217	548	876	436	473	378	733	326	137
TOTAL PCBs (ND=1/2RL)	UG/KG		59.8	676	143	1.906	521	1,618	711	482	449	219	550	882	438	475	380	739	331	141
TOTAL PCBs (ND=RL)	UG/KG		59.8	676	146	1.917	524	1.623	717	484	451	221	552	888	439	477	382	745	336	141
*Source MacDonald et al. 2000 De			77,10			34727	327	1,023	717	704	431	441	552	000	439	4//	302	745	330	145

^{*}Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

PEC = Probable Effect Concentration

FD = field duplicate

concentration exceeds TEC

RL = average reporting limit

TEC = Threshold Effect Concentration

J (inorganic) = detected in the laboratory method blank

TABLE 10. CONCENTRATIONS OF TARGET ANALYTES THAT EXCEED SEDIMENT LOWER BRANDON POOL, MAY 2008 **QUALITY GUIDELINES**

					BR08-01	BR08-02	BR08-03	BR08-04
ANALYTE	UNITS	RL	TEC*	PEC*				
ARSENIC	MG/KG	0.108	9.79	33	-	10.5	-	;
CADMIUM	MG/KG	0.108	0.99	4.98	21	2.3	8.4	1.8
CHROMIUM	MG/KG	0.215	43.4	111	274.1	282.3	125.1	244.3
COPPER	MG/KG	0.215	31.6	149	235	264	146	177
LEAD	MG/KG	0.108	35.8	128	456	322	196	315
MERCURY	MG/KG	0.0355	0.18	1.06	1,4	2.0	0.84	0.83
NICKEL	MG/KG	0.108	22.7	48.6	163	109	80	129
ZINC	MG/KG	0.535	121	459	933.1	1,170 J	642.1	F 008
ANTHRACENE	UG/KG	361	57.2	845	7,100	6,300	1,800	10,000
BENZO(A)ANTHRACENE	DG/KG	361	108	1050	35,000	16,000	6,100	40,000
BENZO(A)PYRENE	UG/KG	361	150	1450	35,000	21,000	006'9	38,000
CHRYSENE	NG/KG	361	166	1290	38,000	26,000	6,400	47,000
DIBENZO(A,H)ANTHRACENE	UG/KG	361	33	1	9,500	4,600	066	6,700
FLUORANTHENE	UG/KG	361	423	2,230	45,000	36,000	11,000	65,000
FLUORENE	UG/KG	361	77.4	536	2,900	2,800	720	2,800
NAPHTHALENE	UG/KG	361	176	561	1,900	009'9	840	3,700
PHENANTHRENE	NG/KG	361	204	1,170	00999	11,000	3,300	12,000
PYRENE	UG/KG	361	195	1,520	26,000	23,000	6,700	32,000
TOTAL PAHs (ND=0)	UG/KG	;	1,610	22,800	322,000	216,600	64,070	359,800
TOTAL PAHs (ND=1/2RL)	DA/DN	:	1,610	22,800	322,310	216,810	64,107	359,965
TOTAL PAHs (ND=RL)	NG/KG	**	1,610	22,800	322,620	217,020	64,144	360,130
TOTAL PCBs (ND=0)	UG/KG	i i	59.8	9/9	4,324	3,238	1,118	3,832
TOTAL PCBs (ND=1/2RL)	UG/KG		59.8	676	4,343	3,251	1,123	3,852
TOTAL PCBs (ND=RL)	DZ/SO	1	8.65	9/9	4,361	3,263	1,127	3,872
		֖֝֝֝֝֡֝֝֝֝֝֡֝֝֝֡֜֝֝֡֜֝֝֡֜֜֜֜֝֡֜֜֜֜֜֜֜֜֜֜			:		: .	

*Source: MacDonald et al. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater

concentration exceeds TEC

Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

RL = average reporting limit

TEC = Threshold Effect Concentration

PEC = Probable Effect Concentration

J (organic) = compound was detected, but below the reporting limit (value is estimated)

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TABLE 11. COMPARISON OF SEDIMENT CONCENTRATIONS TO HISTORICAL DATA* DRESDEN AND LOWER BRANDON POOLS, MAY 2008

	DR	08-01	DR0	8-03	DRO	8-05	T	DR08-06		DR0	8-07	DRO	8-08	DRO	8-09	DR0	8-11	DRO	08-15	DRO	3-17	DRO	3-20	DROS	3-25	DR0	8-27	DR0	8-29	DRO	3-30
Year	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008	1994/1995	2008
River Mile	271.6	271.6	273.0	273.0	273.6	273.6	274.8	274.8	274.8	274.8	274.8	276.0	276.0	276.0	276.0	276.9	276.9	278.3	278.3	279.2	279.2	280.4	280.4	283.6	283.6	284.5	284.5	285.6	285.7	285.8	285.8
					Manual Sea		947 W.C.		(A LANGE												ा अवस्ति विस्तित				ALECATIVA			
ARSENIC	6.44	7.90	8.25	2.20	5.94	3.40	6.92	6.36	3.20	5.52	4.40	5.43	3.90	5.88	5.20	11.7 3 §	4.7	7.59	6.30	4.44	4.40	8.12	4.60	6.02	4.30	2.03	4.20	8.92	6.00	6.31	9.80
CADMIUM	8.84	7.50	0.831	0.490	8.43	2.90	2.88	3.1	4.5	3.07	2.80	3.85	3.60	4.49	5.20	24.7	9.1	23.3	12.7	1.2	1.5	6.77	4.90	8.99	5.50	0.76	4.40	3.9	3.7	<0.034	2.2
CHROMIUM	110	93.4 J	12.2	7.5 J	96.3	34.6 J	54.6	55	59.2 J	48.9	45.9 J	55.6	46.4 J	67.6	59.5 J	205	56.2 J	217	158 J	19.7	28 J	106	79.1 J	148	125 J	21.1	56.5 J	90.1	57.2 J	26.7	19.8 J
COPPER	112	112	17	8	102	44	53.1	54.5	67.8	47	52	69.5	62.3	68.8	72.9	176	57	188	161	22.2	37.4	112	58	120	98	13.5	68.4	61.9	49.6	26.2	103.0
LEAD	153	125	21.2	10.1	123	54	75.1	73	85.7	73	72	78	66	97.7	97.8	222	91	232	176	30.1	39.8	169	100	212	222	115	90	119	99	47.7	241.0
MERCURY	0.958	0.720	0.076	0.031	0.596	0.240	<0.040	0.24	0.56	0.238	0.270	0.256	0.290	0.268	0.450	0.856	0.560	0.951	0.790	<0.034	0.13	0.475	0.480	1.11	0.97	0.111	0.300	0.215	0.290	0.235	0.150
NICKEL	54.5	37.2	14.4	7.5	48.7	22.7	38.4	42.9	24.3	33.9	29.3	37.8	29.0	50.5	37.5	61.2	41.1	84.9	64.7	13.8	18.2	59.6	77.2	59.2	57.2	20.6	34.1	42.3	55.1	17.3	32.1
ZINC	587	519 J	82.2	44 J	543	213 J	297	321	264 J	217	225 J	345	296 J	477	455 J	1,020	354 J	1,070	655 J	115	145 J	578	342 J	868	547 J	119	330 J	346	429 J	122	333 J
ACENAPHTHENE	<7,500	300	<5,900 │	130 U	<6,500	220	<6,700	<6,900	210 J	<7,700	160 J	<7,800	160	<7,700	250	<7,000	490	<8,700	220	<5,700 │	51	<8,500	1,700	<7,000	1,600	<4,900	410	<5,900	620	<5,500	47
ACENAPHTHYLENE	<7,500	700	ර,900	140	<6,500	340	<6,700	<6,900	380	<7,700	240	<7.800	290	<7,700	710	<7,000	1,700	<8,700	830	<5,700	130	<8,500	10,000	<7,000	1,900	<4,900	1,300	<5,900	3,200	<5,500	37
ANTHRACENE	<740	820	96	140	660	410	83	92	440	<76	270	130	320	270	650	1,100	1,500	840	910	57	140	1,300	5,800	2,000	4,000	940	1,200	450	3,000	550	140
BENZO(A)ANTHRACENE	3,200	2,000	340	57 J	3,300	1,000	390	460	770	260	210	650	740	2,000	1,900	6,300	5,300	4,300	2,600	360	500	7,100	43,000	19,000	16,000	5,400	5,800	1,600	12,000	2,000	590
BENZO(A)PYRENE	4,300	2,700	580	130	3,300	1,200	680	770	1,000	440	360	1,300	1,100	3,100	2,500	4,800	7,000	4,800	3,400	610	580	9,800	45,000	20,000	18,000	6,400	7,200	2,300	12,000	2,900	590
BENZO(B)FLUORANTHENE	8,800	3,100	980	210	3,500	1,400	1,100	1,100	1,400	1,100	560	2,000	1,400	4,300	2.700	8,500	6,500	8,600	5,200	670	720	14,000	45,000	28,000	25,000	9,200	9,600	3,100	16,000	4,100	880
BENZO(GHI)PERYLENE	7,100	2,100	1,100	61 J	4,900	840	1,200	1,100	840	740	220	2,500	880	4,100	1,900	6,600	4,700	6,400	3,000	1,200	520	14,000	31,000	28,000	13,000	8,100	4,500	3,700	9,300	4,000	360
BENZO(K)FLUORANTHENE	2,200	1,300	190	41 J	1,600	550	320	330	430	200	140 J	640	510	1,500	1,100	2,200	3,400	2,600	47 U	260	320	4,300	17,000	9,800	320 U	2,800	64 U	1,000	310 U	1,300	32 U
CHRYSENE	6,600	2,700	440	70 J	61,000	1,300	700	770	920	480	280	1,100	1,100	2,700	2,300	11,000	6,100	11,000	3,600	580	610	9,200	41,000	24,000	18,000	7,300	7,100	250	12,000	2,500	570
DIBENZO(A,H)ANTHRACENE	5,300	620	1,400	130 U	3,400	250	1,200	1,600	230	1,000	77 J	1,500	210	<17	550	4,900	1,300	6,100	590	920	90	14,000	2,700	27,000	2,500	6,800	1,500	1,500	2,700	2,400	89
FLUORENE	<1,600	680	<1,200	130 U	<1,400	400	<1,400	<1,500	560	<1,600	200 U	<1,600	430	<1,600	490	<1,500	750	<1,800	340	<1,200	64	<1,800	1,500	1,600	1,800	<1,000	460	<1,300	570	<1,200	51
INDENO(1,2,3-CD)PYRENE	3,200	1,900	430	70 J	2,500	790	560	600	740	370	250	1,400	820	1,400	1,600	3,300	4,200	2,700	2,500	650	450	7,500	27,000	17,000	12,000	4,200	4,600	2,300	8,200	2,500	360
NAPHTHALENE	<7,500	240	ර,900	130 U	<6,500	89 J	<6,700	<6,900	87 J	<7,700	200 U	<7,800	69 J	<7,700	130 J	<7,000	370	<8,700	380	<5,700	50	<8,500	1,100	<7,000	970	<4900	460	ර,900	720	<5,500	29 J
PHENANTHRENE	2,600	1,200	720	100 J	1,800	470	1,410	550	520	270	200	730	490	1,100	880	3,800	2,000	2,800	1,600	290	300	3,100	3,900	4,000	19,000	2,500	2,200	1,100	2,900	920	510
PYRENE	6,200	2,900	1,400	98 J	5,700	1,700	1,400	1,500	1,200	910	330	2.400	1,400	3,500	2,200	11,000	4,400	9,200	3,800	880	700	12,000	32,000	20,000	24,000	7,800	5,000	3,500	8.900	4,000	710

	BRO	B-01	BRO	8-02	BRO	-03
Year	1994/1995	2008	1994/1995	2008	1994/1995	2008
River Mile	286,4	286.4	286.2	286.2	286.0	286.0
RSENIC	12.6	8.7	11.6	10.5	9.97	5.90
CADMIUM	27.3	21.0	10.5	23.3	12.8	8.4
HROMIUM	323	274 J	149	282 J	192	125 J
OPPER	314	235	154	264	201	146
EAD	423	456	272	322	284	196
IERCURY	FE LI SE	1.4	0.985	2.00	0.093	0.840
ICKEL	199	163	82.5	109.0	75.4	50.3
INC	1420	933 J	841	1.170 J	1010	642 J
CENAPHTHENE	71,000	3,000	84,000	2,000	<45,000	520
CENAPHTHYLENE	⊲3,7000	10,000	<43,000	5,300	<45,000	1,500
NTHRACENE	7,800	7,100	13,000	6,300	1,400	1,800
ENZO(A)ANTHRACENE	30,000	35,000	25.000	16,000	5,000	6,100
ENZO(A)PYRENE	30,000	35,000	23,000	21,000	4,600	6,900
ENZO(B)FLUORANTHENE	43,000	47,000	38,000	27,000	7,200	9,500
ENZO(GHI)PERYLENE	40,000	29,000	30,000	15,000	6,600	3,900
ENZO(K)FLUORANTHENE	17,000	620 U	12,000	420 U	2,300	74 U
HRYSENE	36,000	38,000	35,000	26,000	6,800	6,400
IBENZO(A,H)ANTHRACENE	22,000	9,500	19,000	4,600	9,200	990
LUORENE	<7,800	2,900	<9,200	2,800	<9,600	720
NDENO(1,2,3-CD)PYRENE	23,000	26,000	15,000	14,000	2,700	3,900
APHTHALENE	<37,000	1,900	<43,000	6,600	<45,000	840
HENANTHRENE	14,000	6,600	22,000	11,000	3,800	3,300
YRENE	15,000	26,000	38,000	23,000	12,000	6.700

2008 concentrations that exceed 1994-1995 concentrations

2008 concentrations that are within a factor of two lower than 1994-1995 concentrations

ssment. Prepared for Commonwealth Edison Company, Chicago, Illinois.

J (organic) = compound was detected, but below the reporting limit (value is estimated) J (inorganic) = detected in the laboratory method blank U = compound was analyzed, but not detected



APPENDIX A FIELD LOGBOOK

Location Date 5/4/48 53
Project/Client_Nijman - Frain 26th Seline +
0634 arrive Bresdon Lock + Dain
on board: 304 Vandruska + Latin Olson
load brat
clear, surny warran
and the second second
6730 BROK-01
73 87 73 37 73 37 37 37 37 37 37 37 37 37 37
The state of the s
- 1st attendo Par los moves (180 atis)
rest b/c den
5 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6
X SO TOGETUS HS & TOGE COLL
Q.
stream of
20 th 10 th
The second secon
5255 70 (1 N) 20. Later
A

62 in from RNB from point primarily sand with some sitts Project (Cleni Nyman - Frangesti Sediment -19 m from back of No wate sign mouth - Kankake Birer Date 5/6/68 graining with visible samel grains that forms coursers tream - 189 m sepstream from maderial is light grey, - 45 m out from boat reum end of sadewater water depth 2.8 ft (15/2 shorts + sign) 524 168.22 N 306 200.37 E Buy Hill Marine 14581.02 09 11 (DROR-103) 2949 (Daos-04 visible, sheen visible at surface sheen, one sampled had dense gray siltagilets of worker + visible Stern downstream 2nd mooning Project/Client Nightsan - Franz zetti Sedime t descending bank (LDB) Date 5/6/04 Ematerial is dark to light gray, porimently silt w/ same talay chumps) sevine leads debris * mosterial was donk brown to [DROS-02] - on location . 13 hm from shore left & 34 - Sample collected きのかのからして一分 of sectionent in pot slight permoberny ador 525204.64 C 305066.82 E 70.18541 De-08-01)(cont) Locations 177

- Corbicula present in sediment Project/ Clerif - Wilman Chan zeth Soliment 3 - nottende oder of product and thre grained (no said grains) Date 5/6/08 というとうとなっと - motionize ador of product light gray charpen silt very 34 m from UDB 60 m from menner pren Worker depth of 4,800 low whater conteins Shigher oil sheen 524200,45 N 308708.11 E Daos-05/ (comx) 14581.02 ent 10 rection 11/3/1008 - DG がん Location 🕬 🗼 VISIBLE sand grains; visible shear noticetic easer of production (40) -30 m from month of IAM Comed sands (tover, now visible, grains) Project/Olent Nig Vancon - Frank Letter Sectionent organic matter (lesons, sticks) + Date 5/6/08 light gray sitt w/ some sond when depth - 2.0 Pt Sont large grand water depth = 3.9 ft 307200, 70 C ~2 524150.12 N 45.81.02 VA08-04 (504) 77.4008773 304041,19 り見るペーログ Locations **でめ**

58 Location 3 Challed	l ocation
Project/Client Nijeriech - Frenzett sellment	Men Wilmun - Franze
[280 - 8072d] Ohl)	[D208-08] (comt)
-57 m supstream of road	worth dopped 3,3 ft
<u> </u>	- Coarton for MS/MSD
water cleptin = = 8 ft	. T
52402×.91 12	mo visible gheen, no ador
1 5	1365 [DEGS - 0 G]
no petroleum ador, no visible shen	Island, towards main your
1221 (5208-05) and DEOS-05 MS	- Weter drugsh = 43 ft
- 22 m from SW the of Bear / moore	535840, S7 N
- 44 m downstream from orange painted post; start of exectorish	* to cation unsuccessful
525952.64 N 309184, 43E	

60 Location S1c/0X	
lient Wijnstam - Gram 2025 September 14581.02	Project Client Nyman Frankly Rulent -
1310 (2209-69)	2 pt - privec mile 175 8:06
-84 m from SE Hp of Bear / Moss	194 W Christophy Christophy 194
L TO B A	RM 276.1 den mark
ships	-SS m From LDB NDW Chemicals
Warter despth = 6.2 ft	(0 ading dock / remine)
	1451 [DROS-11] + (DROS-11 FD)
יבל בין	2 Daw Chemicals
-gray sit w/ some fire-grained	243 m SEOT growed boat range
79 CISID	13 m NE OF LUCK DIVE
mir matter	Med mouth (1500 m) from
mo Oder, Mo Visible sheen	Du Page liver
1403 [DF08-10]	27 5 77 77 77 77 77 77 77 77 77 77 77 77
* to gation added bey July Non Drivister	Noi the Cu
7	
1. 10 2 2 2 2 2 2 2	- water death = 3 8 Ct.
5-48-45.87	
309 743, 79 E	1453 feeld duplicate
There brown said with the His	2 Kora
in ; pesporteur	
and cisible steen	

Location Project Chent Mynam - Franzette Studes 14581.02	Medical gray Si He sand visible Shight odos of petroleum no visible sheen	1615 DROS-13	nstream of barge	145 m from LDB 527436.31 M 311064,39 E
62 Location Project/Client Minden - Frenzecth Seetiment (4581:02	- dark brown sandy silt with visible medium grained sands, organic matter petroleum oder visible sheer	1538 (DROS-12) 225 225 (20 - 195 m Northwest Down Chemical 195275 m Northwest bounds belief	to SS bridge downstream of to SS bridge downstream of the point)	S27526, 20 N 310717 647 E -Industrial facilities on left bout no development on right bout

Date 577/08 67 -dark gray to black clayed solt Jackson Cook awersion chowned - 96 m from downstream tip of Project/ Chent IN Jonam - From Bett Seelingut - A cort gray silt w/ Pine gracined sends (not visible, only touch), - 70 m downstream of mouth of 73 m damstram from のことの tackson cheek dam water depth + 3,8 th -2018Sh1 THE M KNOW LDES tatm from RDB treats Itsland water depth = Dec 16/600 313372.95E とのこののでして 10/2 [OBOR-17] Location , gray chayey 514, low Hzo context, visible of shear, noticetake 36 m wostream of Exxon the bile Project/ Client Wignam - From Esta Sectionent Date 5/4/08 -84 m storuns treem of Jackson water depte 1 8.7 P. 14581.02 ; -ay in from LAB 528909, 28 N 528 301.02 N 312 425.64 E pedro leaven adol いら、カプログラの 10208-16 Creek dam 6906 (DRO8-15) かったった Location

ocation.	Location Date 577/08 69
Project/Client Myndom-Franzecki Schimenst	Project/Digit Nijman - Franzetti Seliment
(xs) (+1-80%C	1142 [0208-19]
- Wisible sheem, showng permeteren	
() () () () () () () () () ()	-21 m from LDB
recovery extricuent ble sticks and	1 to the tex that
leaves on bottom	
	- 206 m downstream from Stopen
1058 [DROS-18]	
	52031
- I m declarstream powerhine pole	314049.81
†	
from 200	Water depth = 3.1 Ct
- Warter depth = 4.1 ft.	- dowle brown sitt wi some
	medium grained sand (visible)
か29451.6512	Sign Hz 6 content
314045, 21 E	
1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
	(NE CIT 240 A)
betroleum oder	- octubil so diverst campling
	site, Investigated both banks; of
	conditions predominated course grained
	gravelo wlo sed, deposition

Visible michigh grant sandy silt, Visible michigh grained cands, Slight odos, minor sheen, high Co - 3 for 11 across mer him south Date 5/7/08 Project Poller N Umary - Fran Esti Sectional water depth 1 2,2 Ft RM 280.4 daymart -132 m downskeam of -Water depth = 31 ft -50 m from LDB 70/18541 1326 (DROS-21 314067.50 B 1422 10208-22 530829.91 N なるのです Sandy silt, dark gray medium grained sands (Visible); high Hat content 1 ren strong petroleum odor and no suitable substantes were -34 m from furtheat downstream no Pomar attempts made 5/c Amora chemical chocking cell Date 5/4/0'S Project Client NIChnard - Fran 2011 Sedimand pronounced), some corbinal MBISH RM 27951 (cont) - Nater deptr = 1-1 ft 401/8571 530791.69N 313816.77E -12m from RDB 1248 (DECS-20 Hentitres in semple.

-10 m. upstread Cakrailla, 42 (p. 11 -darle brown soundy sit y/ medium 3/1944 Octor Date 5/8/67 Sed 10000 - 45 50 Project Client it Vijnaun - Franketty Ledment - OWHALL ASD in west som of -clerk brown silk wi some onshore sectling basin of petrolderun, slight shan wester depth = 2.0 PE a rowned sands wish ble, 4581.02 (trest) medium grained -30m for 208 534825.44 N 534548.22 N Ulsible streen 31.6278.61 € 316661.89 E 09110 10008-1261 D208-25 Location _ - on bosard, doe Joharusky + Karrin - over cust, wol (on sos) breezes your from RDB, directly off from Project / Client Wilman Frem retto . Sedimand 0705 arrive maring + bad boat ack sikpholos, not collected yesterday ble ariving rains Vesteralary ble driving rains take sit photosinot will ched during somple will ection othering sample to lection -495 m Washran from Carino 84 # in stormthe o aut fail -water south = 1.8 CE 70 125h Misen 0343 (DROB-25) D208-18 Location रु ६०

- 1025 Deck-28 FD (Gold duplicate) Project Cited Window Programment Sediment Date SKN4 wind moved yout off weather Recovered · Corbieula and organic matter & down group scorley sitt with mored, reameting, and est no Sample 121 DEC 8-128 - 2 m en 12-20 12-20 vater depth = 1.9 ft and DR 08- 28 FD (Hear) 14581:02 318479.48 区 N 78 17 6 84 N 3463.34 water dept. 1. new location Location medum grained sonds stight - dark brown soundy silt w/ visible some Cortibucula and organic permissala dividung -40 m upstradown of main drawnow Project/Client Nijeram - Franzetta Stalines patroleum ochor, munder steem, -27 m from head of coure -10 in from Kead of cove -267 m SN OF permisula channel from tail waters · water state 1 4. 4 ch -32 m Gram LDB 14581.02 = 31 mg From LDB DR08-27 517.08888 3 (76291,038 1945-16 Scrar ple Lecation, 134 17 00

78 Constrain.	Location Date 578,08 79
Clear Wilman - Gram zeld	Clear Wignan Franzett
- Notreable retraterm ofer.	5-37 484.68 N
modestati sheen	(29310113-73E
12 m Gan LBB	water des his 3,6 ft
	i
35 from LDB OF main channel	-davit green 51/7 W/ Firegraine
275 SW of penimenta divising	sands (100) visible, touchoway)
channel from tailowaters	noticeatale, pertasive pertaleum
	Odor persistent me devete
1105 puil boat from Big Bashin	streen , organic matter (mostly streets)
Menione and move to boat	
ramp lozated above Branchon	1258 (Balos-0-2)
7707	
	+ end of 30g exchosishing was
1203 pur boat in above Brandion	+175 White Brandon Lack + Dain
LOCK (11/10) I-80 ~ LOCK); Check in	16 in from LDB
WITH USFICE	
1226 [8208-01]	537246,52 N
	319934.23 €
-10 m from LDB	
10 mm	Water Broth - 4.7. Ft
432 m upstream of Brandon Lock	
and Down	

80	
Project / Client Willymann Frammetta Lediment	Project Mignan - Fringeth Seliment 145 & 1.02.
(BEOS-02) (con+)	1403 Beox - OL
- dork grow sit with not contie	537348, 42 N 319438 30 E
watter C	Of D. M. C.
1324 (B208-03)	Adam Court to Elication Control of the Court
¥ +	200
from CDB	- Water 2016
- Water depth= 1,6 Ct	- dark gray sit w/ Am grained
537194.82 N	Some organic matter linesty
	and moderate sheen
-down gray silt wineth washe ever	
and stight sheen i few Corbicula	-1452 (EOBDAV31
	1535 2 coolers to 72st America
	tracking # J213 161 9013
	J JA13 161 92119

13-15 107809

	579/c% Location	nate 579
Sty Styles Sty Styles of Some Steen Steen Steen Steen Steen Steen Steen Steen Steen Steen Steen Steen Steen Styles St	Project / Olient	
ente gray se sandy sort; ente gray se sandy sort; eduin to ce and grained some grained; some reach roots; edgae on bottom [15 bt odor, minor sheen to m from RDB on four RDB on from RDB on four Andream tracking # JZ13 161 9022 sofor sorthiday delivery		20.18571
ente gray ge sandy sn); ende may ge sande grained ands w) some grained; some gewie metter l'mostry strees light odor, minor stoen m from RDB m from RDB m from LDB m f		
entegray se sandy sitti edum to be and grained gaine metter (mostry strees med roots) algae on bottom 11 gat odor, minor shen 7 m from RDB 9 m from head of cove 7 m mpstram of chiek 5 th mpstram of chiek 5 th mostram of chiek		
reduin to exerce grained ands of some frank some gravel, some frank stakes the stakes of bottom staken show them to Test America. The from RDB of cove of the stakes of cover the test of the stakes	7.	chenk avery so sandy sil
EGBDAY 4] Early by Test America on botton 1/3/14 order minor sheen 7 m from RDB 9 m from head of cove 17 m upstream of cluck 18 m from head of cove 18 m from head of cove 19 m from head of cove 20 m from head of c		to secon
rganic meather l'mostry streks not roots, algae on bottom 7 m from RDB 9 m from head of asse 9 m from head of asse 17 m upstream of cluck being # 7213 161 902 2 racking # 5213 161 902 2 > For Schwaay delivery	Sme) some a
Light odor minor sheen I ght odor minor sheen I'm from RDB I'm from R	75+265	zerter"
11.544 odor, minor shen 7 m from 208 9 m from head of cove 7 m wostream of duck 52 m wostream of duck 17 m wostream of duck 18 m from 208 18 m from 2	o Horr	75) dee
7 m from 12DB 9 m from 12DB 17 m upstream of curek 15 m upstream of cluck 600ler to Test Amonica 15 for sochward # 5213 161 9022 15 for sochward deliveny	7. C. J.	į
7 m from RDB 9 m from Need of corve 7 m westream et cluek 66650444 Looler to Test America. 1 7213 161 902 2 2 502 Scotmagay delivery		
of m from head of cover bund read of cover Cooler to Test America. Tracking # J213 let 9022 > Fee Sochweday delivery		14 m from 2DB
For upstream of duck Cooler to Test America. Lycicking # J7213 161 9022 > For Schwaday dedivery	3	from beed of
Coler to Test America. Gracking # J213 161 902 2 For Sortwidely delivery		Track
Cooler to Test America. Fracting # J213 161 9022 Fracting # J213 161 9022		
Coler to Test America. Lyacking # J213 161 9022 > For Sortwidery dedivery		
Cooler to Test America. Gracking # J213 161 902 2 > Fer Schweday delivery		A Commence of the contract of
9022 Unvery		(CQ 12 UA 7
2 70 b		j /
> Fer Schwedy	7	
	Ros	> fer Sortunday delaber
		Ť



APPENDIX B SAMPLING PHOTOGRAPHS

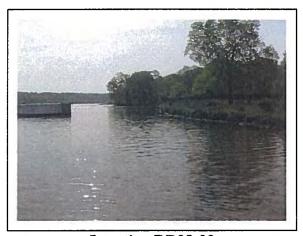




Location DR08-01



Location DR08-01



Location DR08-02



Location DR08-02

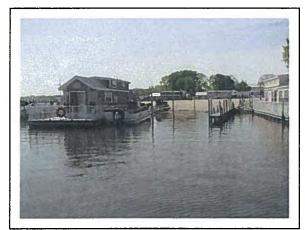


Location DR08-03

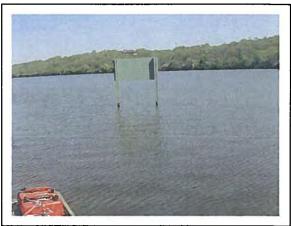


Location DR08-03





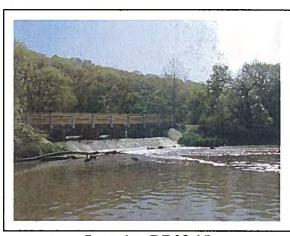
Location DR08-04



Location DR08-04



Location DR08-04



Location DR08-05



Location DR08-05



Location DR08-06

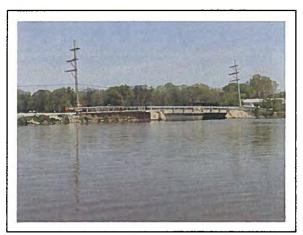




Location DR08-06



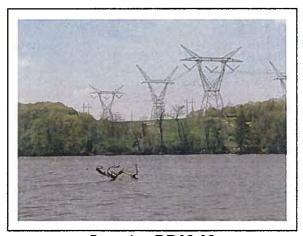
Location DR08-06



Location DR08-07



Location DR08-07



Location DR08-08



Location DR08-08





Location DR08-09



Location DR08-09



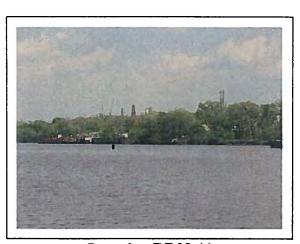
Location DR08-10



Location DR08-10



Location DR08-10



Location DR08-11





Location DR08-11



Location DR08-11



Location DR08-11



Location DR08-12



Location DR08-12



Location DR08-12

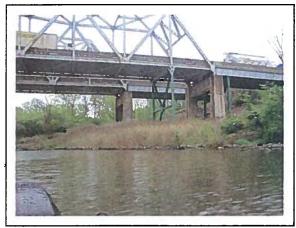




Location DR08-13



Location DR08-13



Location DR08-14



Location DR08-14



Location DR08-14



Location DR08-15





Location DR08-15



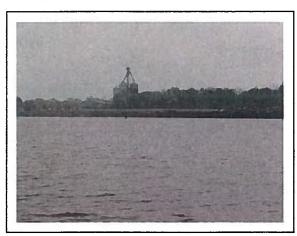
Location DR08-15



Location DR08-16



Location DR08-16



Location DR08-17



Location DR08-17

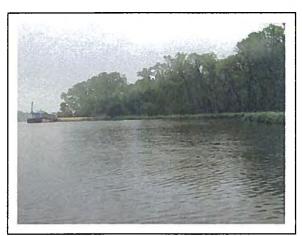




Location DR08-18



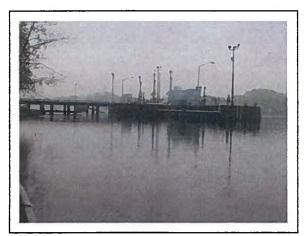
Location DR08-18



Location DR08-19



Location DR08-19



Location DR08-20



Location DR08-20





Location DR08-21



Location DR08-21



Location DR08-22



Location DR08-22



Location DR08-23



Location DR08-23





Location DR08-24



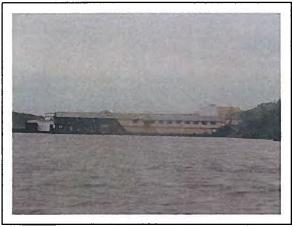
Location DR08-24



Location DR08-24



Location DR08-25

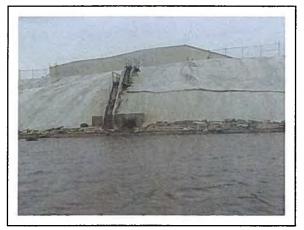


Location DR08-25



Location DR08-25





Location DR08-26



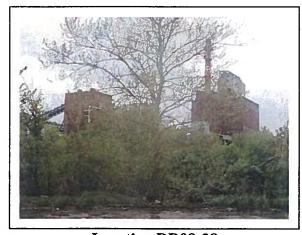
Location DR08-26



Location DR08-27



Location DR08-27



Location DR08-28



Location DR08-28





Location DR08-29



Location DR08-29



Location DR08-29

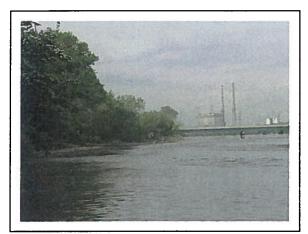


Location DR08-30



Location DR08-30





Location DR08-31



Location DR08-31



Lower Brandon Pool May 6-9, 2008



Location BR08-01



Location BR08-01



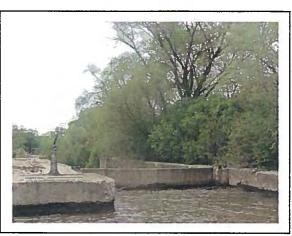
Location BR08-02



Location BR08-02



Location BR08-02



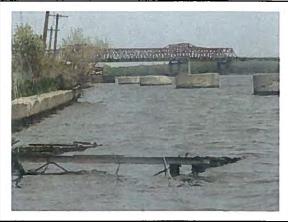
Location BR08-03



Lower Brandon Pool May 6-9, 2008



Location BR08-03



Location BR08-04

Electroni Filiting Receiveter Cseokis Office 04/20/2003

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)	
)	
WATER QUALITY STANDARDS AND)	
EFFLUENT LIMITATIONS FOR THE)	R08-9
CHIÇAGO AREA WATERWAY SYSTEM)	(Rulemaking - Water)
AND THE LOWER DES PLAINES RIVER:)	,
PROPOSED AMENDMENTS TO 35 III.)	
Adm. Code Parts 301, 302, 303 and 304)	

PRE-FILED TESTIMONY OF GREG SEEGERT

Good morning, my name is Greg Seegert. I am employed as a Senior Scientist and Chief Ichthyologist with EA Engineering, Science, and Technology ("EA Engineering"). I have been employed with EA Engineering since 1982 and have over 35 years of experience in the areas of aquatic ecology and ichthyology. I have a Bachelor and Master of Science in Zoology from the University of Wisconsin. I have attached my *curriculum vita* hereto as Exhibit 1.

I have extensive involvement in aquatic life field studies in the Upper Illinois Waterway ("UIW") for many years and am very familiar with the physical and biological conditions of this waterway. I have been engaged by Midwest Generation ("MWGen" or Midwest Generation) to review and analyze relevant information and data to assess the use designation issues relating to aquatic life goals for the Chicago Area Waterways ("CAWS") and the Lower Des Plaines River ("LDR"), as these relate to Illinois Environmental Protection Agency's ("Illinois EPA" or "IEPA") Proposed UAA Rules.

My testimony will focus on the following items: (1) a review of the regulatory requirements applicable to use attainability analysis ("UAA") pursuant to 40 C.F.R. §131.10(g) used in assessing whether certain waters can attain the Clean Water Act ("CWA") goals for aquatic life uses; (2) an assessment of whether CWA aquatic life uses are attainable in the South Branch of the Chicago River and Chicago Sanitary Ship Canal (collectively referred to herein as

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the "CSSC") and the LDR, as well as an assessment of the UAA factors applicable to the CSSC and LDR; (3) a review of the aquatic habitat suitability for the CSSC and Upper Dresden Island Pool ("UDP") directly relevant to Illinois EPA's Proposed UAA Rules; and (4) a review of fish and qualitative habitat evaluation index ("QHEI") surveys conducted in the UDP.

As I will testify, and as set forth in greater detail in the attached EA Engineering report (Exhibit 2, Report on the Aquatic Life Use Attainability Analysis for the South Branch of the Chicago River, the Chicago Sanitary and Ship Canal and the Upper Dresden Island Pool), the Illinois EPA failed to adequately consider and assess the unique aspects of the CSSC and UDP in determining whether these water bodies are capable of attaining CWA aquatic life goals. Due to the limiting physical and biological conditions of these water bodies (conditions wholly unrelated to thermal discharges), the present fish community in the CSSC and the UDP is limited in diversity and quality and does not represent a balanced population. Therefore, it is my professional opinion, based on extensive experience and firsthand knowledge of these waters, that the limiting conditions adversely affecting them preclude the attainment of CWA aquatic life goals.

1. A Minimum of Four of Six UAA Factors Apply to the CSSC and LDR, Thus Precluding Attainment of CWA Aquatic Life Use Goals.

Under U.S. EPA's rules, the existence of any one of the six UAA factors alone is sufficient to demonstrate that a water body is not capable of meeting CWA aquatic life use goals. I have assessed the potential applicability of the UAA factors (excluding Factor 6, widespread economic and social impacts) to the CSSC and LDR with respect to aquatic life uses, and it is my professional opinion, that UAA factors 2, 3, 4, and 5 are all applicable.

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UAA Factor 2 – Flow Conditions

Factor 2 applies in the event that natural, ephemeral, intermittent or low flow conditions or water levels prevent use attainment, unless such conditions may be mitigated by the discharge of sufficient volumes of effluent discharges without violating state water quality standards. 40 C.F.R. §131.10(g)(2). Flows in the CAWS are highly variable and do not follow a normal seasonal cycle which is necessary to support a balanced aquatic community. As discussed in Exhibit 2, the CAWS is specifically designed and managed to regulate and minimize peak flows attributable to flooding and combined sewer overflow input in order to facilitate barge traffic. The Illinois EPA acknowledged that it did not consider whether extreme flow changes occurred and what negative impact such changes may have on aquatic life. See March 10, 2008, Hearing Transcript, p. 193. It is well known that high flow regimes such as those in the CAWS can adversely affect fish by causing nest abandonment and displacement of recently hatched fry (juvenile fish) and causing sediment deposition to bury and suffocate eggs. Similarly, low flow regulation, which is controlled by the U.S. Army Corps of Engineers in anticipation of flooding, can also adversely affect fish by exposing fish nests and eggs to ambient air and causing stranding in shallow areas, which leads to increased predation on fish. These artificially controlled flow conditions, which are a necessary part of the navigation on the CAWS, constitute a significant factor that prevents use attainment. Therefore, in my opinion, Factor 2 is clearly met.

UAA Factor 3 – Barge Traffic and Sedimentation

Factor 3 applies where use attainment of a water body cannot be met due to human caused conditions or sources of pollution that cannot be remedied or, if attempted to be

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remedied, would cause greater environmental harm than leaving in place. 40 C.F.R. §131.10(g)(3). The heavy barge traffic and navigation, protected uses in the CSSC and UDP, have a direct, adverse impact on the aquatic ecosystem. For example, barge traffic can adversely affect aquatic organisms through physical injury, stranding, disrupting spawning, uprooting aquatic vegetation used as habitat, increasing turbidity, and increasing mortality through the resuspension of sediments, both contaminated and uncontaminated. As noted in Exhibit 2, several surveys have documented direct mortality of fish as a result of propeller strikes. Additionally, moving barges produce wakes or waves that push water into the backwater channels, causing rapid changes in water levels and stirring up harmful sediment.

In addition to barge traffic, a key limiting factor to the CAWS aquatic ecosystem is the physical and chemical makeup of the river sediments and how sediments are dispersed and accumulated in the river. Despite Illinois EPA agreeing that sediment could limit suitable habitat quality, the Agency acknowledged that it evaluated the impact of sediment resuspension only in a very "cursory" manner (and only then for assessing compliance with the cadmium chronic water quality standard). *See* March 11, 2008, Hearing Transcript, pp. 143-144, 148-149. Based on EA's extensive studies in the CAWS, the fine, silty, and organic nature of sediments in the CSSC and LDR are not suitable for many higher quality fish species which require hard, clean substrate for spawning and reproduction. Excess sediment can fill interstitial spaces of spawning gravels, impair fish food sources, fill rearing pools, and reduce beneficial habitat structure. Studies, including those conducted by Mr. Chris Yoder, have documented that streams in highly urbanized areas typically do not achieve CWA's "fishable/swimmable" goals due to the multiple stressors and physical limitations. Even the removal of one limiting factor, such as sediments, would not improve aquatic habitat, as the urban nature of the CAWS and the many sources of

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pollutants would continue to cause additional fine, silty sediments to be deposited, thus preventing the improvement of aquatic life habitat. Deleterious sedimentation in the CAWS is both unpreventable and irreversible and will remain a major impediment to biological improvements. In a 2003 evaluation of the Dresden Pool, EA Engineering found that sedimentation was moderate to severe in 70% of the areas where QHEI scores were assessed. Our recent July 2008 habitat survey of the UDP again found that much of the area was heavily silted. See Exhibit 2, Attachment 2.

Contaminated sediments are also a significant limiting factor to the CAWS. *See* Allen Burton Pre-Filed Testimony and Report. Toward this end, extensive studies have found that contaminated sediments occur in all three navigational pools (Brandon, Dresden, and Lockport), but predominantly in the side-channels and backwater areas. Despite these extensive studies, the Illinois EPA failed to consider whether contaminated sediments in the Brandon and Upper Dresden Pools precluded these waters from attaining CWA aquatic life goals. *See* March 10, 2008, Hearing Transcript, p. 164.

Consequently, because of the direct physical harm and serious habitat degradation that has occurred and will continue to occur as a result of ongoing barge traffic and sedimentation (both toxic and otherwise), it is my opinion that UAA factor 3 for the CSSC and the UDP is met.

<u>UAA Factor 4 – Dams and Other Hydrologic Modifications</u>

Factor 4 applies in situations where dams, diversions, or other types of hydrologic modifications preclude use attainment, and restoration is not feasible. 40 C.F.R. §131.10(g)(4). As mentioned previously, the CAWS is specifically designed and operated to facilitate barge traffic and to convey massive quantities of storm water and municipal wastewater. The CSSC

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and LDR are a series of large pools separated by locks and dams to control water flow. These impoundments have a significant effect on the fish communities by transforming the river from a lotic (flowing waters) to a lentic (lake-like) system.

Impoundments adversely affect lotic fish species by eliminating riffles, reducing stream velocity, increasing sedimentation, interrupting fish migration, reducing insects that provide a food source, and reducing overall habitat complexity and biological integrity. Fish species that are habitat generalists, such as the common carp, gizzard shad, and channel catfish, as well as pelagic species, such as emerald shiner and freshwater drum, do quite well within impounded systems. Whereas, fish species, such as fluvial specialists, including most darters and madtoms and some suckers, are adversely impacted. Others, such as simple lithophils, which include species such as the redhorse and most darters, which require clean, hard substrates, are also adversely impacted. As described in greater detail in Exhibit 2, it is well documented that impounded river systems, such as the CSSC and UDP, have correspondingly lower indices of biological integrity ("IBI") scores upstream of each dam. For example, extensive studies of the nearby Fox River, funded in part by U.S. EPA, documented significant and widespread adverse impacts on the aquatic communities due to the effects of impounding. See Exhibit 2, Attachment 3. Notably, only about 50% of the Fox River is impounded relative to the Brandon and Dresden Pools, which are 100% and 93% impounded, respectively. The impoundments exclude or reduce large groups or classes of fishes, including species that are obligate riffle dwellers (e.g., most darters and madtoms and some minnows) and other species that prefer fast moving water and hard substrates (e.g., many sucker species, and some minnows and sunfish).

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The dams and locks in the CSSC and UDP currently function as originally designed and constructed and their impact on aquatic communities is unmistakable and irreversible.

Therefore, I have concluded that UAA factor 4 equally applies.

<u>UAA Factor 5 – Physical Features</u>

Factor 5 applies to water bodies where there is a lack of natural features such as proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, that preclude attainment of aquatic life protection uses. 40 C.F.R. §131.10(g)(5). The physical factors that characterize the CSSC and LDR, some of which have already been discussed, are limiting to aquatic communities. These factors include excessive siltation, lack of suitable substrate, minimal instream cover, lack of riffles, and lack of fast moving water. These unalterable limits in the physical condition and habitat features of the LDR, even without consideration of severity of sediment contamination, preclude the attainment of aquatic life uses consistent with the General Use requirements. Based on these physical limitations alone, I have concluded that UAA Factor 5 applies as well.

The UAA analysis also entails consideration of potential remedial efforts that, if taken, may facilitate achievement of CWA goals. In this case, the one remedial option that could have the most significant influence of helping the CAWS and UDP achieve CWA aquatic life goals would be to remove the locks and dams entirely. However, the locks and dams are essential to navigation, which is a protected use within this waterway; and no one has seriously suggested that navigational use in the CAWS will be discontinued in the foreseeable future.

2. Habitat Conditions in the CSSC, Including the UDP, are Degraded and Irreversible and Preclude Attainment of CWA Aquatic Life Goals.

The qualitative habitat evaluation index ("QHEI") is a measure of habitat suitability. Most experts, including Mr. Edward Rankin, the developer of the QHEI system, conclude that streams with QHEI scores greater than 60 generally are capable of supporting balanced indigenous fish populations that are consistent with the goals of the CWA. Scores between 45 and 60 must be examined more closely to determine whether or not balanced fish populations are supportable.

Between 1993 and 2008, EA Engineering has collected habitat data and derived QHEI scores for over 100 sites for the CSSC and LDR, including the UDP, as part of studies conducted in 1993-1994, in 2003, and most recently in July 2008. *See Exhibit 2*. In 1993 and 1994, QHEI scores were derived at 169 locations in the Lockport, Brandon Road, and Dresden Pools, and were, on average, found to be low (mean scores in the 40s), demonstrating that habitat generally was of poor quality. The low QHEI scores were attributed to the lack of riffle/run habitat, lack of clean, hard substrates (*i.e.*, gravel/cobble), excessive siltation, channelization, poor quality riparian and floodplain areas, and lack of cover. Habitat was found to be poorest in the Lockport Pool, marginally better in the Brandon Pool, and better still in the Dresden Pool; but QHEI scores were still well below 60 in most of the Dresden Pool.

With respect to the UDP, specifically, QHEI data subsequently collected by EA in 2003 and in July 2008, confirm that the average score in the UDP is generally between 45 to 50, which is at the lower end of the range of habitat that may have the potential to support CWA aquatic life goals. These low scores are a strong indication that the majority of habitat in the UDP is not

¹ EA Engineering compared its 2008 QHEI scores to scores calculated by MBI in 2006 for three sites that appear to be in close proximity. *See* Exhibit 2. While the score for one of the sites appears to be comparable and within an acceptable range of difference, scores calculated by MBI for the other two sites were substantially inflated relative

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sufficient to support CWA aquatic life goals. As documented in Exhibit 2, Attachment 2, there is very little "good" quality habitat present in the UDP and a much greater abundance of "poor" habitat. Relative to the Brandon or Lockport Pools in the CSSC, habitat in the UDP is "less poor" than that in the CSSC, but is still poor nonetheless.

As documented in Exhibit 2, Attachment 2, the July 2008 survey of UDP conducted by myself and my associate, Mr. Vondruska, is particularly relevant to the issue of habitat quality in UDP. During the July 2008 QHEI field survey of the UDP, the entire linear distance of each bank was surveyed separately. We established a series of contiguous, 500 meter zones along each shore of the UDP. Over a two-day period, we evaluated 50 such zones, which is significantly more than the two or three evaluated by MBI or Mr. Rankin. The extensive and contiguous nature of the 50-site QHEI survey by EA eliminated potential bias that may arise from the selection and scoring of only a limited number of QHEI site locations. QHEI scores were calculated using two scoring procedures: the standard Ohio EPA QHEI scoring procedure used by Mr. Rankin and the "MBI-modified procedure." The MBI-modified procedure is MBI's recently developed version of the QHEI that takes into account the impounding of a waterway and which was used by MBI during their 2006 assessment of the CAWS and UDP.

The UDP 2008 QHEI study results clearly support my opinion that the UDP is not capable of attaining the Clean Water Act aquatic life goals because:

Almost all of the QHEI scores are below 60.

Based on the Ohio EPA scoring procedure, 45 of the 50 (90%) QHEI scores were <60, and 49 of 50 (98%) of the scores were <60 using the Modified MBI procedure.

> Approximately Half of the QHEI scores were <45.

to EA's scores (e.g., 69 v. 54 and 81.5 v. 67.5). The scores for these two sites are not within the acceptable range of difference. Further analysis of MBI's scoring as discussed in Exhibit 2 confirm that MBI's scores are simply too high and are not supported by the facts.

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Based on the Ohio EPA procedure, 20 of the 50 (40%) scores were <45 and well over half (32 of 50 or 64%) of the scores using the MBI procedure were <45.

> The mean QHEI score is closer to 45 than to 60.

The mean QHEI scores were 47.4 and 42.0 for the Ohio EPA and MBI protocols, respectively. Thus, on average, the QHEI scores are well below the "good" cutoff of 60, regardless of the QHEI scoring procedure used. Moreover, these scores are closer to the 45-point cutoff that, under Ohio EPA's use classification protocol, would automatically qualify the UDP as a limited or modified use category that is intended for waters that cannot attain the Clean Water Act aquatic life goal. (*See* discussion below in Section 4 regarding Ohio EPA's use classification protocol).

Furthermore, the spatial distribution of QHEI scores (Exhibit 2, Attachment 2f) clearly shows that, except for the Brandon tailwaters, the vast majority of habitat in UDP is poor or occasionally fair.

Consistent with Ohio EPA protocols, the area within the navigational channel was not evaluated. However, due to a lack of cover and constant disturbance due to barge traffic, the navigational channel, which comprises roughly 50% of the UDP, certainly would have scored well below 45 had it been evaluated. This further accentuates the limited amount of good habitat available within the UDP. Roughly half of the UDP is within the navigational channel, which is unsuitable, poor habitat and the remaining half is characterized by poor to fair quality habitat, with only a very limited area of good habitat.

Balanced indigenous fish populations that are consistent with CWA aquatic life goals must have suitable habitat, including, for example, sufficient riffles, boulder/cobble substrates, and fast water areas to spawn and reproduce. Such physical features, however, are lacking from

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the UDP, except for the Brandon tailwater area, which accounts for only a small fraction (around 7 percent) of the entire Dresden Pool. Although the Brandon tailwater may technically qualify as good habitat, it is isolated and surrounded by predominantly poor to fair habitat in the Dresden Pool. The Illinois EPA appears to be giving significant weight to the existence of this very limited area of good habitat and speculating that, based on the availability of this habitat, that the entire Dresden Pool can minimally attain CWA goals. However, this assumption is refuted by the overwhelming evidence to the contrary and indicates a fundamental misunderstanding of aquatic ecosystems and how they function. Illinois EPA has acknowledged that it did not consider whether this very limited "good" habitat was usable by the fish community due to the presence of legacy pollutants and sediments. *See* March 11, 2008, Hearing Transcript, p. 74.

As detailed in Exhibit 2, the adverse effects of dams on aquatic life in river systems, such as the nearby Fox River, are well documented. Impounded systems such as the CSSC and UDP do not function as natural river systems, whose predictable, seasonal flows serve to flush accumulated sediments downstream and trigger migratory movements of certain fish species. These adverse effects of dams include, for example, lower Index of Biotic Integrity (IBI) scores, significantly lower QHEI scores in impounded areas, poor macroinvertebrate populations dominated by pollution-tolerant species due to increased volumes of sediments and lower sediment quality, lack of species dependent on riffle/run habitats, and fragmented fish populations characterized by much lower species richness. The influence of the dams in the CSSC and the UDP are expected to be even more profound than those observed in the Fox River, due to height of the dams, the greater extent of impounding, and the erratic and highly variable flow levels in the CSSC and UDP.

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The areas in the UDP most adversely impacted by the effects of impounded and erratic flows are the shallow areas, such as the Brandon tailwaters. *See* Julia Wozniak Pre-Filed Testimony, Attachment 5 (Flow Graphs). These tailwaters offer all of the riffle habitat in the UDP and, therefore, are important for potential spawning of obligate riffle species, such as darters and madtoms. As previously described, however, the adverse effects of the erratic and drastic flow fluctuations include increased stranding of nests, larvae and adult fish during low flows and, conversely, the sweeping away of nests, eggs, and larvae during increased flows.

Due to its permanent and irreversible habitat limitations, the Dresden Pool is not capable of supporting viable populations of certain fishes such as most darters, walleye and sauger, some suckers (including redhorse and white sucker), most madtoms, and certain minnow and centrarchids (*e.g.*, smallmouth bass). The species that are thriving in the Dresden Pool are habitat generalists. The absence or low abundance of many minnows, darters, and suckers – the most diverse groups of fish species in Illinois – does not reflect a balanced indigenous population consistent with the CWA goals. The poor habitat structure and limitations in the Dresden Pool, such as heavy siltation and the lack of riffles and fast water, are fixed and irreversible and thus the Dresden Pool will not support habitat specialists, despite proposed changes to water quality standards.

EA also conducted a review of MBI's 2006 IBI metric values and scores presented as Attachment S to the Illinois EPA Statement of Reasons. As discussed in Exhibit 2, numerous, substantive mistakes were identified in MBI's 2006 report, some of which were acknowledged by Mr. Yoder in his pre-filed testimony, and inaccurately raised the IBI scores for the CSSC and UDP. These mistakes included, for example, misidentification of several fish species, inaccurate or improper tallying of fish species, incorrect assignment to breeding guilds, arbitrary assignment

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of drainage area, the use of defective pH and dissolved oxygen probes which resulted in seriously erroneous entries made in the field notebooks, and the failure to revise clearly flawed data and scores, all of which call into question the reliability of MBI's IBI scores and incorrectly portray a higher biological integrity than actually exists in the UDP.

3. Much of the Data Relied Upon by IEPA to Establish Uses in the LDR are Significantly Flawed.

IEPA relied heavily on fish (*i.e.*, IBI) and especially habitat data provided by MBI. However, my review of those data indicates that much of those were flawed.

QHEI Scores

First, the MBI QHEI scores were calculated from a very small (3 locations) and nonrepresentative portion of the UDP. Second, as documented in Exhibit 2, Attachment 2, many of
the QHEI scores provided by MBI, including those from the UDP, are wrong. In some cases,
these mistakes were due to multiple math errors, which could and should be corrected. However,
they also made a number of methodological errors such as incorrectly interpreting current speed,
ignoring the obviously impounded nature of sites, not properly accounting for channelization,
over-scoring cover types and amounts, incorrectly assessing riparian width, and erroneously
considering some areas to possess at least some sinuosity when they possessed none. Although
individually some of the necessary scoring changes would be relatively small, collectively they
result in systematic scoring inflation that wrongly gives the impression that habitat in the UDP
(and elsewhere) is better than it really is.

IBI Scores

MBI also made mistakes in calculating IBI scores at numerous locations including those within the UDP. These mistakes included misidentifying species, incorrectly assigning species

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to breeding guilds, using one drainage area for all their locations, including exotic species (which, according to their protocols should have been excluded) in the total species richness metric, incorrectly tallying sunfish species, and incorrectly tallying the number of fish caught. The large number of errors on the metrics result in many, perhaps most of the IBI scores being wrong.

The various QHEI and IBI errors occurred despite the fact that MBI submitted revised data sets that were supposed to address these issues, many of which had already been brought to their attention. The fact that even after being brought to their attention, many errors remain indicates that MBI's QA/QC procedures are fundamentally flawed and therefore the data they provide should be disregarded or, at a minimum, limited in their consideration as questionable or non-credible data.

4. Comparison of UDP and CSSC to Ohio Use Classification System Categories.

The Illinois EPA's proposed use designation rule for the UDP assigns a site-specific, use designation that, by the Agency's own description, is intended to be "unique," while also contending that the UDP shares characteristics with Illinois General Use waters that enable it to attain CWA aquatic use goals. The comparison to Illinois General Use waters is misleading and misguided, as General Use waters do not have the combination of channelization, impoundment, commercial navigation, irregular flows, and significant inputs from urban storm water and wastewater discharges that characterize the UDP. The Illinois EPA's proposed use designation for the UDP is not an appropriate designation and is not scientifically supportable.

With respect to the CSSC, the Illinois EPA agrees that it cannot attain the CWA's aquatic use goal and has proposed a lower aquatic life use referred to as "Aquatic Life Use B." The

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Illinois EPA further agrees that the CSSC has poor habitat and that the aquatic community suffers adversely from the artificially controlled flow conditions and heavily industrialized nature of this waterway, including the high volume of barge traffic. What is less clear is whether the proposed language of the "Aquatic Life Use B" use classification accurately classifies highly-modified streams that are characterized by poor habitat, heavily industrialized use and very limited aquatic community aquatic life potential.

In this regard, a review of the Ohio EPA's use classification approach of describing categories of streams, such as "Limited Warm Water," "Modified Warm Water" and its use of subclassifications, such as "Impounded"(I), for streams like the CSSC, shows that the Ohio use classification approach would serve as a better and clearer model on which to expand the current Illinois use classification system. While I agree with the Illinois EPA's attempt to expand and refine the existing Illinois use classification system, its proposed language does not provide a sound and clearly articulated basis for doing so. In my opinion, the more generic descriptions of use classifications used by the Ohio EPA, which still identify the key stream characteristics that qualify a waterbody for a given use classification, is a more scientifically credible approach to establishing a multi-tiered use classification under state water quality regulations.

In 2004, Mr. Rankin recommended to Illinois EPA that the Ohio Modified Warmwater Habitat Use for impounded rivers (MWH-I) would be the most appropriate use category for UDP (See Attachment R to Illinois EPA's Statement of Reasons). Despite Illinois EPA agreeing with Mr. Rankin's conclusion, the Agency without explanation has completely ignored Mr. Rankin's recommendation and instead determined that the UDP can attain the CWA aquatic life goals. It is important to note that Ohio's MWH-I use designation applies to waters that are not capable of attaining the CWA's aquatic life goals, due to the limiting factors inherent to impounded waters.

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Mr. Rankin reached this conclusion based largely on the physical habitat limitations he observed as a result of systematic alteration and urbanization. The extensive biological data collected by EA Engineering supports Mr. Rankin's assessment. Because the impounded nature of a waterbody has such a significant effect on the aquatic life uses that it can attain, a use classification description that recognizes the "impounded" attribute of certain waterbodies serves as a reliable and helpful tool in crafting scientifically sound use categories within a state's use classification system.

Although no single attribute separates limited use from modified use, several factors have been identified as being particularly important. According to Rankin (See Attachment R to Illinois EPA's Statement of Reasons), factors that have a high influence are:

- Channelized or no Recovery from Channelization
- Silt/Muck substrates
- No sinuosity
- No or sparse cover

Based on these and other QHEI attributes associated with "lower" aquatic life uses, particularly moderate to heavy silt, fair/poor riffle/pool development, the absence of riffles, and the amount of embeddedness, Mr. Rankin recommended various uses for the CAWS and LDR. Of particular relevance is the fact that Rankin did not recommend any of the segments subject to this Rule-Making be classified as warmwater habitat, an aquatic life use consistent with CWA goals. Instead, he recommended modified or limited resource water for each and every segment he evaluated. For example, he recommended Limited Resource Water for most of the CSSC, but noted that a portion of it might be able to support a Modified-Channelized category of fauna.

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For the LDR, he recommended the category Modified-Impounded, the same category that EA believes is appropriate for the UDP (Exhibit 2, Attachment 2).

EA Engineering has compared the attributes of the UDP using attributes of Ohio's use designation classification system. The UDP has far more in common with Ohio's modified warm water use designation (which does not meet CWA goals) than Ohio's warm water habitat use designation (which does meet CWA goals). Both Messrs. Rankin and Yoder have concluded in at least one published report that as the predominance of modified habitat attributes relative to warm water attributes increases to a ratio of greater than 1.0 to 1.5 to 1, the likelihood of having IBI scores consistent with warm water habitat use declines. For comparison purposes, the ratio for the Dresden Pool is 4:1, which is significantly greater than the 1.5:1 threshold recommended by both Rankin and Yoder. Therefore, based on Messrs. Yoder's and Rankin's own assessment guidelines, the Dresden Pool is more akin to a modified warm water system not capable of achieving CWA goals.

5. Extensive Fish Surveys Confirm that the CSSC, Including the UDP, is Dominated by Pollutant Tolerant Species, Reflecting Degraded Habitat Conditions.

EA Engineering has been conducting fish surveys in the Upper Illinois Waterway ("UIW") and CAWS since 1980. A brief summary of our results as well as an overview of what they mean is appropriate because these results clearly demonstrate that the fish community in the CSSC and the UDP is a result of the habitat limitations discussed above. Since 1993, EA Engineering has made a total of 3,159 collections from the Dresden, Brandon, and Lockport Pools to assess the resident fish populations. This compares to only 22 collections made by MBI from these pools, only six of which were collected from the UDP, and all of which were

collected during a single year (2006). A more detailed discussion of these fish surveys is attached to the EA Engineering report. *See* Exhibit 2, Attachment 1.

Larval Fish

In 1994, EA collected fish eggs and larvae at 16 locations in the UIW, including six locations in Lockport Pool, one in Brandon Pool, one in the Upper Des Plaines River, and eight in Dresden Pool. Over the course of the study, tens of thousands of eggs and larval and young-of-the-year (YOY) fish were collected. Among the larval and YOY fish collected, the six most commonly collected species or taxa during this study (*Lepomis* spp., gizzard shad, common carp, bluntnose minnow, unidentified *Pimephales* spp., and emerald shiner) share early life history characteristics that appear to be most successful in this system. These include adaptations that allow eggs and/or larvae to tolerate low dissolved oxygen concentrations and have minimal contact with the sediment. Collectively, these six species or taxa accounted for more than 86% of all larvae/YOY collected.

Juvenile and Adult Fish

In 1993 and 1994, EA Engineering conducted fish sampling along a 53-mile stretch of the UIW, including 18 locations in Lockport Pool, six in Brandon Pool, one in the Upper Des Plaines River, 22 in Dresden Pool, and six downstream of Dresden Island Lock and Dam. Fish were collected by electrofishing, gillnetting, and seining, and most locations were sampled both years. This two-year study resulted in the capture of 25,349 adult and juvenile fish representing 82 species. Numerically dominant species were bluntnose minnow (20.0%), gizzard shad (19.4%), common carp (11.3%), and emerald shiner (10.5%). Thus, the UIW was dominated by a combination of prolific pelagic species (e.g., gizzard shad and emerald shiner) and highly

tolerant species (e.g., bluntnose minnow and common carp). Thus, at all life stages from egg through adult, the UIW fish community is dominated by highly tolerant and pelagic fishes; a clear response to the severe habitat limitations within the system.

The most common and consistent trends in the UIW were spatial. These spatial patterns were:

- A very poor native fish assemblage was present in Lockport Pool. The assemblage in Lockport Pool was characterized by low native fish abundance (catch rates typically <50 fish/km), low species richness, and domination by highly tolerant species.
- The community was marginally better in Brandon Pool but was still very poor.
- The fish communities in the Upper Dresden Pool and the 5-mile Stretch, Dresden Pool downstream of the Kankakee River, and downstream of Dresden Lock and Dam were relatively similar to each other and noticeably better than those upstream of Brandon Lock and Dam.
- Results at thermally-influenced sampling stations were comparable to those at other stations.

Based on biological criteria established by Ohio EPA, the fish community in the five areas would be classified as follows:

Lockport Pool	very poor
Brandon Pool	very poor
Upper Dresden Pool and the 5-mile Stretch	poor
Dresden Pool downstream of the Kankakee River	poor
Downstream Dresden Lock and Dam	fair

As discussed in greater detail in Attachment 1 of Exhibit 2, the highest incidence of diseased fish as measured by abnormalities such as deformities, erosion, lesions, and tumors ("DELTs") were observed in the upper three segments of the study area (*i.e.*, Lockport Pool, Brandon Pool and Upper Dresden Pool). DELT percentage rates ranged from a low of 7.5%

(downstream of Dresden Dam) to a high of 14.6% (Brandon Pool). DELT anomalies were greatest among bottom feeders such as carp, channel catfish, and redhorse species. For large rivers like the UIW, any site with >3% DELT anomalies receives the lowest possible IBI metric score. DELT anomalies exhibited by fish in the UIW are 2-5 times higher than the Ohio EPA's criterion for the lowest metric score.

The following conclusions were reached, based on the 1993-1994 surveys:

- Habitat severely limited the fish community.
- Fish diversity and abundance followed clear-cut patterns, with conditions being poorest in Lockport Pool and generally improving in a downstream direction.
- The spatial pattern appeared to be unrelated to operation of the ComEd power plants.
- Growth and condition of most species were generally within expected ranges, except for smallmouth bass.
- The incidence of diseased fish is very high in the UIW.
- Reproduction in the upper portion of the study area is primarily limited to a few tolerant or pelagic fishes.
- None of the measures used in this study to evaluate individual or community health indicated that ComEd power plants were contributing to the poor fauna observed in much of the UIW.
- Based on the lack of impacts and habitat-imposed constraints, it was concluded that the
 aquatic community of the UIW would essentially be the same as it is currently if ComEd
 plants were load-restricted or even taken off line.

In 1995, EA conducted additional fish studies within the same study area, the results of which closely paralleled those of the 1993-1994 study. A detailed discussion of the 1995 study and fish surveys conducted annually from 1997 to present are provided in Exhibit 2.

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Species Composition (1993-2005)

The fish surveys conducted from 1993 through 2005 for the UPD and the 5-mile Stretch, produced 143,156 fish representing 82 species and four hybrids. The ten most abundant species collected during this period were, in descending order of abundance, bluntnose minnow (22.2%), gizzard shad (+ Dorosoma spp.) (20.4%), bluegill (17.2%), green sunfish (7.0%), emerald shiner (6.6%), orangespotted sunfish (4.4%), largemouth bass (3.4%), common carp (2.8%), bullhead minnow (2.3%), and spottail shiner (1.9%). These same species were also the ten most abundant collected during both the period before the AS96-10 Adjusted Standard went into effect (i.e., 1993-1995) and after that (i.e., 1997-2005). For all years combined, 16 moderately and highly tolerant species (plus two other taxa) composed 52.8% of the catch. Conversely, only 1.7% of the fish collected were intolerant or moderately intolerant. This species assemblage does not reflect a balanced indigenous population. And although there has been a modest improvement in the UDP in the terms of fish abundance since 1993, the same ten species continue to dominate the community of the UPD and the 5-mile Stretch and remained unchanged since before the Adjusted Standard went into effect. In conclusion, it is my professional opinion that the preponderance of moderately tolerant and highly tolerant fishes reflects the degraded habitat of Dresden Pool, and not the effects of thermal discharges. It also reflects the limited availability of good quality habitat that is necessary to attain a balanced, indigenous species that equates to the attainment of the CWA aquatic use goals.

Conclusion

It is my professional opinion, based on many years of experience and firsthand knowledge of the CAWS and the UDP, that irreversible physical and biological factors limit the

biological potential of the CSSC and UDP (conditions wholly unrelated to thermal effects) and prevent these waters from attaining CWA aquatic life use goals. It is also my opinion that the Illinois EPA in developing the UAA Proposed Rules has completely ignored many attributes, constraints and habitat limitations of the UDP that prevent this waterway from attaining CWA aquatic use goals. Limiting habitat conditions such as channelization, impoundment, commercial navigation (a protected use), lack of riffles and fast water, irregular and extreme water flows, excessive sedimentation and siltation, toxic sediments, and significant inputs from urban storm water and wastewater discharges will continue to prevent the occurrence of balanced indigenous fish populations. These are irreversible conditions with unmistakable negative impacts on the aquatic community which the UAA Proposed Rules will not and cannot change to the extent necessary to attain the CWA aquatic use goals.

Greg Seegert

EXHIBIT 1

Resume for Mr. Greg Seegert of EA Engineering, Science, and Technology, Inc.

Professional Profile Gregory L. Seegert

Gregory L. SeegertChief Aquatic Biologist

Mr. Seegert is a senior scientist at EA's office in Deerfield, Illinois as well as Chief Ichthyologist at EA. His areas of special expertise are aquatic ecology and aquatic toxicology. In his 35 years of experience in these areas, Mr. Seegert has conducted studies throughout the Midwest and much of the East and Southeast. He is a recognized expert on biocriteria and biological sampling methods to assess impacts to aquatic life. He works regularly with the private sector and regulatory agencies in designing and implementing bioassay and aquatic biological studies. He has designed and directed numerous studies investigating the effects of water intakes and discharges on aquatic life. Issues regularly addressed by Mr. Seegert include factors affecting the abundance and distribution of fishes, entrainment at hydroelectric facilities, 316(a) and (b), aquatic toxicology, bioaccumulation, endangered species, and ecological risk.

Qualifications

Education

M.S.; University of Wisconsin–Milwaukee; Zoology; 1973

B.S.; University of Wisconsin–Madison; Zoology; 1970

Specialized Training

SEAK Expert Witness Training; 2007 EA Project Manager Training; 1997 EA Expert Witness Training; 1990 EA Toxicity Reduction Evaluation Training; 1989

Professional Affiliations/Appointments

American Fisheries Society National Society and three State Chapters American Society of Ichthyologists and Herpetologists Wisconsin Society of Omithology

Professional Experience

Aquatic Ecology—Designed, conducted, managed, and reviewed aquatic studies throughout the East, South, and Midwest. Recognized expert on the distribution of fishes and fish taxonomy, biocriteria, and Index of Biotic Integrity (IBI) theory and implementation. Worked on small streams, wetlands, large rivers (e.g., Ohio, Wabash, Mississippi), ponds, reservoirs, and the Great Lakes. Worked with numerous utilities in studying the effects of thermal discharges on aquatic life. Evaluated impingement and entrainment losses of aquatic organisms and the effects of construction and flow alterations on salmonids. Annually directs a large fish study that covers most of the Ohio River. Regularly conducts surveys of endangered fishes. Instructor at several workshops on fish identification.

Habitat Evaluation—Used a variety of qualitative and quantitative techniques (e.g., Ohio Environmental Protection Agency's [EPA's] Qualitative Habitat Evaluation Index, ORSANCO Habitat Class) to evaluate the suitability of waterbodies for fishes. Using correlation analysis, determined which habitat (e.g., amounts of cover, silt, cobble, ORSANCO class) or physical (e.g., river flow, depth, temperature) variables significantly affected biological variables (e.g., catch-per-unit-effort, Index of Well Being mod scores, IBI scores, fish biomass, diversity). Determined how fish communities in the Upper Illinois Waterway responded to habitat quality as measured by the Qualitative Habitat Evaluation Index. Determined how changes in physical variables (current velocity, depth) and the amount of useable habitat would affect fish and macroinvertebrate in the Red River of the North as a result of planned water diversions.

Clean Water Act Section 316(a)—Designed and conducted field studies in 1995 and 2000 as part of 316(a) demonstrations at a paper mill on the Pigeon River in North Carolina. Also prepared all associated reports. Prepared 316(a) demonstrations for the WE-Energies Oak Creek/Elm Road project and the Point Beach Nuclear Plant, both on Lake Michigan, as well as demonstrations for plants on the Wabash and Muskingum Rivers. Used EA-collected biological data to develop alternative thermal limits for the Lower DesPlaines River.

Clean Water Act Section 316(b)—From 1998 through 2003, served as a principal advisor to Utility Water Act Group (UWAG) on freshwater issues and has worked with them and various industry representatives in developing comments on EPA's 316(b) Phase I and II rules. During this period, attended various workshops, conferences, and meetings representing UWAG and various utilities. On behalf of a group of Ohio River users, developed and submitted comments regarding EPA's Ohio River Case Study Example. On behalf of the American Petroleum



Professional Profile Gregory L. Seegert

Institute, developed a position paper relative to establishment of the Calculation Baseline and various related issues. Based on these reviews, has made numerous presentations at various industry forums. Has managed or directed entrainment and/or impingement studies at approximately 50 plant sites. These include studies on lakes, reservoirs, small rivers, large rivers, and Lake Michigan. For Electric Power Research Institute, was project director on impingement studies at 15 power plants on the Ohio River. Also managed impingement and entrainment studies at 5 American Electric Power plants on smaller Midwestern rivers.

Environmental Toxicology—Conducted numerous acute and life cycle bioassays to determine the effects of effluents and of numerous individual organic and inorganic chemicals on aquatic organisms. These tests involved a wide variety of freshwater and marine fish and macroinvertebrates. Determined the upper thermal tolerance of smallmouth redhorse and golden redhorse. On behalf of Cincinnati Gas and Electric, evaluated the effects of ash pond and cooling tower blowdown on aquatic organisms. Designed and conducted laboratory and field studies at two Ashland Oil refineries. For the Minnesota Pollution Control Board, evaluated the effects of chlororganics from the St. Regis paper plant at Sartell on aquatic life and human health. Directed two 28-day dioxin biouptake studies at a Champion International paper mill in Quinnesec, Michigan. At this same site, directed a long-term research and development effort to assess and mitigate impairment of the flavor of fish in the receiving waterbody.

Critical Reviews—On behalf of various companies and trade associations (e.g., American Petroleum Institute), conducted detailed reviews of various state and federal technical and regulatory documents. Several of these reviews have led to extensive revisions in the subject document. Chlorine-related literature is an area of particular expertise and, as a result, Mr. Seegert's expertise has been solicited regularly by EPA, various states, and numerous industrial clients. For American Petroleum Institute, reviewed the status of biocriteria development in the United States. Also reviewed several ecoregion IBI reports in Indiana.

Mining Studies—Directed all aquatic and water quality activities associated with a 2-year, \$1 million study designed to assess the impacts of New Source coal mining in West Virginia. In conjunction with this study, developed a unique system of ranking the biological resources of each waterbody, developed detailed methodologies to monitor the aquatic environment before, during, and after mining, and ranked all the fishes of West Virginia with regard to their susceptibility to coal mining. Directed a five-year study of issues related to effluent quality, sedimentation, tissue contamination, loss of spawning habitat, alterations in flows, and rates of recolonization at the site of a proposed copper/zinc mine in Wisconsin. Directed and managed a long term study to evaluate biological recovery following the pumpout of a flooded coal mine in Ohio.

Hydropower Development—Evaluated effects of hydropower development on aquatic life at numerous sites throughout the Midwest and Southeast. Designed and conducted population surveys of various fish species to evaluate impacts on these species. Measured entrainment rates and entrainment mortality at various sites and assessed the impact of these losses on resident and migratory warmwater and coldwater fishes. Evaluated effects of flow alterations and flow reductions on stream fishes.

Selected Publications and Presentations

Organizer and moderator of a national workshop on evaluating large river fish communities.

Seegert, G.L. (B.M. Burr, D.J. Eisenhour, K. M. Cook, C.A. Taylor, R.W. Sauer, E.R. Atwood, co-authors). 1996. Nonnative fishes in Illinois waters: What do the records reveal? *Trans. Ill. Acad. Sci.* 89:73-91.

Seegert, G.L. (B.M. Burr, K. M. Cook, D.J. Eisenhour, K.R. Piller, W.J. Poly, R.W. Sauer, C.A. Taylor, E.R. Atwood, co-authors). 1996. Selected Illinois fishes in jeopardy: New records and status evaluations. *Trans. Ill. Acad. Sci.* 89:169-186.

Seegert, G.L. 1986. Rediscovery of the greater redhorse in Illinois. Trans. Ill. Acad. Sci. 79:293-294

Seegert, G.L. 1984. Fisheries studies of Pool 5A of the Upper Mississippi River, 1982, in Proc. 40th Upper Mississippi River Conservation Committee. UMRCC, Rock Island, Illinois.



Professional Profile Gregory L. Seegert

Seegert, G.L. (J. Fava and P. Cumbie, co-authors). 1983. How representative are the data sets used to derive national water quality criteria?, in Proc. Seventh Aquatic Toxicological Symposium. ASTM, Philadelphia.

Seegert, G.L. (R.B. Bogardus, co-author). 1980. Ecological and environmental factors to be considered in developing chlorine criteria, in Water Chlorination: Environmental Impact and Health Effects, Vol. 3 (R.L. Jolley, ed.). Ann Arbor Science, Ann Arbor, Michigan.

Seegert, G.L. (A.S. Brooks, J. Vande Castle, and K. Gradall, co-authors). 1979. The effects of monochloramine on selected riverine fishes. Trans. Am. Fish. Soc. 108:88-96.

The fish community of the Chippewa River and Dells Pond near Eau Claire, Wisconsin. Presented at WI AFS meeting. 1998. Eau Claire, WI. January.

Entrainment and impingement studies at two power plants on the Wabash River in Indiana. 1998. Presented at Electric Power Research Institute Clean Water Act Section 316(b) Technical Workshop. Berkeley Springs, West Virginia. September.

Status and application of biocriteria. 1998. Presented at the TAPPI Environmental Conference. Vancouver, British Columbia. April.

Improvements to the Pigeon River following modernization of the Champion International Mill. 1997. Presented at the TAPPI Environmental Conference. Minneapolis, Minnesota. May.

Improvements to the Pigeon River following modernization of the Champion International Mill. 1997. Presented at the TAPPI Biological Symposium. San Francisco, California. October.

Geographic and historic changes in Ohio River Fish Communities. 1997. Presented at the Ohio River Fisheries Conference. Cincinnati, Ohio. January.

Small mammals of the Ohio River floodplain in western Kentucky and adjacent Illinois. 1982. Trans. Kentucky Acad. Sci. Co-authored by R.K. Rose.

Factors in the design of chlorine toxicological research. 1982. In: R.L. Jolley, ed. Water chlorination: environmental impact and health effects, Vol. 4, Ann Arbor Science, Ann Arbor, Michigan. Co-authored by J.A. Fava.

Low level chlorine analysis by amperometric titration. 1979. J. Water Poll. cont. Fed. 51:2636-2640. Co-authored by A.S. Brooks.

WAPORA, Inc. 1978. Review of the Mattic and Zittel paper: site-specific evaluation of power plant chlorination. Project 218. Submitted to Edison Electric Institute, Washington, D.C.

A preliminary look at the effects of intermittent chlorination on selected warmwater fishes. 1978. Pages 95-110. In: R.L. Jolley, H. Gorchev, and M. Hamilton eds., Water chlorination: environmental impact and health effects, Vol. 2. Ann Arbor Science. Ann Arbor, Michigan. Co-authored by A.S. Brooks.

The effects of intermittent chlorination on coho salmon, alewife, spottail shiner, and rainbow smelt. 1978: Trans. Am. Fish. Soc. 107:346-353. Co-authored by A.S. Brooks.

Dechlorination of water for fish cultures: a comparison of the activated carbon, sulfite reduction, and photochemical methods. 1978. J. Fish. Res. Bd. Can. 35:88-92. Co-authored by A.S. Brooks.

Diel variations in sensitivity of fishes to potentially lethal stimuli. 1977. Prog. Fish. Cult. 39:144-147. Co-authored by R.E. Speiler and T.A. Noeske.



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Professional Profile Gregory L. Seegert

The effects of intermittent chlorination of rainbow trout and yellow perch. 1977. Trans. Am. Fish. Soc. 106:278-286. Co-authored by A.S. Brooks.

The effects of intermittent chlorination of the biota of Lake Michigan. 1977. Special Report #31, Center for Great Lakes Studies, University of Wisconsin. Milwaukee, Wisconsin. Co-authored by A.S. Brooks.

The effects of a 30-minute exposure of selected Lake Michigan fishes and invertebrates to residual chlorine. 1977. Pages 91-99. In: L.D. Jensen, ed. Biofouling control procedures: technology and ecological effects, Marcel Dekker, Inc., New York, New York. Co-authored by A.S. Brooks.

The effects of intermittent chlorination on selected warm water fishes. 1977. Presented at the Conf. on Water Chlorination: Environmental Impact and Health Effects. 31 October – 4 November 1977. Gatlinburg, Tennessee. Co-authored by A.S. Brooks.

The effects of intermittent chlorination on selected Great Lakes fishes. 1977. Presented at the 38th Midwest Fish & Wildlife Conf. 5-8 December 1975. Dearborn, Michigan. Co-authored by A.S. Brooks.

Toxicity of chlorine to freshwater organisms under varying environmental conditions. 1976. Pages 277-298. In: R.L. Jolley, ed. Proceedings of the Conference on Environmental Impact of Water Chlorination, 22-24 October 1975, Conference 761096. Oak Ridge National Laboratory. Oak Ridge, Tennessee. Co-authored by A.S. Brooks.

The Beaver Dam River. 1976. Pages 210-213. In: D.D. Tessen, ed. Wisconsin's favorite bird haunts. Wisconsin Society for Ornithology. Green Bay, Wisconsin.

The effects of heat on plasma potassium levels, hematocrit, and cardiac activity in the alewife, common shiner, and two other teleosts. 1973. Presented at the 16th Conf. on Great Lakes Research. 16-18 April. Huron, Ohio. Coauthored by C.R. Norden.

The effects of lethal heating on plasma potassium levels, hematocrit and cardiac activity in the alewife (Alosa pseudoharengus) compared with three other teleosts. Pages 154-162. In: Proceedings of the 16th Conf. Great Lakes Res. International Association Great Lakes Res.

Numerous presentations at state, division, and national American Fisheries Society Meetings. Topics have included:

- · Effects of power plant intakes
- · General fish surveys
- Threatened and endangered species surveys
- · Thermal assessments
- · IBI protocols
- Large river sampling methods
- · Toxicity studies
- Use attainability
- · Biological variability
- Habitat assessment



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Professional Profile Gregory L. Seegert

Professional Recognition

Chief Instructor for several fish identification workshops sponsored by the Indiana American Fisheries Society, Co-Instructor for two, 3-day fish identification workshops sponsored by the Wisconsin American Fisheries Society.

Candidate for President, Wisconsin Chapter of American Fisheries Society. 1998 and 2008.

Chairperson, Fish Physiology Section, American Society of Ichthyologists and Herpetologists, 1997 Annual Meeting. Seattle, Washington.

Member, Endangered Species Committee, American Fisheries Society. 1996 and 1998.

Invited speaker at various seminars and workshops.



EXHIBIT 2

EA Engineering, Science, and Technology's Report on the Aquatic Life Use Attainability Analysis for the South Branch of the Chicago River, the Chicago Sanitary and Ship Canal, and the Upper Dresden Island Pool



Aquatic Life Use Attainability Analysis for the South Branch of the Chicago River, the Chicago Sanitary and Ship Canal, and the Upper Dresden Island Pool

Prepared for:

Nijman Franzetti, LLP 10 South LaSalle St., Suite 3600 Chicago, IL 60603

Prepared by:

EA Engineering, Science, and Technology 444 Lake Cook Road, Suite 18 Deerfield, IL 60015

September 2008

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TABLE OF CONTENTS

Section	<u>Pa</u>	36
I.	INTRODUCTION	ı
II.	EXECUTIVE SUMMARY	2
III.	THE ARTIFICIAL, CONTROLLED FLOW CONDITIONS IN THE CAWS AND UDP SATISFY UAA FACTOR 2	5
IV.	BARGE TRAFFIC AND SEDIMENTATION PRESENT IN THE CSSC AND UDP SATISFY UAA FACTOR 3	7
	A. Barge Traffic in the CSSC and UDP Limits the Quality of Aquatic Life Attainable	3
	B. Adverse, Physical Aspects of Sedimentation in the CSSC and UDP Significantly Limit the Quality of Aquatic Life Attainable)
V.	DAMS AND OTHER HYDROLOGIC MODIFICATIONS IN THE CSSC AND UDP PRECLUDE ATTAINMENT OF AQUATIC LIFE GOALS UNDER UAA FACTOR 410)
	A. The Adverse Effects of Dams on Aquatic Life	
	B. The Fox River Studies of the Adverse Effects of Dams	,
VI.	THE "NATURAL" FEATURES OF THE CAWS AND UDP PRECLUDE ATTAINMENT OF AQUATIC LIFE USES UNDER UAA FACTOR 515	;
	A. Habitat Conditions in the CAWS and UDP Are Inadequate To Support A Balanced Fish Population	;
	 QHEI Scoring Process and Support Categories)
	a) QHEIs for UDP RM 279.5	
	5. Key Habitat Types required for a Balanced Fish Community are Lacking	
	B. The Extensive Urbanization of the CAWS and UDP Prevent Attainment of the Clean Water Act Aquatic Life Goals	
	C. Remediation to Address Habitat Limitations is not Feasible in the CAWS and UDP	

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TABLE OF CONTENTS (cont.)

<u>Section</u>	<u>l</u> ,		<u>Page</u>
VII.	AP	PROPRIATE USE DESIGNATION FOR UPPER DRESDEN POOL	33
	A.	Upper Dresden Pool Has Most of Ohio's Modified Warmwater Habitat Streams Characteristics and Almost None of Ohio's Warmwater Habitat Characteristics	33
	В.	The Habitat in the UDP Generally Will Not Support an Aquatic Life Use Consistent with CWA Goals	34
VIII.	LIS	ST OF REFERENCES	35

REPORT ON THE AQUATIC LIFE USE ATTAINABILITY ANALYSIS FOR THE SOUTH BRANCH OF THE CHICAGO RIVER, THE CHICAGO SANITARY AND SHIP CANAL, AND THE UPPER DRESDEN ISLAND POOL

I. INTRODUCTION

EA Engineering, Science, and Technology, Inc. (EA) is a national environmental company, with offices located across the nation, including its EA Midwest office in Deerfield, Illinois. EA provides a variety of environmental services, including expertise in aquatic ecology, habitat assessment, stream hydrology, and water quality. EA Midwest specializes in aquatic studies. Our senior staff collectively has over 150 years of experience in this area. EA Midwest's work in the area of aquatic studies is extensive. EA Midwest has conducted aquatic studies at numerous industrial facilities. These aquatic studies have been performed at approximately 100 power plants and at sites with similar issues (e.g., paper mills, steel mills, wastewater treatment plants, etc.). EA also has reviewed the use attainment and non-attainment status of several streams in Ohio and provided input to various clients as to which UAA factors were relevant and applicable at a particular site.

EA has studied aquatic habitat throughout the United States. These studies have involved a variety of qualitative and quantitative methods for evaluating/measuring habitat. Some of the methods used include:

- Montana Method and PHABSIM (Physical Habitat Simulation), qualitative and quantitative methods, respectively for determining how water flow affects fishes;
- Methods used by ORSANCO and the states of Ohio, Wisconsin, Michigan, Illinois, and North Carolina to measure habitat quality in biological sampling reaches;
- A Delphi approach to assessing habitat quality in the Osage River, Missouri
- Methods approved by the U.S. EPA, including the Rapid Bioassessment Protocol; and
- Habitat Suitability Index Curves

EA also has extensive experience in the use of Qualitative Habitat Evaluation Index (QHEI) procedures to assess the quality of aquatic habitat. Soon after the QHEI was first developed nearly 20 years ago, EA was involved in a project to assess several streams in Northwestern Ohio to determine the replicability of QHEI scores reported by Ohio EPA. Since then, EAs has used the QHEI to evaluate many streams and rivers in Illinois, Indiana, Ohio, and elsewhere, including in the Lower Des Plaines River (LDR).

EA biologists have been studying the Upper Illinois Waterway (UIW), including the Des Plaines River (DPR) and the Chicago Sanitary and Ship Canal (CSSC) since the company first came to the Chicago area in the late 1970's. EA has conducted studies of the DPR and the CSSC on a nearly annual basis since that time. EA biologists have made literally thousands of fish collections from the waterway. A summary of the fish and habitat studies conducted by EA from 1993 through 2006 is provided as Attachment 1.

Several years ago, Midwest Generation (MWGen) retained EA to review and comment on the LDR and the Chicago Area Waterway System (CAWS) Use Attainability Analyses being conducted by the Illinois Environmental Protection Agency (Illinois EPA or Agency). As part of its work for MWGen, EA reviewed and analyzed relevant information and data to assess use designation issues related to aquatic life goals for the CAWS and the LDR. EA, through the services of Greg Seegert, also participated in several Illinois EPA stakeholder meetings. Mr. Seegert served as a biological expert on the Biological Committee established by Illinois EPA as part of the LDR UAA process.

For this report, MWGen requested that EA evaluate the regulatory requirements in 40 CFR §131.10 (g), known as the UAA factors, to determine whether the Clean Water Act goals for aquatic life are attainable for the South Branch of the Chicago River, the CSSC and the LDR, which are the areas in the UIW where the MWGen electrical generating stations are located. For the LDR, our review focused on the Upper Dresden Island Pool (UDP) area as defined in the proposed UAA rules by the Illinois EPA. EA's review was limited to evaluating the attainability of aquatic life goals under the Clean Water Act by applying the first five UAA factors. EA's review did not include a review of the applicability of UAA Factor 6 relating to widespread economic and social harm. This report presents the results of EA's review and evaluation of the UAA factors as applied to the aforesaid areas of the CAWS and LDR.

II. EXECUTIVE SUMMARY

Based on EA's evaluation and application of the UAA factors, it was found that the South Branch of the Chicago River, the CSSC, and the UDP are not capable of attaining the Clean Water Act aquatic life goals. For purposes of this report, references to the CSSC include that portion of the South Branch of the Chicago River on which the MWGen Fisk Generating Station is located and which is immediately upstream of the CSSC. EA concluded that at least one of the UAA factors applied to each of these areas.

The present fish community in the CSSC and the LDR, including the UDP, is of limited diversity and quality. It does not represent a balanced population. It is the result of the following conditions, which satisfy the referenced UAA factors, none of which are reversible in the foreseeable future:

• Artificial, controlled flow conditions (UAA Factor 2): The flow in the CAWS does not follow a normal seasonal cycle which is necessary to support a balanced aquatic community. The flow is artificially controlled to support the navigational use of the system and to manage the periodic peak flows. Peak flows, in particular, adversely affect certain fish by causing nest abandonment and/or displacement of recently hatched fry and

by mobilizing fine sediments and then depositing them over their eggs, leading to suffocation of the eggs or reduced hatching success. Flow controls in the CAWS also result in fast, significant drops in water levels, which can strand fish in shallow areas, especially backwaters, leading to direct mortality or increased predation. Such conditions can also lead to nests and eggs randomly distributed on the bottom being exposed to the air.

- Barge Traffic (UAA Factor 3): Barge traffic adversely affects fish directly by propeller strikes and indirectly by a variety of mechanisms, especially by re-suspension of sediments. Barge traffic causes some direct mortality, constantly re-suspends soft sediments that can bury bottom organisms and fish eggs, contributes to toxicity which negatively impacts those types of organisms, and causes temporary changes in water levels.
- Sedimentation (UAA Factor 3): Sedimentation is a result of the impounding of the CSSC and the UDP and also the result of the urban character of the watershed, including the existence of Combined Sewer Overflows (CSOs) and non-point source or run-off pollution that flows into the waterway. Sedimentation causes burial of eggs and limits the availability of clean substrates needed to support a balanced, diverse fish population.
- Dams/Impoundment (UAA Factors 2 and 4): The presence of dams and the impounding effect they cause limit fish populations in many ways, but particularly by eliminating certain types of good habitats, such as riffles and fast water, and impairing existing habitat by causing excessive siltation. Simply put, the dams on the CSSC and the LDR have changed the waterway from a river to a lake and the fish community has responded (or been impaired) accordingly.
- Lack of Adequate Habitat (UAA Factor 5): Various key habitat types (e.g., riffles and fast water) are lacking. Further, overall habitat is only fair to poor thus precluding attainment of CWA aquatic life goals. The lack of quality habitats in UDP was recently documented by EA through an intensive habitat study of the UDP performed in July 2008.
- Urbanization (UAA Factor 5): The degree of urbanization in the CSSC and the UDP precludes attainment of CWA aquatic life goals. Urbanization not only contributes to increased sediment loads, but also leads to CSO overflows, changes in the natural flow pattern and a variety of factors that are not well understood but whose collective influence is widely accepted.

With respect to the CSSC, the Illinois EPA agrees that it can not attain the Clean Water Act's aquatic use goal and has proposed a lower aquatic life use referred to as "Aquatic Life Use B". The Illinois EPA further agrees that the CSSC has poor habitat and that the aquatic community suffers adversely from the artificially controlled flow conditions and heavily industrialized nature of this waterway, including the high volume of barge traffic. What is less clear is whether the proposed language of the "Aquatic Life Use B" use classification accurately classifies highly-modified streams that are characterized by poor habitat, heavily industrialized use, and

limited aquatic life potential. In this regard, the Ohio EPA's use classification approach of describing categories of streams, such as "Limited Warm Water", "Modified Warm Water" and its use of subclassifications, such as "Impounded", for streams like the CSSC, is a more workable and clearer approach to establishing a multi-tiered use classification under state water quality regulations. Also, to the extent that there are other waterways in the state that may share these same stream characteristics, an approach that describes categories and subcategories of use classifications would allow similar waterways to be similarly classified, thereby eliminating the need or risk of having to continually develop new use classification categories because the Illinois EPA's currently proposed aquatic life use designations are effectively site-specific use descriptions rather than classifications of aquatic life uses.

With respect to the UDP, the Illinois EPA's conclusion that the UDP is capable of "minimally attaining" the Clean Water Act's aquatic life goals is not supported by the weight of the relevant evidence. As documented by EA's July 2008 50-site QHEI/Habitat Study and its prior 2003 QHEI/Habitat Study of the UDP, there is little good quality habitat (*i.e.*, areas with QHEI scores greater than 60) present and there is a considerable amount of poor habitat (*i.e.*, areas with scores below 45) present. Roughly half of the UDP is navigational channel area that is unsuitable, poor habitat and the remaining half is characterized by poor to fair quality habitat, with only a very limited area of good habitat. As acknowledged in EA's QHEI Study of the UDP in 2003 (EA 2003), habitat is marginally better in the UDP as compared to Brandon Pool or Lockport Pool in the CSSC. More accurately stated, habitat in UDP is "less poor" than that in the CSSC, but it is still poor nonetheless. The only place where many "natural" features are evident is in the very limited area of the Brandon tailwaters. This is an isolated pocket of good, not great, habitat surrounded by miles of fair to poor habitat.

EA's July 2008 Study confirmed that siltation/sedimentation remains a significant problem in the UDP and will prevent certain better quality fish species from spawning and living in the UDP. The UDP is located in an urbanized area. Several studies have demonstrated that biological measures consistently decline significantly as urbanization increases. These declines occurred regardless of site-specific habitat quality. The amount of impervious cover in the Des Plaines Basin is significant, ranging from 30-56% (US Army Corps of Engineers 1997), which studies have shown results in significant declines in biological quality measured by such indices as the Index of Biological Integrity (IBI). The Pre-filed Testimony of Mr. Richard Lanyon (at page 6), General Superintendent, Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), cites a similar percentage (42%) of impervious area for Cook County. Further, the UDP does not resemble an Illinois General Use water - the current use designation for streams that are capable of attaining the Clean Water Act goals. Other General Use waters in Illinois do not have the combination of commercial navigation, receipt of wastewater from a city of three million people, a much altered winter temperature regime because of those wastewater inputs, extensive urbanization, channelization, reversal of flow, periodic but irregular flow alterations, an electric barrier, extensive sedimentation, and an almost complete loss of riffles and fast water. The Illinois EPA has acknowledged the uniqueness of the waterway and justified its site-specific use classification approach (e.g., "Upper Dresden Island Pool" use designation) on the basis that these waters are unique. The UDP certainly is unique as compared to General Use Waters. It clearly does not have the extent of good or great habitat that is characteristic of General Use

Waters and it will not in the foreseeable future.

The possibility of remediation actions in the UDP to address UAA factors that are preventing attainment of Clean Water Act goals must be considered whenever a proposed use designation falls below the Clean Water Act goals. Here, the main limiting factor in this waterway system is the impoundments. To remediate the impounded nature of the waterway would require removing or greatly modifying the locks and dams now present. However, such remediation would in turn severely impair or prevent the existing navigational use for which this waterway was intended, and which is also a protected use of the CAWS and the UDP under the Clean Water Act.

Short of removing or greatly modifying the existing locks and dams on the waterway, some more limited types of remediation could be implemented (e.g., the amount of instream cover potentially could be increased). However, due to the extensive amount of habitat area that would need to be successfully improved by such measures in order to have any measureable effect on fish populations and species, they would have to occur on an unprecedented scale. Illinois EPA has acknowledged that there are no such plans for remediation at the scale required here. Moreover, unless the dams themselves are removed, the factors that are most severely limiting (i.e., lack of riffles, fast water, clean cobble/boulder areas, and impoundment) will continue to limit the system by preventing the species that depend on such areas from establishing viable populations.

III. THE ARTIFICIAL, CONTROLLED FLOW CONDITIONS IN THE CAWS AND UDP SATISFY UAA FACTOR 2

The second of the six UAA factors ("UAA Factor 2") provides as follows:

Natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met. (40 CFR §131.10(g)(2))

For the reasons stated below, the flow conditions present in the CSSC and the UDP satisfy the requirements of UAA Factor 2.

Rather than being managed to optimize, or to at least accommodate aquatic life, flows in the CSSC and the UDP are managed to provide minimum flows/levels to accommodate barge traffic and handle periodic flow peaks, including flow peaks that are amplified by CSO inputs. Riverine fishes are adapted to handle occasional high flows and the attendant changes in water levels. However, these fish adaptations are based the flow of the river following a normal seasonal cycle (*i.e.*, generally highest in the late winter and spring and lowest in the late summer and early fall). Thus, most fishes, including those species present in the CAWS, spawn from May through July when flows should be more stable (EA 316b Study). However, the flow in the CAWS does not follow a normal seasonal cycle. It cannot due to the flow management system necessary to support the navigational use of the system and to manage periodic storm event and

runoff flows. Because of its constrained nature, the water level alterations described herein are most pronounced in the CSSC, but they are also a significant factor in the UDP.

In a natural system, high spring flows result in a flushing effect which is then followed by relatively constant flows through the course of the summer. However, in the LDR there is no seasonality to these flushing events; they occur any time there is significant rainfall in the Metropolitan Chicago area because the CSSC cannot accommodate the large volumes of runoff water that result from a heavy rainfall. In a natural system, these spring flows flush out accumulated sediment and trigger migratory movement of certain big river fishes. The managed but unpredictable flow regimes in the CSSC may not provide the necessary flushing or provide migratory cues at the proper time. Collectively, the random fluctuations in flows in the CSSC are detrimental to the fishes in the CAWS because they do not follow the expected seasonal pattern and thus, may occur when fishes, especially larval fishes, are most vulnerable. Also, because of the artificial nature of the CAWS, flow fluctuations are more pronounced and much more frequent than in a natural system.

Depending on the species, high flows can adversely affect fish by causing nest abandonment and/or displacement of recently hatched fry. High flows can also adversely affect fish by mobilizing fine sediments and then depositing them over their eggs, which can lead to suffocation of the eggs or reduced hatching success. It has previously been determined that the species faring best in the CAWS and UDP are those that have special adaptations, which allow their eggs to survive better under the silty conditions prevalent in most of the CAWS and UDP (ComEd 1996).

At the other end of the flow variation spectrum in the CAWS are occasional precipitous drops in water levels, which are done in anticipation of high CSO discharges and rainfall inputs. When water levels drop fast enough, fishes can be stranded in shallow areas, especially backwaters. This can lead to direct mortality of stranded fishes or increased predation by avian or mammalian predators. It can also lead to nests and eggs that are distributed on the bottom being exposed to the air, which can result in either predation or dessication. EA biologists personally experienced such extreme flow fluctuations while conducting field work in the CAWS. A sudden and significant drop in the water level resulted in the EA biologists' boat being literally left "high and dry" in the Lockport Pool. As was noted in the testimony of Illinois EPA witnesses in the UAA Rule-Making Proceeding, R08-09, extreme water level variations of four to six feet within only a twenty-four hour period occur in the CSSC (See UAA Hearing 1/31/08 Transcript at p. 227; see also flow diagrams in Pre-filed Testimony of Julia Wozniak, Midwest Generation, Attachment 4). It was agreed that the adverse effects of such extreme variations in water level on habitat, by disrupting fish spawning and feeding, are greater than the potential effects of temperature (UAA hearing 1/31/08 at p. 227).

Similarly, in the UDP, extremely low water levels were encountered during fish surveys recently conducted by EA in the Brandon tailwaters during July 2008. Shallow areas will be most affected by these sudden flow/level changes because, on a proportional basis, depth will change most in shallow areas. To the extent they occur, flow fluctuations are felt most severely in the Brandon tailwaters. This area offers the only riffle habitat in UDP and therefore is crucial to the spawning success of species that spawn exclusively in such areas; particularly darters, madtoms,

and other obligate riffle species. Flow fluctuations in this area will adversely affect these and other species by:

- stranding larvae, possibly even adult fish,
- reducing hatching success of eggs,
- sweeping away larvae if flows increase suddenly, which could cause direct mortality or subject them to increased predation, and
- conversely, extremely low water levels would expose eggs, larvae, and adults to predators, including avian and mammalian predators.

As was observed by Mr. Rankin during the QHEI survey conducted in the UDP during late March 2004, "the lack of flow throughout much of the reach we boated through would limit species and taxa dependent on flow" (See Attachment R to Illinois EPA Statement of Reasons, at section entitled "Des Plaines River [Recommended Category: MWH-I, Other]"). With regard to fluctuations in flow, it is probable that all of the fish species that the Illinois EPA has identified on its Representative Aquatic Species (RAS) list for the UDP (the "Modified RAS") would benefit from a more stable flow regime if one existed in the UDP. Those species that would likely benefit most would be the nest builders, such as the various catfishes and sunfishes. Based on EA field data from the Ohio River, gizzard shad also seem to reproduce best (i.e., have the strongest year classes) when flows during the spawning season (May-July) are fairly low and stable. So long as water levels remain fairly constant, the species on the Modified RAS list should be able to reproduce in the system, but the absence of natural flow conditions will prevent establishment of a community consistent with the Clean Water Act aquatic life goals.

Because commercial navigation is and will continue to be a protected use in the CSSC and the UDP, the random and extreme flow fluctuations will continue because they are necessary to maintain navigation and to provide flood control. The Agency agrees that the navigational use and flow management control constraints for the UDP will continue and are not reversible for the foreseeable future (UAA January 29, 2008 Hearing Transcript at pp. 41 and 43). Because of how the water (flow) management system is operated by the Army Corps of Engineers and MWRDGC, these conditions cannot be countered or compensated for by the discharge of any sufficient volume of effluent discharge. Thus, these artificial flow conditions satisfy the requirements of UAA Factor 2.

IV. BARGE TRAFFIC AND SEDIMENTATION PRESENT IN THE CSSC AND UDP SATISFY UAA FACTOR 3

The third of the six UAA factors ("UAA Factor 3") provides as follows:

Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place. (40 CFR §131.10(g)(3))

UAA Factor 3 focuses on the effect of "human caused conditions and sources of pollution" in the waterway. Both the CSSC and the UDP satisfy UAA Factor 3, primarily due to the adverse effects of barge traffic and sedimentation upon the aquatic life community. As noted above, because barge traffic is part of the protected navigational use of the CSSC and UDP, these adverse effects are not reversible. Similarly, there are no known plans for reducing sedimentation in either waterbody and the contributing sources will continue to add sediment to the waterway.

A. Barge Traffic in the CSSC and UDP Limits the Quality of Aquatic Life Attainable

The constant barge traffic through the CSSC and UDP adversely affect aquatic organisms, particularly macroinvertebrates, mussels, and fishes, by:

- physically injuring or stranding fishes;
- disrupting or disturbing spawning habitat;
- uprooting aquatic vegetation;
- increasing turbidity via re-suspension of bottom materials; and
- enhancing toxicity by re-suspending and dispersing the fine-grained sediments shown to be associated with toxic compounds.

The net effect of barge traffic on the CSSC and UDP is to make the main channel and channel border areas a less hospitable environment for most aquatic life.

Direct mortality to the aquatic community due to barge traffic has been well-documented. A joint study by the United States Geological Survey (USGS) and the Illinois Natural History Survey (INHS) documented direct mortality to aquatic life caused by towboats. Gutreuter *et al.* (2003) found that various medium to large fish were killed as a result of propeller strikes in Pool 26 of the Mississippi River, as well as the lower portion of the Illinois River. They estimated that 790,000 gizzard shad were killed in this area alone as a result of propeller strikes. The number of fish killed was a function of the number of fish killed per kilometer times the amount of barge traffic (kilometers traveled). On a large river such as the Mississippi, at least some fish will be able to move away and avoid oncoming barge traffic (Lowery 1987, Todd *et al.* 1989). In a smaller, narrower river like the Des Plaines, and in the confined, narrow CSSC, propeller avoidance would likely be more difficult, so it is reasonable to assume that the mortality rate estimated for the Mississippi River and the lower Illinois River will at least be as high and likely higher in the CSSC and the UDP.

Another effect of barge traffic is short-term but significant changes in river levels. As a barge approaches, it pushes water into adjacent backwaters, then, as it passes, this water is sucked out of the backwater, which causes rapid changes in water levels. The surge effects likely displace fish eggs and larvae from their nests. Barge traffic also stirs up sediment. The props from the barges stir up and re-suspend fine particulate matter. Aside from any toxic properties these sediments may possess, the re-suspended sediment can exert harmful effects by burying invertebrates and fish eggs.

In addition to constant barge traffic through the system, the section of the river in the UDP from the I-55 Bridge upstream for about 1 mile is a major barge fleeting area. Barges are often tied up one after the other, often two abreast, throughout this mile-long stretch (See EA photographs taken July 10, 2008 attached as Attachment 2a). These barges are located in close proximity to the shoreline, which is an area of better habitat for fish than is the main channel. The presence of this major barge fleeting area, with the attendant adverse effects on fish, further diminishes the quality of the shoreline habitat in this area for aquatic life. However, as noted by the Illinois EPA, the commercial activity that is a protected use under the proposed use designation for the UDP includes barge fleeting (UAA January 19, 2008 Hearing Transcript at p. 24). Hence, the adverse effects caused by barge fleeting in the UDP are a protected use and are not reversible.

B. Adverse, Physical Aspects of Sedimentation in the CSSC and UDP Significantly Limit the Quality of Aquatic Life Attainable.

A key limiting factor to improved biological conditions in the CSSC and UDP is the physical characteristics of the sediment itself (*i.e.*, fine, silty, organic). The fine, silty, and organic nature of the sediments are not suitable for many higher quality fish species which need a hard, clean substrate for spawning. Even if the stream could be remediated and the existing sediment (contaminated or not) removed, the urban nature of the waterway itself (*e.g.*, impounded) would ensure that additional fine, silty sediment (whether clean or contaminated) would continue to be deposited, thereby preventing an improved habitat for better quality aquatic life (UAA February 1, 2008 Hearing Transcript at p. 41, Testimony of C. Yoder "So in excessive amounts, [silt] can be detrimental. A lot of nonpoint source problems when you hear nonpoint due to sedimentation affects, due to excessive siltation."). The unpreventable and irreversible accumulation and physical quality of the sediments that will always be present in the system is limiting further biological improvements in the CSSC and UDP, with existing, depositional area sediment contamination exacerbating the fundamental siltation problem.

The July 2002 draft guidance by the U.S. EPA on non-point source pollution identified many detrimental effects on aquatic life caused by excessive sedimentation from urban runoff (U.S. EPA, July 2002, p. 26-31). Sediment, whether contaminated or not, was found to be the leading cause of impairment, accounting for 38% of the impaired waters in the nation. More recently, the US EPA reported that "[s]edimentation and siltation problems account for more identified water quality impairments of US waters than any other pollutant" (U.S. EPA, August 2003). Excessive erosion, transport, and deposition of sediment in surface waters are significant forms of pollution. Sediment imbalances impair many waters' designated uses. Excessive sediment can impair aquatic life by filling interstitial spaces of spawning gravels, impairing fish food sources, filling rearing pools, and reducing beneficial habitat structure in stream channels. Yoder et al. 2000 found that streams in highly urbanized areas -- which the CSSC and the UDP certainly are -- typically do not achieve Clean Water Act goals.

The extensive studies performed by ComEd in the mid-90's (Burton 1995a, 1995b, 1998, and 1999) found that contaminated sediments occur in all three navigational pools (*i.e.*, Lockport, Brandon and the Upper Dresden Pools) and are present primarily in side-channels and backwater areas. Sediment inputs from local drainages appear to have covered the historically contaminated sediments in some areas, especially along the lower reaches of Dresden Pool.

However, substantial deposits of fine-grained and potentially contaminated materials remain throughout the UIW, including in the limited habitat areas in the UAA area, posing a permanent impediment to significant improvement of overall ecological integrity in the system. In the 2003 habitat evaluation of the Dresden Pool conducted by EA, it was found that sedimentation was moderate to severe in many (23 out of 34, or 70%) of the areas where QHEI scores were calculated (EA 2003). During the July 2008 QHEI survey, sediment was rated as moderate or severe at 33 out of 50 locations (66%). Based on the observations of EA field crews during the 2003 and 2008 Upper Dresden Pool field surveys, sedimentation appears to have gotten worse over the past 5-10 years in some areas (e.g., DuPage Delta).

V. DAMS AND OTHER HYDROLOGIC MODIFICATIONS IN THE CSSC AND UDP PRECLUDE ATTAINMENT OF AQUATIC LIFE GOALS UNDER UAA FACTOR 4

The fourth of the UAA factors ("UAA Factor 4") provides as follows:

Dams, diversions, or other types of hydrologic modifications preclude the attainment of use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in attainment of the use. (40 CFR §131.10(g)(4))

Both the CSSC and the UDP satisfy UAA Factor 4 because of the adverse effects of the dams present in these waterways, particularly the impounded pool areas formed by these dams and the water level manipulations that accompany their presence. As further discussed below, studies of similarly impounded Illinois waters support the finding that their adverse effects preclude the attainment of the Clean Water Act aquatic life goals.

The entire CSSC and LDR is basically a series of pools separated by locks and dams. Flow in the system is controlled entirely by diversions from Lake Michigan, effluents from large POTWs, and water level manipulation to accommodate barge traffic. It is the impounding effect caused by these dams that has the greatest effect on the fish community. This impounding changes most of the system from its original lotic (riverine) nature to its current, modified lentic (lake-like) condition. As the Illinois EPA's witness Mr. Yoder agreed, the locks along the various reaches of the CSSC could have an effect more significant than temperature on the aquatic community (UAA January 31, 2008 Hearing Transcript at p. 228). Similarly, in Dresden Pool, only 1 mile out of a 15-mile long pool is not impounded. Such profound changes in habitat conditions adversely affect the fish community.

Fish species most affected by the impounded nature of the CSSC and LDR are so-called fluvial specialists (e.g., mostly darters, many suckers, etc.), whereas habitat generalists (e.g., common carp, gizzard shad, channel catfish), and pelagic species (e.g., emerald shiner, freshwater drum) do quite well under impounded conditions. Similarly, simple lithophiles (e.g., redhorse and most darters), which require clean, hard substrates, do poorly in impounded waters because of increased siltation, while those that are nest builders (e.g., centrarchids) or have modified spawning strategies (e.g., bluntnose minnow) do quite well under the same set of circumstances.

Dams adversely affect many lotic species by:

- eliminating riffles;
- reducing the amount of fast water;
- increasing sedimentation;
- interrupting migration;
- reducing the number and variety of aquatic insects such as mayflies and stoneflies that serve as prey for many lotic fishes; and
- reducing habitat complexity. (Santucci et al. 2005, Poff et al. 1997, American Rivers 2002).

The result of the adverse effects of dams is a simplified habitat that can support only a simplified (*i.e.*, less diverse) fish community (Santucci *et al.* 2005, Guenther and Spacie 2006, Edds *et al.* 2005). Such a simplified fish community does not, and cannot due to the limited quality of the habitat, attain the Clean Water Act's aquatic life goals.

Studies have shown that the reductions in the diversity of the fish community are greatest where the spacing between dams is least, such as is the case in the CSSC and the LDR (Lyons *et al.* 2001). Studies on the Fox River in Illinois sponsored by U.S. EPA clearly demonstrated these impacts as shown by declines in IBI scores upstream of each dam (Santucci and Gephard 2003). The adverse impacts on aquatic communities caused by dams are well-recognized by other Region V states. For example, Wisconsin and Michigan are actively promoting dam removal. Ohio has a separate use classification that recognizes effects from dams, as reflected by the subcategory of their Modified Warmwater Habitat (MWH) designation described as applicable to waters that are "impounded". In addition, Ohio also retains a MWH subcategory for "Channel-Modified" conditions (*See* Table 7-15 of Ohio Administrative Code, Chapter 3745-1, effective July 7, 2003).

The impounding effect of dams in the CSSC and UDP is pervasive and irreversible. Its effect is particularly severe because it eliminates or greatly reduces large groups or classes of fishes, including all species that are obligate riffle dwellers (e.g., most darters and madtoms, some minnows) and other species that, though not obligate riffle dwellers, spend much of their life in fast water areas and/or over hard substrates (e.g., many sucker species, as well as some minnows, darters, and sunfish). With large segments of the fish community reduced or eliminated, maintenance of a fish community consistent with the goals of the CWA is not possible. Further documentation on the adverse effects of dams on riverine fish communities is provided below.

A. The Adverse Effects of Dams on Aquatic Life

It is well established that dams reduce the abundance and diversity of aquatic life in riverine systems (American Rivers 2002, Santucci et al. 2005, Guenther and Spacie 2006, Edds et al. 2005). Dams do this by:

• interrupting or eliminating migration (American Rivers 2002, Guenther and Spacie 2006);

- altering natural flow regimes (Poff et al. 1997);
- impounding the river, thereby inundating riffle/run areas (Santucci et al. 2005, Eley et al. 1981);
- reducing current speeds throughout the area impounded (Poff et al. 1997, Santucci et al. 2005); and
- allowing sediment to build up behind them as well as interrupting the normal sediment flow (Poff et al. 1997).

The degree to which dams cause these adverse effects and associated changes in the quality of fish communities depends on the degree of fragmentation (Lyons *et al.* 2001). Rivers that have dams close to one another such that a large percentage of the area between adjacent dams was impounded are affected more than rivers on which dams are widely spaced (Lyons *et al.* 2001). Similarly, dams that are high and have no mechanism to pass fish would be expected to have a greater impact than low head dams that are frequently overtopped during high water or those that have fish ladders that allow fish to move from one pool to the other. For example, the Federal Energy Regulatory Commission (FERC) typically prescribes fish ladders whenever hydro licenses are up for renewal.

In recognition of the adverse effects that dams have on fish communities, Ohio has adopted a use classification called "Modified-Impounded", specifically to deal with dam-affected rivers and to recognize that such rivers typically do not attain the Clean Water Act aquatic life goals. The Modified-Impounded designation is the designation Mr. Rankin opined was the most appropriate category for the Upper Dresden Pool. (See Attachment R to Illinois EPA Statement of Reasons, section entitled "Des Plaines River [Recommended Category; MWH-I, Other"). For the same reason, Wisconsin and Michigan are actively promoting dam removal. The American Fisheries Society recently held a symposium devoted to the effects of dams on aquatic life and the subject of dam removal. Studies on a medium-size, warmwater river in Wisconsin showed that the fish community improved noticeably following removal of a dam (Kanehl et al. 1997).

B. The Fox River Studies of the Adverse Effects of Dams.

The adverse effects of dams on aquatic life also have been documented on the nearby Fox River in northeastern Illinois. The Fox River studies, which were partially funded by U.S. EPA Region V, evaluated fish and macroinvertebrate communities in free-flowing, mid-reach, and above-dam (i.e., impounded) sections of the Fox River. The authors noted that 55% of the river's surface area and 47% of its length within the study reach was impounded. As a result of impoundment, they found the following adverse impacts:

- lower IBI scores in the impounded reaches;
- poorer macroinvertebrate scores in the impounded reaches;
- the macroinvertebrate community in open water areas of the impounded reaches was dominated almost exclusively by pollution-tolerant worms and midges;
- QHEI scores were significantly lower in the impounded reaches;
- fish species richness was lower in impounded reaches;

- dams fragmented the fish community; and
- wider dissolved oxygen and pH fluctuations were found in the impounded reaches compared to the free-flowing reaches.

The authors concluded that "low-head dams adversely affect warmwater stream fish and macroinvertebrate communities by degrading habitat and water quality and fragmenting the river landscape" (See "Effects of Multiple Low-Head Dams on Fish, Macroinvertebrates, Habitat, and Water Quality in the Fox River, Illinois" attached to this report as Attachment 3). The authors also reported that the fish species most adversely affected by impoundment were darters, suckers, and intolerants, the same species described here as adversely affected by similar conditions in the CAWS and UDP. Also, as expected, the Fox River studies found that tolerant species abundance increased in impounded segments, whereas the number of harvestable-sized sport fish decreased. The study findings noted that it was habitat quality that was "an important factor affecting aquatic biota in the Fox River" and emphasized "the importance of habitat quality to lotic fish and macroinvertebrate communities". The authors explained the correlation between habitat quality and aquatic life quality as follows:

We found strong correlations between habitat quality and fish and invertebrate community quality, and index scores were consistently higher in free-flowing reaches than in impoundments. Differences in habitat quality reflected differences in habitat diversity between free-flowing and impounded areas. Free-flowing areas were made up of a variety of physical features (i.e., riffles, runs, and natural pools) that provided a wide array of water depths, current velocities, substrate types, and cover characteristics. In contrast, impoundment habitat was more homogenous and typically consisted of extensive, deeper open-water areas; lower and more uniform current velocities; and substrates dominated by deposited fine silts and sands (Attachment 3 at p. 987).

The Fox River study found that the effects of impoundments in the waterway were not limited to the area in the immediate vicinity of each dam, but rather the adverse effects of the dams were more wide-ranging. The study reported the following assessment of these adverse effects:

[L]ow-head dams adversely affected the biotic integrity of the Fox River on local and landscape scales. Local effects were largely related to the impoundments that formed upstream of each dam, whereas landscape-level effects rose from fragmentation of the river basin and restricted movements of fish. [They] found that the use of impoundments by important macroinvertebrate and fish taxa was limited by degraded habitat and poor summer water quality conditions. Abundance, richness, and biotic integrity of fish and invertebrate assemblages were consistently lower in impoundments than in the free-flowing river. Degraded habitat, water quality,

and biotic communities were found throughout impoundments, not just in the most impacted areas immediately above dams.

Conversely, good habitat quality, water quality, macroinvertebrate assemblages, and sport fish and nongame fish communities occurred throughout free-flowing reaches, not just in areas immediately below dams (Attachment 3 at p. 986).

The conditions in the CAWS and the UDP strongly parallel those in the nearby Fox River. The influence of dams in the CSSC and UDP is likely to be greater than in the Fox River because the dams in the CSSC portion of the CAWS are "high" dams rather than the low-head dams found in the Fox River. Similarly, Brandon Pool is 100% impounded and Dresden Pool is 93% impounded, compared to the roughly 50% impounded areas in the Fox River. Thus, if anything, adverse impacts due to impoundment should be greater in the CAWS and the UDP than those found in the Fox River.

The Fox River study confirms and corroborates the conclusion that fluvial specialists (e.g., most darters, many suckers) and simple lithophiles (e.g., redhorse and most darters), which require clean, hard substrates, do poorly in impounded situations because of the increased siltation, and conversely, habitat generalists (e.g., common carp, gizzard shad, channel catfish) and pelagic species (e.g., emerald shiner, freshwater drum) do quite well under impounded conditions. Nest builders (e.g., centrarchids) or those having modified spawning strategies (e.g., bluntnose minnow) also do quite well under impounded conditions.

In summary, dams prevent the attainment of CWA aquatic life goals in the CSSC and the UDP for the following reasons:

- the impounding nature of these multiple dams has changed the system from a river to a series of lakes;
- riffles have been eliminated except in the Brandon tailwaters;
- the amount of fast water has been reduced;
- migration has been interrupted; and
- habitat complexity has been reduced.

The resultant simplified habitat has lead to a simplified fish community, one in which fish habitat generalists can persist, but habitat specialists are eliminated or greatly reduced. The effects are pervasive and irreversible, meaning that the aquatic communities of the CSSC and the UDP currently do not meet CWA aquatic life goals, nor are they capable of attaining those goals in the future.

VI. THE "NATURAL" FEATURES OF THE CAWS AND UDP PRECLUDE ATTAINMENT OF AQUATIC LIFE USES UNDER UAA FACTOR 5

The fifth of the UAA factors ("UAA Factor 5") provides as follows:

Physical conditions related to the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses. (40 CFR §131.10(g)(5))

As discussed in greater detail in the section of this report on QHEI scores (See Section A2 below), many habitat features required for a balanced fish community are lacking or greatly reduced in the CSSC and UDP. The physical factors in these portions of the UIW that adversely affect the abundance and variety of fishes are:

- excessive amounts of silt;
- insufficient amounts of hard substrates such as cobble and boulder;
- minimal instream cover except for rooted macrophytes;
- lack of riffles; and
- lack of fast water.

These unalterable limitations in the physical conditions/habitat features of the waterbody, even without the presence of contamination, preclude the attainment of aquatic life protection uses consistent with General Use requirements. The presence of these physical conditions in the CSSC and the UDP satisfy the conditions described in UAA Factor 5 and prevent these waters from attaining the Clean Water Act aquatic life goals.

Some might argue that because the predominant physical features of the CAWS and UDP are "man-made", they do not equate to the "natural features" of the waterway referenced in UAA Factor 5 and instead are addressed by their evaluation in the context of UAA Factors 2 and 3 above. There is almost nothing "natural" about the CSSC and UDP areas when that term is used to mean areas that have not been modified. But the unique characteristics of the CSSC and, to a lesser extent, the UDP may well be considered for UAA purposes as "natural features" for this waterway. For the CSSC, it is largely a man-made and artificially controlled waterway created for navigational purposes and to convey wastewater away from Lake Michigan. Its "natural features" are in essence the concrete, sheet-piling or rock-lined, steep walls, but for whose construction this waterway would not exist and which are responsible for its inability to attain Clean Water Act goals. For the UDP, the features addressed here (e.g., riffles, fast water) are natural. The factors that caused these natural features to be limited stem from the purpose to which this area was dedicated many years ago. The waterway became what it is based on societal decisions regarding what purposes the CSSC and the LDR would serve; namely, serving as a conduit for commercial barge traffic and a means of transporting wastewater, treated and otherwise, away from Lake Michigan. Until those value judgments are reversed, the system will operate under the same set of habitat constraints as are currently in place. Regardless of their characterization as either "natural" or "man-made" features, and as further discussed below,

these features, or the lack thereof, are not reversible to the extent necessary to support an aquatic community that meets the Clean Water Act's goals.

A. Habitat Conditions in the CAWS and UDP are Inadequate to Support a Balanced Fish Population

Large amounts of silt prevent an adequate exchange of oxygen in bottom materials. Many species of fish lay their eggs on the bottom or bury them in the bottom substrates. When silt loads are high, eggs are smothered and hatching success is eliminated or greatly reduced (U.S. EPA 1986). Many "high quality" invertebrates (e.g., mayflies and stoneflies) also have high oxygen demands that cannot be met when siltation is excessive. These organisms are prey for many of the fishes necessary to achieve a balanced fish community (e.g., redhorse, darters, madtoms, and certain minnows). Without adequate food resources, viable populations of such fishes can not develop. Many fish species need cobble/boulder substrates to spawn (this includes the group Ohio EPA calls the "simple lithophils"). Various small to medium size fishes (e.g., darters, madtoms, and some minnows) use the cover within the interstitial spaces as cover to avoid predation. Many of these same species as well as others (e.g., redhorse, small channel catfish) also feed extensively in such areas on the mayflies, stoneflies, and caddisflies (collectively referred to as "EPT") that are the common invertebrate inhabitants of such areas. Large amounts of silt embed the hard substrates making them unavailable to fishes and macroinvertebrates. Given the number and severity of these limitations in the CAWS and the UDP, establishment of a fish community consistent with the CWA aquatic life goals is not possible, regardless of what numeric or narrative standards are established for the various water quality parameters, including thermal water quality standards.

EA has been studying the aquatic community in the CSSC and the UDP since 1993. A detailed summary of the results of these studies is presented in Attachment 1 to this report. EA made 1361 fish collections in 1993-1995, 1310 collections from Dresden Pool alone during 1997-2005, and 488 more collections from Brandon and Lockport Pools in 1997-2005, for a total of 3159 collections from 1993-2005. This compares to 22 collections made by MBI from these pools, with all collections confined to a single year, 2006. The most significant findings from these extensive studies of the waterway merit a brief discussion here before presenting the most recent study, a QHEI field survey of the UDP conducted by EA in July 2008.

The contention that lowering the ambient temperature of the CSSC and UDP will significantly improve the quality of the aquatic community is simply not supported by the results of the fish surveys conducted from 1993 to the present. Some may contend that because these studies have shown the presence of spawning activity in the CSSC and UDP, this translates to the conclusion that better water quality conditions in these waters will result in an aquatic community that attains the Clean Water Act aquatic life goals. A close review of the data shows that this is not an accurate conclusion. The evidence of spawning is predominantly associated with fish species/taxa that have the ability to lay eggs that have minimal contact with sediment, can tolerate low dissolved oxygen concentrations, and do not require the coarse or hard substrates that are rare in much of this system. The study results suggest a complex but highly stressed and habitat-limited fishery that is heavily dependent for its diversity on: 1) species adapted to

contaminated conditions, 2) a few critical spawning and nursery areas, primarily in UDP, and 3) immigration from Lake Michigan and tributary drainages.

Turning to the quality of the fish community in these waters, the most common and consistent trends during the 1993-1995 studies were spatial. These spatial patterns were:

- A very poor native fish assemblage was present in Lockport Pool. The assemblage in Lockport Pool was characterized by low native fish abundance (catch rates typically <50 fish/km), low species richness, and domination by highly tolerant species. Using the IWBmod criteria established by Ohio EPA, the Lockport Pool would be classified as very poor.
- 2. The community was marginally better in Brandon Pool but was still very poor.
- 3. The fish communities in the Upper Dresden Pool and the 5-mile Stretch, Dresden Pool downstream of the Kankakee River, and downstream of Dresden Lock and Dam were relatively similar to each other. While the fish community in the Upper Dresden Pool was better than in the Brandon Pool, it still fell into the "poor" classification under the IWBmod criteria.
- 4. Results at thermally-influenced sampling stations were comparable to those at other stations. The spatial pattern appeared unrelated to the operation of the electric generating stations. None of the measures used in the studies to evaluate individual or community health of fish species indicated that the electric generating stations were contributing to the poor fish communities observed in much of the UIW.
- 5. The incidence of diseased fish was (and continues to be) very high in the UIW.
- 6. Habitat severely limited the fish community
- 7. Based on the lack of impacts and habitat-imposed constraints, it was concluded that the aquatic community of the UIW would essentially be the same as it is currently if ComEd plants were load-restricted or even taken off line.

For the Upper Dresden Pool and the 5-mile Stretch, electrofishing and seining during the 12 study years produced 143,156 fish representing 82 species and four hybrids. Only ten species collectively represented 85-90% of the fish community. The 10 most abundant species collected were, in descending order of abundance: bluntnose minnow (22.2%), gizzard shad (+ *Dorosoma* spp.) (20.4%), bluegill (17.2%), green sunfish (7.0%), emerald shiner (6.6%), orangespotted sunfish (4.4%), largemouth bass (3.4%), common carp (2.8%), bullhead minnow (2.3%), and spottail shiner (1.9%). These same species were also the 10 most abundant collected during each period (i.e., 1993-1995 and 1997-2005):

Species	<u> 1993-1995</u>			<u> 1997-2005</u>		
<u>Species</u>	No.	Rank	%	No.	Rank	%
Bluntnose minnow	3,626	1	27.8	28,170	1	21.7
Gizzard shad (+ Dorosoma)	2,924	2	22.4	26,220	2	20.2
Bluegill	327	10	2.5	24,283	3	18.7
Green Sunfish	413	7	3.2	9,544	4	7.3
Emerald shiner	853	3	6.5	8,568	5	6.6
Orangespotted sunfish	373	8	2.9	5,872	6	4.5
Largemouth bass	760	5	5.8	4,050	7	3.1
Common carp	796	4	6.1	3,217	8	2.5
Bullhead minnow	345	9	2.6	2,916	9	2.2
Spottail shiner	689	6	5.3	2,068	10	1.6
		•	85.1		·	88.3

The fact that the same 10 species dominated the area before the current ComEd/MWGen Adjusted Standard went into effect as have dominated after it went into effect indicates that the slightly higher thermal standards allowed by the Adjusted Standard did not affect fish populations.

Ohio EPA (1987, plus 2006 update) classifies fish based on their tolerance to environmental perturbations such as decreasing water and habitat quality. Of the 82 species collected from Dresden Pool, eight species are classified as intolerant and another eight species classified as moderately intolerant. For the twelve study years combined, the 16 moderately and highly tolerant species (plus two other taxa) composed 52.8% of the catch. The 42 intermediately tolerant species (plus six other taxa) composed 42.4% of the catch. At the other end of the spectrum are the intolerant and moderately intolerant fishes, which exhibit a distinct and rapid decreasing trend in abundance with decreasing habitat and/or water quality. Only 1.7% of the fish collected were intolerant or moderately intolerant. The preponderance of moderately tolerant and highly tolerant fishes reflects the degraded habitat of Dresden Pool.

In summary, the present fish community in UDP is somewhat more abundant, has slightly more species, and generally has higher IWBmod scores compared to 1993-1995. However, the community continues to be dominated by species at the high end of the tolerance scale and the community dominants have <u>not</u> changed over the period.

1. **QHEI Scoring Process and Support Categories**

The Qualitative Habitat Evaluation Index (QHEI) was developed by Mr. Ed Rankin, who at the time of its development was employed by the Ohio EPA. The QHEI is a simple but fairly robust method of evaluating the physical habitat in streams (Rankin 1989). The index is composed of six components (often referred to as "metrics"):

- Substrate
- Instream cover
- Channel morphology
- Bank erosion and riparian zone

- Pool/run/riffle quality
- Stream gradient

Within each metric, scoring criteria are established for each possibility for that metric. For example, in the substrate metric, boulders are assigned a score of 10, while muck and silt substrates rate only a 2. The sum of the metric scores equals the QHEI score.

Rankin (1989) found that there was a direct relationship between QHEI scores and the quality of the fish community. Based on examination of QHEI scores from many streams, Rankin (1989) concluded that streams with QHEI scores > 60 were capable of supporting fish communities that were consistent with CWA goals, while streams with scores <45 typically did not support such communities. According to Rankin (1989), streams with scores between 45 and 60 need to be examined closely to determine whether they can or cannot support balanced fish populations. He emphasizes that the QHEI at a single site does not accurately reflect the potential of that stream, rather "general basin characteristics and overall habitat quality influence stream fish communities more than does site-specific habitat".

2. The July 2008 EA QHEI Field Survey of the UDP

Within the CAWS, there seems to be uniform agreement that habitat quality in the South Branch of the Chicago River and the CSSC is poor and will not support Clean Water Act aquatic life goals (See, e.g., UAA January 29, 2008 Hearing Transcript at p. 108-9 [Sulski Testimony] and Attachment R [2004 Rankin Report] to the Illinois EPA Statement of Reasons). There seems to be wide-spread agreement as well that conditions in the UDP are marginal. The Illinois EPA, however, speculates, with little or no supporting evidence, that the UDP can "marginally attain" the Clean Water Act goals. However, the weight of the evidence shows that attainment of these goals in the UDP will not occur, absent extensive and wide-ranging improvements to the waterway, the most significant of which would be the removal of the dams and locks and cessation of barge traffic. As discussed in greater detail below, this conclusion is supported by the following facts:

- the preponderance of QHEIs are below 60;
- many QHEI score are below 45 the accepted threshold that represents an inability to attain the Clean Water Act aquatic life goal;
- the mean of all the QHEI scores calculated using Ohio EPA protocols is about 47, much closer to 45 than to 60;
- the mean of all the QHEI scores calculated using MBI's protocol is 42, below the accepted threshold of 45;
- certain key habitat types (e.g., riffles, fast water, hard substrates) are greatly reduced;
- siltation is excessive; and
- urbanization is high within the watershed.

When Mr. Rankin, the developer of the QHEI, visited the area in 2004, he concluded that the appropriate classification for the UDP would be "Modified Warmwater Habitat, Impounded", using the use classification terminology of the Ohio EPA for a stream that does not attain Clean Water Act aquatic life goals (See Attachment R to Illinois EPA Statement of Reasons). In contrast, when MBI visited the UDP not long after, in 2006, it concluded that although the area was impaired, it could marginally meet CWA aquatic life goals (See Attachment S to Illinois EPA Statement of Reasons: Aquatic Life and Habitat Data Collected in 2006 on the Illinois and Des Plaines Rivers. Midwest Biodiversity Institute, prepared for U.S. EPA Region 5 [2006]). However, the evaluations performed by both Mr. Rankin and MBI were based on a very limited and not necessarily representative subset of the UDP area. In each visit, only two and three locations within the UDP, respectively, were scored for QHEI values.

EA has now much more extensively sampled the UDP than was done during either Mr. Rankin's or the MBI's visit to the area. In 2003, EA conducted a QHEI field survey of the Dresden Pool that included 34 sites (EA 2003). Based on the 2003 QHEI field survey, EA calculated QHEI scores similar to those reported by Rankin in 2004 and lower than those reported by MBI in 2006. To consider whether EA's 2003 QHEI scores were still representative, EA senior biologists, Greg Seegert and Joe Vondruska, surveyed the entire UDP from the Brandon tailwaters to the I-55 Bridge in July 2008. Both Messrs. Seegert and Vondruska have years of experience working in the UDP and in conducting QHEIs. Mr. Vondruska is a certified data collector based on training provided by Ohio EPA. Mr. Seegert has used the QHEI methodology to evaluate habitats at many sites in several states.

During the July 2008 QHEI field survey of the UDP, each bank of the UDP was surveyed separately. The entire linear distance was surveyed except where barges or other obstructions (e.g., the Empress Casino) blocked access to the shore. EA established a series of contiguous, 500 meter zones along each shore of the UDP. Over a two-day period on July 10-11, 2008, EA evaluated 50 such zones, far more than the two or three evaluated by MBI or Mr. Rankin. The extensive and contiguous nature of the 50-site QHEI survey by EA eliminated any potential bias that may arise from the selection and scoring of only a limited number of QHEI site locations.

The latest guidance from Ohio EPA (OEPA 2006) was used to score each QHEI metric. EA obtained a series of aerial photos to assess floodplain and riparian zone quality accurately, as recommended by Mr. Yoder. Except for the two tailwater zones, substrate composition was obtained by slowly motoring the boat through each 500 m zone and using a metal pole to regularly probe the bottom. At the two shallower tailwater zones, both biologists walked much of the zone to assess substrate conditions. The start and end of each zone was marked with GPS coordinates and a photo log that included three to four photos for each zone was compiled (*See* Attachment 2b). Also, the area evaluated at each location was marked on aerial photos (*See* Attachment 2c).

A spreadsheet showing for each zone the value for each QHEI metric and the QHEI total score was prepared (*See* Attachment 2d). QHEI scores were calculated using two QHEI scoring procedures: the standard Ohio EPA QHEI scoring procedure (OEPA 2006) used by Rankin and the "MBI-modified procedure." The MBI-modified procedure is the MBI's recently developed version of the QHEI that takes impounding of waterways into account and which was used by

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MBI during their 2006 assessment of the CAWS. The QHEI scores under both the Ohio EPA and MBI-modified QHEI procedures for the EA July 2008 QHEI field survey are presented in Attachment 2e to this report.

The findings set forth below are based on the EA 2008 QHEI field survey results. The UDP 2008 QHEI scores clearly support the conclusion that the UDP is not capable of attaining the Clean Water Act aquatic life goals.

> Almost all of the QHEI scores are below 60.

Based on the Ohio EPA scoring procedure, 45 of the 50 (90%) QHEI scores were <60, and 49 of 50 (98%) of the scores were <60 using the Modified MBI procedure (Attachment 2d).

> Approximately Half of the QHEI scores were <45.

Based on the Ohio EPA procedure, 20 (40%) of the scores were <45 and well over half (32 of 50 = 64%) of the scores using the MBI procedure were <45 (Attachment 2d).

> The mean QHEI score is closer to 45 than to 60.

The mean QHEI scores were 47.4 and 42.0 for the OEPA and MBI protocols, respectively. Thus, on average, the QHEI scores are far below the "good" cutoff of 60 and, depending on the QHEI scoring procedure used, either near or below the 45 cutoff that automatically pushes an area into Ohio EPA's limited or modified use category that is intended for waters that cannot attain the Clean Water Act aquatic life goal.

The spatial distribution of QHEI scores in the UDP is visually depicted in the charts contained in Attachment 2f to this report. All of the charts show that little good quality habitat (*i.e.*, areas with QHEI scores \geq 60) is present, that a considerable amount of poor habitat (*i.e.*, areas with scores \leq 45) is present, and that, on average, UDP habitat is of poor to fair quality.

Consistent with Ohio EPA protocols, the area within the navigational channel was not evaluated. However, due to a lack of cover and constant disturbance due to barge traffic, the navigational channel area, which comprises roughly 50% of the UDP, certainly would have scored well below 45 had it been evaluated. This further accentuates the limited amount of good habitat available within the UDP. Roughly half of the UDP is navigational channel area that is unsuitable, poor habitat and the remaining half is characterized by poor to fair quality habitat, with only a very limited area of good habitat.

3. Comparison of EA 2008 QHEI Scores and MBI 2006 QHEI Scores

EA compared the 2008 QHEI scores it calculated at three sites that appear to be located in the vicinity of the three sites scored by MBI in 2006 (Attachment S). At one of the three locations (MBI RM 283.9), the scores calculated by EA and MBI were within a couple of points (*i.e.*, 36 [EA] v. 33.5 [MBI]), well within the range expected for scores obtained at the same site by different investigators. However, at MBI RM 279.5, located in the UDP approximately 1.6 mi upstream of I55, MBI scored the site as having a QHEI of 69 versus the EA QHEI score of 54.

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Similarly, in the Brandon tailwaters (RM 285.8), MBI scored the site at 81.5 versus the EA score of 67.5. The differences at the latter two sites are not within the acceptable range of difference. Based on EA's review, the MBI QHEI scores for these two sites are too high based on actual site conditions. As discussed below, these differences simply cannot be explained by potential temporal or seasonal changes to the waterway that may have occurred since MBI conducted its evaluation in 2006.

(a) QHEIs for UDP RM 279.5

RM 279.5 was described by MBI as its "Power Line Crossing" location. The MBI and EA RM 279.5 QHEI scores for the individual metrics are provided and compared below:

· · · · · · · · · · · · · · · · · · ·	Metric Score			
<u>Metric</u>	<u>MBI</u>	<u>EA</u>		
Substrate	19	20		
Cover	17	8		
Channel Morphology	7	4		
Erosion/Riparian	10	10		
Pool/Velocity	8	6		
Riffle Quality	0	0		
Gradient	<u>8</u> .	<u>6</u>		
	69	54		

The MBI and EA QHEI scores for the substrate, erosion/riparian, and riffle quality metrics are identical or comparable. The difference of 15 points between MBI and EA's metric scores is attributable to the other four metrics. The biggest difference is for the cover metric, 17 by MBI and 8 by EA. MBI listed the following five cover types that EA did not find at this location in July 2008: undercut banks, shallows in slow water, root mats, root wads, and aquatic macrophytes. MBI considered cover to be "moderate" while EA considered it "sparse". Shallows in slow water is somewhat subjective, but is typically considered only adjacent to riffle/run habitat. It might vary depending on river stage but this area does not have undercut banks, root mats, root wads, or aquatic macrophytes. Similarly, habitat quantity was clearly sparse in July 2008. The same conditions should have existed when MBI visited the site. The lack of cover in terms of quantity coupled with four cover types being absent indicates that the MBI cover score was at least 8 points too high.

The difference in the channel morphology metric score is due to MBI's finding that sinuosity was "low" (as opposed to "none" by EA) and that development was "fair" (as opposed to "poor" by EA). Sinuosity is a term indicating the amount of curvature in a wateway. According to Ohio EPA OHEI scoring guidance:

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No sinuosity is a straight channel. Low sinuosity is a channel with only 1 or 2 poorly defined outside bends in a sampling reach, or perhaps slight meandering within modified banks.

The LDR at this location is straight; it has no bends, poorly defined or otherwise (See Attachment 2c).

According to the same Ohio EPA document in regard to development:

poor means riffles are absent, or if present, shallow with sand and fine gravel substrates; pools, if present are shallow. Glide habitats, if predominant, receive a Poor rating.

MBI's own form acknowledges that no riffle is present at this location. The entire area is clearly a glide, as defined by Ohio EPA (2006). Thus, this metric should be scored a 4, not a 7.

Lastly, MBI indicates in Exhibit 6 that the gradient at this location is 1.0 ft/mi. EA calculated it to be about 0.1 ft/mi (the difference between the headwater stage at the Dresden Island Dam and the tailwater stage at the Brandon Road Lock and Dam). Given that the gradient at the location upstream of this one (i.e., RM 283.9) was considered by MBI to be 0.1 ft/mi and RM 279.5 is closer to the dam, EA does not believe the MBI 1.0 ft/mi gradient value is correct for RM 279.5.

In summary, the MBI score for this location is at least 10 points too high and probably as much as 12 to 13 points too high.

(b) QHEIs for UDP RM 285.5 (Brandon Tailwaters)

MBI created an "excellent" score of 81.5 for RM 285.5 located in the Brandon Tailwaters, whereas Rankin (2004) and EA (2008) gave it "good" scores of 69.5 and 67.5, respectively. EA and MBI had identical scores for the cover and pool/current velocity metrics, but MBI scored the other five metrics higher than EA. The biggest difference was for substrate, which MBI scored a 17.5 and EA a 12.5. MBI considered the dominant substrates to be cobble and gravel. EA agreed that cobble was a dominant substrate but determined that hardpan was the second dominant substrate. EA knew this to be the case based on our long-time familiarity with this location. This was confirmed by walking through much of the zone. The distinction between clean hard substrates and hard substrates embedded in hardpan is difficult to make unless the investigator either has considerable experience in probing the bottom or unless part of the zone is waded. It does not appear that MBI waded any portion of the zone. The substrate distinction would not likely be evident if the QHEI substrate score was based only on a standard electrofishing run through the area, which apparently is what MBI did (See Attachment S).

MBI also inflated or "over-scored" several other metrics at this location. For example, it indicated that sinuosity was "low" even though no bends were present. It considered development to be "good". Development is good in the upper half of the zone but poor in the lower half. MBI acknowledges as much as their drawing of the site (Exhibit 7) shows muck and slow water in the lower portion of the zone. Clearly the EA characterization of development

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within the zone as good/poor is more accurate than the uniformly good rating given by MBI. MBI's higher riparian zone score is largely the result of its considering the riparian zone to be "wide". However, the left bank is within a few feet of a railroad track and the right bank is narrow. Because of the hardpan present throughout much of the area, EA correctly characterized the riffles as being "moderately" embedded whereas MBI erroneously believed that embeddedness was "low". Lastly, the gradient used by MBI is too high. The correct value for the gradient metric should be 6 instead of 8.

It is also important to consider that Mr. Rankin, the developer of the QHEI, scored this area as 69.5, within 2 points of EA's score. Despite what Mr. Yoder may have speculated during his UAA hearing testimony, the magnitude of the difference between Mr. Rankin's score and the MBI score cannot be explained by the fact that Mr. Rankin viewed the area in March, whereas MBI visited the site during the summer; this seasonal difference would account for, at most, a difference of 3 points (*See* UAA February 1, 2008 Hearing Transcript at pp. 143-146).

The correctness of EA's scores for the various QHEI metrics is supported by Mr. Rankin's Report (Attachment R to the Statement of Reasons). MBI indicated that there was no channelization, that sinuosity was low, and that some fast water was present at the one or both of the non-tailwater locations (i.e., RM 279.5 and 283.9) they sampled in UDP. However, like EA, Mr. Rankin found that UDP was channelized, had no sinuosity, and, except for the Brandon tailwaters, had no fast water. The fact that MBI did not score the QHEI correctly also means that Exhibit 6, which compares warmwater and modified warmwater attributes, is seriously flawed and should be disregarded.

In summary, MBI and EA QHEI scores were similar at only one of the three locations scored by MBI. At the other two locations, MBI scored the sites 14-15 points higher than did EA. However, for the reasons discussed above, the QHEI scores reported by EA are more reflective of actual conditions than are the higher scores reported by MBI.

According to Mr. Yoder's testimony, the QHEI scores in Attachment S were wrong because the impounded nature of the CSSC and UDP was not taken into account. It is difficult to understand how the MBI field crew somehow overlooked the fact that the area they were sampling was almost entirely impounded. Also incredible is the fact that according to the hand written notes on the field data sheets (*See* Exhibit 7), this significant error was not recognized and corrected until almost two years later in January 2008 when Mr. Yoder prepared to testify in these proceedings. It appears that the original entry for the two relevant metrics was erased and the box "Impounded" was checked instead. In most cases, this resulted in the QHEI score dropping by 10 points. MBI produced Exhibit 5, which was designed to correct the scoring errors in Attachment S. Although the impoundment scoring error has been corrected, Exhibit 5 unfortunately still contains numerous errors, mostly related to tallying the final QHEI score. In fact, all the "revised" scores were tallied incorrectly. Provided below are examples of these errors:

• Grant Creek--- Based on the boxes checked on the field data sheet (*See* Exhibit 7), the correct score for the Channel Morphology metric is 6, but a score of 13 is reported by MBI on Exhibit 5. Mr. Yoder was

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asked about this error during his February 1, 2008 UAA hearing testimony and could not explain it. The Pool metric at the Grant Creek location adds up to 6 in Exhibit 7, but a score of 9 is shown on Exhibit 5. Collectively, these two errors result the QHEI score for Grant Creek being inflated by 10 points.

- RM 268.0--- According to the boxes checked on the data sheet for this location (See Exhibit 7), the correct score for the Pool/Glide metric is 6, but the score shown in Exhibit 5 for this metric is 9. Thus, the MBI QHEI score for this location should be 57, not 60.
- RM 271.1--- Again, two scoring mistakes were made; the Riparian score should be 10 not 9 and the Pool score should be 12 not 13. The latter mistake is particularly odd, because according to MBI's own data sheet, the maximum possible score for this metric is 12.1

MBI's 2006 QHEI scores at 17 locations were changed from their values presented in Attachment S to the "revised" values presented in Exhibit 5 to account for "overlooking" impoundment initially. However, in every case, the new, revised, and supposedly corrected values are still wrong, sometimes by a little, sometimes by a lot (e.g., Grant Creek). The 100% failure rate to supply correct revised values casts further doubts on MBI's QA/QC procedures.²

¹ The following thirteen locations all had erroneous values presented in Exhibit 5 due to various math errors: RMs 242.1, 243.3, 246.5, 247.8, 251.4, 256.1, 265.0, 274.0, 276.4, 276.5, 279.5, 283.9, and 290.0.

² The MBI field crew's lack of attention to QA/QC procedures was also evident in the MBI 2006 fish survey work. In his February 1, 2008 UAA hearing testimony, Mr. Yoder acknowledged that the MBI field crew had used defective pH and DO probes. What is particularly troubling is that no one on MBI's field crew recognized this obvious problem until well after the field work had been completed. According to the fish field data sheets (Exhibit 20), a pH of 11.2 was recorded at RM 290.1 on the first day (7/21/06) that sampling began in the Des Plaines River/CSSC system. Such an absurdly high pH would have told an experienced crew leader that either the meter or the probe was defective. This obviously defective meter/probe was used by MBI throughout the remainder of the July 2006 sampling trip. During this time, several nonsensical pH values of 2.62, 10.95, 9.96, and 10.25 were recorded and reported without question by the three MBI crew members (Exhibit 20). Moreover, the defective equipment problem remained undetected and continued through the September 2006 MBI field work when a series of even more bizarre pH values were "measured" and dutifully recorded. For example, on September 7, 2006, MBI reported a pH of 12.95 at RM 276.4 (Exhibit 20). Anyone with even a passing familiarity of pH values would recognize that this value was wrong. On the next sampling day, September 9, 2006, an even more stunning series of events occurred. At RM 297.0, MBI reported the pH to be 15.19 and at RM 298.3, 14.08, both of which are difficult to do given that the pH scale for "natural" substances only goes to 14. For example, the pH of household ammonia is about 11.5, bleach is about 12.5, and liquid drain cleaner is about 14. pH values in natural waters, even waterquality challenged ones like this, rarely if ever exceed about 9. MBI continued to report numerous erroneous pH values (e.g., ranging from 11 to 14) for an additional week of sampling that should have raised QA/QC questions for an additional week of sampling.

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4. The MBI 2006 IBI Metric Values and Scores Also Are Unreliable

Among the data that the Illinois EPA is relying on to support its proposed use designations is the IBI study performed by MBI/Yoder in 2006 and memorialized in a report marked as Attachment S to the Illinois EPA Statement of Reasons. During Mr. Yoder's UAA hearing testimony, he acknowledged several mistakes in how IBI scores were originally calculated by MBI in its 2006 Report. These mistakes included erroneously considering emerald shiner to be a simple lithophil, including an erroneously identified silver shiner, and erroneously including round goby and other exotic species in the species total (UAA February 1, 2008 Hearing Transcript at pp. 135-139).

In response to these acknowledged mistakes, the MBI replaced the Attachment S IBI values with the IBI values in Exhibit 21 (*Id.* at p. 156), which supposedly corrected the original, erroneous values. However, a spot check of the data in Exhibit 21 revealed that all of the previous identified errors are still present. Exotic species such as round goby and oriental weatherfish continue to be erroneously included in the species richness metric.³ A check of five sampling locations (RMs 290.1, 289 [2 passes], 285.8, and 274.0) to confirm that emerald shiner had been removed from the simple lithophil count showed that it had not. In all five cases, it was still erroneously included, which in some cases, resulted in inflated IBI scores.⁴ No data sheets were provided for the nine locations in the Illinois River. Given the fact that 15 of the 18 passes on the Illinois River resulted in scores for the simple lithophil metric being either 5 or 3, declines of two or four IBI units would be expected if this metric is scored correctly.

Another problem with the simple lithophil metric scores is that MBI arbitrarily assigned a drainage area of 1000 mi² to all 23 sites they sampled. EA could not obtain a drainage area for Grant Creek, the smallest drainage sampled, but the other sites ranged in size from 740 mi² for the CSSC at Ruby St. to 8529 mi² for the Illinois River at Marseilles. Because the IBI scoring criteria for this metric vary according to drainage area, many of the IBI scores presented by MBI are likely still wrong in Exhibit 21 due to the inaccurate draining area values used (this is true even if the emerald shiner mis-classification issue was corrected).

During the course of reviewing only about 10% of the MBI data sheets to determine whether the mistakes acknowledged by Mr. Yoder had been corrected, EA found a variety of other errors. First, the sunfish metric was often incorrectly scored. MBI did not include crappies in the sunfish count, which it should have, and included redear sunfish, which it should not have. In several cases, the total native species richness totals were wrong but the cause of the errors could not be identified. Often, the relative number minus tolerants was wrong; typically because exotics or hybrids were erroneously included.

³ For example, the field data sheet for RM 287.9 in July 2006 (Exhibit 20) lists only five species, one of which was round goby. The species richness metric for this location on Exhibit 21 shows a total of five species, so round goby was still erroneously included. A similar situation occurred at RM 290.1 in July where both oriental weatherfish and round goby are still erroneously included in the species total shown on Exhibit 21.

⁴ For example, at RM 285.8, the percent simple lithophiles would drop from 26% to 8% if emerald shiner was excluded and the metric score would go from 5 to 1. Thus, the IBI should be 26 rather than 30 as reported in Exhibit 21.

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There are similar Quality Assurance/Quality Control (QA/QC) problems identified in the information presented in Exhibit 32. This exhibit contains a plot of QHEI scores collected by various investigators over a number of years. However, Exhibit 32 is of limited value because the methods for calculating the QHEI have changed (e.g., MBI accounts for impoundment whereas no previous investigators took this into account directly). Also, it is not clear whether the MBI values in this plot came from Attachment S or Exhibit 5. If the MBI values came from Attachment S, they contain significant errors that overstate the QHEI values. If the MBI values came from Exhibit 5, most are still wrong; admittedly somewhat less wrong, but still wrong. Given the number of mistakes found in data sheets from only 5 of 46 MBI site collections, it is clear that proper QA/QC procedures were not followed by MBI. EA submits that the presence of the extensive amount of errors in Attachment S, and Exhibits 20 and 21 renders the accuracy and credibility of the MBI data set highly suspect. EA submits that the Board should disregard the data presented by MBI in Attachment S and Exhibits 20 and 21 until and unless a corrected and accurate set of data is provided. Further, EA cautions that the usefulness of the QHEI data in Exhibit 32 is minimal due to differing methods of how QHEI values were calculated and the use of erroneous MBI-calculated QHEI values.

5. Key Habitat Types required for a Balanced Fish Community are Lacking

To have a fish community consistent with Clean Water Act aquatic life goals, a variety of habitat types must not only be present, but present in amounts sufficient to support viable populations of various fishes. However, in the UDP, riffles and fast water areas are essentially confined to the Brandon tailwater area. This area is roughly one mile long and represents about 7% of the area within Dresden Pool (Note: Dresden Pool is the appropriate basis for comparison because the "UDP" is a regulatory construct proposed by the Illinois EPA that is not recognized by the fish populations that have access to the entire pool). Boulder/cobble substrates, though not confined to the tailwater area, occur in appreciable amounts in only a few of the other 48 zones EA evaluated. The small and few areas of good habitat located in the Brandon tailwater area are overwhelmed by the large preponderance of poor to fair habitat that characterizes the UDP. Species-groups that need these key habitat types in order to flourish include:

- most darters,
- walleye and sauger,
- many suckers, including redhorse, northern hog sucker, and white sucker (this group of species is often referred to as the "round-bodied" suckers and is highly valued in rivers),
- most madtoms,
- some minnows (e.g., longnose dace, stonerollers, hornyhead chub, suckermouth minnow, and rosyface shiner), and
- some centrarchids, especially smallmouth bass.

Minnows, darters, and suckers are the most diverse groups in Illinois. Having the number of species in these groups reduced or eliminated makes it essentially impossible to have a balanced fish community. The reduction in round-bodied suckers results in lower IBI scores, also indicative of unbalanced fish communities. The species that are doing well in the UDP are

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habitat generalists, those with a high tolerance to silt, and those preferring lentic rather than lotic conditions. Regardless of how well those species do, the community will remain unbalanced and will not attain Clean Water Act goals because of a lack of habitat specialists like the species listed above. These habitat limitations are fixed and will not improve regardless of whether and how the water quality standards are changed.

In this discussion of the types of fish species that can and cannot reasonably be expected to be present in the CSSC and CAWS, it is important to include a review of the fish survey data presented in the UAA Rule-Making through the testimony of Mr. Yoder because of the presence of clear errors in fish identification that these data contain. During the January 2008 UAA hearings, Mr. Yoder was questioned concerning the MBI's 2006 fish identification results for the LDR. He agreed that the silver shiner identified by MBI was actually an emerald shiner. (UAA February 1, 2008 Hearing Transcript at p. 128) He further agreed that the specimen MBI had identified as a blacknose shiner was more likely a pallid shiner. (Id.) Mr. Yoder testified that he had "full confidence" in the identification of the other three fish species (brown bullhead, highfin carpsucker, and black redhorse) in the 2006 MBI survey that were questioned by Midwest Generation.

Subsequently, in the document introduced by Illinois EPA as Exhibit 37, the MBI provided photographs of these three questioned fish species. EA has reviewed the photographs of these fish. Two photographs of what MBI called a brown bullhead are instead photos of a yellow bullhead. MWGen also requested documentation from Illinois EPA regarding the MBI's alleged identification of highfin carpsucker, because of the large number MBI reportedly found in the Illinois River. In Exhibit 37, MBI provided two photos of what EA agrees is a highfin carpsucker. However, the specimen in question is from the Vermillion River, which is clearly not part of the CAWS, the LDR, or the Illinois River. Therefore, a specimen from the Vermillion River does not address the question of whether specimens reported by MBI as highfin carpsuckers from the Illinois River were properly identified. Therefore, the MBI reports of highfin carpsuckers are questionable and unconfirmed by either field specimens or photographs. With regard to the third species, black redhorse, MBI again provided two photographs. One specimen is from Raccoon Creek in Ohio and is, therefore, irrelevant with regard to these proceedings. The other specimen, which appears to be a black redhorse, is labeled as Kankakee River or Des Plaines River, so this specimen may or may not be from a waterway that is the subject of these hearings. In summary, MBI misidentified three species (silver shiner, blacknose shiner, and brown bullhead) and provided inappropriate documentation regarding two others. EA cautions that the fish identification data and numbers reported by MBI in this proceeding are not reliable for these species.⁵

⁵ EA also notes that MWGen had requested copies of all field fish data sheets from the Illinois EPA for the July and September 2006 fish study performed by the MBI/Yoder. According to the information in Exhibit 21 in the UAA proceeding, all locations in the Des Plaines River, the CSSC, and Grant Creek were allegedly sampled twice, once in July and once in September. However, in Exhibit 20, which contains the data sheets for this 2006 study, there are no data sheets for sampling sites located at River Mile (RM) 273.5, 274.0 and Grant Greek during the July sampling.

Hence, either this sampling was not performed or the accuracy of the July fish sampling at these locations has not been documented by the completion and submission of field data sheets.

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Miltner et al. 2000). The range for percent urban area (8-50%) is broader but the negative effect of urbanization is still plainly evident (Steedman 1988, Wang et al. 1997, Yoder et al. 1999, and Groschen et al. 2004).

In 1990, 58.7% of the area in the Des Plaines subbasin was classified as urban (NAWQA 1998) and, given the extensive development that has occurred since 1990 in the Joliet area, that percentage is likely higher now. Even the 58.7% figure equals or exceeds all reported thresholds for significant effects. The Chicago Army Corps of Engineers in their 1997 Annual Report indicated that the percent impervious area for the Des Plaines Basin ranged from 30.1-56.4%; again well above all reported thresholds.

The studies cited above demonstrate that biological measures consistently decline significantly as urbanization increases. This phenomenon has been demonstrated in the CAWS and LDR as well as in nearby Midwestern states. Groschen *et al.* 2004 noted that fish and benthic communities declined at levels of 15-25% urbanization in the Fox and Des Plaines River Basins. In fact, as support for the decline in the fish community, they reference a written communication from Illinois EPA witness, Mr. Roy Smogor. Mr. Yoder, another witness appearing on behalf of Illinois EPA in these proceedings, has reached similar conclusions. In a 1996 paper (Yoder and Rankin 1996), Mr. Yoder reported that 85% of urban sites sampled had poor or very poor (*i.e.*, non-attaining) biological index scores. In a 1999 paper (Yoder *et al.* 1999), he reported that threshold levels for percent urban land use ranged from 8-33%. In this same paper, Mr. Yoder discussed the inability of urban streams to attain a use classification that meet the Clean Water Act aquatic life goals, which is called the "Warm Water Habitat" or "WWH" use under Ohio's use classification system. Mr. Yoder concluded that:

[T]he recent finding that no urban headwater stream sites in the Ohio EPA database attain the WWH biocriteria (Yoder and Rankin 1997) only serves to further the notion that the degree of watershed urbanization can preclude the WWH use regardless of the site specific habitat quality. (Yoder et al. 1999 at p. 25)

In a subsequent paper (Yoder et al. 2000 at p. 32), Mr. Yoder similarly found that:

Only a very few sites exhibited attainment at urban land uses between 40-60% and none occurred above 60%. These former sites had either an intact, wooded riparian zone, a continuous influx of groundwater, and/or the relatively recent onset of urbanization. These results indicate that it might be possible to mitigate the negative effects of urbanization by preserving or enhancing near and instream habitats, particularly the quality of the riparian buffer zone. The results also suggest that there is a threshold of watershed urbanization (e.g., >60%) beyond which attainment of warmwater habitat is unlikely.

With regard to the threshold of watershed urbanization above which attainment of Clean Water Act aquatic goals is unlikely, the Des Plaines River watershed was already 59% urbanized in

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1990, right at the threshold of 60% cited in the Yoder et al. studies described above. In a later paper (Miltner, White, and Yoder 2004), IBI values in the watersheds studied "declined significantly when the amount of urban land use measured as imperious cover exceeded 13.8%, and fell below expectations consistent with the Clean Water Act goals when impervious cover exceeded 27.1%". According to the Army Corps of Engineers, the amount of impervious cover in the Des Plaines Basin is 30-56%.

Similar results have been observed in nearby Wisconsin where Wang et al. (1997 at p. 9) noted that:

Watersheds with more than 20% urban land invariably had IBI scores < 30 (poor-very poor), although their habitat scores varied from 5 (very poor) to 70 (good). There appeared to be a sharp threshold between 10% and 20% urban land use across which IBI scores declined dramatically.

Clearly, the severe negative consequences on the quality of aquatic life communities caused by urbanization have been well-documented in these and other studies. It is important to note that the declines noted by these studies occurred regardless of site-specific habitat quality. In other words, in highly urbanized areas, even streams with good habitat (*i.e.*, high QHEI scores) often fail to attain CWA goals. Given the high percentage of urban land use and impervious area within the CSSC and the UDP, it is clear that even in the absence of the poor habitat quality and the other limiting factors discussed above, the CSSC and the UDP would not likely achieve attainment of the Clean Water Act aquatic life goals due to the high levels of urbanization in this area.

C. Remediation to Address Habitat Limitations is not Feasible in the Caws and UDP

The possibility of remediation to address UAA factors that are preventing attainment of Clean Water Act goals must be considered whenever a proposed use designation falls below the Clean Water Act goals. Here, the main limiting factor in this waterway system is the impoundments. To remediate the impounded nature of the waterway would require removing or greatly modifying the locks and dams now present. However, such remediation would in turn severely impair or prevent the existing navigational use for which this waterway was intended, and which is also a protected use of the CAWS and the UDP under the Clean Water Act.

Further, the system now has a series of flow controls in place that are specifically designed to send Chicago's wastewater to the Illinois River rather than to Lake Michigan. Even if navigation were no longer deemed a protected use, which the Illinois EPA acknowledges will not occur, the City of Chicago and Illinois EPA would still be faced with the problem of how to dispose of wastewater from a city of three million people. Clearly, impounding from the dams and the attendant problems it causes (e.g., lack of riffles and fast water, increased siltation, etc.) cannot be remediated over the foreseeable future (i.e., the next 10-20 years).

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Short of removing or greatly modifying the existing locks and dams on the waterway, some more limited types of remediation could be implemented (e.g., the amount of instream cover could be increased). However, due to the extensive amount of habitat area that would need to be improved by such measures in order to have any measureable effect on fish populations and species, they would have to occur on an unprecedented scale. Illinois EPA has acknowledged that there are no such plans for remediation at the scale required here. Moreover, unless the dams themselves are removed, the factors that are most severely limiting (i.e., lack of riffles, fast water, and clean cobble/boulder areas) will continue to limit the system by preventing the species that depend on such areas from establishing viable populations.

VII. APPROPRIATE USE DESIGNATION FOR UPPER DRESDEN POOL

Illinois EPA has proposed to assign the UDP its own use designation. While admitting that the UDP is somewhat impaired, Illinois EPA suggests that it has the potential to "marginally meet" CWA goals. However, the above analysis and review of stream data, facts and recognized studies, along with the additional support cited below, show that the extent of the impairments in the UDP prevent it from attaining the Clean Water Act aquatic life goals.

With regard to the UDP, Mr. Rankin of the CABB/MBI advised the Illinois EPA "we suggest that the Ohio Modified Warmwater Habitat Use for impounded rivers (MWH-I) would be the most appropriate category." This Ohio use designation category applies to waterbodies that are not capable of attaining the Clean Water Act's aquatic life goals. This conclusion acknowledged the existence of and took into account the presence of the limited area of better habitat in the Brandon tailwaters. Mr. Rankin correctly noted that the tailwater area was isolated, which could influence its potential. He also acknowledged the impounded nature of the UDP and that it was subject to barge traffic. Finally, he noted that "systematic alteration and urbanization also contributes to the physical limitations we observed". Mr. Rankin's independent opinion as to the appropriate use designation for the UDP, as the developer of the QHEI system (Rankin 1989) relied on by the Illinois EPA, should be given significant weight. He notes that he did not have access to the biological data at the time of his assessment. Toward that end, the extensive, long-term biological data sets collected by EA from this area show the fish community, both existing and potential, to be consistent with the MWH-Impounded Use classification, thus supporting Mr. Rankin's findings and recommendation.

A. Upper Dresden Pool Has Most of Ohio's Modified Warmwater Habitat Streams Characteristics and Almost None of Ohio's Warmwater Habitat Characteristics

In a prior submittal by Midwest Generation to Illinois EPA (EA 2003) as part of the UAA Stakeholder process for the LDR, EA applied to the UDP each of the attributes of each use type established by Ohio EPA for its use designation system. EA found that the UDP possessed only one characteristic (max depth >40 cm) of the Warm Water Habitat Use that under Ohio's use classification system meets the Clean Water Act aquatic life goals. In comparison, the UDP possessed seven characteristics of the Modified Warmwater Habitat Use that under Ohio's system does not meet the Clean Water Act aquatic life goals. Comparison of these characteristics in this manner is a standard analysis technique used by Ohio EPA to determine the proper aquatic life use for a particular water body.

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With regard to this approach, Yoder and Rankin (1996), both then with Ohio EPA, stated that "as the predominance of modified habitat attributes increase to a modified warmwater ratio of greater than 1.0-1.5, the likelihood of having IBI scores consistent with WWH use declines". In Dresden Pool, the ratio is 4:1, far greater than the 1.5:1 trigger point suggested by Messrs. Yoder and Rankin. Thus, it is clear, based on this well-established methodology, that the UDP is not capable of attaining a Warmwater (i.e., General) Use, which meets the Clean Water Act aquatic life goals. Clearly, a lower aquatic life use classification is warranted.

B. The Habitat in the UDP Generally Will Not Support an Aquatic Life Use Consistent with CWA Goals.

An alternative way of looking at the question of what aquatic life use the UDP can support is to consider how little good habitat there is:

- 1. The only area of good habitat is confined to a roughly 1-mile long section in the Brandon tailwaters. Given that Dresden Pool is about 15 miles long, this area of good habitat represents only about 7% of the linear distance of the Pool, and even this small area may be of limited value because of toxic sediments that cannot reasonably be remediated.
- 2. Based on 2003 data, the average QHEI in UDP was about 45 (EA 2003). The average score in this same area in July 2008 was about 47 using Ohio EPA scoring procedures and only 42 using the MBI version of the QHEI (Attachment 2d). The figures in Attachment 2f provide a visual depiction of how QHEI scores vary spatially over the UDP. It is clear from these figures that QHEI scores in most of the 7-8 mile reach comprising the UDP were well below the accepted cutoff of 60. In fact, they are, on average, much closer to the cutoff of 45 for limited warmwater habitat (LWH) under the Ohio Use Classification System.
- 3. The version of the QHEI currently being used by Mr. Yoder and MBI includes an automatic deduction of up to 10 points for all areas that are impounded. This represents a clear acknowledgement that impounding a river not only affects individual QHEI metrics, but also has a cumulative and pervasive effect on the quality of the aquatic life within such areas. It is this scoring adjustment that causes the scores in the UDP calculated using the MBI version of the QHEI to be about five points lower than the Ohio EPA version.

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VIII. LIST OF REFERENCES

- American Rivers. 2002. The Ecology of Dam Removal: A Summary of Benefits and Impacts. American Rivers. Washington, D.C.
- Booth, D.B., and C.R. Jackson. 1997. Urbanization of aquatic systems: degradation thresholds, stormwater detection, and the limits of mitigation. Journal of the American Water Resources Association 33 (5):1077-1090.
- Burton, G.A., Jr. 1995a. The Upper Illinois Waterway Study Interim Report: 1994-1995 Sediment Contamination Assessment. Institute for Environmental Quality, Wright State University. Prepared for Commonwealth Edison Co., Chicago, IL.
- ______. 1995b. Reviews of Literature Concerning: 1) Effects of Temperature on Freshwater Fish, 2) Effects on Freshwater Biota and Interactions of Temperature and Chemicals, and 3) Effects of Turbidity and Barge Traffic on Aquatic Ecosystems. Institute for Environmental Quality, Wright State University. Prepared for Commonwealth Edison Co., Chicago, IL.
- Burton, G.A., Jr., K. Kroeger, J. Brooker, and D. Lavoie. 1998. The Upper Illinois Waterway Ecological Survey (July 1997-March 1998). Continuous In Situ Toxicity Monitoring and Thermal Effect Characterization Tasks. Final Report. Institute for Environmental Quality, Wright State University. Prepared for Commonwealth Edison Co., Chicago, IL.
- Burton, G.A., Jr., and C. Rowland. 1999. The Upper Illinois Waterway Ecological Survey (July 1998-October 1998). Continuous In Situ Toxicity Monitoring and Thermal Effect Characterization Tasks. Final Report. Institute for Environmental Quality, Wright State University. Prepared for Commonwealth Edison Co., Chicago, IL.
- Commonwealth Edison Company (ComEd). 1996. Aquatic Ecological Study of the Upper Illinois Waterway.
- Dreher, D. 1997. Watershed Urbanization Impacts on Stream Quality Indicators in Northeastern Illinois. Pages 129-135, in D. Murray and R. Kirshner (ed.) Assessing the Cumulative Impacts of Watershed Development on Aquatic Ecosystems and Water Quality. Northeastern Illinois Planning Commission. Chicago, IL.
- EA Engineering, Science, and Technology. 2003. Appropriate Thermal Water Quality Standards for the Lower Des Plaines River. Report to Midwest Generation, Chicago, IL.
- Edds, D.R., J.S. Tiemann, M.L. Wildhaber, D.P. Gillette. 2005. Spatiotemporal patterns of fish assemblage structure in a river impounded by low-head dams. Copeia 2005 (3):539-549.

Electroni Filiting Receiveter Cseokis Office 04/20/2003

- Eley, R., J. Randolph, and J. Carroll. 1981. A comparison of pre- and post-impoundment fish populations in the Mountain Fork River in southeastern Oklahoma. Proceedings of the Oklahoma Academy of Science 61: 7-14.
- FitzHugh, T. 2002. Watershed Characteristics and Aquatic Ecological Integrity: A Literature Review. TNC Freshwater Initiative.
- Groschen, George E., Arnold, Terri L., Harris, Mitchell A., Dupre, David H., Fitzpatrick, Faith A., Scudder, Barbara C., Morrow, Jr., Williams S., Terrio, Paul J., Warner, Kelly L., and Murphy, Elizabeth A.. 2004. Water Quality in the Upper Illinois River Basin, Illinois, Indiana, and Wisconsin. 1999-2001: Reston, VA, U.S. Geological Survey Circular 1230, 42 p.
- Guenther, C.B. and A. Spacie. 2006. Changes in fish assemblage structure upstream of impoundments within the upper Wabash River basin, Indiana. Transactions of the American Fisheries Society 135 (3): 570-583.
- Gutreuter, S., J. M. Dettmers, and D.H. Wahl. 2003. Estimating mortality rates of adult fishes from entrainment through the propellers of river towboats. Transactions of the American Fisheries Society 132:646-661.
- Kanehl, P.D., J. Lyons, and J.E. Nelson. 1997. Changes in the habitat and fish community of the Milwaukee River, Wisconsin, following removal of the Woolen Mills Dam. North American Journal of Fisheries Management 17:387-400.
- Klein, R. 1979. Urbanization and Stream Quality Impairment. Water Resources Bulletin 15(4).
- Lowery, D.R., R. W. Pasch, and E.M. Scott. 1987. Hydroacoustic survey of fish populations of the lower Cumberland River. U.S. Army Engineer District, Nashville. Nashville, TN.
- Lyons, J., R.R. Peitte, and K.W. Niermeyer. 2001. Development, validation, and application of a fish-based index of biotic integrity for Wisconsin's large warmwater rivers. Transactions of the American Fisheries Society 130:1077-1094.
- Maxted, J. and E. Shaver. 1996. The Use of Retention Basins to Mitigate Stormwater Impacts on Aquatic Life. In:Effects of Watershed Development and Management on Aquatic Ecosystems. Roesner, L.A. (ed.), Proceedings of Engineering Foundation Conference. August, 1996. Snowbird, UT.
- May, C.R., Horner, J., Karr, B., Mar, B.W., and E. Welch. 1997. Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion. Watershed Protection Techniques 2(4): 483-494.
- Metropolitan Washington Council of Governments (MWCOG). 1992. Watershed Restoration Sourcebook. Department of Environmental Programs, MWCOG, Washington, DC.

Electroni Filingra Receive thr Cseokis of Since 04/20/2003

- Miltner, Robert J., White, Dale, and Yoder, Chris. 2004. The Biotic Integrity of Streams in Urban and Suburbanizing Landscapes. Landscape and Urban Planning 69(1):87-100.
- NAWQA. 1998. USGS Fact Sheet-072-98. USGS. Water Resources Division, Urbana, IL
- Ohio EPA. 1987 (plus 2006 updates). Biological criteria for the protection of aquatic life: Volume II: User's manual for biological field assessment of Ohio surface waters. Ohio EPA, Division of Water Quality Planning and Assessment, Columbus, Ohio. 125pp. plus appendices.
- Ohio EPA. 2006. Methods for assessing habitat in flowing waters: Using a Qualitative Habitat Evaluation Index (QHEI). Ohio EPA. Columbus, Ohio.
- Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The natural flow regime. BioScience 47(11):769-784.
- Rankin, E.T. 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Applications. Ohio EPA Division of Water Quality Planning and Assessment, Ecological Assessment Section. Columbus, OH.
- Santucci, V.J. and S.R. Gephard. 2003. Fox River fish passage feasibility study. Final Report of the Max McGraw Wildlife Foundation to the Illinois Department of Natural Resources, Springfield.
- Santucci, V.J., S.R. Gephard, and S.M. Pescitelli. 2005. Effects of multiple low-head dams on fish, macroinvertebrates, habitat, and water quality in the Fox River, Illinois. North American Journal of Fisheries Management 25:975-992.
- Steedman, R. J. 1988. Modification and assessment of an index of biotic integrity to quantify stream quality in Southern Ontario. Canadian Journal of Fisheries and Aquatic Sciences 45: 492-501.
- Todd, B.L., and C.F. Rabeni. 1989. Movement and habitat use by stream-dwelling smallmouth bass. Transactions of the American Fisheries Society 118:229-242.
- U.S. Army Corps of Engineers, Chicago District. Lake Michigan Diversion Accounting--Water Year 1997 Report, Table 3 SCALP Landuse Designations for the Modeled Basins, p. 10 (http://155.79.114.198/divacct/1997 Diversion.html)
- U.S. EPA. 1986 Quality Criteria for Water. EPA Publication 440/5-86-001. EPA Washington, DC.
- US EPA. August, 2003. Strategy for Water Quality Standards and Criteria. Office of Science and Technology. EPA-823-R-03-010. Washington, D.C.

Electroni Filiting Receiveter Cseokis Office 04/20/2003

- Wang, L, J. Lyons, and R. Gatti. 1997. Influences of watershed land use on habitat quality and biotic integrity in Wisconsin Streams. Fisheries 22 (6):6-12.
- Yoder, C.O. and E.T. Rankin. 1996. Assessing the condition and status of aquatic life designated uses in urban and suburban watersheds. Pages 201-226 in: L.A. Roesner (ed.) Effects of Watershed Development and Management on Aquatic Ecosystems. American Society of Civil Engineers. New York, NY.
- Yoder. C.O., R. Miltner, and D. White. 1999. Assessing the Status of Aquatic Life Designated Uses in Urban and Suburban Watersheds. Pages 16-28 in R. Kirschner (ed.) National Conference on Retrofit Opportunities for Water Resources Protection in Urban Environments. EPA/6325/R-99/002.
- Yoder, C.O., R.J. Miltner, and D. White. 2000. Using Biological Criteria to Assess and Classify Urban Streams and Develop Improved Landscape Indicators. In Proceedings of the National Conference on Tools for Urban Water Resource Management and Protection. Published by U.S. EPA, Office of Research and Development. Washington, D.C. EPA/625/R-00/001.

ATTACHMENT 1

Detailed Summary of EA Engineering, Science, and Technology's Stream Surveys for the Upper Illinois Waterway (UIW), 1993–2006

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Detailed Summary of EA Engineering Stream Surveys for the Upper Illinois Waterway (UIW) 1993–2006

I. Overview

EA Engineering, Science, and Technology (EA) has conducted annual stream surveys in the Upper Illinois Waterway (UIW) since 1993, with the exception of only 1996. The studies conducted in the 1993-1995 time period by EA and other contractors for Commonwealth Edison (ComEd) were subsequently relied upon by the Illinois Pollution Control Board (IPCB) to grant ComEd an Adjusted Standard regarding thermal water quality standards in the A96-10 proceeding. The studies subsequently conducted on an annual basis beginning in 1997 to the present have been performed by EA at the request of ComEd (through 1999) or Midwest Generation EME (since 2000). These studies are not required by the terms of the IPCB Order granting the adjusted standard in AS96-10 or in any NPDES permits issued to the subject electrical generation stations formerly owned by ComEd and now owned by MWGen. These annual studies have been performed on a voluntary basis in order to monitor conditions in the UIW and to continue to confirm that compliance with the alternate thermal water quality standards granted in AS96-10 is not having an adverse impact on the aquatic community. These annual stream surveys have been submitted to the Illinois EPA upon their completion. Due to the voluminous nature of these stream survey reports, this detailed summary has been prepared to present the key data and findings contained therein which are relevant to the UAA R08-09 rule-making proceeding.

II. EA 1993-1994 Studies

By the terms of the NPDES permits issued to the Joliet 9 & 29, Will County, Fisk, and Crawford Stations, in the early 1990's, ComEd, then the owner of those plants, was required to undertake a comprehensive aquatic study of the combined thermal impacts of these facilities on receiving waterways. Specifically, ComEd was to:

"prepare a comprehensive thermal impact demonstration assessing the effects of cooling water discharges from [each power plant] in conjunction with its other generating facilities on the Chicago Sanitary and Ship Canal and on the Des Plaines River. The study [was to include]:

- (a) assessment of the physical characteristics of the affected waters relative to their ability to support and sustain aquatic life;
- (b) assessment of the thermal environment of the affected waters and the effects of the various heat inputs, and documentation of compliance with water quality standards;

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- (c) assessment of waters, sediments, and organisms for toxic materials to determine the extent to which these materials may limit aquatic life; and
- (d) assessment of current populations of macrophytes, macroinvertebrates, and fishes."

In addition, the NPDES permits required a preliminary assessment related to §316(b) of the Clean Water Act that consists of "limited biological studies near the cooling water intake to document whether previous conclusions (i.e., lack of fish species diversity and early life stages due to poor water quality) remain valid."

To address these requirements, EA classified and evaluated habitat to address (a) above, and along with other ComEd experts assessed the impact of the thermal environment on aquatic life (a and b above), assessed current fish populations (Item d), and did a larval fish study to address the §316(b) concerns as cited above.

The studies were conducted over the period from 1993 to 1994. The study area included the following portions of the UIW: Lockport Pool, Brandon Pool, Upper Dresden Island Pool, which are all part of the current UAA rule-making proceeding. The UIW study area also included portions of the Lower Des Plaines River downstream of the I-55 Bridge which are not part of the UAA rule-making proceeding, including the area referred to as the "Five Mile Stretch" of the Lower Des Plaines River below the I-55 Bridge. The studies were subject to the oversight of a Task Force of experts that reviewed and approved all study plans. The Task Force included representatives from IEPA, USEPA Region V, MWRD, and several stakeholder groups. The studies conducted were extensive and the resultant reports, even in summary form (ComEd 1996) are voluminous. Therefore, we have presented a summary of the results below.

A. HABITAT

Habitats within the Upper Illinois Waterway (UIW) were initially classified on a broad scale according to mesohabitat type. Percentages of each mesohabitat in the UIW were: main channel (51.6%), main channel border (22.4%), backwaters (10.4%), tributary delta (7.0%), tailwater (4.6%), tributary mouth (3.0%), and intake/discharge (1.0%).

Habitat quality at individual sampling locations on the UIW was assessed using the Qualitative Habitat Evaluation Index (QHEI) to determine to what extent habitat was limiting the aquatic biota of the UIW. It was found that QHEI scores varied depending on mesohabitat type. Mean QHEI scores were lowest in main channel habitats, the dominant mesohabitat in the UIW. Conversely, mean QHEI scores were best in tailwaters, one of the least available mesohabitats in the UIW representing only 4.6% of the UIW study area.

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In 1993 and 1994, QHEI scores were derived at 169 locations¹ in the Lockport, Brandon Road, and Dresden Pools. Roughly half of these scores (85 locations) were calculated by EA with the other half (84 locations) calculated by other ComEd contractors (ComEd 1996). This level of coverage is far greater than that of the QHEI survey work performed in 2006 by MBI (Yoder) or in 2004 by the CABB (Rankin). All of the ComEd contractors reported similar scores in the study area, evidencing a good degree of consistency in how the different contractors performed the QHEI scoring work.

QHEI scores in the UIW were, on average, found to be low (mean scores in the 40s). Thus, habitat generally is poor. The low QHEI scores are the result of a lack of riffle/run habitat, lack of clean, hard substrates (i.e., gravel/cobble), excessive siltation, channelization, poor quality riparian and floodplain areas, and lack of cover. Habitat was found to be poorest in Lockport Pool, marginally better in Brandon Pool, and better still in Dresden Pool; but mean QHEI scores were still <60 in Dresden Pool.

Other factors, notably low dissolved oxygen concentrations, constant barge traffic, and toxics, especially in the sediments, were also found to likely limit the aquatic biota of the UIW. These factors and the habitat limitations identified previously are largely irreversible and cannot practically be mitigated.

B. LARVAL FISH

During the spring and summer of 1994, fish eggs and larvae were collected at 16 locations in the UIW. This included six locations in Lockport Pool, one in Brandon Pool, one in the Upper Des Plaines River, and eight in Dresden Pool. Fish were collected by net tows, benthic pumping, dipnetting, stationary netting, light trapping, seining, and the physical examination of vegetation. A total of 1240 samples were collected.

The purpose of the study was to determine what portion of the fish community found in the Illinois River drainage is currently using this physically limited and impacted subunit of the system as a spawning or nursery area, as well as when and where those uses occur. The study was not intended to quantify the extent or success of spawning activity or make quantitative comparisons with reproductive performance in other systems.

Over the course of the study, about 29,400 fish eggs and about 21,800 larval and young-of-the-year (YOY) fish were collected. Most of the eggs that could be identified were found to be those of common carp. Among the larval and YOY fish collected, the six most commonly collected species or taxa during this study (*Lepomis* spp., gizzard shad, common carp, bluntnose minnow, unidentified *Pimephales* spp., and emerald shiner) share early life history characteristics that appear to be most successful in this system. These include adaptations that allow eggs and/or

¹ Eight of these locations were in the Illinois River just downstream of Dresden Island Lock and Dam

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larvae to tolerate low dissolved oxygen concentrations and have minimal contact with the sediment. Collectively, these species or taxa accounted for more than 86% of all larvae/YOY collected. The first five species/taxa have either adhesive or buoyant eggs, a characteristic that isolates their eggs from the contaminants and high oxygen demand of the substrate. They are spawning "generalists" that release eggs over a wide variety of substrates and specifically do not require the coarse or hard substrates (gravel or cobble) so rare in this system. They prefer to spawn in slack water or protected areas and the larvae tend to reside in similar areas. The larvae of some of these species or taxa are pelagic or have cement glands such that they can attach to vegetation or local structure and remain off the substrate. Most of these species or taxa have well-developed respiratory structures or have parents that fan the eggs and early larvae, thus reducing the problem of low dissolved oxygen levels near the sediment surface. The last species, emerald shiner, shares many of these characteristics and it is extremely prolific as well. Adults of all six species or taxa are moderately or highly tolerant.

The results suggest a complex but highly stressed and habitat-limited fishery that is heavily dependent for its diversity on: 1) species adapted to contaminated conditions; 2) a few critical spawning and nursery areas, primarily in Upper Dresden Pool and the 5-mile Stretch; and 3) immigration from Lake Michigan and tributary drainages.

C. JUVENILE AND ADULT FISH

Fish sampling was conducted along 53 miles of the UIW (RM 270.2 – RM 323.4) at 46 locations in 1993 and at 42 locations in 1994. Most locations were sampled both years. This includes 18 locations in Lockport Pool, six in Brandon Pool, one in the Upper Des Plaines River, 22 in Dresden Pool, and six downstream of Dresden Island Lock and Dam. Fish were collected by AC 3-phase electrofishing (EF) at 40-45 locations depending on year, gillnetting at 31-38 locations each year, and seining at 26-27 locations each year. In all, 968 fish collections (398 EF, 322 gill net, 248 seine) were made during the 1993-1994 study. As had been the case in previous years, electrofishing was conducted for 15 minutes in an upstream direction during 1993. However, to be consistent with the techniques being used by other researchers, each electrofishing zone in 1994 was 500 meters long and was fished in a downstream direction. The 500 meter long zone, downstream approach has been continued in all subsequent monitoring of the system by EA. Sampling was conducted in May, August, and October/November of both years; in July and September at all plants in 1993; in June both years near the Dresden Station; and all the plants in June 1994. Since 1994, sampling in the study area has typically been conducted from May through September.

The 1993-1994 programs resulted in the capture of 25,349 adult and juvenile fish representing 82 species. Numerically dominant species were bluntnose minnow (20.0%), gizzard shad (19.4%), common carp (11.3%), and emerald shiner (10.5%). Thus, the UIW was dominated by a combination of prolific pelagic species (i.e., gizzard shad and emerald shiner) and highly tolerant species (i.e., bluntnose minnow and common carp). Although all fish collected were processed,

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exotic species were not included in most analyses because of the confounding influence they exert. Exotic species often do not follow expected trends with regard to water quality. Similarly, highly tolerant fishes (as defined by Ohio EPA) were excluded from certain analyses (e.g., modified Index of Well-Being [IWBmod])

Although various seasonal (i.e., spring vs. summer vs. fall) and habitat differences were noted, most of these were either not statistically significant or were not consistent. The most common and consistent trends were spatial. These spatial patterns were:

- 1. A very poor native fish assemblage was present in Lockport Pool. The assemblage in Lockport Pool was characterized by low native fish abundance (catch rates typically <50 fish/km), low species richness, and domination by highly tolerant species.
- 2. The community was marginally better in Brandon Pool but was still very poor.
- 3. The fish communities in the Upper Dresden Pool and the 5-mile Stretch, Dresden Pool downstream of the Kankakee River, and downstream of Dresden Lock and Dam were relatively similar to each other and noticeably better than those upstream of Brandon Lock and Dam.²
- 4. Results at thermally-influenced sampling stations were comparable to those at other sampling stations.

Mean IWBmod (an index of fish community health) scores were:

Lockport Pool	1.4
Brandon Pool	2.8
Upper Dresden Pool and the 5-mile Stretch	5.2
Dresden Pool downstream of the Kankakee River	5.3
Downstream Dresden Lock and Dam	6.5

Using IWBmod criteria established by Ohio EPA, each segment would be classified as follows:

Lockport Pool	very poor
Brandon Pool	very poor
Upper Dresden Pool and the 5-mile Stretch	poor
Dresden Pool downstream of the Kankakee River	poor
Downstream Dresden Lock and Dam	fair

² Historically, Upper Dresden Pool has been used in our reports to denote Dresden Pool upstream of the Kankakee River and Lower Dresden Pool denoted the Illinois River (i.e., the portion of Dresden Pool below the confluence with the Kankakee). To avoid confusion, we herein refer to the old Upper Dresden Pool area as Upper Dresden Pool and 5-mile Stretch. If we use the term Upper Dresden Pool, we are referring only to the portion of the pool upstream of I-55, consistent with its usage during this rule-making.

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During the two-year study period, 5,104 young-of-the-year (YOY) fish (24.2% of the catch) representing 39 species were collected:

Species	Total	Percent
Gizzard shad	3,130	61.3
Bluntnose minnow	506	9.9
Emerald shiner	161	3.2
Largemouth bass	141	2.8
Unidentified Lepomis	128	2.5
White sucker	126	2.5
Bullhead minnow	126	2.5
All other species	786	15.4

The seven most abundant species or taxa accounted for 85% of the YOYs collected. Gizzard shad alone accounted for 61% of the YOYs, with the highly tolerant bluntnose minnow being the next most abundant (10%). As judged by the presence of YOYs, reproductive success in Lockport Pool and Brandon Pool was confined almost entirely to gizzard shad and highly tolerant species like bluntnose minnow and fathead minnow. A few (25) white sucker YOY were collected in Brandon Pool, however, most, probably all of these drifted in from the Upper Des Plaines River. This conclusion is supported by the fact that no white sucker larvae were collected from Brandon Pool during the 1994 ichthyoplankton study but they were found in the Upper Des Plaines River (EA 1995a), and the fact that nearly four times as many (91) YOY were collected from the single sampling location on the Upper Des Plaines River as the four (1993) to six (1994) locations sampled in Brandon Pool (EA 1994 and 1995b). Drift is a common dispersal mechanism for stream fishes, so it is not surprising to find a few white sucker YOY in Brandon Pool that would have been hatched elsewhere.

A total of 2,128 fish were tagged in the UIW; however, only 18 tagged fish were recaptured, and only two of these fish moved an appreciable distance. A largemouth bass moved ~4 miles upstream in 11 months and a white crappie moved ~11.5 miles downstream. Although data are sparse, they suggest that fishes in the Upper Illinois Waterway exhibit limited movement.

Percentages of fish afflicted with some sort of abnormality in each pool were as follows:

Lockport Pool	17.1%
Brandon Pool	22.1%
Upper Dresden Pool and the 5-mile Stretch	15.8%
Dresden Pool downstream of the Kankakee River	8.7%
Downstream Dresden Lock and Dam	10.0%

Thus, the incidence of abnormalities was highest in the upper three segments. DELT (Deformities, Erosion, Lesions, and Tumors) anomalies are of particular concern because they are strongly correlated with water quality. A summary of DELT anomalies throughout the Upper Illinois Waterway is presented below:

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Lockport Pool (%)	Brandon Pool (%)	Upper Dresden Pool and the 5- mile Stretch (%)	Dresden Pool downstream of the Kankakee River (%)	Downstream of Dresden Dam (%)
10.9	14.6	12.6	8.0	7.5

As was the case with total anomalies, DELT anomalies were also highest in the three upstream segments. Eighty percent of all DELT anomalies were the result of fin erosion. The percent of DELT anomalies was greatest among bottom feeders such as common carp, channel catfish, and redhorse species. A high incidence of DELT anomalies is an indication of stress caused by a variety of environmental factors, including chemically contaminated substrates. For large river sites like the UIW, Ohio EPA gives any site with >3% DELT anomalies the lowest possible IBI (Index of Biotic Integrity) metric score. Thus, depending on the segment, DELT anomalies percentages exhibited by fish in the UIW are 2-5 times higher than the 3% criterion established by Ohio EPA for the lowest metric score.

In summary, it was found that during 1993-1994:

- Habitat severely limited the fish community.
- Fish diversity and abundance followed clear-cut patterns, with conditions being poorest in Lockport Pool and generally improving in a downstream direction.
- The spatial pattern appeared to be unrelated to operation of the ComEd power plants.
- Growth and condition of most species were generally within expected ranges, except for smallmouth bass. W_r values for smallmouth bass (typically <90) were consistently below optimum values. For several species, W_r values were highest in Lockport Pool and decreased in a downstream direction.
- The incidence of diseased fish is very high in the UIW.
- Reproduction in the upper portion of the study area is primarily limited to a few tolerant or pelagic fishes.
- None of the measures used in this study to evaluate individual or community health indicated that ComEd power plants were contributing to the poor fauna observed in much of the UIW.
- Based on the lack of impacts and habitat-imposed constraints, it was concluded that the aquatic community of the UIW would essentially be the same as it is currently if ComEd plants were load-restricted or even taken off line.

III. 1995 Study

The 1995 study (EA 1996) was very similar to the 1993-1994 studies in terms of the area covered, the sampling gears used, and the level of effort expended. In 1995, a total of 393 collections were made. When coupled with the effort in 1993 and 1994, a total of 1361 fish

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collections were used to support the ComEd Petition to the IPCB for the Adjusted Standard regarding thermal standards. The spatial patterns seen in 1995 closely tracked those observed in 1993-1994 (ComEd 1996). Most trends or observations noted in 1993-1994 were also apparent in 1995, namely:

- Habitat was poor at most locations.
- DO values were typically lower in Brandon and Lockport Pools compared to Dresden Pool
- Numerically dominant species were bluntnose minnow (29.8%), emerald shiner (13.2%), common carp (8.9%), and gizzard shad (8.2%). Thus, the UIW was dominated by a combination of prolific pelagic species (i.e., gizzard shad and emerald shiner) and highly tolerant species (i.e., bluntnose minnow and common carp). These same four species dominated catches in 1993 and 1994.
- A very poor fish assemblage was present in Lockport Pool. The assemblage in Lockport Pool was characterized by low fish abundance and domination by highly tolerant species.
- The community was marginally better in Brandon Pool but was still very poor.
- The fish communities in Upper Dresden Pool and the 5-mile Stretch below the I-55 Bridge, Lower Dresden Pool, and downstream of Dresden Lock and Dam were relatively similar to each other and noticeably better than those upstream of Brandon Lock and Dam but still considered to represent a limited aquatic community.
- IWBmod scores were:

Lockport Pool	2.9
Brandon Pool	2.7
Upper Dresden Pool and the 5-mile Stretch	5.5
Lower Dresden Pool	5.4
Downstream Dresden Dam	6.7

Using IWBmod criteria established by Ohio EPA, each segment would be classified as follows:

Lockport Pool	very poor
Brandon Pool	very poor
Upper Dresden Pool and the 5-mile Stretch	poor
Lower Dresden Pool	poor
Downstream Dresden Dam	fair

- Highly tolerant and pelagic species composed 42% of the YOY catch.
- The percentage of fish with DELT anomalies was high throughout the study area.

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IV. 1997-2005 Annual Surveys

At the request of ComEd (1997-1999) and subsequently by MWGen, EA has conducted annual adult fish monitoring in the lower Des Plaines River, between the Brandon Road Lock and Dam and its confluence with the Kankakee River (i.e., Upper Dresden Pool and the 5-mile Stretch below the I-55 Bridge) since 1997. Provided below is a summary of the methodologies and findings from the 1997-2005 studies. The annual fish monitoring conducted by EA included areas that are a part of the pending UAA proceeding or immediately downstream. Those areas are the Brandon Pool, the Lockport Pool, the Upper Dresden Pool and the 5-mile Stretch of the Lower Des Plaines River immediately downstream of the Upper Dresden Pool. Although a considerable amount of work has been conducted in the Brandon and Lockport Pools during this period, the majority of the effort has focused on Upper Dresden Pool and the 5-mile Stretch. Thus, this section only discusses work in the Upper Dresden Pool and the 5-mile Stretch.

For some of the analyses below, study results from what was historically called Upper Dresden Pool have been segregated into and compared between two segments: 1) Upstream I-55 (the secondary contact waters of the lower Des Plaines River from the I-55 bridge upstream to the Brandon Road Lock and Dam, i.e., Upper Dresden Pool as defined in the UAA rule-making proceeding) and 2) Downstream I-55 (the General Use waters of the lower Des Plaines River from the I-55 bridge downstream to its confluence with the Kankakee River, referred to as the 5-mile Stretch in this hearing.)

Electrofishing was conducted each year using a boat-mounted system energized by a 230-volt, 5,000-watt, three-phase AC generator. In 1993, electrofishing was based on time (15 minutes per location) and was conducted in an upstream location. Since 1993, electrofishing has been based on distance (500 meters per location) and conducted in a downstream direction, which is consistent with other researchers' methodologies, such as the Ohio EPA and the Midwest Biodiversity Institute (MBI). Due to the change in electrofishing methods, data from 1993 are excluded from certain analyses and comparisons. EA has made 727 electrofishing collections in Upper Dresden Pool and the 5-mile Stretch since 1995.

Seining was conducted each year using a straight seine that was 25 feet (7.6 m) long by 6 feet (1.8 m) deep with 3/16 inch (4.8 mm) Ace mesh. The effort consisted of a single haul at each sampling location. EA has made 583 seine collections from Upper Dresden Pool and the 5-mile Stretch since 1995.

Experimental gillnetting was conducted only during 1993-1995. Therefore, those data are excluded from the following analyses.

In summary, EA made 1361 fish collections in 1993-1995, 1310 collections from Dresden Pool alone during 1997-2005, and 488 more collections from Brandon and Lockport Pools in 1997-2005, a total of 3159 collections from 1993-2005. This compares to 11 collections made by MBI from these pools, with all collections confined to a single year, 2006.

A. TAXONOMIC COMPOSITION AND ABUNDANCE - Upper Dresden Pool and the 5-mile Stretch

Electrofishing and seining during the 12 study years produced 143,156 fish representing 82 species and four hybrids (Table 1). The 10 most abundant species collected were, in descending order of abundance: bluntnose minnow (22.2%), gizzard shad (+ *Dorosoma* spp.) (20.4%), bluegill (17.2%), green sunfish (7.0%), emerald shiner (6.6%), orangespotted sunfish (4.4%), largemouth bass (3.4%), common carp (2.8%), bullhead minnow (2.3%), and spottail shiner (1.9%). These same species were also the 10 most abundant collected during each period (i.e., 1993-1995 and 1997-2005):

Charles	<u>1993-1995</u>		<u>1997-2005</u>			
Species	No.	Rank	%	No.	Rank	%
Bluntnose minnow	3,626	1	27.8	28,170	1	21.7
Gizzard shad (+ Dorosoma)	2,924	2	22.4	26,220	2	20.2
Bluegill	327	10	2.5	24,283	3	18.7
Green Sunfish	413	7	3.2	9,544	4	7.3
Emerald shiner	853	3	6.5	8,568	5	6.6
Orangespotted sunfish	373	8	2.9	5,872	6	4.5
Largemouth bass	760	5	5.8	4,050	7	3.1
Common carp	796	4	6.1	3,217	8	2.5
Bullhead minnow	345	9	2.6	2,916	9	2.2
Spottail shiner	689	6	5.3	2,068	10	1.6
		•	85.1		•	88.3

Collectively, these 10 species composed remarkably similar percentages of the catches during these two periods (85.1% vs. 88.3%) and, individually, the percentages were also quite similar between periods for bluntnose minnow, gizzard shad (+ *Dorosoma* spp.), emerald shiner, orangespotted sunfish, largemouth bass, and bullhead minnow. In fact, bluegill was the only dominant species that exhibited an appreciable difference between these two periods: 2.5% of the catch during 1993-1995 compared to 18.7% during the period of 1997-2005. Therefore, with the exception of some "re-shuffling" among the ranks, the fish community of Upper Dresden Pool and the 5-mile Stretch continues to be dominated by the same species that dominated the community during the period of 1993-1995. The fact that the same 10 species dominated the area before the Adjusted Standard went into effect as have dominated after it went into effect indicates that the slightly higher thermal standards allowed by the Adjusted Standard did not affect fish populations.

B. TOLERANCE OF FISHES – Dresden Pool

Ohio EPA (1987, plus 2006 updates) classifies fish based on their tolerance to environmental perturbations such as decreasing water and habitat quality. At the high end of the spectrum are the intolerant and moderately intolerant fishes, which exhibit a distinct and rapid decreasing trend in abundance with decreasing habitat and/or water quality. Of the 82 species collected

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from Dresden Pool, eight species are classified as intolerant and another eight species classified as moderately intolerant. At the other end of the spectrum are the highly tolerant and moderately tolerant fishes that can become a predominant component of the fish community in areas with degraded habitat and/or water quality. In Dresden Pool, nine highly tolerant species and seven moderately tolerant species have been collected. Therefore, an equal number of intolerant and moderately intolerant species (16) and highly tolerant and moderately tolerant species (16) have been collected. However, for years combined and for both periods, the relative abundances of moderately and highly tolerant fishes have been markedly higher than those of the intolerant and moderately intolerant fishes. Of the remaining 50 species, 42 are classified as having intermediate tolerance and eight (mostly exotics) are unclassified.

Ohio EPA Tolerance	<u> 1993-</u>	<u> 1993-1995</u>		<u>1997-2005</u>		Years Combined	
Classification	No.	%	No.	%	No.	%	
Intolerant	18	0.1	158	0.1	176	0.1	
Moderately Intolerant	346	2.7	2,000	1.5	2,346	1.6	
Intermediate Tolerance	6,012	46.1	54,647	42.0	60,659	42.4	
Moderately Tolerant	1,275	9.8	27,515	21.2	28,790	20.1	
Highly Tolerant	5,156	39.5	41,724	32.1	46,880	32.8	

For years combined, the 16 moderately and highly tolerant species (plus two other taxa) composed 52.8% of the catch. The 42 intermediately tolerant species (plus six other taxa) composed 42.4% of the catch. The preponderance of moderately tolerant and highly tolerant fishes reflects the degraded habitat of Dresden Pool. For years combined, only 1.7% of the fish collected were intolerant or moderately intolerant.

The relative abundances of all tolerance classifications, except for the moderately tolerant fishes, were similar between the two periods. The relative abundance of moderately tolerant fishes was markedly higher for the period of 1997-2005 than for the period of 1993-1995, due solely to the increased abundance of bluegill.

V. Summary of Fish Community Changes from 1993-2006

Although the fish community in both the pre- and post-Adjusted Standard periods was dominated by the same 10 species and the community continues to be dominated by moderately and highly tolerant species, there has been a modest improvement in Upper Dresden Pool in some measures (EA 2008). In Upper Dresden Pool, electrofishing catch rates (CPEs) for all native fishes combined have consistently been higher during the post-Adjusted Standard period (EA 2008). IWBmod scores during the post-Adjusted Standard period have consistently been as high or higher compared to the pre-Adjusted Standard period; however, the difference has been statistically significant in only two of the 10 post Adjustment Standard years (EA 2008). Native species richness during the post-Adjusted Standard period has also usually been as high or higher as during the pre-Adjusted Standard period. For this measure, the difference was statistically significant in three of 10 years.

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In summary, the present fish community in Upper Dresden Pool is somewhat more abundant, has slightly more species, and generally has higher IWBmod scores compared to 1993-1995. However, the community continues to be dominated by species at the high end of the tolerance scale and the community dominants have <u>not</u> changed over the period.

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VI. List of References

Commonwealth Edison Company (ComEd). 1996. Aquatic Ecological Study of the Upper Illinois Waterway (Volume 1 and 2).
EA Engineering, Science, and Technology, Inc. (EA). 1994. The Upper Illinois Waterway study: Interim Report: 1993 fisheries investigation RM 270.2-323.2. Report by EA to Commonwealth Edison Company, Chicago, IL.
1995a. The Upper Illinois Waterway study: Interim Report: 1994 ichthyoplankton investigation RM 276.2-321.7. Report by EA to Commonwealth Edison Company, Chicago, IL.
1995b. The Upper Illinois Waterway study: Interim Report: 1994 fisheries investigation RM 270.2-323.2. Report by EA to Commonwealth Edison Company, Chicago, IL.
1996. 1995 Upper Illinois Waterway fisheries investigation RM 270.2-323.2. Report by EA to Commonwealth Edison Company, Chicago, IL.
1998. 1997 Upper Illinois Waterway fisheries investigation RM 272.1-285.5. Report by EA to Commonwealth Edison Company, Chicago, IL.
1999. 1998 Upper Illinois Waterway fisheries investigation RM 272.1-285.5. Report by EA to Commonwealth Edison Company, Chicago, IL.
2000. 1999 Upper Illinois Waterway fisheries investigation RM 272.1-285.5. Report by EA to Midwest Generation and Commonwealth Edison Company, Chicago, IL.
2001. 2000 Upper Illinois Waterway fisheries investigation RM 274.4-296.4. Report by EA to Midwest Generation EME, LLC, Chicago, IL.
. 2002. 2001 Upper Illinois Waterway fisheries investigation RM 274.4-296.4. Report by EA to Midwest Generation EME, LLC, Chicago, IL.
2003. 2002 Upper Illinois Waterway fisheries investigation RM 274.4-296.4. Report by EA to Midwest Generation EME, LLC, Chicago, IL.
2004. 2003 Upper Illinois Waterway fisheries investigation RM 274.4-285.5. Report by EA to Midwest Generation EME, LLC, Chicago, IL.
. 2005. 2004 Upper Illinois Waterway fisheries investigation RM 274.4-285.5. Report by EA to Midwest Generation EME, LLC, Chicago, IL.
. 2007. 2005 Upper Illinois Waterway fisheries investigation RM 274.4-296.0. Report by EA to Midwest Generation EME, LLC, Chicago, IL.
. 2008. 2006 Upper Illinois Waterway fisheries investigation RM 274.4-296.0. Report by EA to Midwest Generation EME, LLC, Chicago, IL.

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Ohio Environmental Protection Agency. 1987 (and 2006 updates). Biological criteria for the protection of aquatic life: Volume II: User's manual for biological field assessment of Ohio surface waters. Ohio EPA, Division of Water Quality Planning and Assessment, Columbus, Ohio. 125 pp. plus appendices.

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ATTACHMENT 2

Qualitative Habitat Evaluation Index (QHEI) Study of Upper Dresden Island Pool, July 2008

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ATTACHMENT 2A

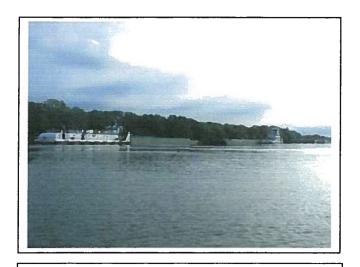
Photographs of barge fleeting area along the right bank of the lower Des Plaines River between RM 278.0 (I-55 bridge) and RM 279.1.

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Barge fleeting area along right bank of lower Des Plaines River between RM 278.0 (I-55 bridge) and RM 279.1.



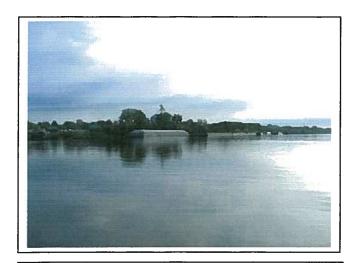
Facing upstream.



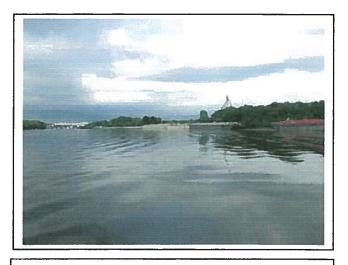
Facing upstream.



Facing downstream.



Facing upstream.



Facing downstream.

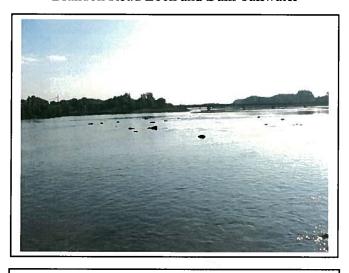
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ATTACHMENT 2B

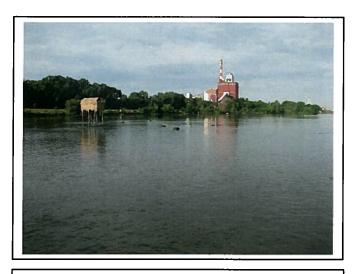
Photograph documentation log for the July 2008 QHEI study

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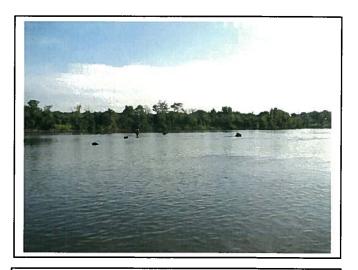
Brandon Road Lock and Dam Tailwater



Near mid-point of MBI's Site RM "285.8" facing upstream.



Near mid-point of MBI's Site RM "285.8" facing downstream and left bank.



Near mid-point of MBI's Site RM "285.8" facing upstream and right bank.

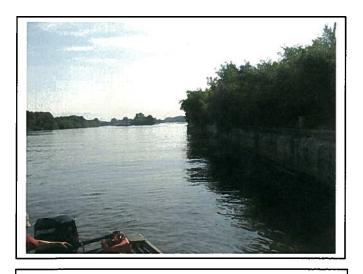


Near mid-point of MBI's Site RM "285.8" facing downstream and right bank.

RM 285.1 Left Bank



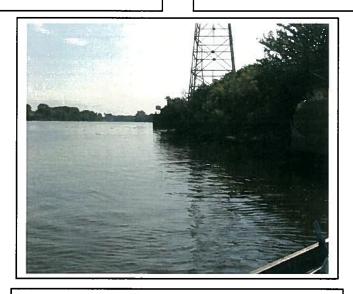
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 285.0 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.

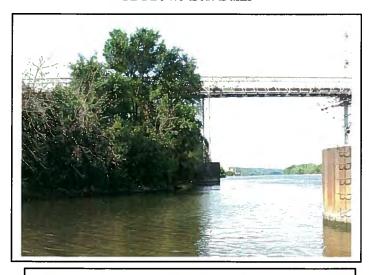


Middle of zone facing downstream.



Downstream end facing upstream.

RM 284.8 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.

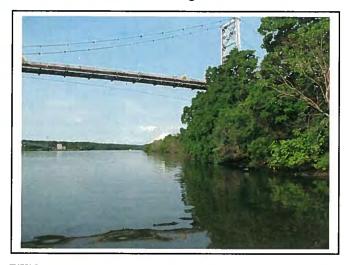


Middle of zone facing downstream.



Downstream end facing upstream.

RM 284.7 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 284.5 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

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RM 284.4 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

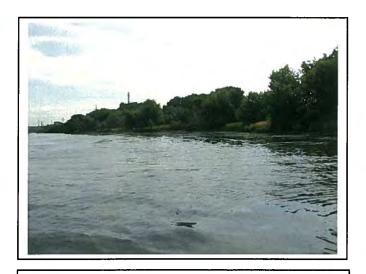


Downstream end facing upstream.

RM 284.2 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

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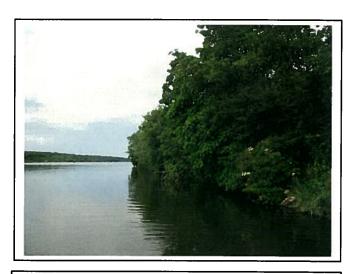
RM 284.1 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 283.9 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.

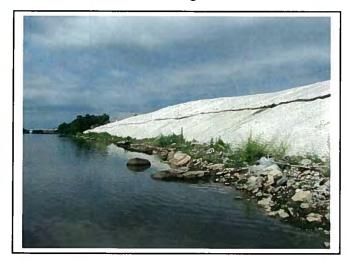


Middle of zone facing downstream.

Downstream end facing upstream (no photo).

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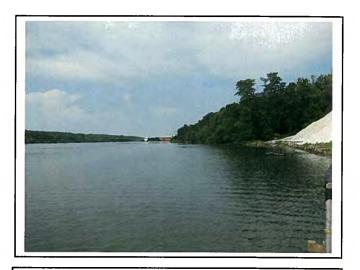
RM 283.8 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.

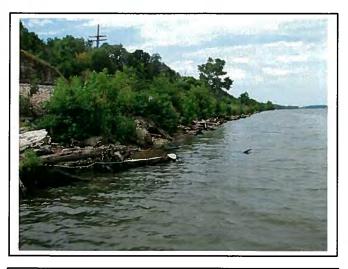


Middle of zone facing downstream.



Downstream end facing upstream.

RM 283.6 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

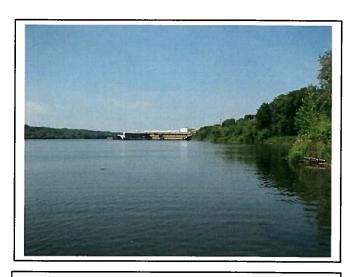
RM 283.5 Right Bank



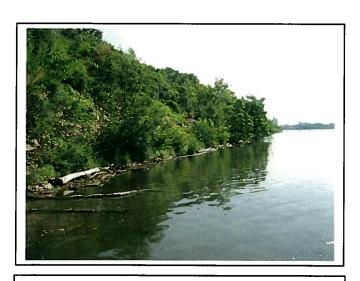
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

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RM 283.3 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



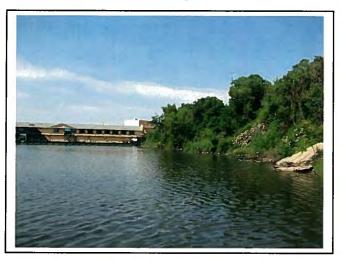
Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grade ceity extended continued the continued of the cont

RM 283.2 Right Bank



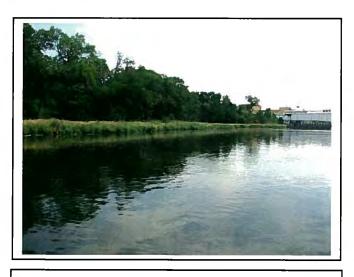
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 283.0 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



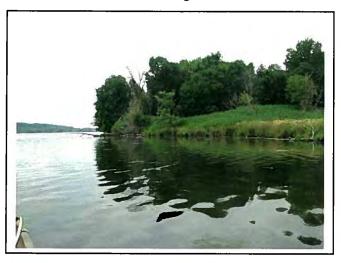
Middle of zone facing downstream.



Downstream end facing small backwater.

Electroni Filmign grade ceity extended continued the continued of the cont

RM 282.9 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 282.6 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 282.5 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

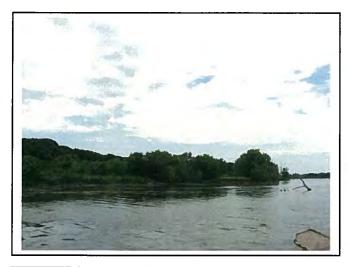


Downstream end facing upstream.

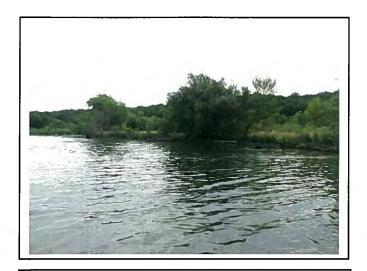


Construction activities adjacent to this location.

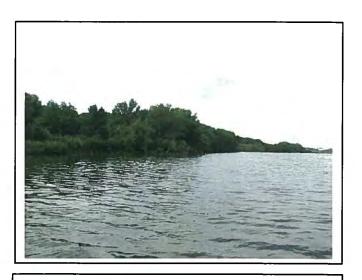
RM 282.3 Left Bank



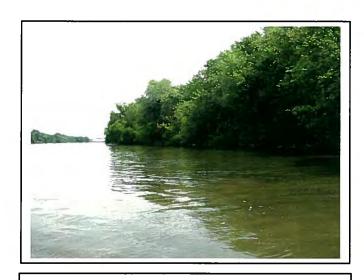
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grade ceity extended continued the continued of the cont

RM 282.2 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 282.0 Left Bank



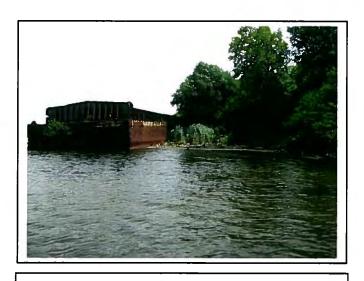
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 281.9 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 281.7 Left Bank



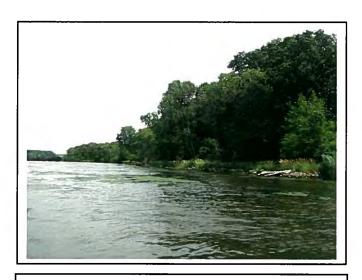
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



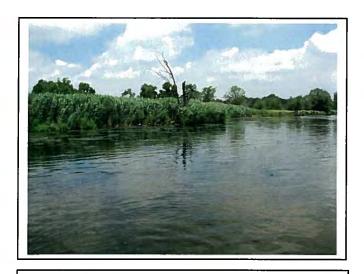
Downstream end facing upstream.

Electronoi Filmiting Reserventy enter Cherolatins enter the 104/201/20208

RM 281.6 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmijn grane ceivethr Chenkins Office 04/2023

RM 281.3 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

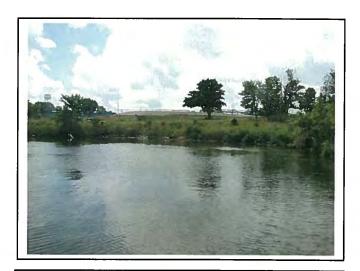
RM 281.3 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grane iveter Checkins of ince 04/20/2023

RM 281.0 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

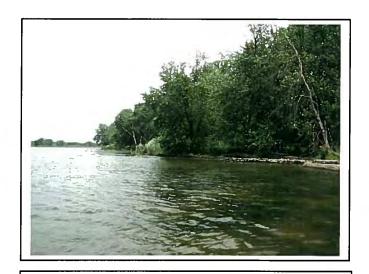


Downstream end facing upstream.

RM 280.9 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 280.7 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grade ceity extended continued the continued of the cont

RM 280.6 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

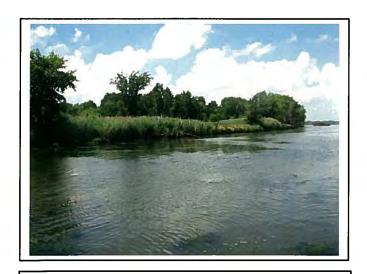


Downstream end facing upstream.

RM 280.4 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 280.3 Left Bank



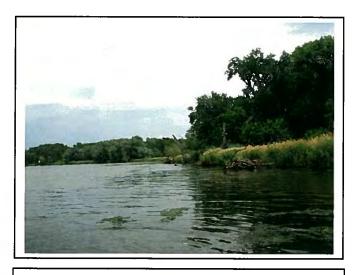
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grade ceity extended continued the continued of the cont

RM 280.0 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 279.8 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 279.7 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



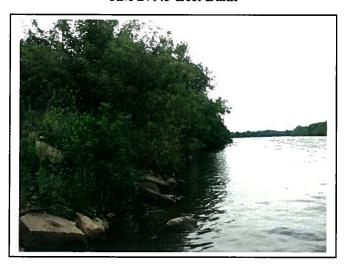
Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grade ceity extended with a Office of the office of th

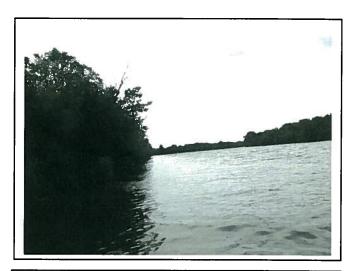
RM 279.5 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 279.4 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 279.1 Left Bank



Upstream end facing downstream.



Downstream tip of Treats Island facing upstream.



Mouth of Treats Island side channel facing downstream.



Downstream end facing upstream.

RM 279.1 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 278.9 Right Bank



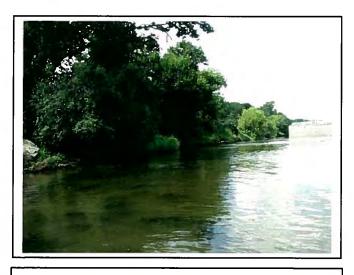
Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

RM 278.7 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

Electroni Filmign grade ceity extended continued the continued of the cont

RM 278.7 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

Downstream end facing upstream (no photo).

Electroni Filmign grade ceity extended of 200203

RM 278.4 Left Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

Downstream end facing upstream (no photo).

RM 278.3 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.



Downstream end facing upstream.

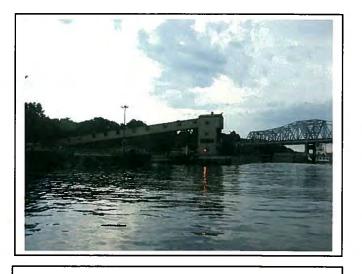
RM 278.0 Left Bank



Upstream end facing downstream.



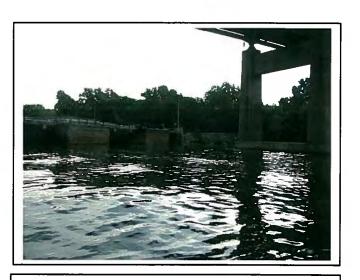
Middle of zone facing upstream.



Middle of zone facing downstream.

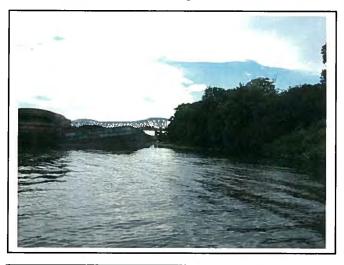


Downstream end facing upstream.



Downstream end.

RM 278.0 Right Bank



Upstream end facing downstream.



Middle of zone facing upstream.



Middle of zone facing downstream.

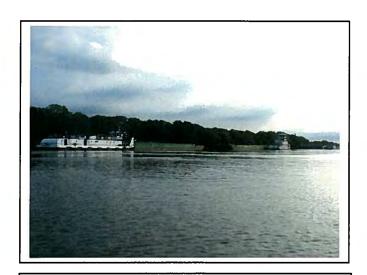


Downstream end facing upstream.

Moored barges along right bank from RM 278.0 to RM 279.1.



Facing upstream.



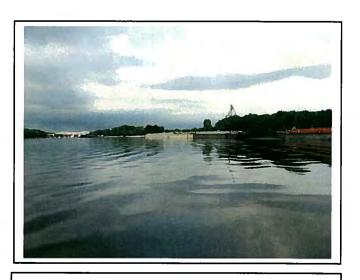
Facing upstream.



Facing downstream.



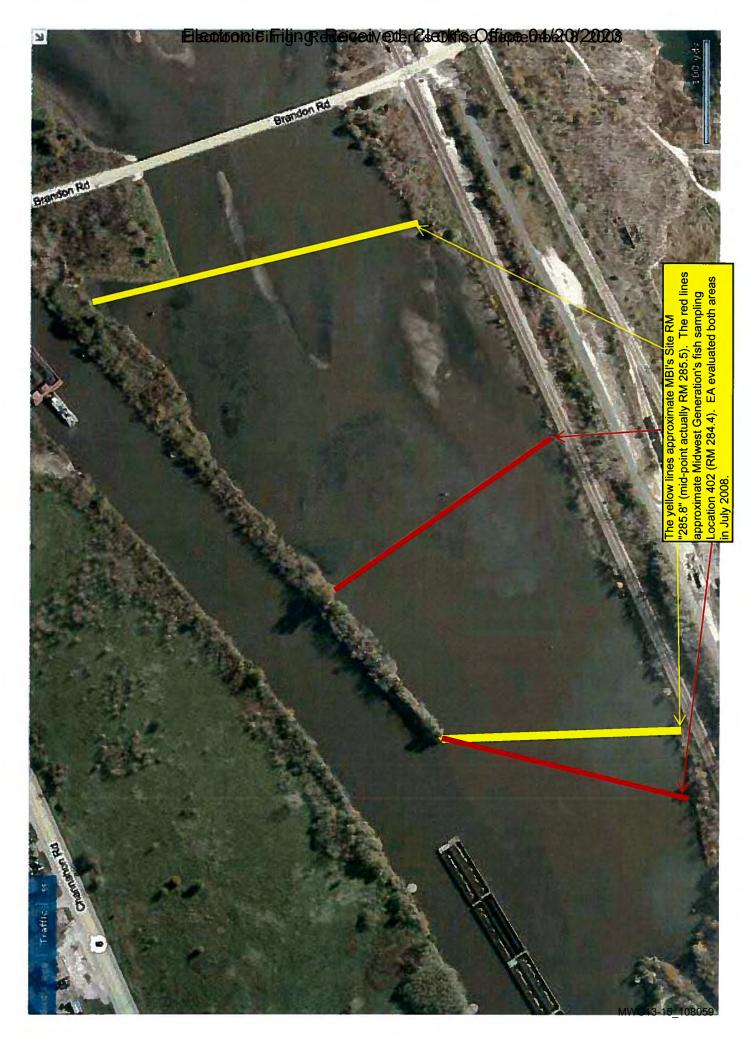
Facing upstream.



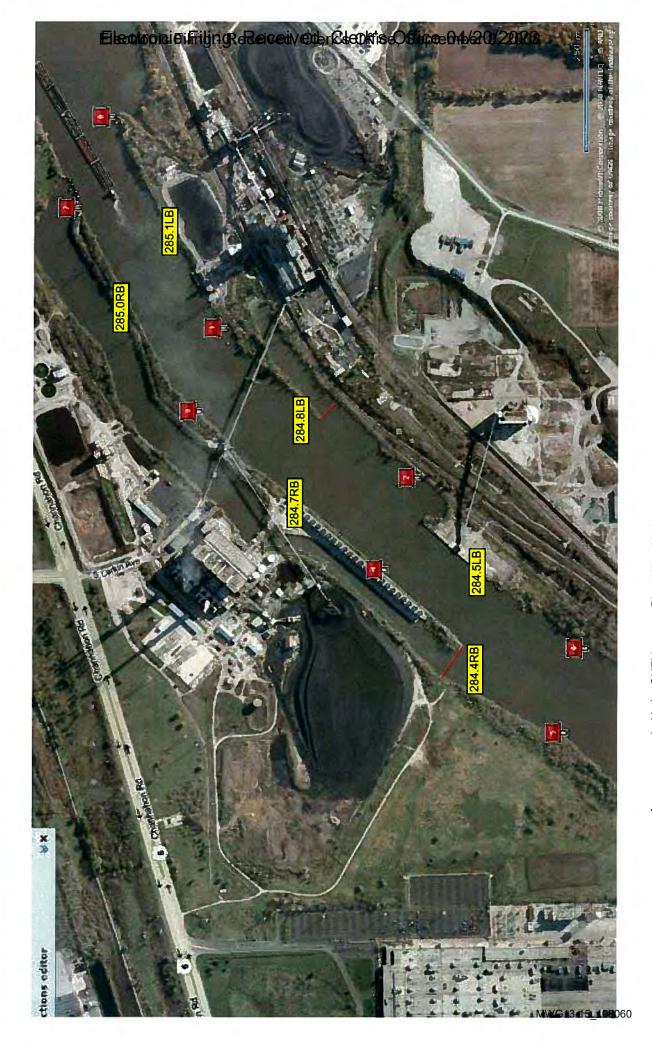
Facing downstream.

ATTACHMENT 2C

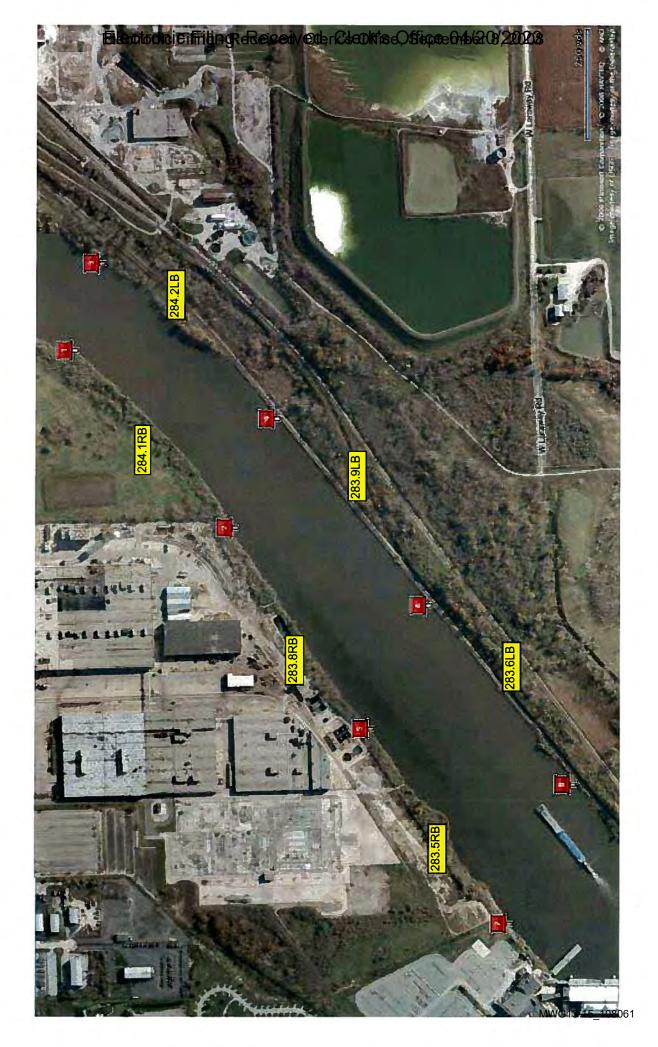
Aerial photographs showing the sites evaluated during the July 2008 QHEI study



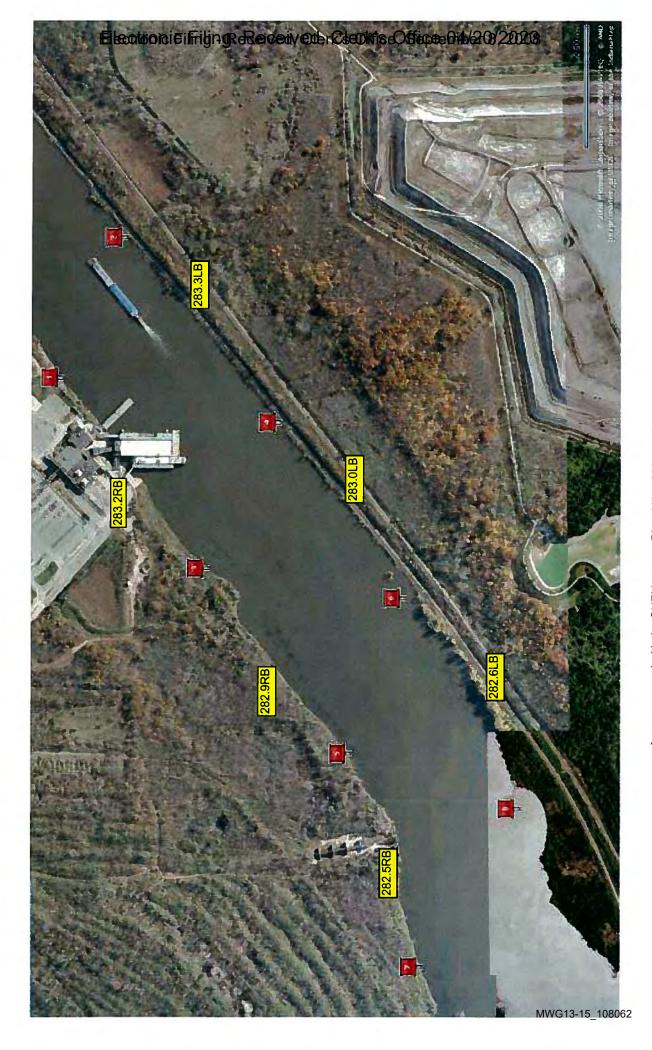
Areas within the Brandon Road Lock and Dam tailwater that were assessed with the QHEI during July 2008.



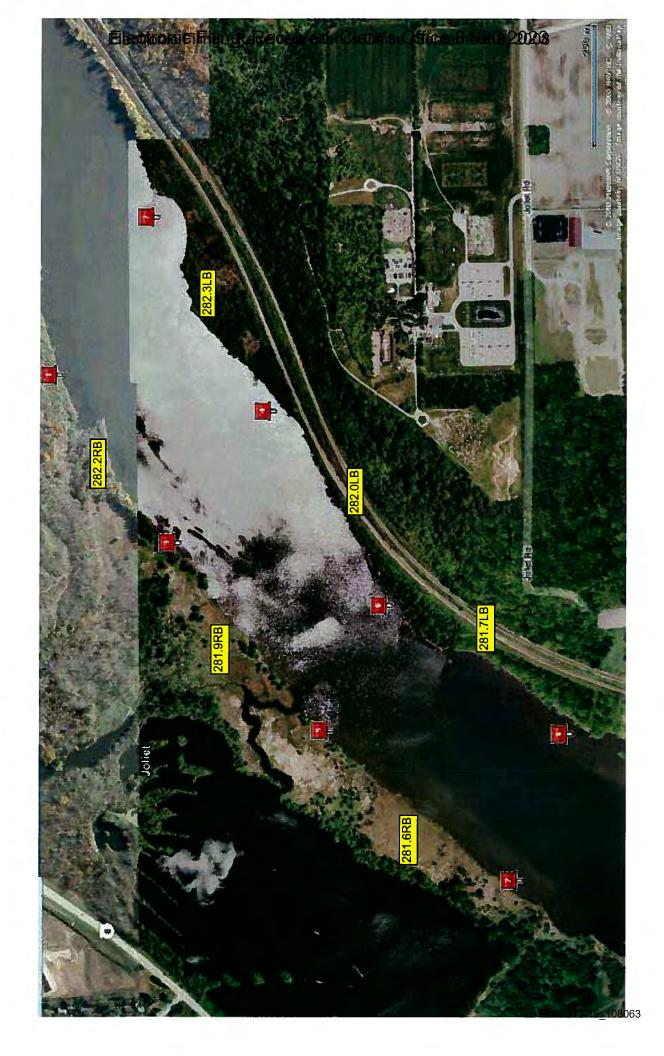
Areas assessed with the QHEI between River Miles 284.4 and 285.1 during July 2008.



Areas assessed with the QHEI between River Miles 283.5 and 284.2 during July 2008.



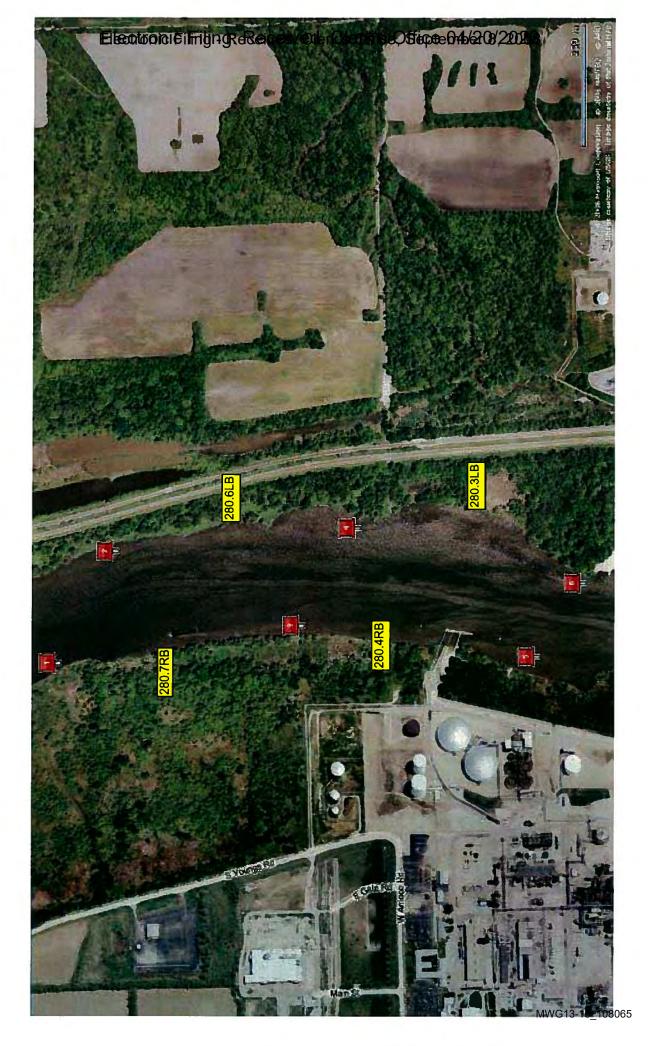
Areas assessed with the QHEI between River Miles 282.5 and 283.3 during July 2008.



Areas assessed with the QHEI between River Miles 281.6 and 282.3 during July 2008.



Areas assessed with the QHEI between River Miles 280.9 and 281.3 during July 2008.

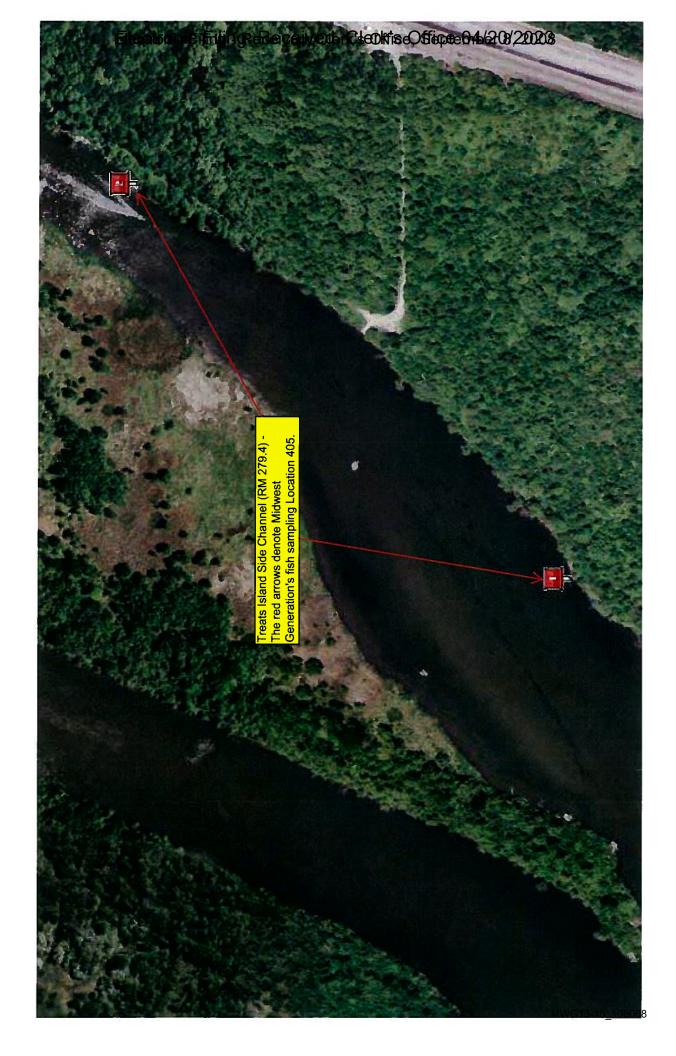


Areas assessed with the QHEI between River Miles 280.3 and 280.7 during July 2008.

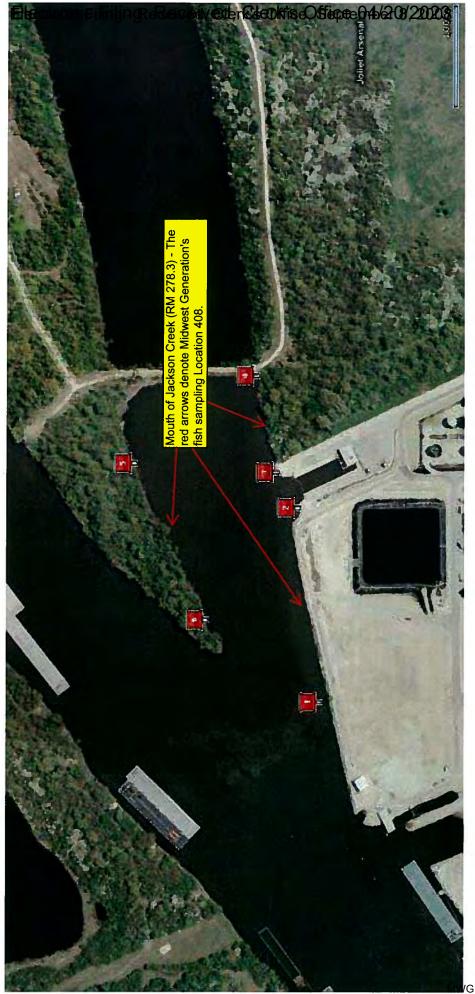
Areas assessed with the QHEI between River Miles 279.7 and 280.0 during July 2008.



Areas assessed with the QHEI between River Miles 278.9 and 279.5 during July 2008.

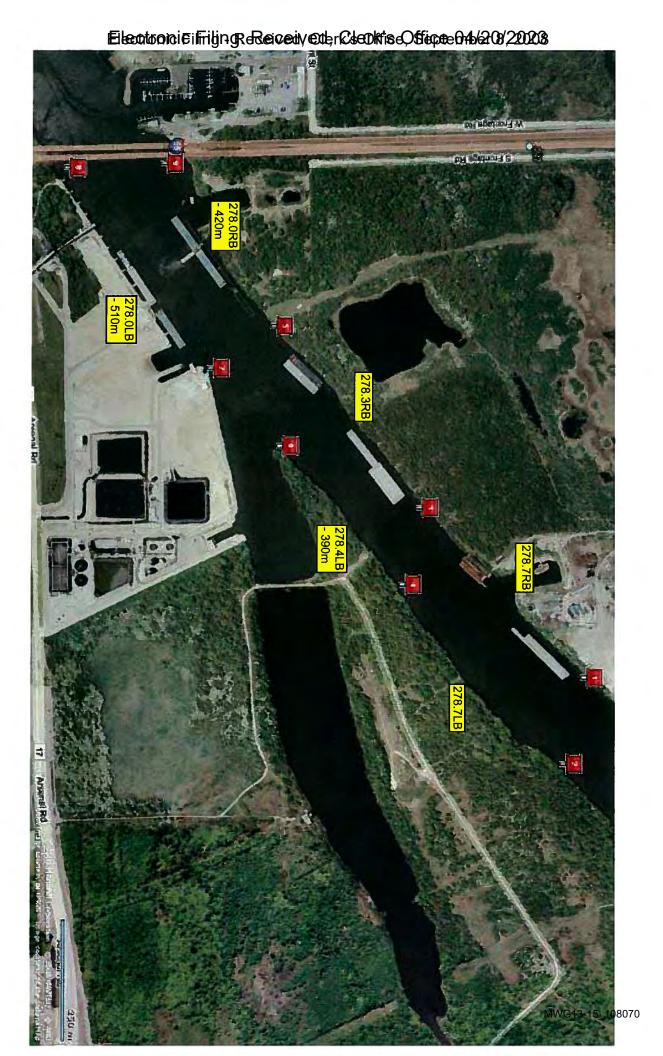


Area within the Treats Island Side Channel that was assessed with the QHEI during July 2008.



Areas within the Mouth of Jackson Creek that were assessed with the QHEI during July 2008.

/G13-15_108069



Electroni Filmign grane iveter Caentris en Sierte 04/20/2023

ATTACHMENT 2D

Summary of QHEI metrics and scores for the July 2008 QHEI study

Electroni Filingre Received; rCsentis entire 04/201220203

	(lified																														
	SHS 3	Score MBI Modifi	67.5	99	43.6	49	35	46	38.5	50	37	50.5	36	31.6	42	34.5	42.5	40.5	45.6	34.5	37.5	30.5	39	43.5	31	34.5	31	32	33	40	34.6	37
	QHEI	Ohio EPA	67.5	56	47.5	55	40	51	43.5	55	43	56.5	40	36.5	46	40.5	46.5	45.5	49.5	40.5	43.5	35,5	45	48.5	36	37.5	37	38	39	45	38.5	43
	Gradi	ent	ဖ	9	9	9	9	9	9	9	9	စ	ဖ	ဖ	9	9	စ	9	စ	9	စ	ဖ	9	9	9	9	9	9	စ	9	9	9
Summary of QHEI Metrics and Scores for Upper Dresden Pool, July 2008.	uality	Riffle/Run	5.5	0	٥	0	0	0	0	0	0	o	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	te & Riffle/Run Q	Ohio EPA MBI Modified Riff	12	10	9	8	9	8	9	6	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	Pool/Glid	Ohio EPA	12	10	8	10	8	10	80	+	8	8	80	8	8	8	80	ဆ	æ	œ	8	œ	8	8	8	8	æ	8	80	8	8	α
	Ban Erosio Ripari Zon	n & ian	5.5	5.5	3.5	4	3.5	4	4	5	5.5	8.5	4.5	7.5	9	6.5	4.5	6.5	4.5	9.5	6	6.5	6	6.5	9	6.5	8	9	6	5	2.5	6
	Channel	MBI Modified	13	11	4	4	3	4	3	4	2	4	3	2	4	2	4	3	3	2	2	2	2	2	2	2	3	2	3	3.5	3	2
	Channel	Ohio EPA	13	11	9	80	9	7	9	7	9	80	2	5	9	9	9	9	5	9	9	2	9	5	2	9	7	9	7	6.5	5	9
	Instrea Cove	am er	13	12	7	6	8	7	6	80	1	6	6	6	9	12	2	15	9	7	14	5	12	55	=	=	8	12	6	=	4	
	Substr	i	12.5	11.5	11	18	8.5	42	10.5	18	6.5	17	7.5	0	14	2	17	4	16	0	0.5	0	4	8	0	0	0	0	0	8.5	13	9
	River Mile	& Bank	285.5 Brandon Road Lock & Dam Tailwater ^(a)	285.4 Brandon Road Lock & Dam Tailwater ^(b)	285.1 LB ^(c)	285.0 RB	284.8 LB	284.7 RB	284.5 LB	284.4 RB	284.2 LB	284.1 RB	283.9 LB	283.8 RB	283.6 LB	283.5 RB	283.3 LB	283.2 RB	283.0 LB	282.9 RB	282.6 LB	282.5 RB	282.3 LB	282.2 RB	282.0 LB	281.9 RB	281.7 LB	281.6 RB	281.3 LB	281.3 RB	281.0 RB	280.9 LB

	QHEI Score MBI Modiffed	39.5	37.5	28.5	41.5	45	52.5	54	54.5	54	46	55.5	50	36.5	47.5	42.5	50	46	43.75	35.5	40.5	42.0 28.5 67.5
	QHEI Score Ohio EPA	45.5	43.5	34.5	47.5	51	58.5	09	60.5	90	55	61.5	56	41.5	53.5	47.5	56	52	52.75	39.5	45.5	47.4 34.5 67.5
	Gradient	9	9	9	9	9	9	မ	9	9	و	9	9	9	9	9	9	9	9	9	9	6.0
08 (cont.)	uality Riffle/Run	0	0	0	0	0	0	0	0	0	0	0	0	0	o	o	0	0	0	o	0	0,1 5,5
en Pool, July 200	Pool/Glide & Riffle/Run Quality Surrent Pool/Current DEPA MBI Modifled Riffl	9	9	9	9	9	7	89	7	9	9	7	9	9	9	9	9	9	9	9	9	6.4 6 12
for Upper Dresd	Pool/Glid Pool/Current Ohio EPA	8	8	80	8	æ	0	10	6	8	- εο	6	8	ω	80	8	æ	8	8	8	8	8.4 12
and Scores	Bank Erosion & Riparian Zone	8	9.5	6.5	9.5	8.5	9.5	8	9.5	10	8.5	9.5	10	6.5	10	6.5	10	10	8.25	ဇ	6.5	7.0 2.5 10
Summary of QHEI Metrics and Scores for Upper Dresden Pool, July 2008 (cont.)	Channel Morphology MBi Modified	3	2	2	2	3	4	4	4	4	е	4	3	3	3	3	3	3	3	3	3	3.3 2 13
Summan	Channel Morphology Ohio EPA	7	9	9	9	7	8	8	æ	æ	10	æ	7	9	7	9	7	7	10	2	မ	6.7 5 13
	Instream Cover	8	8	∞	12	Ξ	7	6	6	8	4	F	9	2	9	8	=	/	10	8	F	9.6 4 5
	Substrate	8.5	9	0	9	10.5	6	19	19	20	8.5	18	15	9	12.5	13	4	14	10.5	9.5	8	9.6 0 20
	River Mile & Bank	280.7 RB	280.6 LB	280.4 RB	280.3 LB	280.0 RB	279.8 LB	279.7 RB	279.5 LB	279.4 RB	279.4 Treats Island Side Channel ^(d)	279.1 LB	279.1 RB	278.9 RB (350m)	278.7 LB	278.7 RB	278.4 LB (390m)	278.3 RB	278.3 Mouth of Jackson Creek ^(e)	278.0 LB (510m)	278.0 RB (420m)	Mean Score Minimum Score Maximum Score

⁽a) MBI's fish sampling site RM "285.8".
(b) Midwest Generation's fish sampling Location 402.
(c) All zones 500m in length unless otherwise noted. River mile designations represent the mid-point of each zone. Bank desigations based on facing downstream. LB=left descending bank. RB=right descending bank.
(d) Midwest Generation's fish sampling Location 405.
(e) Midwest Generation's fish sampling Location 408.

ATTACHMENT 2E

QHEI field data sheets (both Ohio EPA and MBI-modified) from the July 2008 QHEI study

CRETA		tat Evaluation Index sment Field Sheet	QHEI Score: (4구,5
Stream & Location: Des 1/2	aines Aiver - Brad	on Tallwater - MBI 1	RM: <u>286.5</u> Date: <u>07-1 1 ol</u> 08
River Code:	Score	rs Full Name & Affiliation: <a>C	The Vondriella CA Englisoring Office verified -
11 SUBSTRATE Check ONLY Two	substrate TYPE BOXES:	(NAD 83 - decimal ")	
BEST TYPES POOL RIFF	te every type present OTHER TYPES PO	OL RIFELE ORIGIN	IE (Or 2 & average) QUALITY
☐ ☐ BLDR/SLABS [10] //		LIMESTONE [1]	HEAVY [-2] MODERATE [-1] Substrate
☐ GRAVEL [7]	MUCK 2	☐ ☐ WETLANDS [0] ☐ HARDRAN [0]	SILT NORMALIOI
	ARTIFICIAL [0] (Score natural subst	SANDSTONE [0] rates: ignore RIP/RAP [0]	DDED MODERATE [4] Maximum
NUMBER OF BEST TYPES:		int-sources)	NORMAL [0] Meximum 20 NONE [1]
Comments	(14)	COAL FINES [2]	
2] INSTREAM COVER Indicate property quality; 2	-Moderate amounts, but not of	ry small amounts or if more common	highest
quality; 3-Highest quality in moderate diameter log that is stable, well develo	or greater amounts (e.g., very l oped rootwad in deep / fast wate	arge boulders in deep or fast water, k er, or deep, well-defined, functional po	argo Check UNE (Ur 2 & average)
UNDERCUT BANKS [1] OVERHANGING VEGETATION	TOTAL CONTROL OF THE PROPERTY	AQUATIC MACROPHYTE	
2 SHALLOWS (IN SLOW WATER ROOTMATS [1]	()[1] BOULDERS[1]	LOGS OR WOODY DEBR	
Comments			A Cover Maximum 13
3] CHANNEL MORPHOLOGY SINUOSITY DEVELOPME		- ·	
☐ HIGH [4] ☐ EXCELLENT	[7] LZ NONE[6]	(HIGH IS)	
☐ MODERATE [3] ☐ GOOD [5] ☐ LOW [2] ☐ FAIR [3]	RECOVERED [4]	MODERATE[2]	
Comments Poor [1]	RECENTION NO RE	COVERY[1]	Channel Maximum. 13
4] BANK EROSION AND RIPA	(G)	O	20
River right looking downstream RI	PARIAN WIDTH	FLOOD PLAIN QUALITY	- I R
P NONE / LETTLE [3] □ □ MG	DERATE 10-50m [3] 22	FOREST(SWAMP [3] SHRUB:OR:OLD/FIELD:[2]	CONSERVATION TILLAGE [1]
□ □ MODERATIE [2] □ ☑ NA □ □ HEAVY / SEVERE [1] ☑ □ VE	RROW 5-10m (2)	PECIDENTIAL DADVANEWEIELD IA	Indicate predominant land use(s)
PUNO	NE [0]	OPEN PASTURE, ROWGROP [0]	past 100m riparian. Riparian
_ O sal	racent to KA truck	777 1 + 13 - 20/2	1,25 Maximum 10
5] POOL/GLIDE AND RIFFLE MAXIMUM DEPTH C	HANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
2 ≥ 1m [6] 2 PGOLV	k ONE (<i>Or 2 & average</i>) VIDTHI≫RIFELE WIDTH [2] □	Check ALL that apply TORRENTIAL [-1] SLOW [1]	Primary Contact Secondary Contact
□ 0.7≪1m [4] □ POOLV □ 0.4≪07m [2] □ POOLV	VIDTH = RIFFLE WIDTH (1) UIDTH < RIFFLE WIDTH (0)	VERY FAST [4] TINTERSTITIA	(circle one and comment on back)
☐ 0.2<0.4m [1] ☐ < 0.2m [0]		MODERATE [1] EDDIES [1] Indicate for reach - pools and riffles	Pool/
Comments			Maximum 12
Indicate for functional riff of riffle-obligate species:	les; Best areas must be Check ONE	large enough to support a p (Or 2 & average).	oopulation
RIEELE DEPTH RU		RUN SUBSTRATE RIFFL	
BEST AREAS 5-10cm [1] MAXI	MUM < 50cm [1] MOD: STA	BLE (e.g., Large Gravel) [1]	□ NONE [2] □ LOW [1] ■ MODERATE IN Riffle /
[metric=0] Comments	CD)	E (e.g., Fine Gravel, Sand) [0]	MODERATE [0] Riffle / Run 5,5
	VERY LOW-LOW [2-4]	%POOL:(20)%	GLIDE: 50 Gradient
	MODERATE [6-10] HIGH - VERY HIGH [10-6]		RIFFLE: 15 Maximum 6
EPA 4520 Pring sel	KP 7/16/08		06/11/08

	cililigity adelective con		TRUCK OF ZALAND
A STATE OF THE STA	Qualitative Habitat and Use Assessm		QHEI Score: 56
Stream & Location: Pes Pl	lalves River - Brandon	Tollwater - E A	RM: 285 .4 Date: ©7// ©/ 08
River Code:	Scorers F	uil Name & Affiliation:_	Too Vonehader - CA Englosering
1] SUBSTRATE Check ONLY Two sa	Ibstrate TYPE BOXES:	Lat./Long.: NAD 83 - decimal " "	
estimate % or note of BEST TYPES POOK RIFFLE	OTUED TVDES	Check O	NE (Or 2 & average) QUALITY
BLDR/SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] ED BEDROCK [5]	HARDPAN.[4] HARDP	LIMES ONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0]	SILT MODERATE [-1] Substrate MODERATE [-1] Substrate MODERATE [-1] Substrate MODERATE [-1] MODERATE [-1] Maximum
NUMBER OF BEST TYPES: Comments	or more 21 sludge from point-so or less [0]	Urces) LACUSTRINE [0]	NONE [1]
2] INSTREAM COVER Indicate pre quality; 3-Highest quality in moderate or diameter log that is stable, well develope UNDERCUT-BANKS [1]: / OVERHANGING VEGETATION [1]: 2. SHALLOWS ((IN SLOW WATER)) [ROOTMATS [1]]: Comments	oderate amounts, but not of highe greater amounts (e.g., very large I d rootwad in deep / fast water, or POOLS ≥ 70cm [2] ROOTWADS [1]	nail amounts or if more common st quality or in small amounts of houlders in deep or fast water	of highest large Check ONE (<i>Or</i> 2 & average) cools. ☐ EXTENSIVE ≥75% [11] cools
3] CHANNEL MORPHOLOGY Ch SINUOSITY DEVELOPMEN HIGH [4]	T CHANNELIZATION	STABILITY Z HIGH(3): MODERATE(2) LOW(4)	Channel Maximum 20
EROSION	NRIAN WIDTH	FLOOD PLAIN QUALIT ST/SWAMP [3] JB:OR OLD FIELD [2]	
Check ONE (ONLY!) Check C	RUN QUALITY ANNEL WIDTH DNE (Or 2 & average) TH > RIFFLE WIDTH [2]	CURRENT VELOCITY Check ALL that apply RENTIAL [-1] SLOW [f] Y FAST [1] INTERSUIT T [1] EDDIES [1] dicate for reach - pools and riffe	NT [2]

Check ONE (ONLY!)	Check ONE (Or 2 & average)	Check ALL that ap	ply Pi	rimary Contact	
Z ≥ 1m [6] □ 0-7-<1m [4]	POOL WIDTH > RIFFLE WIDTH POOL WIDTH = RIFFLE WIDTH			ondary Contact	
□ 0.4<0.7m [2]	POOL WIDTH < RIFFLE WIDTH	The state of the s	RMITTENT [-2]	one and comment on back)	Į;
□ 0.2≪0.4m [1] □ < 0.2m [0]		ØMODERATE [1] Ø EDE	(IES [1]	Pool/	
Comments		Indicate for reach - pools	and nmes.	Current Maximum	0]
Indicate Fay from	dianal viffiant Dant annua mar	-		12	
of riffle-obligate	ctional riffles; Best areas mu e species: Chec	st be large enough to sup « ONE (Or 2 & average).	port a population	NO RIFFLE [metri	ic=0]
RIFFLE DEPTH	RUN DERTH RI	FLE / RUN SUBSTRATE	RIFFLE / RUN EM	BEDDEDNESS	
BEST AREAS > 10cm	2] ☐ MAXIMUM > 50cm [2] ☐ ST/	BLE (e.g., Cobble, Boulder) [2]			
□ BEST AREAS 5-10cm □ BEST AREAS < 5cm	II LIMAXINIONISSOCIIELIE LIME	D. STABLE (e.g., Large Gravel) STABLE (e.g., Fine Gravel, Sand)	1] □ LOW [1] [0] □ MODER	SECRETARY PROPERTY AND ADDRESS OF THE PARTY AN	
[metric=	01		EXTENS	NETH KUN K	8
Comments			Diffe the state of	Maximum 8	manual di
6] GRADIENT (Ło.	/_ft/ml) □ VERY LOW LOW [2:4	1 %POOL: (2	7) %GLIDE:(80	Gradient (
DRAINAGE ARE			=	Maximum L	
(71.5	(63-ml²)	6] %RUN: (_)%RIFFLE:(10	
EPA 4520	•		Droged KC	7/16/08 06/11/08	8

Official	Qualitative Habita and Use Assessn	t Evaluation Index nent Field Sheet	QHEI Score: (४१५)
Stream & Location: Des	Places R. 285.1 LB	R	RM: 285./ Date: 67/10/08
		Fuli Name & Affiliation:	Toe Vortigles EA Englacering
River Code:	STORET #:	Lat./ Long.: 41. 49 5.	5 188.1153 Office verified location
1] SUBSTRATE Check ONLY Tweestimate % or no	ote every type present	Check ON	E (Or 2 & average)
BEST TYPES POOL RIF	FLE OTHER TYPES POOL	PIEELE ORIGIN	QUALITY 0.5
BEDR/SLABS[10]		LIMESTONE (1)	☐ HEAVY [-2] MODERATE [-1] Substra
☑☐ COBBLE[8]	□ □ MUCK[2]	WETLANDS [0]	SILI NORMAL [0]
☐ GRAVEL [7]	D SILT [2]	☐ HARDPAN [0] ☐ SANDSTONE [0].	FREE (1)
□ □ BEDROCK ISI	(Score natural substrate 2 sludge from point-s	s: ignore RIP/RAP (0)	EDDEON MODERATE [-1] Maximu
	☑ 4 of more [2] studge from points ☐ 3 of less [0]	Sources) LACUSTRINE [0]	NORMAL [0] 20 20 NONE [1]
Comments	(1)	□ COAL FINES [-2]	-0.5
2] INSTREAM COVER Indicate	presence 0 to 3: 0-Absent; 1-Very s	mall amounts or if more common o	of marginal AMOUNT
quality: 3-Highest quality in moderate	2-Moderate amounts, but not of high or greater amounts (e.g., very large	lest quality or in small amounts of	highest Check ONE (Or 2 & average)
diameter log that is stable, well devel	loped rootwad in deep / fast water, o POOLS>70cm [2]	r deep, well-defined, functional po ——— OXBOWS BACKWATERS	
OVERHANGING VEGETATION	N[1] ROOTWADS[1] .	/_AQUATIC MACROPHYTE	S[i]
SHALLOWS (IN SLOW WATE ROOTMATS [1]	R)[1] Z BOULDERS[1]	LOGS OR WOODY DEBR	Water Control of the
Comments	one-modification in Assure		(4) (3) Cover Amaximum 7
3] CHANNEL MORPHOLOGY		- •	
SINUOSITY DEVELORM		CONTRACTOR OF THE PROPERTY OF	
■ MODERATE [3] □ GOOD [5]	RECOVERED[4]	HIGH[3] MODERATE [2]	
□ LOW[2] □ FAIR[3] ☑ NONE[4] □ PGOR[4]	RECOVERING [3] RECENT OR NO RECO	LOW [1]	Channel
Comments			Maximum 6
41.041/6500000141/0500	ADIAN TOUR ST		20
4] BANK EROSION AND RIPA	ARIAN ZONE CHECK ONE IN EAC IPARIAN WIDTH	h category for EACH BANK (Or 2) FLOOD PLAIN QUALITY	per bank & average)
L B EROSION D DW	IDE≥50m[4]	REST, SWAMP (3)	L CONSERVATION TILLAGE (1)
	ODERATE 10-50m [3] 🔲 🗔 SHF ARROW 5-10m [2]	RUB OR OLD FIELD [2]	☑ ☐ URBAN OR INDUSTRIAL [0] ☐ ☐ MINING / CONSTRUCTION [0]
☐ ☐ HEAVY/SEVERE [1] ☐ VE	ERY NARROW < 5m [1] ☐ ☐ FEN	GED PASTURE [1]	Indicate predominant land use(s)
Comments O	ONE [0]	N PASTURE, ROWGROP (0)	past 100m riparlan. Riparian
Comments 3 (o.5)		i	Maximum 3/3
5] POOL / GLIDE AND RIFFLI			
	CHANNEL WIDTH ck ONE (Or 2 & average)	CHRENT VELOCITY Check ALL that apply	Recreation Potential Primary Contact
1m [6] □ POOL	WIDTH ≳RIFFLE WIDTH [2] □ TC	RRENTIAL [-1] Z SLOW [1]	Secondary Contact
	WIDTH≡RIFFLEWIDTH[1] □ VE WIDTH≪RIFFLEWIDTH[0] □ FA	RY FAST [1]. □ INTERSTITIAI ST [1]. □ INTERMITTEN	(circle one and comment on back)
□ 0.2≼0.4m [1]		DERATE [1] 🗆 EDDIES [1]	Pool/
□<0.2m [0] Comments		ndicate for reach - pools and riffles	Current 8 Maximum 12
Indicate for functional rif	fles; Best areas must be la	ge enough to support a p	
of riffle-obligate species: RIFFLE DEPTH RI		2 & average). UN SURSTRATE DIEELS	NO RIFFLE [metric=0] [KUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2] ☐ MAX	IMUM > 50cm [2] STABLE (e.g.	Cobble, Boulder) (21	□ NONE [2]
☐ BEST AREAS 5-10cm [1] ☐ MAX ☐ BEST AREAS < 5cm	IMUM < 50cm [1] ☐ MOD. STABL	E (e.g., Large Gravel) [1] .g., Fine Gravel, Sand) [0]	☐ LOW [1] ☐ MODERATE [0] Riffle /
[metric=0]			EXTENSIVE [4] Run

6] GRADIENT (< o, | ft/ml) | VERY LOW LOW [2-4]

EPA 4520

DRAINAGE AREA | MODERATE [6-10] | HIGH: VERY HIGH [10-6]

Proped KC 7/16/08 06/11/08

%GLIDE:

)%RIFFLE:

%POOL:(100

%RUN:

Gradient

Maximum

<u>Cicipa</u>		tat Evaluation Index sment Field Sheet	QHEI Scoi	re: [55]
Stream & Location: Des P?	ower diver - 285,0 R	В	RM:2850 Date:	07/1//08
river stage ~6" higher	than 1/10 Score	rs Full Name & Affiliation:	Joe Vondrustea EA	Casturetha
River Code:	STORET #:		1 188.1174	Office verified location
1] SUBSTRATE Check ONLYTW estimate % or no	ote every type present	Check C	NE (Or 2 & average)	
BEST TYPES	FLE OTHER TYPES	OL RIFFLE ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIF/RAP [0]	QUA HEAVY MODER MODER MODER EXTEN MODER MODER MODER MODER MONE	(-2)
	2		(-1))
2] INSTREAM COVER Indicate quality; 3-Highest quality in moderate claimeter log that is stable, well developments [4] 2 OVERHANGING VEGETATION SHALLOWS (IN SLOW WATE ROOTMATS [4]) Comments	2-Moderate amounts, but not of i or greater amounts (e.g., very li oped rootwad in deep / fast wate POOLS > 70cm [; V-[1] ROOTWADS [1]	nighest quality or in small amounts arge boulders in deep or fast water, r, or deep, well-defined, functional OXBOWS, BACKWATE AQUATIC MACROPHY: LOGS OR WOODY DEB	of highest large Check ONE (pools. ☐ EXTENSIV RS[1] ☐ MODERAT ES [1] ☐ SPARSE 5 RIS [1] ☐ NEARLY A	E 25-75% [7]
		b	3	20
SINUOSITY DEVELOPM HIGH [4]	ITI NONE (6) RECOVERED (4) RECOVERING (3) RECENTION NO RE	HIGH [3] MODERATE [2] LOW [1]		Channel Maximum 20
	IPARIAN WIDTH	each category for EACH BANK (Or FLOOD PLAIN QUALIT		· .
☐ Z NONE/LITTLE [3] ☐ ☐ M	ODERATE 10-50m [3] □ □ □ NRROW 5-10m [2] □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	OREST, SWAMP [3] SHRUB, OR OLD, FIELD [2] RESIDENTIALL PARK, NEW FIELD ENCED: PASTURE [1] DPEN PASTURE, ROWGROP [0]	GONSERVATI	IDUSTRIAL [0] STRUCTION [0]
-3	1	adjacent to general	in shalion p	10
Check ONE (ONLY!) Che	CHANNEL WIDTH ck ONE (Or 2 & average) WIDTH > RIFFLE WIDTH [2] WIDTH = RIFFLE WIDTH [1] WIDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1]	Primary Secondal (circle one and o	n Potential Contact ry Contact comment on back Pool / Current Maximum 10
Indicate for functional rif	fles; Best areas must be	large enough to support a	population 🎿	12
of riffle-obligate species: RIFFLE DEPTH	Check ONE JN-DEPTH RIFELE	(Or 2 & average). I RUN SUBSTRATE RIFF	· ·	RIFFLE [metric=0] EDNESS
☐ BEST AREAS > 10cm [2] ☐ MAX	IMUM > 50cm [2] ☐ STABLE (IMUM < 50cm [1] ☐ MOD, STA	e.g. Cobble Boulder (2)	☐ NONE[2] ☐ LOW[1] ☐ MÖDERATE[0] ☐ EXTENSIVE[-1	Riffie /
DRAINAGE AREA	VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]		%GLIDE: /ov	Gradient 6

EPA 4520

	Ÿ.		Ç.		
			Evaluation Inde		core: (40)
Stream & Location:	Des Plaines	284,BLB		RM: 284 80	ate: 07/ <u>/ 0</u> / 08
		Scorers	Full Name & Affiliation	: Toe Vandiusla	- EA Engineeric)
River Code:	STORE	<i>T #:</i>	Lat./Long.: 41 . 49	<u> 28 188.120</u>	<u>o</u> Office verified ☐
1] SUBSTRATE Check C estimate	ONLY Two substrate TYF e % or note every type p	PE BOXES; resent	Check	ONE (Or 2 & average)
BEST TYPES BEDR /SLABS [10] BOULDER [9] GOBBLE [8] GRAVEL [7] GRAVEL [7]	OOL RIFFLE OTHE	RTYPES RDFAN [4] TRITUS [3] CK [2] T [2] TIFICIAL [0] core natural substrates Tistudge from point-s	RIFFLE ORIGIN LIMESTONE [1] TILLES [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0]	SILT DEON, SE	QUALITY AVY. [-2] DEFRATE [-1] Substrate RMAL [0] EE [1] TENSIVE [-2] DEFRATE [-1] Maximum 20 NE [1]
2] INSTREAM COVER	Indicate presence 0 to 3	3: 0-Absent; 1-Very s	mall amounts or if more comm	on of marginal	AMOUNT
diameter log that is stable, v UNDERCUT BANKS OVERHANGING VEG SHALLOWS (IN SLO	moderate or greater and well developed rootwad in [1]F	ounts (e.g., very large	est quality or in small amount boulders in deep or fast wate r deep, well-defined, functiona OXBOWS, BACKWAT AQUATIC MACROPH LOGS OR WOODY DE	er, large Check Cal pools. EXTE ERS [1] MODE VIES [1] SPAR	NE (<i>Or 2 & average</i>) NSIVE >75% [41] FRATE 25:75% [7] SE'5≪25% [3] LY ABSENT <5% [1]
ROOTMATS [1] Comments				3	Cover 8 Maximum 20
3] CHANNEL MORPHO					
☐ HIGH [4] ☐ EX ☐ MODERATE [3] ☐ GO	CELLENT [7] □ NO DOD [5] □ REG IR [3] ♣ REG	IANNELIZATION NE [6] DOVERED [4] DOVERING [3] SENTIOR NO RECO	HIGH [3] MODERATE [2 Z LOW [1]		Channel Maximum 20
4] BANK EROSION AI River right looking downstream	ND RIPARIAN ZON	E Check ONE in each	h category for EACH BANK (0		ge)
EROSION NONE/EITHE [3] MODERATE [2] HEAVY/SEVERE [1] Comments		□ □ For	FLOOD PLAIN QUAL REST, SWAMP [3] RUB OR OLD FIELD [2]	CONSER CO	VATION TILLAGE [1] DRINDUSTRIAL [0] GONSTRUCTION [0] inant land use(s) an. Riparian Maximum 10
☐ 0.7-<1m[4] 】	ORIFFLE / RUN QU CHANNEL W Check ONE (Or 2 & POOLWIDTH > RIFE POOLWIDTH = RIFE POOLWIDTH < RIFE	VIDTH Raverage) EWIDTH [2] DTG EWIDTH [4] DVE EWIDTH [6] DE	CURRENT VELOCIT Check ALL that apply PRENTIAL [-1] SLOW:[1] RY FAST [1] INTERST ST [1] INTERMIT DERATE [1] DEDDIES [Indicate for reach - pools and re	Print Seco (circle on 1)	eation Potential mary Contact and Contact and Comment on back) Pool / Current Maximum 12
Indicate for function of riffle-obligate seriffle-obligate seriffle DEPTH BEST AREAS > 10cm [2] BEST AREAS > 5cm [metric=0] Comments	pecies: RUN DEPTH	Check ONE (Or RIFFLE / R [2] STABLE (e.g [1] MOD STABLE	rge enough to support 2 & average). LUN SUBSTRATE RIF Cobble (Boulder) [2] E (e.g., Large Gravel) [1] e.g., Fine Gravel, Sand) [0]	FLE / RUN EMBI	NO RIFFLE [metric=0] EDDEDNESS

EPA 4520

%GLIDE:

%RIFFLE:

%POOL:(100

%RUN:

Gradient Maximum 10

QHEI Score: 51



Stream & Location:	Dos Pla	ives Kijer-	284,7R	B	RM: 2	847 Date: 6	2 <u>71 </u>
Di		OTO DET #	_Scorers F	full Name & Affil Lat./ Long.: կ)		Unduska C	V Engreering Office verified
River Code:		STORET #:	 (/	NAD 83 - decimal 9	<u>.4932/8</u>	<u>8.1219</u>	location -
	ite % or note e	very type present			Check ONE (Or	2 & average)	
BEST TYPES	OOL RIFFLE	OTHER TY	PUUL K	IFFLE ORIG		QUAL	
☐ ☐ BLDR/SLABS [10] ☐ ☐ BOULDER [9]	<u></u>	☐ ☐ HARDPAN		LIMESTO		☐HEAVY[_ □MODERA	
ZZ COBBLE[8]	ブ ニ	□ □ MÜCK[2]		□WETLAN	DS [0] SIL	' DINORMAL	[0]
☐ ☐ GRAVEL[7] ☐ ☐ SAND [6]		☐ ☐ SILT [2] ☐ ☐ ARTIFICIA	L 101 — -	□ HARDPAI □ SANDSTO	ONE IOI	☐ EREE [1] EXTENSI	
□□ BEDROCK [5]		(Score nat	ural substrates	ignore DRIP/RAP	IOI LEDDE	MODERA ☐ MODERA	TELII Mavimum
	YPES:	or more [2] ^{sludge} or less [0]	trom point-so	urces)		`&	[0] 20
Comments 16		2		□ COAL FIN			
		* -					
2] INSTREAM COVER	ottality: 2-Mc	oderate amounts, b	ut not of highe	et auglity or in emall	amounta of blaba	31 ZINO.	
quality; 3-Highest quality in diameter log that is stable,	i moderate or d	Treater amounts le	a very lame	houldere in deen or f	activator large	Check ONE (O	THE TANK OF THE PARTY CONTRACTOR AND THE TANK
UNDERCUT BANKS	[1]	// POOLS	>70cm [2]	OXBOWS, BAC	CKWATERS [1]	☐ MODERATE	25-75% [7]
OVERHANGING VE	The state of the s	Professional Profession Company of the Party		AQUATIC MAC	ROPHYTES [1] DDY DEBRIS [1]	SPARSE 5- NEARLY AB	
ROOTMATS [/1]						la l	Cover
Comments					5	2 1	Maximum 7
ot official robots	01 0 0 1 0 b						20
3] CHANNEL MORPHO SINUOSITY DEVI	OLOGY Che ELOPMENT		itegory (Or 2 & ELIZATION	average) STABIL	ITV		
□ HIGH [4] □ E	(CELLENT [7]		-LILATION	HIGH IS			
	DOD [5] = -	RECOVER	PERSONAL PROPERTY AND A SECOND PROPERTY OF THE PARTY OF T	☐ MODER	PORTE BANKS AND THE		
Company of the Compan	UR [3] DOR [1]	RECOVERI RECENT O		ERYIII			Channel (
Comments	1	Company Control of the State Company - The State	a	3		/	Maximum 4
AL PANIZEDGEION A	NO DIDADI	ANZONE	<u></u> .			. ,	20
4] BANK EROSION A River right looking downstrear	NU KIPAKI. P. RIPA	AN ZUNE Chec RIAN WIDTH		category for EACH B		nk & average)	
L R EROSION	D DWDE:	> 50m [4]	D DEORE	ST-SWAMP (315	h P	CONSERVATIO	NTILLAGEIII
NONE / LITTLE [3] MODERATE [2]	☐ ☐ MODE	RATE 10-50m [3]. DW 5-10m [2]		IB OR OLD FIELD 12	21 U.S	URBAN OR IND	USTRIAL [0]
☐ ☐ HEAVY / SEVERE [1]	□ Z VERY	NARROW < 5m [1		DENTIAL PARK, NEV ED PASTURE [1]	Gerley Zahra Zales (200)	MINING / CONS ate predominant la	er man war day to the state of
		[0]	□ □ OPEN	I PASTURE, ROWCI	ROP [0] past		Riparian
Comments 3		1		C 6 A	200 6		faximum 4
5] POOL / GLIDE AND) RIFFLE / F	RUN QUALITY	· · · · · · · · · · · · · · · · · · ·	adjacen 1	of helper your		10
MAXIMUM DEPTH	CHA	NNEL WIDTH		CURRENT VELO	• •	Recreation	Potential
Check ONE (ONLY!)		NE (Or 2 & averag IH > RIFFLE WIDT	ner Management	Check ALL that a		Primary (
□ 0.7-<1m [4]	POOL WIDT	TH = RIFFLE WIDT	HM DVER	RENTIAL [-1] 2 SL Y FAST [1] UIN	OW MI TERSTITIAL EIL	Secondary (circle one and cor	
□ 0.4<0.7m [2] □ 0.2<0.4m [1]		TH < RIFFLE WIDT	HO] LIFAS	T[1] UNI	ERMITTENT [-2]	Tencie die and col	minent on back)
☐ < 0.2m [0]		•	Inc	DERATE [1] DED	DIES [1] s and riffles.		Pool / Current
Comments				,	-	N	faximum 10
Indicate for functi	onal riffles	: Best areas m	ust be larg	e enough to su	nnort a nonul	ation	12
of riffle-obligate s	pecies:	Che	eck ONE (<i>Or 2</i>	& average).		NO R	IFFLE [metric=0]
RIFFLE DEPTH BEST AREAS > 10cm /21	RUN L	DEPIH	RIFFLE / RU	N SUBSTRATE			<u>DNESS</u>
BEST AREAS 5-10cm [1]	□ MAXIMUI	M < 50cm [1] □ N	OD. STABLE	(e.g., Large Gravel)	mi 🗆	NONE [2] LOW [1]	
☐ BEST AREAS < 5cm [metric=0]			NSTABLE (6.0	ı., Fine Gravel, Sand	1101	MODERATE IN	Riffle /
Comments					LI)	EXTENSIVE [-1] _A	Maximum (V)
6] GRADIENT (Zo.(fl/ml) □ÑĒ	RY LOW - LOW [2		N 222: C		-(-)	8
DRAINAGE AREA	□MC	DERATE [6-10]		×		—	Gradient 6
(74,5 86	ml²) □ HIC	GH = VERY HIGH [10-6]	%RUN: (_)%RIFFL	E:() _ ^	laximum 10
EPA 4520				200	120 KC	- 7/16/0	P 06/11/08

O TO SEA		e Habitat Eva Assessment	luation Index Field Sheet	QHEI	Score:	43.5
Stream & Location:	de Plaines River	- 284.5 C	В	RM: <u>고 & 년</u> .	5 Date: <u>0</u> 7∫	<u>/ 2/</u> 08
River Code:	STORET #:_ YTwo substrate TYPE BO	Lat./ . — — — — (NAD 83 - XES-	ame & Affiliation: Long.: 41 - 48 9 decimals	Jue Vond. 19 188.1.		Office verified location
BEST TYPES BEST TYPES BEDR / SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPE Comments	or note every type presen RIFFLE OTHER TY HARDPA DETRITL MUCK [2] ARTIFIC (Score notes) SS: 24 or more [2] slud	POOL RIFFLE [N [4]] [S [3]] [AL [0]] Atural substrates; ignore ge from point-sources)	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0] LAGUSTRINE [0] SHALE [-1] COAL FINES [-2]	SILT E	QUALITY THEAVY [-2] MODERATE NORMAL [0] FREE [1] EXTENSIVE	Substrate
2] INSTREAM COVER Indique quality: 3-Highest quality in modiameter log-that is stable, well under CUT BANKS [1] OVERHANGING VEGETA SHALLOWS (IN SLOW WITHOUT BANKS) [1]	ality; 2-Moderate amounts, lerate or greater amounts (developed rootwad in deep POOE ATION [1] ROOT [1] ATER) [1] BOULT	but not of highest qual (e.g., very large boulde by fast water, or deep, very large boulde by fast water, or deep, very large by fast water, or deep, very large by fast water, or deep, very large by fast water large by fast wa	lity or in small amounts or	of highest Che large Che pools. [E] RS [1] [M] ES [1] 27 SI	AMOUN ck ONE (Or 2 & KTENSIVE >75 ODERATE 25: PARSE 5 < 25% EARLY ABSEN	average) %[11] 75% [7] [3]
Comments	2 Nel Bu	S areas		<u>(</u>	Maxi Ma	
□ MODERATE[3] □ GOOD □ LOW[2] □ FAIR[□ NONE[1] □ POOR Comments	PMENT CHANN LENT [7] NONE [6] [5] RECOVE [1] RECENT	IELIZATION RED [4] RING [3] OR NO RECOVERY [1	STABILITY HIGH (3) MODERATE (2) LOW (1)		Maxi	annel 6
☐ ☐ MODERATE[2] ☐ [☐ ☐ HEAVY/SEVERE [1] ☐ [RIPARIAN ZONE Che RIPARIAN WIDTH WIDE > 50m [4] MODERATE 10:50m [3] NARROW 5:10m [2] VERY NARROW < 5m NONE [0]	R FLOC	OD PLAIN QUALIT WAMP [3] OLD FIELD [2] AL PARK NEW SIEUD		SERVATION TI AN OR INDUST IG / CONSTRU Iominant land u	RIAL [0] CTION [0] se(s) arian
□ 0.7<1m [4]	FFLE / RUN QUALIT CHANNEL WIDTH Check ONE (Or 2 & avera OOL WIDTH > RIFFLE WID OOL WIDTH > RIFFLE WID OOL WIDTH > RIFFLE WID	L CUR ge) Ch TH [2] CTORRENT TH [1] CVERY FAS TH [0] CFAST [1] MODERAL	RENT VELOCITY eck ALL that apply [AL [-1] SLOW [1] T [1] NTERSTITI INTERMITT E [1] EDDIES [1] for reach - pools and riffle	AL [-1] ENT [-2]		ontact ontact tonback)
Indicate for functiona of riffle-obligate spec RIFFLE DEPTH BESTAREAS>10cm [2] BESTAREAS 5-10cm [1] BESTAREAS 5-5cm [metric=0] Comments	ies: C RUN DEPTH MAXIMUM>50cm [2] ☐ MAXIMUM<50cm [1] ☐	Heck ONE (Or 2 & ave RIFFLE / RUN SL STABLE (e.g., Cobbi	rage). JBSTRATE RIFF e Boulder) [2] Large Gravel) [1]	LE / RUN EN	ABEDDEDN [2] I] RATE (0) R	ffile /
6] GRADIENT (< 0.1 ft/m DRAINAGE AREA (THE PARTIES OF THE PARTIE	☐ MODERATE [6-10]			%GLIDE: %RIFFLE:	Grac Maxir	flent 6 mum 10 06/11/08
1			1-00/20		21 - 1	

ondea		abitat Evaluation Inc essment Field She		ore: [55]
Stream & Location: Des	Plalmes Kiver -	2844 RB	RM: <u>≥& Y .</u> ¥ Dat	
River Code:	STORET #:	orers Full Name & Affiliati Lat./ Long.:식 나 (NAD 83 - decima 기 기 나 나	on: <u>Toe Vondruska (</u> 899 188.1256	
DECT TYPES	note every type present	Che	eck ONE (<i>Or 2 & average</i>)	
BEST TYPES POOL R BEDR/SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] BEDROCK [5] NUMBER OF BEST TYPES Comments Small linetens bluff	HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] Score natural s As or less [0]	LIMESTONE LIMESTONE LILES [1] WETLANDS [1] HARDPAN [0] SANDSTONE USANDSTONE USANDSTONE LACUSTRINE SHALE [1] COAL FINES	SILT HEAD NOR CONTROL OF THE CONTROL	VY[-2] ERATE [-1] Substrate MAL [0] [1] [NSIVE [-2] ERATE [-1]
uualiiv: 3-Hidnest dijalijv in moder	y; 2-Moderate amounts, but no ate or greater amounts (e.g., v veloped rootwad in deep / fast ————POOES ≥700 ON [1] ROOTWADS	ot of highest quality or in small amor ery large boulders in deep or fast w water, or deep, well-defined, function im [2]OXBOWS_BACKW [1]AQUATIC MACROF	unts of highest cater, large onal pools. EXTENS ATERS [1] MODER SPARSE DEBRIS [1] NEARLY	MOUNT E (Or 2 & average) SIVE > 75% [11] ATE 25:75% [7] 5 < 25% [3] ABSENT < 5% [1] Cover
Comments from	influence of discharge	ge flow	6 2	Maximum 8
3] CHANNEL MORPHOLOG SINUOSITY DEVELOP HIGH [4] EXCELLE MODERATE [3] GOOD [5 LOW [2] FAIR [3] NONE [1] POOR [4]	MENT CHANNELIZ NT [7] NONE [6] RECOVERED [4] RECOVERING [6] RECENT OF NO	ATION STABILITY HIGH: (3) MODERATE STABILITY MODERATE EGW [1]	[2]	Channel 7 Maximum 20
☐	RIPARIAN WIDTH WIDE > 50m[4] MODERATE 10:50m[3] NARROW 5-10m[2] VERY NARROW < 5m [1] NONE [0]	E in each category for EACH BANK PLOOD PLAIN QUA BOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FIE FENCED PASTURE [1] OPEN PASTURE, ROWERDP adjacent to generally	ALITY	ATION TILLAGE [1] INDUSTRIAL [0] ONSTRUCTION [0] ont land use(s) Riparian Maximum
5] POOL / GLIDE AND RIFF MAXIMUM DEPTH Check ONE (ONLY!) Check ONE		CURRENT VELOCI Check ALL that apply TORRENTIAL [-1] SLOW VERY FAST [1] DINTERS	TY Recreat Prima Second (circle one and driffes.	tion Potential by Contact dary Contact de comment on back Pool / Current Maximum 12
of riffle-obligate specie RIFFLE DEPTH □ BESTAREAS > 10cm (2) □ M	s: Check C RUN DEPTH RIFF AXIMUM> 50cm [2] ☐ STAB AXIMUM < 50cm [1] ☐ MOD	be large enough to suppo DNE (Or 2 & average). LE / RUN SUBSTRATE R LE (e.g., Cobble, Boulder) [2] STABLE (e.g., Large Gravel) [1] ABLE (e.g., Fine Gravel, Sand) [0]	rt a population IFFLE / RUN EMBED □ NONE [2] □ LOW(61)	O RIFFLE [metric=0] DEDNESS RIFFLE [metric=0]
6] GRADIENT (LO. (ft/mi) DRAINAGE AREA (MI2)	☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]	781 002.	%GLIDE: 50 %RIFFLE:	Gradient 6 Maximum 10

e iodi		oitat Evaluation Inde ssment Field Sheet	QHEI Score: 43
Stream & Location			RM:2842 Date:07110108
		rers Full Name & Affiliation:	Joe Vondrisla EA Englacering Office verified
River Code:	STORET #:		<u> </u>
esti	mate % or note every type present	Check	ONE (Or 2 & average)
BEST TYPES BLDR/SLABS[1(BOULDER [9]) COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST	DETRITUS[3] DETRITUS[3] MUCK[2] SILT [2] DARTIFICIAL:[0] (Score natural sub	LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0]	SILT MODERATE [-1] Substrate SILT MODERATE [-1] Substrate DEEL [1] G.5 FREE [1] MODERATE [-1] MODERATE [-1] Maximum ORMAL [0] 20
Comments	(10)	COAL FINES [-2]	(4)
quality: 3-Highest qualit diameter log that is stab UNDERCUT BAN OVERHANGING SHALLOWS (IN SECONT BAN OVERHANGINS (I) Comments	VEGETATION (1] ROOTWADS (1) BOULDERS (1)	Very small amounts or if more commof highest quality or in small amounts of highest quality or in small amounts y arge boulders in deep or fast wate ater, or deep, well-defined, functiona [2]OXBOWS, BACKWATI	of highest r, large Check ONE (0r 2 & average) r pools. □ EXTENSIVE \$75% [11] RS [1] □ MODERATE 25 75% [7] TES [1] □ SPARSE 5 ≤25% [3]
SINUOSITY DE HIGH [4] MODERATE [3] LOW [2] NONE [1] Comments	PHOLOGY Check ONE in each category VELOPMENT EXCELLENT [7] NONE [6] GOOD [5] RECOVERED [4] FAIR [3] RECOVERING [3] POOR [1] RECENT OR NOT	TION STABILITY HIGH [3] MODERATE [2] LOW [1] RECOVERY [1]	Channel Maximum 20
4] BANK EROSION River right looking downst	AND RIPARIAN ZONE Check ONE		
EROSION NONE/LUTTLE [3] MODERATE [2] HEAVY/SEVERE Comments		FLOOD PLAIN QUALI FOREST, SWAMP (3) SHRUBJOR OLD, FIELD (2) RESIDENTIAL PARK, NEW FIELD FENGED PASTURE (1) OPEN PASTURE; ROWGROP (0)	CONSERVATION TILLAGE [1] CONSERVATION TILLAGE [1] CURBAN OR INDUSTRIAL [0] [1] CONSTRUCTION [0] Indicate predominant land use(s) past 100m riparian. Riparian Maximum 10 [5.5]
5] POOL / GLIDE A	ND RIFFLE / RUN QUALITY		
MAXIMUM DEPT Check ONE (ONLY!) > 1m [6] □ 0.7<1m [4] □ 0.4<0.7m [2] □ 0.2<0.4m [1] □ < 0.2m [0] Comments	Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [2] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [-1] VERY FAST [-1] INTERSTI FAST [-1] INTERMIT MODERATE [-1] EDDIES [-1] Indicate for reach - pools and rid	FENT [-2]
Indicate for fun of riffle-obligat	ctional riffles; Best areas must be	oe large enough to support LE (Or 2 & average).	a population NO RIFFLE [metric=0]
RIFFLE DEPTH BEST AREAS > 10cm BEST AREAS 5-10cm BEST AREAS < 5cm [metric	RUN DEPTH RIFFL [2] MAXIMUM > 50 cm [2] STABLE [1] MAXIMUM < 50 cm [1] MOD. S UNSTA	E / RUN SUBSTRATE RIFI	FLE / RUN EMBEDDEDNESS NONE [2] LOW [1] MODERATE [0] EXTENSIVE [-1] MAXimum 8
Marie Control of the	MODERATE [6-10] HIGH - VERY HIGH [10-6]		%GLIDE: Gradient Maximum 10
EPA 4520 >1,5	70 <u>2</u>	Destale C	7/16/08 06/11/08

Elise	MWDIOIDIII IGI 1GI			April 10 cm co		
orety.		2. 3. 1.	Evaluation Ir	. # 26	HEI Scor	e: (56.5)
Stream & Location:	Des Maines Kh	lev -	784.IRB		-, · · · ·	<u>07111</u> 08
River Code: -	- STORET		ull Name & Affilia .at./ Long.: 41 AD 83 - decimal م	tion: <u>Tse</u> (4		Office verified I location
11 SUBSTRATE Check O	VLY Two substrate TYPE % or note every type pre	BOXES;		heck ONE (Or 2		iocation 🖵
BEST TYPES PO	OLRIFFLE OTHER	TYPES POOL RI	FFLE ORIGIN	<u>1</u>	QUAI	AND MARKET THE PERSON AND THE PERSON
BEDR/SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TY		RITUS [3]	LIMESTONE ATILLS [1] WETLANDS HARDPAN; SANDSTON Gnore RIPRAP [0] Irces) LACUSTRIN	[0] SILT 0]	HEAVY MODER NORMA FREE EXTENS MODER NORMA	ATE [-1] Substrate L[0]
Comments /b)		GOAL FINE			Savousationer .
21 INSTREAM COVER	ndicate presence 0 to 3: juality; 2-Moderate amou oderate or greater amou ell developed rootwad in 1 PC TATION[1] RC	ints, but not of highes ints (e.g., very large h	st quality or in small am	nounts of highest water, large ctional pools. WATERS [1] ORHYTES [1]	Check ONE (C Check ONE (C EXTENSIVE MODERATE SPARSE 5-	UNT Dr 2 & average) >75% [11] 25-75% [7]
Comments				6	3	Cover Maximum 9
3] CHANNEL MORPHOL SINUOSITY DEVEL		ach category (<i>Or 2</i> & ANNELIZATION	average) STABILIT	~		-
☐ HIGH [4]; ☐ EXC	ELLENT[7] NON D[5] REG [3] 2 REG		HIGH [3] MODERA LOW [1]		·	Channel 8
4] BANK EROSION AND	O <i>RIPARIAN ZONE</i> RIPARIAN WIL		category for <i>EACH BA</i>		k & average)	
EROSION Display in the control of th	WIDE > 50m [4] MODERATE 10-50		ST, SWAMP (3) B OR OLD FIELD [2], ENTIAL, PARK, NEW, ED!PASTURE [1], PASTURE, ROWCRO		URBANIOR IN MINING / CONS A predominant /	TRUCTION [0]
Comments 3	4		n geventing state			Maximum 8.5
5] POOL / GLIDE AND I MAXIMUM DEPTH Check ONE (ONLY!)	RIFFLE / RUN QUA CHANNEL WI Check ONE (Or 2 & a POOL WIDTH ⇒RIFFLE POOL WIDTH ⇒RIFFLE POOL WIDTH ≼RIFFLE	LITY DTH OVERAGE WIDTH [2] TOR WIDTH [3] VER WIDTH [0] FAS I MOD	CURRENT VELOG Check ALL that app RENTIAL [-1] 2 SUOV VEAST [1] 1 INTE	CITY ly W[1] RSTITIAL [-1] RMITTENT [-2] ES [1]	Recreation Primary Secondar (circle one and co	Potential Contact y Contact
Indicate for function of riffle-obligate sp	nal riffles; Best are	as must be larg Check ONE (Or 2	e enough to supp & average).	oort a popula	tion	RIFFLE [metric=0]

☐ BEST AREAS < 5cm [metric=0]

6] GRADIENT (∠O.| ft/mi) □ VERY LOW LOW [2-4]

>1,502

DRAINAGE AREA ☐ MODERATE [6:10] ☐ HIGH: VERY HIGH [10:6]

Comments

EPA 4520

A Section of the second	·			
Q TO EA		bitat Evaluation In ssment Field Sho		ore: [40]
Stream & Location:	Des Plaines alver - 283		RM: 283.9 Dat	
River Code: -		rers Full Name & Affilia	tion: <u>Tae Vondruska</u> 4834 188.13 13	EA Engineering Office verified Nocation
1] SUBSTRATE Check C	ONLY Two substrate TYPE BOXES; e % or note every type present	(NAD 83 - decimal	heck ONE (Or 2 & average)	- Joseph -
BEST TYPES BEDR /SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5]	OOL RIFFLE OTHER TYPES HARDPAN [4] DETRITUS [3] DETRITUS	ORIGIN COOL RIFFLE CHARLES [1] CHARLES [1	QUENT CONTROL	ERATE [-1] Substrate MAL [0] Q NSIVE [-2] ERATE [-1] MAL [0] MAL [0]
2] INSTREAM COVER	Indicate presence 0 to 3: 0-Absent; 1 quality; 2-Moderate amounts, but not	-Very small amounts or if more c	common of marginal Al	2) MOUNT
quality; 3-Highest quality in a diameter log that is stable, w UNDERCUT BANKS; OVERHANGING VEG SHALLOWS;(IN SLO) ROOTMATS;(1)	moderate or greater amounts (e.g., veryell developed rootwad in deep / fast veryell deep / fast veryel	ry large boulders in deep or fast vater, or deep, well-defined, func n [2] OXBOWS, BACK 1] AQUATIC MACRO	wafer, large Check ONI ctional pools. WATERS [1] MODER DENTITES [1] SPARSE	E (<i>Or 2 & average</i>) IIVE'>75% [11] ATE 25:75% [7] -5≾25% [3] ABSENT <5% [1]
Comments	aliticant paradicional constitución		Q S	Cover Maximum 20
	LOGY Check ONE in each category	• • •	~	
☐ HIGH [4] ☐ EXI ☐ MODERATE [3] ☐ GO ☐ LOW [2] ☐ FAI ☐ NONE [1] ☐ PO	CELLENT [7]	.Ø.HIGH [3]. □ MODERAT Ø LOW [1]		Channel
Comments		(2)		Maximum 5
River right fooking downstream REROSION NONE //LITTLE [3] MODERATE [2] HEAVY//SEVERE [1]		in each category for EACH BAN FLOOD PLAIN QU FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK, NEW F FENCED PASTURE [1] OPEN PASTURE ROWCRO	JALITY GONSERVA GURBAN OR GELD [1] GONSERVA MINING / CC	TION TILLAGE [1] INDUSTRIAE [0] INSTRUCTION [0] Int land use(s)
	4 adjacent to RR frack	(1.5)		Maximum 4.5
MAXIMUM DEPTH Check ONE (ONLY!) ≥ 1m [6] □ 0.7≈1m [4]	RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [2] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0]	CURRENT VELOC Check ALL that appl Check ALL that appl Check ALL that appl Discrete All tha	y Prima N[1] RSTITIAL [:1] RMITTENT [:2] ES [1]	ry Contact lary Contact document on back) Pool / Current Maximum
Indicate for function	onal riffles; Best areas must	be large enough to supp	oort a population	12 TO RIFFLE [metric=0]
of riffle-obligate springle of riffle-obligate springle of riffle obligate springle of riffle obligate springle obligate	RUN DEPTH RIFFL MAXIMUM > 50cm [2] STABL MAXIMUM < 50cm [1] MOD.	NE (Or 2 & average). E. / RUN SUBSTRATE E. (e.g., Cobble, Boulder). [2] TABLE (e.g., Large Gravel). [1 BLE (e.g., Fine Gravel, Sand). [0	RIFFLE / RUN EMBED NONE[2] LOW[1]	DEDNESS
6] GRADIENT (< 0. DRAINAGE AREA	ff/ml)	%POOL:(<i>/ot</i> %RUN: (%GLIDE: %RIFFLE:	Gradient 6 Maximum 10

EPA 4520



QHEI-Score: 36.5



Stream & Location: Des Plans Reve	r- 283 8 KR	RM: 283 .8 Date: 07/11/08
<u> </u>		Too Vandrusky EA Engineering
River Code: STORI		
1] SUBSTRATE Check ONLY Two substrate T	YPE BOXES:	
estimate % or note every type	IER TYPES POOL RIFFLE ORIGIN	ONE (Or 2 & average) QUALITY
BEST TYPES POOL RIFFLE OF	ARDPAN [4] POOL RIFFLE LIMESTONE [1]	HEAVY [-2]
□□ BOULDER [9] □□□	ETRITUS [3] TILLS [1]	SILT MODERATE [-1] Substrate
O GRAVELIZI O N		ONE. □ NORMAL [0]. □ FREE [1]
	RTIFICIAL [0] SANDSTONE [0]	DE EVITENCIVE (201)
PAGE AND	Score natural substrates, ignore RIP/RAP [0]	MODERATE [-1] Maximum
D an loss i	[2] sludge from point-sources) ☐ LACUSTRINE [0] ☐ SHALE [-1]	NORMAL [0] 20 □ NONE [1]
Comments	☐ COAL FINES [-2]	— esperatura esperatur
4 Ø	Ø	- 4
quality: 2-Moderate a	o 3: 0-Absent; 1-Very small amounts or if more commo mounts, but not of highest quality or in small amounts	of highest
quality; 3-Highest quality in moderate or greater at	mounts (e.g., very large boulders in deep or fast wate d in deep / fast water, or deep, well-defined, functional	r, large Uneck UNE (Ur 2 & average)
UNDERCUT BANKS [1]	POOLS > 70cm [2]OXBOWS, BACKWATE	RS [1] MODERATE 25-75% [7]
OVERHANGING VEGETATION [1] SHALLOWS (IN SLOW WATER) [1]	ROOTWADS [1]AQUATIC MACROPHY	
ROOTMATS[1]	BOULDERS [1] LOGS OF WOODY DE	CONTROL CONTRO
Comments		Cover Maximum 1:0
		5 5 20
3] CHANNEL MORPHOLOGY Check ONE		
	CHANNELIZATION STABILITY	
	ONE [6] ☐ HIGH [3] ECOVERED [4] ☐ MODERATE [2]	
□ LOW [2] □ FAIR [3]	EGOVERING (3) Z LOW [1]	
NONE[1] POOR[1] R Comments /	ECENTIOR NO RECOVERY [1]	Channel Maximum
4 rec	cent (2007) canopy removal	20
	NE Check ONE in each category for EACH BANK (O	r 2 per bank & average)
River right looking downstream RIPARIAN V	<u> MIDTH</u> L.R. <u>FLOOD PLAIN QUALI</u>	
EROSION WIDE > 50m [4		CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2] ☐ NARROW 5-10	m [2] RESIDENTIAL PARK NEW FIELD	☐ Ø URBAN OR INDUSTRIAL [0] 141 ☐ ☐ MINING/CONSTRUCTION [0]
☐ ☐ HEAVY//SEVERE[I]] ☐ ☐ VERY NARRO	N<5m [1] □ □ FENCED PASTURE [1]	Indicate predominant land use(s)
	OPEN PASTURE, ROWCROP [0]	7
Comments 3	3 about to Cotecatil	Maximum +-3
5) POOL / GLIDE AND RIFFLE / RUN Q	UALITY	
MAXIMUM DEPTH CHANNEL	WIDTH CURRENT VELOCITY	
Check ONE (ONLY!) Check ONE (Or 2 Z > Im [6] □ POOLWIDTH > RIF	- The complete a section of the contract of th	Primary Contact
0.7<1m[4] POOLWIDTH = RIF		Secondary Contact
☐ 0.4<0.7m[2] ☐ PGOL WIDTH < RIF	FLE WIDTH [0] FAST [1] INTERMIT	TENT [2]
□ 0:2<0:4m [1] □ < 0:2m [0]	☐ MODERATE [1] ☐ EDDIES [1] Indicate for reach - pools and ri	
Comments	, , , , , , , , , , , , , , , , , , ,	Maximum ()
Indicate for functional riffles: Rest	areas must be large enough to support	a population
of riffle-obligate species:	Check ONE (Or 2 & average).	NO RIFFLE [metric=0]
RIFELE DEPTH RUN DEPTH	RIFFLE / RUN SUBSTRATE RIF	FLE / RUN EMBEDDEDNESS
☐ BESTAREAS > 10cm [2] ☐ MAXIMUM > 50ci ☐ BESTAREAS 5:10cm [1] ☐ MAXIMUM < 50ci	m [2] STABLE (e.g., Cobble, Boulder) [2] m [1] MOD. STABLE (e.g., Large Gravel) [1]	
☐ BEST AREAS < 5cm	☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ LOW[f] ☐ MODERATE [0] Riffie /
[metric=0]	and an other section of the section	EXTENSIVE [1] Run Maximum
Comments		8
6] GRADIENT (< 0.1 ft/mi) VERY LOV	V-LOW:[24] %POOL:(100)	%GLIDE: Gradient
DRAINAGE AREA	E [6:10] RY HIGH [10:6] %RUN:	%RIFFLE: Maximum
	vectoristical controls.	
EPA 4520 > 1,502	Durred	ICP 7/16/08 06/11/08

QHEI Score: 46



Stream & Location:	Dos Planas River.	283.6LB	RM: 283 6 Date: 07/10/08
*		_Scorers Full Name & Affiliation:	Toe Vondruston EA Englaceving
River Code:	STORET #:		26 188.1358 Office verified location
1] SUBSTRATE Check	k ONLY Two substrate TYPE BOX ate % or note every type present	ES;	ONE (Or 2 & average)
DECT TYPES	POOL RIFFLE OTHER TYI HARDPAN DETRITUS U DETRITUS U DISILT [2] U ARTIFICIA	PES POOL RIFFLE ORIGIN [4] LIMESTONE [1] [3] MILLS [1] [WETLANDS [0] [HARDPAN [0]]	QUALITY (0.5) HEAVY [-2] SILT MODERATE [-1] Substrate NORMAL [0] FREE [1]
□ □ BEDROCK [5]	(Score nat	ural substrates: ignore	SEDDED MODERATE [1] MOVIMUM
	TYPES: 4 or more [2] sludge	e from point-sources)	S NORMAL [0] 20
Comments	(14)	COAL FINES [-2]	600
quality: 3-Highest quality I diameter log that is stable UNDERGUT BANK OVERHANGING VE SHALLOWS (IN SL ROOTMATS [1]	quality; 2-Moderate amounts, io moderate or greater amounts (e ; well developed rootwad in deep (S[1] POOLS GETATION [1] ROOTW	sent; 1-Very small amounts or if more commonut not of highest quality or in small amounts gu, very large boulders in deep or fast water fast water, or deep, well-defined, functiona 70cm [2] OXBOWS, BACKWATE ADS [1] AQUATIC MACROPHY ERS [1] LOGS OR WOODY DE	of highest r, large Check ONE (Or 2 & average) r pools. RS [1] MODERATE 25-75% [7] PARSE 5-25% [3]
Comments			(4) Maximum 6
31 CHANNEL MODEL	IOLOGY Check ONE in each or	stagony (Or 2.2 augusta)	
SINUOSITY DEV	XCELLENT [7] NONE [6] SOOD [5] RECOVER AIR [3] RECOVER	ELIZATION STABILITY High S	Channel 6
4] BANK EROSION A		k ONE in each category for EACH BANK (O	
River right looking downstres EROSION NONE /LITTLE [3] MODERATE [2] HEAVY / SEVERE [1]		FLOOD PLAIN QUALI POREST, SWAMP, [3]. SHRUB; OR OLD FIELD [2]. RESIDENTIAL PARK, NEW FIELD FENGED PASTURE; [1]. DEEN PASTURE; ROWGROP [0].	CONSERVATION TILEAGE [1] CONSERVATION TILEAGE [1] CONSTRUCTION [0] Indicate predominant land use(s)
Comments 3	Galucat to le	6	past 100m riparian. Riparian Maximum 10
5] POOL / GLIDE AN. MAXIMUM DEPTH Check ONE (ONLY) [D RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & averag POOL WIDTH > RIFFLE WIDT POOL WIDTH = RIFFLE WIDT ROOL WIDTH < RIFFLE WIDT	H [2] UTORRENTIAL [1] A SLOW [1] H [1] UVERY FAST [1] UNITERSTIT	Recreation Potential Primary Contact Secondary Contact (circle one and comment on back) Pool/
Comments		maicate for reach - pouls and m	Maximum
Indicate for function of riffle-obligate RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS > -10cm [1] BEST AREAS < 5cm [metric=0]	Species: Ch RUN DEPTH I □MAXIMUM > 50cm [2] □ S I □MAXIMUM < 50cm [1] □ II	nust be large enough to support a eck ONE (Or 2 & average) RIFFLE:/ RUN SUBSTRATE RIFF TABLE (e.g., Cobble, Boulder) [2] AOD: STABLE (e.g., Large Grave) [4] INSTABLE (e.g., Fine Gravel, Sand) [0]	NO RIFFLE [metric=0] FLE / RUN EMBEDDEDNESS NONE [2] LOW:[1] MODERATE [0] Riffle /
Comments			EXTENSIVE (1) Run Maximum
6] GRADIENT (<0.1 DRAINAGE AREA (2.2)	_ft/mi)	/ii. 002. <u>/ 00</u>	%GLIDE: Gradient 6 %RIFFLE: Maximum 10
EPA 4520 >1,50	>2_	Parts and	ICC 2/11/08 06/11/08

		antative Hab I Use Asses	50 (1997) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	QHL	El Score	e: [40.5]
Stream & Location:	Des Plalings	RIVEY = 283					0 <u>71//</u> 108
			ers Full Name	& Affiliation:		nska Et	Expensering
River Code:		DRET #:	Lat/Lon (NAD 83 - decim	<u>9;41.481</u>	2/8g.	1392	Office verified location
1] SUBSTRATE Check	ONLY Two substrate % or note every	te TYPE BOXES; type present		Check C	ONE (Or 2 & a	average)	
DECT TVDEC	POOL RIFFLE	THEN TWOEN		ORIGIN IMESTONE [1] ILLS [1]	•	QUAL HEAVY [2]
GOBBLE [8] GRAVEL [7] SAND [6]		□ MÜCK[2] □ MÜCK[2] ☑ SILT [2] □ ARTIFICIAL [0]		VETLANDS [0] IARDPAN [0] ANDSTONE [0]	SILT	NORMAL DEREE (1)	[0]
□ □ BEDROCK [5] NUMBER OF BEST T		(Score natural subsore [2] sludge from po	trates; ignore G	IP/RAP[0]	BEDDEDNING	MODERA MORMAL NONE [1	TE [51] Maximu [0] 20
Comments	4	Ø		OAL FINES [-2]		- 2	- 1
21 INSTREAM COVE	indicate presence	0 to 3: 0-Absent: 1-V	erv småll amounts	or if more commo	n of marginal		LINIT
quality; 3:Highest quality in diameter log that is stable, UNDERGUT BANKS	quality; 2-Modera n moderate or great well developed roo [1]	te amounts, but not of er amounts (e.g., very twad in deep / fast wa POOLS > 70cm	highest quality or large boulders in ter, or deep, well-c	in small amounts deep or fast water lefined, functional WS BACKWATE	of highest , large pools. RS III	heck ONE (O EXTENSIVE MODERATE	r 2 & average) >75% [11] 25-75% [7]
/_OVERHANGING VE SHALLOWS (IN SLI ROOTMATS [1]		ROOTWADS [1]	Z AQUA Logs	TIC MACROPHY OR WOODY DEE		SPARSE 5 - NEARLY AB	SENT <5% [1]
Comments	Bibliotechnologies, consequence and consequence of men				5	7	Cover Maximum 20
3] CHANNEL MORPH							
□ HiGH[4] □ E		CHANNELIZAT NONE [6] RECOVERED [4]		STABILITY HIGH(3) MODERATE (2)			
□ LOW[2] □ F	AIR [3]	RECOVERING [3] RECENT OR NO R		LOW [1]			Channel
Comments				and the second second	•	1	Maximum 6
4] BANK EROSION A		ZONE Check ONE I		F <i>EACH BANK</i> (OF PLAIN QUALI		average)	
EROSION NONE/EITHERS	_ ☐ NIDE ≥ 50i	n(4) 🗀 💆	FOREST, SWAM	P [8]			N TIELAGE [1]
☐ MODERATE [2] ☐ HEAVY / SEVERE [1]	MODERAT MODERAT NARROW: VERY NAR	i-10m [2]	SHRUB OR OLD RESIDENTIAL P EENCED PASTI	APK NEW EIEI N	m □ □ M	NING/CONS	USTRIAL [0] TRUCTION [0]
Comments _			OPEN PASTURE	ROWCROP [0]			Riparian
salah terbesah di J			ent to Colors	lla + Empra	53. Caslno	, 1.5	10
5] POOL / GLIDE ANI MAXIMUM DEPTH Check ONE (ONLY!)	CHANN	EL WIDTH Or 2 & average)		IT VELOCITY		Recreation Primary	
⊘ > 1m [6] □ 0.7≲1m [4]	POOLWIDTH >	RIFFLE WIDTH (2) [RIFFLE WIDTH (1) [TORRENTIAL [1] ZSLOW [1]	IAL [-1]	Secondary	/ Contact
☐ 0.4≤0.7m [2] ☐ 0.2<0.4m [1] ☐ < 0.2m [0]	□ POOL WIDTH <	ALCO EN SANCIONE SANCIONES SANCIONES COMPANSIONS COMPA		☐ INTERMITE ☐ EDDIES [/] ach - pools and rife			Pool / Current
Comments			maicale for te	acıı - pools alla tili	168.		Maximum 12
Indicate for funct of riffle-obligate	species:	Check ON	E (Or 2 & average)	<u>).</u>		NOF	RIFFLE [metric=0
RIFFLE DEPTH	RUN:DEF	TH RIFFLE 50cm (2) I STABLE	E / RUN SUBS (e.g. Cobble Bo	TRATE RIFF	LE / RUN		DNESS
BEST AREAS 5:10cm [1] BEST AREAS < 5cm [metric=0] Comments	I ∐MAXIMUM.≪	50cm [1] 🔲 MOD. ST	ABLE (e.g., Larg LE (e.g., Fine Gra	e Gravel) [1]			Riffle / Run Maximum 8
6] GRADIENT (<0.)		LOW - LOW (2-4) RATE (6-10)	%P(00L:(100)	%GLIDE:		Gradient /
DRAINAGE AREA	(v) mi²) □ HiGH	VERY HIGH [10:6]	%R		%RIFFLE:	<u></u>	Maximum 10
EPA 4520 > 1.50	1.1.		ī	3 - 0	KO >	111/02	06/11/08

OFERA				aluation Index Field Sheet	QH	El Score	: 1/6,5
Stream & Location:	Des Plaines	River	283,3 CB		RM:28	33. Date: 0	<u> 71 [01 08 </u>
River Code: -	- STO	RET#:		ame & Affiliation: Long.: 4 1 4フラ	Toe Vo 6 188.	ndustra EH	0551
11 SUBSTRATE Check	ONLY Two substrate	TYPE BOXE	(NAD 83 •	decimal ")	···············	<u> </u>	location [
BEST TYPES P	OOF 1/11 1 FF	THER TYP	FOOL MIFFLE	<u>ORIGIN</u>	NE (<i>Or 2</i> &	average) QUALI	TYOS
□□ BLDR/SLABS [10] _ □□ BOULDER [9]] HARDPAN] DETRITUS	413	LIMESTONE [1]	SILT	☐ HEAVY [-: ☐ MODERA	5. The state of th
COBBLE[8] GRAVEL[7]] MUCK [2]] SILT [2]		☐ WETLANDS [0] ☐ HARDPAN [0]	OILI	NORMAL FREE (1)	
□□ SAND [6] _ □□ BEDROCK [5] _		ARTIFICIAL (Score natur	al substrates innore	☐ SANDSTONE [0] ☐ RIP/RAP [0]	SEDDEON	□ EXTENSI\ □ MODERA	E[-1] Mavimum
100 miles (100 miles (YPES: ☐ 4 or mo 3 or les		from point-sources)	☐SHALE[:1]	, Fig.	NORMAL NONE [1]	[0] 20
Comments	7	(15)		□ COAL FINES [-2]		(7)	(O.5)
2] INSTREAM COVER	guality: 2-Moderati	e amounts, bu	t not of highest gua	lity or in small amounts	of highest	AMOL Check ONE (Or	
quality; 3-Highest quality in diameter log that is stable,	well developed rook	vad in deep / f	ast water, or deep,	well-defined, functional	pools.	J EXTENSIVE:	75% [11]
UNDERGUT BANKS OVERHANGING VE	GETATION [1]	∠ POOLS > ROOTWA	DS[ij]	DXBOWS, BACKWATE QUATIC MACROPHY:	resin C] MODERATE:] Sparse 5≪2	25% [3]
SHAPLOWS (IN SEC		/ BOULDER	KS [1] [OGS OR WOODY DEE		NEARLY ABS	Cover
Comments				(91	N	laximum 5
3] CHANNEL MORPH							
□ HIGH [4] □ E		NONE [6]	<u>LIZATION</u>	STABILITY HIGH [3]			
□ LOW [2] □ F	AIR[3]	RECOVERE RECOVERIN	IG [3]	☐ MODERATE [2] ☐ LOW [1]			Channel (
MONE[1] PO	اهر (DOR [1]	RECENTIOR	NO RECOVERY (laximum 6
4] BANK EROSION A	ND RIPARIAN Z	ONE Check	ONE in each cated	ory for EACH BANK (Or	2 ner hank	& average)	
River right looking downstream EROSION		HTDIW V	FLO	OD PLAIN QUALIT	<u>ry</u> L R	- ·	
NONE/LITTLE [3]	MODERATE NARROW 5	10-50m [3]	☐ ☐ SHRUB OF	OLD FIELD 121	Z O i	ONSERVATION IRBAN OR IND	USTRIAL [0]
HEAVY//SEVERE(1)	U VERY NARR	1011 [2] 10 W < 5m [1]	☐ ☐ FENCED P.	AL PARK NEW FIELD ASTURE [1]	Indicate	IINING / CONST predominant lar	nd use(s)
Comments	1	D , .	and and an analysis of the same of the sam	TURE ROWCROP [0]	past 10		Riparian Jaximum 4.5
5) POOL / GLIDE AND		QUALITY	RL track				10
MAXIMUM DEPTH Check ONE (ONLY!)	CHANNE Check ONE (C	L WIDTH		RENT VELOCITY neck ALL that apply		Recreation Primary (
∠☐ > 1m [6]	□ POOL WIDTH > R	UFFLEWIDTH	[2] TORRENT	TAL [-1] Z SLOW [1] ST [1] D INTERSTIT		Secondary	Contact
	□POOLWIDTH < R		I[0] □ FAST[1]	☐ INTERMITI TE[i] ☐ EDDIES[i]	ENT [-2]	(circle one and con	Pool /
☐ < 0.2m [0]. Comments				for reach - pools and riff			Current 8
	ional riffles: Be	st areas m	ust he large en	ough to support a	nonulat	ion	12
of riffle-obligate s RIFELE DEPTH		Che	ck ONE (Or 2 & ave			JENO R	IFFLE [metric=0]
☐ BEST AREAS > 10cm [2]	☐MAXIMUM ≥ 5	0cm [2] 🗆 Sī	ABLE (e.g., Cobb	le, Boulder) [2] Large Gravel) [1]	□N€	DNE [2]	DALGG
☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]				Large Gravel) [1] e Gravel, Sand) [0]	□MC)W [1] DDERATE [0]	Riffie /
Comments					LIEX	TENSIVE [-1] _{//}	laximum 8
6] GRADIENT (< 0.1 DRAINAGE AREA		DW - LOW [2- ATE [6-10]	41	%POOL:	%GLIDE		Gradient /
(>4)	∂ _{ml²)} □ HiGH∘\	ZERY HIGH (1	0-6]	%RUN:	RIFFLE:	:	laximum 0
EPA 4520 74,50	2			12017	of 100	7/16/0	06/11/08

OFEFA		e Habitat Evaluatio Assessment Field		Score; [45.5]
Stream & Location:	Des Plaines RIVE.	- 283 2 RB	RM:283	.2Date:07 108
Adjacent to Empress		Scorers Full Name & A	Affillation: Joe Un,	lusho - Et Englaceria
River Code:	STORET #:	Lat./Long.: A	11.4790 188.1	442 Office verified location
estimate	ONLY Two substrate TYPE BO. e % or note every type present	1	Check ONE (Or 2 & av	verage)
BLDR/SLABS (10) BOULDER [9] GOBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TY Comments	HARDPA DETRITU MUCK [2] Sill 1 [2] ARTIFICE Score na (PES: 4 or more [2] sludge 3 or less [0]	N [4] LIME LIME S [3] TILLES TILLES TILLES LIME L	SILT SILT SILT SILT SILT SILT SILT SILT	QUALITY HEAVY [-2] Substrate Normal [0] HEE [1] Maximum Normal [0] Maximum Normal [0] None [1] None [
Bould/Edible associal	Indicate presence 0 to 3: 0-Al	sent 1-Very small amounts or if	more common of marginal	(-1)
quality: 3-Highest quality in a	quality: 2-Moderate amounts, moderate or greater amounts (vell developed rootwad in deep [1] POOES ETATION [1] ROOTW	but not of highest quality or in si e.g., very large boulders in deep if fast water, or deep, well-define > 70cm [2]	mall amounts of highest or fast water, large ed, functional pools. BACKWATERS [1] WACROPHYTES [1] WOODY DEBRIS [1]	AMOUNT eck ONE (Or 2 & average) EXTENSIVE >75% [11] MODERATE:25:75% [7] SPARSE 5 < 25% [3] JEARLY ABSENT(<5% [1])
Comments) associa	led with bonk waddliention	(6)	(9) Cover Maximum 15
- N. S. Steam British and St. St.	Casino Gor	med Leap rear shore , alegory (Or 2 & average)	root adjust he be	oulder 20
SINUOSITY DEVE	LOPMENT CHANN CELLENT [7] NONE [6] OD [5] RECOVER	IELIZATION STA	BILITY H(3) DERATE (2)	cobble
None [1] Po Comments	OR[1] PRECENT	OR NO RECOVERY [1]	2	Channel Maximum 20
4] BANK EROSION AN River right looking downstream	<i>ID RIPARIAN ZONE</i> Che RIPARIAN WIDTH	ck ONE in each category for <i>EAc</i>		verage)
EROSION NONE/LITTLE[3] MODERATE [2] HEAVY/SEVERE.[1]		FOREST SWAMP [3]	Digg Diggs	ISERVATION TILLAGE [1] IAN OR INDUSTRIAL [0] ING/(CONSTRUCTION [0] Idominant land use(s) Iriparian. Riparian Maximum
3	ス 		. 5	10
MAXIMUM DEPTH Check ONE (ONLY!) Sim [6]	RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & avera POOL WIDTH = RIFFLE WID POOL WIDTH = RIFFLE WID POOL WIDTH = RIFFLE WID	CURRENT V ge) Check ALL to TH [2] TORRENT[AL[2]] Z TH [1] VERY FAST [1] T TH [0] FAST [1] T MODERATE [1] I Indicate for reach	at apply SEOW[1] SEOW[Primary Contact econdary Contact ricle one and comment on back) Pool / Current Maximum 12
Indicate for function of riffle-obligate sp	onal riffles; Best areas i	must be large enough to	support a population	NO RIFFLE [metric=0]
	RUN DEPTH	heck ONE (Or 2 & average). RIFFLE /-RUN-SUBSTRA	TE-RIFFLE /-RUN-E	Y
☐ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0] Comments	☐ MAXIMUM > 50cm [2] ☐ ☐ MAXIMUM < 50cm [1] ☐	STABLE (e.g., Cöbble, Boulde MOD STABLE (e.g., Large Gra UNSTABLE (e.g., Fine Gravel, S	f) [2]	[2]
	fl/mi)	[2-4] %POOL	:(100) %GLIDE:(Gradient (
DRAINAGE AREA	☐ MODERATE [6=10] ml²) ☐ HIGH = VERY HIGH		%RIFFLE:	Maximum 6

EPA 4520

>1,502

06/11/08

	onie imgagradeved	N COETK SCOM IS C / STEPPE		
OF SEA		oitat Evaluation Inde Sement Field Sheet		
Stream & Location:	Les Plaines 283.01	LB .	RM:283.0Date: ⊘升 1 0 08	
River Code:	Scor	rers Full Name & Affiliation Lat./Long.: 41 4 7	1: Tox VonLinsko EA Engineerly 49188.1450 Office verified location	
1] SUBSTRATE Check ONLYT estimate % or a BEST TYPES POOL RI	note every type present	Check	ONE (Or 2 & average)	
BLDR/SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] GRAVEL [7] BEDROCK [5] NUMBER OF BEST TYPES:		LIMESTONE [1] TILLS; [1] WETLANDS: [0] HARDPAN: [0] SANDSTONE [0] Strates; ignore RIP/RAP [0] point-sources) LACUSTRINE [0]	SILT MODERATE -1 Substrate -1	
Comments	□ 3 or less [0] (1)	Ushale[-1] □ coal-fines[-2]	NONE (1)	
2] INSTREAM COVER Indicat quality and quality 3-Highest quality in modera diameter log that is stable, well dev UNDERCUT BANKS [1] OVERHANGING VEGETATION SHALLOWS (IN SLOW WAT ROOTMATS [1] Comments	; 2-Moderate amounts, but not of te or greater amounts (e.g., very eloped rootwad in deep / fast wa PODES > 70cm POTWADS [1]	of highest quality or in small amount viarge boulders in deep or fast wate ater, or deep, well-defined, function [2]OXBOWS, BACKWAT LAQUATIC:MACROPH	ts of highest er, large check ONE (Or 2 & average) eat pools. ☐ EXTENSIVE > 75% [11] ERS [1] ☐ MODERATE 25.75% [7] YIES [1] ☐ SPARSE 5≥25% [3]	
3] CHANNEL MORPHOLOGY SINUOSITY DEVELOPM		· · · · ·		
☐ HIGH [4] ☐ EXCELLE ☐ MODERATE [3] ☐ GOOD [5] ☐ LOW [2] ☐ FAIR [3] ☐ NONE [1] ☐ POOR [1] Comments	NT[7] NONE[6]	HIGH (3) Moderate (2	Channel Maximum 20	
L PC	RIPARIAN WIDTH	FLOOD PLAIN QUAL	ITY L R	
D None/Little [3] D None/Littl	JARROW:5-10m [2]	FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW FIELD FENCED PASTURE [1] OPEN PASTURE, ROWCROP [0]	CONSERVATION TILLAGE [1] URBAN OR INDUSTRIAL [0] D(1] UMINING / CONSTRUCTION [0] Indicate predominant land use(s) past 100m riparian. Riparian	
Comments 3	Special to RK trac		Maximum 4-5	
Check ONE (ONLY!) Z > 1m [6] D 0.7<1m [4] D 0.4<0.7m [2] D 0.2<0.4m [1] C > 0.2m [0]	CHANNEL WIDTH eck ONE (Or 2 & average) WIDTH > RIFFLE WIDTH [2] WIDTH = RIFFLE WIDTH [1] WIDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERST FAST [1] INTERMITION MODERATE [1] EDDIES [1] Indicate for reach - pools and reach - pools -	Primary Contact Secondary Contact (circle one and comment on back) Pool / Current	S. P. C.
Comments	iffles; Best areas must h	e large enough to support	Maximum 12	9
-fulfile -blimate encoine	Ob1-01	Cord of sure in the cappoint	a population INO RIFFLE Imetric=0	ı

0.7 < 1m [4] 0.7 < 1m [4] 0.4 < 0.7 m [2] 0.2 < 0.4 m [1] < 0.2 m [0] Comments	POOL WIDTH = RIFFLE WIDT	H[1]	INTERSTITIAL [-1] INTERMITTENT [-2] EDDIES [1]	Secondary Contact
of riffle-obligate RIFFLE DEPTH □ BEST AREAS > 10cm [RUN DEPTH [2] MAXIMUM > 50cm [2]	ieck ONE (<i>Or 2 & average</i>). RIFFLE / RUN SUBSTRA STABLE (e.g., Cobble, Boulder	TE RIFFLE / RUN	EMBEDDEDNESS NE [2]
☐ BEST AREAS 5-10cm [☐ BEST AREAS < 5cm [metric=] Comments		MOD: STABLE (e:g.; Large Gra UNSTABLE (e:g.; Fine Gravel; S	and) [0] MC	VV [1] DDERATE [0] Riffle / TENSIVE [-1] Maximum 8
6] GRADIENT (く). DRAINAGE AREA (とご		/81 OOL	:(/ʊʊ─) %GLIDE:	Maximum
EPA 4520 >4,\$6	? 2.	Pa	voted KC	7/16/08 06/11/08 MWG13-15 108092



أوعداد الدا		1
QHEI	Score	: 1.40
*	4	· PRESENCE



Stream & Location:	Des Plaines	River-	0829					07/11	08
			_Scorers	Full Name & A	\ffiliation:			Engineering Office ve	rified
River Code:		ORET #:		Lat./ Long.: /	11.476	<u> 188.</u>	1489	loc	ation
BEST TYPES	YPES: 4 ornic	Type present / OTHER TYF HARDPAN DETRITUS MUCK[2] SILT [2] ARTIFICIA (Score naturation [2] sludge	PES POOL [4] [3] Land Substrate from point-sent: 1-Very sent: 1-Very s	RIFFLE DIMES TILLS WETLE HARD SAND S, ignore RIP, Recources) SHALL GOAL	Check ON RIGIN STONE [1] ANDS [0] PAN [0] STONE [0] AP [0] AP [0] E [-1] FINES [-2]	SILT SILT	QUA HEAVY MODER NORM FREE MODER MODER NORM NORM HEAVY	LITY [-2] ATE [-1] SIVE [-2] ATE [-1] ATE [-1] M	ubstrate Ø laximum 20
quality; 3-Highest quality in diameter log that is stable, UNDERGUT BANKS OVERHANGING VE SHALLOWS (IN SEC REGOTMATS (1)	quality; 2-Moder I moderate or grea well developed ro- [[1]] GETATION [1] DW WATER) [1]	ate amounts, be ter amounts (e. otwad in deep / POOLS ROOTW/BOULDE	ut not of high g., very large fast water, o 70cm [2] ADS [1] RS [1]	est quality or in sne e boulders in deep ir deep, well-define OXBOWS; AQUATIC LOGS OR	mall amounts of or fast water, led, functional po BACKWATER MACROPHYTE	highest arge ools. [S[1] [8][1] [Check ONE (EXTENSIV MODERAT SPARSE 5	Or 2 & averag E >75% [11] E 25 75% [7]	
☐ HIGH [4] ☐ E ☐ MODERATE [3] ☐ G ☐ LOW [2] ☐ F ☐ NONE [1] ☐ P Comments	ELOPMENT XGELLENT (7) [OOD [5] [AIR [3] [OOR [1] [CHANNE NONE [6] RECOVERI RECOVERI RECENTIO	ELIZATION ED.(4) NG.[3] R.NO RECO	VERY[1]	DERATE(2) W (1)		·	Channel Maximum 20	6)
4] BANK EROSION A River right feeking downstres EROSION NONE/LINTUE(3) MODERATE(2) HEAVY/SEVERE (1) Comments	RIPARI RIPARI WIDE > 50 MODERA MODERA MODERA	AN WIDTH Im [4] FE 10-50m [3]		ch category for EAG FLOOD PLA REST SWAMP. (3) RUBIOR (GLDIELEI BIDENTIALE PARK IGED PASTURE (RIPASTURE RO	IN QUALIT D (2) NEW FIELD (1)	C C C C C C C C C C C C C C C C C C C	ONSERVATI RBAN OR IN	ON TILLAGE DUSTRIAL [STRUCTION land use(s) Riparlan Maximum 10	Ō]
5] POOL / GLIDE AND MAXIMUM DEPTH Check ONE (ONLY!) 1m [6] 0.7 < 1m [4] 0.4 < 0.7 m [2] 0.2 < 0.4 m [1] < 0.2 m [0] Comments	CHANN	IEL WIDTH (Or 2 & averag RIFFLE WIDT RIFFLE WIDT	e) H [2] □ To H [0] □ Vi H [0] □ F A	CURRENT V Check ALL; ti DRRENT(AL[-1] L ERV FAST [1] L ST [1] L DDERATE[1] L Indicate for reach	nat apply SLOW [1] INTERSTITU INTERMITIE LEDDIES [1]	NT [:2]	Primary Seconda	n Potentia r Contact ry Contact comment on back Pool / Current Maximum 12	t
Indicate for function of riffle-obligate services RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS < 5cm [metric=0] Comments	species: RUN DE □ MAXIMUM> □ MAXIMUM <	Ch PTH F	eck ONE (OI RIEFLE / F ITABLE (e.g IOD STABL INSTABLE (rge enough to 2 & average). LUN SUBSTRA , Cobble, Boulde E (e.g., Large Gra eg., Fine Gravel,	NTE RIFFL n)[2] aval) [1]	E/RUN	NO	Riffje / 🗗	tric=0]
DRAINAGE AREA (XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	☐ MODE	EOW - LOW [RATE [6-10] - VERY HIGH [%POOL %RUN:		GLIDE:	: : : : : : : : :	/U \	6 /08

O TO ITA		ibitat Evaluation Index essment Field Sheet	QHEI Score: 43.5
Stream & Location:	Des Plaine, Kiver	2826 LB	RM: 282,6 Date: 0H /0/08
	Sco	orers Full Name & Affiliation:	Joe Vondruska EA Engineering
River Code:	STORET #:	Lat./ Long.: 41 . 47 .	2 /88. 149 B Office verified □
estimate 9	WLY Two substrate TYPE BOXES; % of note every type present	Check C	NE (Or 2 & average)
BEST TYPES POO	OL RIFFLE OTHER TYPES	POOL RIFFLE ORIGIN	QUALITY
□ □ BOULDER [9]		TILLS (1)	HEAVY [-2] MODERATE [-1] Substrate
☐☐ GOBBLE [8]	MUCK [2]	☐ WETLANDS [0] ☐ HARDPAN [0]	□ NORMAL [0] □ FREE [1]
SAND [6]	ARTIFICIAL [0] Score natural su	SANDSTONE [0]	
	PES: 4 or more [2] sludge from	point-sources) LACUSTRINE [0]	NORMAL[0] 20
Comments (4)	∫ 3 or less [0] .	☐ SHALE [:1] ☐ COAL EINES [:2]	NONE [1]
March State Commence		(0.5)	(-4)
a a constant and a co	uality: 2-Moderate amounts, but not	l-Very small amounts or if more commoi t of highest quality or in small amounts ery large boulders in deep or fast water,	of highest
diameter log that is stable, we	II developed rootwad in deep / fast \	water, or deep, well-defined, functional	pools. EXTENSIVE >75% [11]
OVERHANGING VEGE	TATION [1]:/_ ROOTWADS [1] 2 AQUATIC MACROPHYT	
SHALLOWS (IN SLOW ROOTMATS [1]	WATER)[/] BOULDERS [I] LOGS OR WOODY DEB	
Comments	Paradio Principal Conference in Conference Conference Conference Conference Conference Conference Conference Co		S Cover /4
31 CHANNEL MORPHOL	OGY Check ONE in each categor	v (Or 2 & average)	20
SINUOSITY DEVEL	OPMENT CHANNELIZA	ATION STABILITY	
☐ HIGH [4] ☐ EXCE ☐ MODERATE [3] ☐ GOO	LLENT [7] NONE [6] D [5] REGOVERED [4]	☐ HIGH [3] ☐ MODERATE [2]	
□ LOW [2] □ FAIR ☑ NONE [1] ☑ POOR	[3] RECOVERING [3	i Eōwiai	Channel
Comments		RECOVERSION	Maximum 6
AL DANIE EDOCIONI AND	DIDADIANTONE		20
River right looking downstream	RIPARIAN WIDTH	in each category for EACH BANK (Or FLOOD PLAIN QUALIT	
EROSION DE LA NONEZUTILE (3) 8 D	☐ WIDE > 50m [4]	FOREST SWAMP [3]	CONSERVATION TILLAGE [1]
□ □ MODERATE [2]	☐ NARROW 5-10m [2] ☐	SHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW FIELD [☐ ☐ URBAN OR INDUSTRIAL [0] ☐ MINING / CONSTRUCTION [0]
☐ ☐ HEAVY/SEVERE [i] ☐	☐ VERY NARROW < 5m [1] ☐ ☐ NONE [0] ☐	☐ FENCED PASTURE [1]. ☐ OPEN PASTURE, ROWCROP [0].	Indicate predominant land use(s)
Comments 3			past 100m riparian. Riparian Maximum
5] POOL / GLIDE AND R	IFFI F / RIIN OUALITY	(2.5)	10
MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
Check ONE (ONLY!) ☑ > 1m [6]	Check ONE (Or 2 & average) POOL WIDTH SRIFFLE WIDTH [2]	Check ALL that apply GreenTIAL [-1] SLOW [1]	Primary Contact
	POOLWIDTH = RIFFLE WIDTH [1] POOLWIDTH < RIFFLE WIDTH [0]	☐ VERY FAST [1] ☐ INTERSTITI	Secondary Contact (circle one and comment on back)
☐ 0.2<0.4m [1]		☐ FAST [1] ☐ INTERMITT	Pool/
□≲0:2m [0] Comments		Indicate for reach - pools and riffle	Maximum 0
Indicate for function	al riffles; Best areas must	be large enough to support a	nonulation
of riffle-obligate spe	cies: Check O	NE (Or 2 & average).	NO RIFFLE [metric=0]
RIFFLE DEPTH BEST AREAS > 10cm [2]] MAXIMUM > 50cm [2] ☐ STABL	E / RUN SUBSTRATE RIFFI E (e.g., Cobble, Boulder) (2)	<u>E / RUN EMBEDDEDNESS</u> □ NONEI2I
☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm	JMAXIMUM≪ 50cm [1] ☐ MOD s	STABLE (e.g., Large Gravel) [1] BLE (e.g., Fine Gravel, Sand) [0]	LOW [1] DMODERATE IO Riffle
[metric=0] Comments	- Green and a second a second and a second a		☐ MODERATE [0] Rime/ ☐ EXTENSIVE [-1] Maximum
CI COADIENT /	- I VEDVI OVERONICA		8
DRAINAGE AREA	mi)		%GLIDE: Gradient Maximum
(23,210 m	12) HIGH - VERY HIGH [10-6]	%RUN: (/ob)%	RIFFLE: Maximum 10

Ala		6
	(8 m	

4-168 51 6144	- Breeness	٠,	A STATE OF THE STA
~	A	_	35.5
JHEI	SCO	re	!! 計 35.5
			Commence and the second

Stream & Location:	Des Plaines River-	282.5 RB	RM: 281 5 Date: 07 / / 08
		_Scorers Full Name & Affi	Mation: Joe Vondreslew CA Erginoaria
River Code:	STORET#:	Lat./ Long.: 4	. 4736 188.15385 Office verifie location
1] SUBSTRATE Check Control estimate	NLYTwo substrate TYPE BOX % or note every type present		Check ONE (Or 2 & average)
	OK RIFFLE OTHER TY	PES POOL RIFFLE ORI	GIN QUALITY
BLDR/SLABS[10]	LI LI HARDPAN		Secretary Control of the Control of
□□ BOULDER [9] □□ COBBLE [8]			THE TRANSPORT TO THE TRANSPORT OF THE PARTY
□□ GRAVEL [7]		✓	N [O] GREE [1]
SAND [6] BEDROCK [5]	ARTIFICIA	d [0]	MI CODED THORED TERM
NUMBER OF BEST TY		e from point-sources) LACUST	RINE[0] PORMALIO
Comments	3 or less [0]		II NONE III
	(H) (C	D COAL FI	(-4)
2] INSTREAM COVER	Indicate presence 0 to 3: 0-Ab	sent; 1-Very small amounts or if mo	re common of marginal AMOUNT
quality; 3-Highest quality in n	noderate or greater amounts (e	out not of highest quality or in small g, very large boulders in deep or	fast water, large Check ONE (Or 2 & average)
diameter log that is stable, w UNDERGUT BANKS [ell developed rootwad in deep	/ fast water, or deep, well-defined,	functional pools. EXTENSIVE >75% [11]
OVERHANGING VEG	ALTERNATION AND ACTUAL STREET, SECURITION AND ACTUAL STREET, SECUR	>70cm [2]OXBOWS; BA ADS [1] AQUATIC MA	GKWATERS [1] → MODERATE 25-75% [7] CROPHYTES [1] → SPARSE 5~25% [3]
SHALLOWS (IN SLOV			ODY DEBRIS [1] NEARLY ABSENT <5% [1]
ROOTMATS [1] Comments		•	Cover C
Comments	*		(2) Maximum / (20 20 20 20 20 20 20 20 20 20 20 20 20 2
31 CHANNEL MORPHO	LOGY Check ONE in each ca	ategory (Or 2 & average)	10000
		ELIZATION STABI	LITY
	ELLENT[7] NONE[6]	THE PROPERTY AND ADDRESS OF THE PROPERTY ADDRESS OF THE PROPER	
☐ MODERATE [3] ☐ GO ☐ LOW [2] ☐ FAII			
PRONEID POO	OR III A RECENT C	R NO REGOVERY [1]	Channel Channel
Comments	6.10.	, 0 , ,	Maximum 5,
AL DANIE EDOCION AN		ete mooring structure @	
4] BANK EROSION AN River right looking downstream	RIPARIAN ZUNE CREC	K ONE in each category for EACH	
LR EROSION	WIDE > 50m (4)	FOREST, SWAMP [3]	CONSERVATION TILLAGE [1]
	MODERATE 10-50m [3]	□ □ SHRUB OR OLD FIELD	21 URBAN OR INDUSTRIAL [0]
	☐ NARROW 5-10m [2] ☐ VERY NARROW < 5m [1	□ □ RESIDENTIAL PARK NE] □ □ FENCED PASTURE (1]	WEELD [1] MINING CONSTRUCTION [0]
	DONONE [O].		Indicate predominant land use(s) ROP [0] past 100m riparian Riparian
Comments (2)		1 1 1 1	
51 POOL (CLIDE AND	RIFFLE / RUN QUALITY	Ly land clearly &	grading in flood plain is 10
MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VEL	OCITY Recreation Potential
Check ONE (ONLY!)	Check ONE (Or 2 & average	(e) Check ALL that	apply Primary Contact
	POOL WIDTH > RIFFLE WIDT POOL WIDTH = RIFFLE WIDT	MADE TO THE PROPERTY OF THE PARTY OF THE PAR	Secondary Contact
	POOL WIDTH < RIFFLE WIDT		TERSTITIAL [-1] (circle one and comment on back)
☐ 0:2-<0.4m [1]		□ MODERATE [1] □ E	DDIES[1] Pool /
□ < 0.2m [0] Comments		Indicate for reach - po	ols and riffles. Current Maximum
	1 4001 Was 4		12
of riffle-obligate sp	onal riffles; Best areas n Decles: Ch	nust be large enough to si eck ONE (Or 2 & average).	Ipport a population
RIFFLE DEPTH	RUN DEPTH I	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2] ☐ 5	STABLE (e.g., Cobble, Boulder) (21 □ NONE [2]
☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm		MOD: STABLE (e.g., Large Grave JNSTABLE (e.g., Fine Gravel, San	
[metric=0]			d) [0]
Comments			- Maximum 8
6] GRADIENT (人O、) f	t/ml) VERY LOW : LOW [²⁻⁴ 1 %POOL:(/	/のび)%GLIDE: Gradient (
DRAINAGE AREA	☐ MODERATE [6-10].	701 002.	Z Yavimum h
(>±,340	AND CHICAGO STATE CONTRACTOR AND	sancary II.	
EPA 4520 >1,508		D.	irople Ke 7/16/08 06/11/08
		/~	/

E10x	Musicipiii igitgidasi			ممم
GEFA		Habitat Evaluati sessment Field		HEI Score: 45
Stream & Location:	Des Maines River	282.3LB	RM:2	823 Date: 07/ 10/ 08
		Scorers Full Name &		Intuska EA Engineering
River Code:	STORET #:	Lat./Long.:	<u>41.4710 188</u>	. 1555 Office Verified Location
estimate	NLY Two substrate TYPE BOXES % or note every type present OTHED TYPE		Check ONE (Or 2	& average) QUALITY
□□ BLDR/SLABS [10]	U LI HAKUPAN I	4] ULIME	STONE (1)	HEAVY [+2]
☐☐ BOULDER [9] ☐☐ COBBLE [8]		- 59123322	S[f] LANDS[0] SILT	☐ MODERATE [-1] Substrate
GRAVEL[7]	Ø Silt [2] Dartificial		DPAN (0) DSTONE (0)	FREE[1]
□□ BEDROCK [5]	(Score natur	al substrates; ignore RIP/	RAP [0] EDDEO	MODERATE EI Maximur
NUMBER OF BEST TY Comments	PES: 4 for more [2] studge i	□SHA		NONE [1] 20
			(P)	(=4)
quality: 3-Highest quality in n	Indicate presence 0 to 3: 0-Abse quality; 2-Moderate amounts, but noderate or greater amounts (e.g.	not of highest quality or in s	mall amounts of highest	Check ONE (Or 2 & average)
UNDERCUT BANKS [70cm [2] OXBOWS		☐ EXTENSIVE >75% [11] MODERATE:25:75% [7]
OVERHANGING VEGE SHALLOWS (IN SLOW		PARADALSHIE MARKETANING	MAGROPHYTES [1] WOODY DEBRIS [1]	□ SPARSE 5≍25% [3] □ NEARLY ABSENT <5% [1]
ROOTMATS[1]		terrore telephone	5	7 Cover
			4	Maximum 12
The converted District of the control of the contro	LOGY Check ONE in each cate			
□ HIGH [4] □ EXC	LOPMENT CHANNEL	□aHi	<u>ABILITY</u> SH[3]	
☐ MODERATE [3] ☐ GOO ☐ LOW [2] ☐ FAIR	DD [5] RECOVERED		DERATE [2] Wi11	
☑ NONE[1]	R 11 RECENT OR	NO RECOVERY [1]	वार के के शिक्ष करता है के दिख्य के किए हैं कि है कि है 	Channel / / / / / / / / / / / / / / / / / / /
<u>a la di Alahanda a la </u>				20
4] BANK EROSION AN River right looking downstream	D RIPARIAN ZONE Check RIPARIAN WIDTH		CH BANK (Or 2 per bank	: & average)
EROSION NONE/LUTTLE [3]	7	DEOREST SWAMP 13	i de la companya de l	CONSERVATION TILLAGE [1]
	NARROW 5-10m 21	SHRUB OR OLD FIE	NEW FIELD MI 🗆 🗆 i	URBAN OR INDUSTRIAL [0] WINING/GONSTRUCTION [0]
	☐ VERY NARROW < 5m [1] ☐ NONE [0]:	☐ ☐ FENCED PASTURE ☐ ☐ OPEN PASTURE, RO	[1] Indicate DWCROP[0] past 10	e predominant land use(s) 00m riparian. Riparian
Comments 3	6.5	(2, 5.)	mistire and the allest states and mistral sellings.	Maximum 7
5] POOL / GLIDE AND I	RIFFLE / RUN QUALITY	()		
MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT V		Recreation Potential Primary Contact
	POOL WIDTH > RIFFLE WIDTH POOL WIDTH = RIFFLE WIDTH	[2] TORRENTIAL [-11]	ZSLOWIII.	Secondary Contact
□ 0.4<0.7m [2] □ □ 0.2<0.4m [1]	POOLWIDTH < RIFFLE WIDTH		INTERMITTENT [-2]	
☐<0.2m [0] Comments		Indicate for reach	pools and riffles.	Pool / Current Maximum
	mal william Day			12
indicate for functio	nal riffles; Best areas mເ	ist be large enough to	o support a popula	tion

NO RIFFLE [metric=0] of riffle-obligate species: Check ONE (Or 2 & average). RIEFLE ARUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS RIFFLE DEPTH RUN DEPTH ☐ NONE [2] LOW [1] ☐ BEST AREAS < 5cm [metric=0] Riffle / ☐ MODERATE [0] EXTENSIVE [-1] Maximum Run Comments 6] GRADIENT (< C. | ft/mi) ☐ VERY LOW - LOW [2-4] %POOL:(100 %GLIDE: Gradient DRAINAGE AREA ☐ MODERATE [6-10] Maximum HIGH - VERY HIGH [10-6] %RUN: %RIFFLE: (277 9 mi2) EPA 4520 >1,502 06/11/08

	Qualitative Habitat Evaluation Index and Use Assessment Field Sheet	QHEI Score: [48.5]
Stream & Location:		RM: 282,2 Date: 07 08
River Code: -	Scorers Full Name & Affiliation: STORET#:(NAD 83 - decimal 2 円 - 月 2 2	The Vorshusha Et Freshoeving 2 188.1587 Office verified location
1] SUBSTRATE Chec	ONLY Two substrate TYPE BOXES;	NE (Or 2 & average)
BEST TYPES BEDR/SLABS [10] GOBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST	OOL RIFFLE OTHER TYPES POOL RIFFLE HARDPAN [4] DETRITUS [3] DETRITUS [3] HARDPAN [6] WETLANDS [0] HARDPAN [6] WHARDPAN [6] WHARDPAN [6] WHARDPAN [6] WHARDPAN [6] SANDSTONE [6] (Score natural substrates; ignore RIP/RAP [6]) (PES 4 or more [2] sludge from point-sources) SHALE [1]	SILT MODERATE [-1] Substrate Normal [0] Normal
Comments	⑥ □ COAL FINES: [:2]	
quality: 3-Highest quality	SETATION [1] / ROOTWADS [1] 2 AQUATIC MACROPHYTI W. WATER) [1] / BOULDERS [1] 2 LOGS OR WOODY DEBI	f highest Check ONE (Or 2 & average)
Comments	Lygood amounts in Rock	8 7 Maximum 15
SINUOSITY DEV HIGH [4]	CLOGY Check ONE in each category (Or 2 & average) ELOPMENT CHANNELIZATION STABILITY CELLENT[7] NONE [6] RECOVERED [4] RECOVERING [3] OR [1] RECENT OR NO RECOVERY[1] A on bank Constructions directions	Channel Maximum 20
4] BANK EROSION A	ND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2	
EROSION NONE (LITTLE [3] MODERATE [2] HEAVY/SEVERE [1] Comments	□ MVIDE > 50m [4] □ □ FOREST; SWAMP [3] □ □ MODERATE 10-50m [3] □ □ SHRUB; OR OLD FIELD [2] □ □ NARROW 5-10m [2] □ □ RESIDENTIAL PARK NEW FIELD [3]	□ □ □ CONSERVATION TILLAGE [1] □ □ □ /URBAN OR INDUSTRIAL [0]
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (ONLY!) 1m.[6] 0.7-<1m.[4] 0.2-0.4m.[1] 0.2-0.4m.[1] 0.2-0.2m.[0] Comments	RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [1] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0] POOL WIDTH < RIFFLE WIDTH [0] POOL WIDTH < RIFFLE WIDTH [0] PAST [1] INTERMITTE MODERATE [1] Indicate for reach - pools and riffle	NT[-2]
Indicate for function of riffle-obligate RIFFLE DEPTH BESTAREAS > 10cm [7] BESTAREAS < 5cm [7] BESTAREAS < 5cm [metric=0]		

6] GRADIENT (< 0.1 ft/mi) | VERY LOW LOW [2-4]
DRAINAGE AREA | Moderate [6-10]
(> -2;249 mi2) | HIGH - VERY HIGH [10-6]

>1,502

EPA 4520

%GLIDE:

%RIFFLE:

%POOL:

%RUN:

1000

Gradlent Maximum

Organa.		oitat Evaluation Index ssment Field Sheet	QHEI Score: 36
Stream & Location: Des	Plasnes River	28260 LB	RM: 282.0 Date: 07-1 101 08
		rers Full Name & Affiliation:_	Joe Vonduste EA Engineering
River Code:	STORET #:	Lat./Long.: 4 1 8	2 188.1599 Office verified location
1] SUBSTRATE Check ONLY Two estimate % or not	e every type present	Check O	NE (Or 2 & average)
BEST TYPES POOL RIFF	OTHED TYPES	OOL RIFFLE ORIGIN	QUALITY
□□ BLDR/SLABS [10]	☐ ☐ HARDPAN [4] ☐ ☐ DETRITUS [3]	LIMESTONE (1)	HEAVY [-2]
☐ ☐ BOULDER [9]		WETLANDS [D]	SILT MODERATE [-1] Substrate
GRAVEL[7]	_ Z SILT [2]	HARDPAN [0]	□ FREE (I) Ø
SAND [6]	□ □ ARTIFICIAL [0] _ (Score natural sub	SANDSTONE [0]	EDDED MODERATE I Maximum
NUMBER OF BEST TYPES:	4 or more [2] sludge from [ooint-sources) LACUSTRINE [0]	Y UNORMAL [0] 20
Comments	3 or less [0]	GOAL FINES [-2]	LI NONE [f]
(Sunkin burge)	<u>(4)</u> <u>(4)</u>		<u> </u>
2] INSTREAM COVER Indicate p quality; 2-	-Moderate amounts, but not d	of highest quality or in small amounts o	of highest
quality: 3 Highest quality in moderate of diameter log that is stable, well develo	or dreater amounts (e.g., ver	v large boulders in deep or fast water	(arge Check ONE (Or 2 & average)
UNDERCUT BANKS [1]	POOLS ≥ 70cm	[2]OXBOWS, BACKWATER	RS [1] MODERATE 25:75% [7]
OVERHANGING VEGETATION SHALLOWS (IN SLOW WATER			
ROOTMATS [1]			Cover
Comments			(4) (7) Maximum
21 OF ANNEL MORPHOLOGY	Shook ONE in such automate	/O.O.O.O.O.O.O.O.O.O.O.O.O.O.O.O.O.O.O.	20 (1000)
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPME		· · · · · · · · · · · · · · · · · · ·	
☐ HIGH[4] ☐ EXCELLENT		□ HIGH[3]	
☐ MODERATE [3] ☐ GOOD [5] ☐ LOW [2] ☐ FAIR [3]	RECOVERED [4]	☐ MODERATE [2]	
ONONE[1] POOR [1]	REGENT OR NO	LOW[1] RECOVERY [1]	Channel
Comments	(2	Secretary of the Secretary	Maximum 5
4] BANK EROSION AND RIPA	PIAN ZONE Chark ONE	in each enterer for EACH DANIS (O-	Oneshari 2 marray
	PARIAN WIDTH	FLOOD PLAIN QUALIT	Z per bank & average) ▼
		FOREST, SWAMP [3]	CONSERVATION TILLAGE [1]
		SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FIELD [
☐ ☐ HEAVY/SEVERE [1] ☐ ☐ VEF	RY NARROW < 5m [1] 🔲 🗀	FENCED PASTURE IN	Indicate predominant land use(s)
☑ □NO	NE [0]	OPEN PASTURE, ROWCROP [0]	past 100m riparian. Riparian
Comments 3	(1.5)	(1.5)	Maximum 6
5] POOL / GLIDE AND RIFFLE			
	HANNEL WIDTH k ONE (Or 2 & average)	CURRENT VELOCITY	Recreation Potential
	ent contract to the property of the contract o	Check ALL that apply TORRENTIAL [1] Z SLOW [1]	Primary Contact Secondary Contact
	IDTH = RIFFLE WIDTH [1]	□ VERY FAST [1] 🗟 🔲 INTERSTITI	AL 1-11 (circle one and comment on back)
□ 0.2<0.4m,[1]		☐ FAST[1] ☐ INTERMITTI ☐ MODERATE [1] ☐ EDDIES [1]	Pool / Pool /
□<0.2m[0]		Indicate for reach - pools and riffle	es. Current
Comments			Maximum 12
Indicate for functional riffl	es; Best areas must b	e large enough to support a	population MNO RIFFLE [metric=0]
of riffle-obligate species: RIFFLE DEPTH RU		IE (Or 2 & average). E / RUN SUBSTRATE RIFFI	LE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2] ☐ MAXII	MUM > 50cm [2] STABLE	(e.g., Cobble, Boulder) [2]	
☐ BEST AREAS 5-10cm [1] ☐ MAXII ☐ BEST AREAS < 5cm	MUM < 50cm [1] □ MOD:S	TABLE (e.g., Large Gravel) [1] 3LE (e.g., Fine Gravel, Sand) [0]	LOW [1]
[metric=0]		3FE/(6:8% Eine Gravel/2940) [N]	☐ MODERATE [0] Riffle / ☐ EXTENSIVE [-1] Maximum
Comments			no a serious de serious de serious de la companya d
	VERY LOW - LOW [2-4]	%POOL:(/10)	%GLIDE: Gradient /
	MODERATE [6-10] HIGH - VERY HIGH [10-6]		Maximum 6
		/01.011.	KIFFLE. 10
EPA 4520 > 1,50よ			Ke 7/16/08 06/11/08

QHEI Score: 37.5



Stream & Location:_	Des Plains River-	281.9 RB	RM: <u>2</u>	81.9 Date: 07/1/1/08
<u> </u>	ATA D W W	Scorers Full Name &		Vouluska Ett Enjmering
River Code: -	STORET #:	Lat./Long.:	<u>4[.4694 188</u>	3.1633 Onice verified to location to
estima	ite % or note every type present	•	Check ONE (Or 2	T -1
BEST TYPES BLDR/SLABS[10] BOULDER [9] GOBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST T Comments	□□ DETRITUS □□ MUCK[2] □□ ARTIFICIAI (Score natu	[4] UIM [3] UTILI [3] UWE [4] HAF [6] USAN ural substrates; ignore RIP/ from point-sources) LAC	ORIGIN ESTONE [1] S.[1] S.[1] ILANDS [0] IDSTONE [0] RAP [0] USTRINE [0] LE [-1] LE [-1]	EREE [1]
2] INSTREAM COVER	Indicate presence 0 to 3: 0-Abs	ent; 1-Very small amounts or	if more common of marg	inal AMOUNT
quality; 3-Highest quality in diameter log that is stable, UNDERCUT BANKS OVERHANGING VECTOR SHALLOWS (IN SECTION OF THE COMMENTS [1]	GETATION [1]ROOTWA	g., very large boulders in dee fast water, or deep, well-defi 70cm [2] OXBOWS NDS [1] AQUATIO	n or fact water large	Check ONE (Or 2 & average) EXTENSIVE >75% [11] MODERATE 25:75% [7] SPARSE 5:<25% [3] NEARLY ABSENT <5% [1] Cover Maximum 20
3] CHANNEL MORPH	OLOGY Check ONE in each ca	tegory (Or 2 & average)		
□ High'[4] □ Đ □ MODERATE[3]: □ GI □ LOW[2] □ FA ■ NONE [1] □ PO Comments	(GELLENT [7] NONE [6] COD [5] RECOVERE VIR [3] RECOVERI COR [1] RECENT OF	D[4] HI D[4] M VG[3] M NO RECOVERY[1]	ABILITY GH[3] DERATE[2] DW[1]	Channel Maximum 20
4] BANK EROSION A. River right looking downstream	<i>ND RIPARIAN ZONE</i> Check			ik & average)
EROSION NONE/EITTLE [3] MODERATE [2] HEAVY/SEVERE [1] Comments	R	DEFOREST, SWAMP; DESHRUB OR OLD FILE DESHRUB O	ELD [2] \$\text{New Field [1] } \qua	CONSERVATION TILL AGE [1] URBAN OR INDUSTRIAL [0] MINING/CONSTRUCTION [0] te predominant land use(s) 00m riparian. Maximum 10
0.7≼1m [4] J	ORIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & average POOL WIDTH > RIFFLE WIDTH POOL WIDTH = RIFFLE WIDTH POOL WIDTH < RIFFLE WIDTH	[2]	that apply SLOW [1] INTERSTITIAL [-1] INTERMITTENT [-2]	Recreation Potential Primary Contact Secondary Contact (ctrcle one and comment on back) Pool / Current Maximum
Indicate for function of riffle-obligate services RIFFLE DEPTH BESTAREAS > 10cm [2] BESTAREAS 5-10cm [1] BESTAREAS < 5cm	RUN DEPTH R □ MAXIMUM > 50cm [2] □ S □ MAXIMUM < 50cm [1] □ M	ck ONE (<i>Or 2 & average</i>). IFFLE:// RUN SUBSTR IABLE (e.g., Cobble, Bould OD. STABLE (e.g., Large G	ATE RIFFLE / RU	N EMBEDDEDNESS IONE [2] OW [1]
Comments 6] GRADIENT (< 0, l		NSTABLE (e.g., Fine Gravel,		EXTENSIVE [-1] Maximum 8
DRAINAGE AREA (デール中に	☐ MODERATE [6-10] 9 mi²) ☐ HIGH VERY HIGH [1	/ui G G		
EPA 4520 71,502			D. Dall KO	7/16/08 06/11/08

18 A				
Cicara	and Use Asse	bitat Evaluation I		ore: [37]
Stream & Location:	Des Plalnes River	281.7 LB		te:07/(0/08
River Code: -	Sco - STORET#:	prers Full Name & Affili Lat./ Long.:۲	ation: Joe Vondusha 4654/88.164	Office verified
11 SUBSTRATE Check Of	NLY Two substrate TYPE BOXES:	(NAD 83 - decimal °)!! "		location
DECT TVDEC	% or note every type present OL RIFFLE OTHER TYPES	POOL RIFFLE ORIGI	Check ONE (Or 2 & average) IN Q	UALITY
□ □ BLDR/SLABS [10]	HARDPAN [4]		200 A 100 A	WY [:2]
☐☐ BOULDER[9]	DETRITUS [3] 	☐ TILLS [1] ☐ WETLAND		DERATE [-1] Substrate
GRAVEL[7]		HARDRAN SANDSTO	(0) DERE	
□ □ BEDROCK[5]	(Score natural st. PES: 1/4 or more [2] sludge from	ubstrates; ignore RIP/RAP [0	SEDDEON MOI	ERATE 1 Maximum
NUMBER OF BEST TYLE Comments	2ES: Life or more [2] studge from	point-sources) LACUS RI SHALE 1	WEINI TO AND IN NOT	(MAL [0] 20 E [1]
(swkin bages)	(4) (D)	□ COAL FINE	S[2]	- 4)
21 INSTREAM COVER	ndicate presence 0 to 3: 0-Absent; 1	-Very small amounts or if more	common of marginal A	MOUNT
quality: 3-Highest quality in m	uality; 2-Moderate amounts, but not oderate or greater amounts (e.g., ve ill developed rootwad in deep / fast v	ery large houlders in deen or fac	mounts of nignest Check ON	IE (Or 2 & average)
UNDERGUT BANKS [1	I POOLS≥70G	m [2] OXBOWS; BAC		SIVE >75% [11] (ATE 25:75% [7]
OVERHANGING VEGE SHALLOWS (IN SLOW				E 5≪25% [3] Y ABSENT <5% [1]
ROOTMATS [ii]		Section in the section of the sectio		Cover
Comments			(3)	Maximum 8
3] CHANNEL MORPHOL	OGY Check ONE in each categor	y (Or 2 & average)		- Company
Contribution of the Contri	OPMENT CHANNELIZ			
☐ MODERATE[3] 🔲 GOO	D[5] RECOVERED[4]	A CONTRACT OF THE PROPERTY OF	TE[2]	
LOW [2]				Channel
Comments	A way on a special to be the state of the st	a ngamingan katang kabang katang kalang kalang terlang kang katang terlang katang terlang katang terlang katan Kang katang kang katang kang kang kang kang kang kang kang k		Maximum +
4] BANK EROSION AND	D RIPARIAN ZONE Check ON	E in each category for EACH BA	NK (Or 2 per bank & average)
River right looking downstream	RIPARIAN WIDTH WIDE > 50m (4)	FLOOD PLAIN Q	L R	
NONE /LITTLE (3)	I ☐ MODERATE 10:50m [3]. ☐	☐ FORESTESWAMP [3] ☐ SHRUB OR OLD FIELD [2]	⊿ □ URBAN OF	ATION TILLAGE [1] RINDUSTRIAL [0]
MODERATE [2] // HEAVY//SEVERE [1]		RESIDENTIAL PARK NEW DEENGED PASTURE (1)		ONSTRUCTION [0]
Comments		OPEN PASTURE, ROWCR	Indicate predomina OP [0] past 100m riparia	
	(3.5)	(1.5)		Maximum 10
5] POOL / GLIDE AND F MAXIMUM DEPTH	RIFFLE / RUN QUALITY		[Page 1	tion Potential
Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELO Check ALL that ap		ary Contact
	POOLWIDTH > RIFFLE WIDTH [2] POOLWIDTH = RIFFLE WIDTH [1]	TORRENTIAL [-1] ZSLO	W[1] Secon	dary Contact
	POOLWIDTH < RIFFLE WIDTH 101	□ FAST [f] □ INTE	ERMITTENT [-2]	and comment on back)
☐ < 0.2m [0]		☐ MODERATE [1] ☐ EDD Indicate for reach - pools	IES [1] and riffles.	Pool / Current
Comments				Maximum 12
Indicate for function	nal riffles; Best areas must	be large enough to sup	port a population	NO RIFFLE [metric=0]
of riffle-obligate spe RIFFLE-DEPTH	RUN DEPTH RIEF	NE (Or 2 & average). LE I RUN SUBSTRATE	Too was	
☐ BEST AREAS > 10cm [2] [☐ BEST AREAS 5-10cm [1] [□ MAXIMUM > 50cm [2] □ STABL □ MAXIMUM < 50cm [1] □ MOD.:	E (e.g., Cobble, Boulder) (21		
☐ BEST AREAS < 5cm		(BLE (e.g., Fine Gravel, Sand)	101 □ MODERATE	[0] Riffle / CA
[metric≘0] Comments			EXTENSIVE	Maximum 9
6] GRADIENT (人口, l ft	mi) VERY LOW LOW [2-4]	%POOL:	WOLDE!	
DRAINAGE AREA	☐ MODERATE [6-10]	>	=	Gradient 6
(≻2,2/0 n	ni²) 🗌 HIGH - VERY HIGH [10-6]	%RUN: ()%RIFFLE:(10

7/16/08-06/11/08

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>1,502

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QHEI	Score:	[38]

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Stream & Locatio	on:	Des Plaines	Kiver .		LRB			7/ <u>.6</u> Date:		-
				_Scorers	Full Na	me & Affiliation	7: Joe U	Sudruska	EA Engl	weering
River Code:		STO	RET#:		Lat./ I	ong. 41 . 4 6	64 188	. 1676	Office	verified L
1] SUBSTRATE	heck ONLY	Two substrate	TYPE BOX	(ES;	MAD 63 - 1				•	000000
e:	stimate % o	r note everv tv	pe present				k ONE (Or 2		I ITS	
BEST TYPE	- PUUL P	RIFFLE _	HER IY	PESPOOL	RIFFLE	ORIGIN LIMESTONE [1]	Men	***************************************	LITY	
BOULDER [9]	[10]		HARDPA DETRITU			☐ TILLS [1]		☐ HEAVY		Substrate
□□ COBBLE [8]			MUCK [2]			☐WETLANDS [0]	SILT	□ NORM.		
☐☐ GRAVEL [7]			SILT [2]	<u> </u>		HARDPAN [0]			0	0
SAND [6]	- 	🗆 🗆	ARTIFICI	3322074-142-1		SANDSTONE [0]	ς nDEΛ	EXTEN	SIVE [-2]	
□□ BEDROCK [5] NUMBER OF BES	ST TVDES	. ∏ 4 or mor	ocore na المانية	tural substrate e from point-	s; ignore sources)	LACUSTRINE	J SEDDEO,	MODEI MODEI MORM	AL INT	Maximum 20
Comments	JI IIELC	3 or less	[0]	•		LI SHALE [-1]	13	"□ NONE		20
Comments		(ii)	(D)			☐ COAL FINES [-2	I	EW)	ALTON WARRY TO ARREST AT LANCE A	
01/11/07/07/11/00	مالحدا حسي	oto propopos	4- 21 0 AL			(\$)				
2] INSTREAM CO	guali	tv: 2-Moderate	amounts.	but not of hial	nest qual	ty or in small amoun	ts of highest	2 440.	OUNT	
quality; 3-Highest qua diameter log that is st	ality-in model	rate or dreater	amounts (e.a verv lara	e houlde	's in deen or fast wat	er lame	Check ONE		
UNDERGUT BA		veloped look	POOLS	7 last water, t > 70cm [2]		XBOWS: BACKWA			E 25:75% [
OVERHANGING		ION [1]	ROOTV	VADS [1]		QUATIC MACROPH		SPARSE 5	≺2 5% [3]	
SHAELOWS (IN	THE PARTY OF THE P	TER) [1]	BOULD	ERS [1] -		DGS OR WOODY D		☐ NEARLY A	BSENT <59	6[1]
ROOTMATS [1]								(a)	Cover	
Comments							(3)	(9)	Maximum 20	المحا
31 CHANNEL MOR	DUOL OC	Check ON	E in each c	ofogon/Or 2	2 01/070	\			 	The state of the s
	DEVELOP	-		ELIZATIO		STABILITY				
□ HIGH.[4]	☐ EXCELL		NONE [6]			HIGH 131				
Participant and Control of the	□ GOOD (S		RECOVER			MODERATE [2]			
	☐ FAIR [3]		RECOVER	ING [3]		LOW(I)			Channel	
NONE [1] Comments	≥ POOR [1		RECENIC	OR NO RECO	XEKÆ 13	j			Maximum	/ /
									20	
4] BANK EROSIO	N AND R	IPARIAN Z	ONE Che	ck ONE In ear	ch catego	ry for FACH BANK	Or 2 ner hank	& average)		
River right looking down	nstream	RIPARIAN				D PLAIN QUAL		a avolugo)		
L R. EROSION		WIDE > 50m	[4]		REST, SV	VAMP (3)		CONSERVATI	ON TILLAG	EM
MODERATE [2]	400000000000000000000000000000000000000	MODERATE		. □ □shi	RUB OR	OLD FIELD 121		JRBAN OR IN		
HEAVY/SEVER		NARROW 5-	(UM [2] ()W < 5m (SIDENTIA	L, PARK, NEW FIEL	25257 ·	VINING/CON	to can with a subject to	N [O]
* Secretaria de la Mariera de Capacida de America de Am		NONE [0]			EN PAST	STURE [] URE ROWCROP [0	Indicate	e predominant 10m riparian		
Comments	7	anti-continued and any and any		SEC STATE			Manage Past 70	om npanan.	Riparlan Maximum	6
-	<u> </u>	fragnites	adj	ecent fo	qua	ry			10	
5] POOL / GLIDE					U	d comment.				
MAXIMUM DEP Check ONE (ONLY		CHANNE				RENT VELOCIT	<u>Y</u>	Recreation		 1;
2 1m [6]		Check ONE (O DLWIDTH > RI	EFI E WID		Che DDEXITI	eck ALL that apply AL [-1]		-	/ Contact	11
(1 0.7≪1m [4]	₽ ₽00	OL WIDTH = RI	FFLEWID	THUI UV	RY FAS	[[]] INTERST	ITIAL I-11	Seconda (circle one and		
□ 0.4×0.7m [2]	□ PO(OL WIDTH < RI	FFLE WID	TH[0] \Box FA	(ST [1]		TTENT [-2]	Touce oue and	COMMISSIE ON DA	21/1
☐ 0.2<0.4m [1] ☐ < 0.2m [0]				LM	DDERAT	E[1] DEDDIES or reach - pools and	1)		Pool / Current	
Comments				•	iiiuical o ii	or reacir - poors and i	illes.		Maximum	8
									12	(Marie Marie
of riffle-obliga	unctional ate specie	riffles; Bes	t areas	must be la heck ONE (<i>Ol</i>	rge end	ough to support	t a popula	tion	RIFFLE [m	etric=01
RIFFLE DEPTH	•	RUN DEPT					FLF / RIII	N EMBEDE	FDNESS	
☐ BEST AREAS > 10ci	m[2] 🗆 M	AXIMUM > 50	cm [2] 🔲	STABLE (e.g	Cobble	Boulder) [2]		ONE [2]	LDITLOC	•
☐ BEST AREAS 5:10ci	m[1] ∐M	AXIMUM < 50	cm [1] 🔲	MOD. STABL	E (e.g., I	arge Gravel) [1]	#35%	ow [i] wc		
☐ BEST AREAS < 5cr [metri	m= ic=01		Ш	UNSTABLE (e.g., Fine	Gravel, Sand) [0]		ODERATE [0]	Riffle / Run	
Comments	and his first	•					ЦЕ	CTENSIVE [:1	Maximum	
	0.1	ZKIZONIGI KINTIZANAN		w wareaute					8	CALLED TO SERVICE OF THE PARTY
6] GRADIENT		☐ VERY LC		[2-4]	•	%POOL:(/ <i>DT</i>) %GLIDE	::():	Gradient	
DRAINAGE AR	KEA J₁&⁴(o ml²)	☐ HIGH -V		[10-6]		%RUN:)%RIFFLE		Maximum	6
		Probablish Series			Harry Branch Street		,		10	4/00
* EPA 4520 > 1,	,502					1/2017	el KC	7/16/0	06/1	1/08

EIBEMW	Dio Elingity acevely			
OTOLFA		tat Evaluation Indo		eore: [39]
Stream & Location:	les Planes River	281.BLB		nte: <u>07</u> <u>/ o</u> / 08
River Code:	Score STORET #:	rs Full Name & Affiliation	n: Joe Vanhush 16 188. 67	Office verified location
1] SUBSTRATE Check ONLYT estimate % or	note every type present	Checi	k ONE (Or 2 & average)	
BEST TYPES POOL RI	OTUED TYPES	OL RIFFLE <u>ORIGIN</u> □ LIMESTONE [1]		UALITY AVY [-2]
	DETRITUS [3]	☐ TILLS[1] ☐ WETLÄNDS [0] ☐ ØHÄRDPÄN [0] ØSÄNDSTONE [0]	SILT ☐ MO □ NO □ FRE	DERATE [-1] Substrat RMAL [0] EE [1]: ENSIVE [-2]
NUMBER OF BEST TYPES:	(Score natural substitution of the substitutio	rates; ignore	DIS VÇ□NOI	DERATE [-1] Maximum RMAL [0] 20
Comments	3 or less [0]	☐ SHALE [-1] ☐ COAL FINES [-2	y⊓Nōi	VE(1)
2] INSTREAM COVER Indica	te presence 0 to 3: 0-Absent 1-Ve	ny small amounts or It more come	mon of marginal	110112
quality; 3-Highest quality in moders diameter log that is stable, well dev UNDERCUT BANKS[1] OVERHANGING VEGETATION SHALLOWS (IN SLOW WAT ROOTMATS [1]	r; 2-Moderate amounts, but not of ite or greater amounts (e.g., very liveloped rootwad in deep / fast wate POOLS > 70cm [: ON [1] ROOTWADS [1]	nighest quality or in small amoun arge boulders in deep or fast wat er, or deep, well-defined, function	nts of highest ter, large Check Ol extended the control of the con	\MOUNT NE (Or 2 & average) SIVE>75% [11] RATE:25:75% [7] IE 5≪25% [3] Y ABSENT <5% [1]
Comments'		, which	(4) (5)	Cover 9
3] CHANNEL MORPHOLOG	V Check ONE in each category ()r 2 & average)		20
SINUOSITY DEVELOPI	MENT CHANNELIZATI	ON STABILITY	all the	
☐ HIGH [4] ☐ EXCELLE ☐ MODERATE [3] ☐ GOOD [5] ☐ LOW [2] ☐ FAIR [3] ☐ NONE [1] ☐ POOR [1] Comments	RECOVERED [4] RECOVERING [3] RECENT OR NO RE	The second section of the second section of the second section of the second section s		Channel Maximum 20
4] BANK EROSION AND RIV	PARIAN ZONE Check ONE in RIPARIAN WIDTH	each category for EACH BANK (FLOOD PLAIN QUAL		9)
BEROSION NONE/LITTLE[3] MODERATE[2] HEAVY/SEVERE [1]	WIDE > 50m [4]	FOREST, SWAMP. [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK, NEW FIEL FENCED PASTURE (1)	CONSERV	ATION TILLAGE [1] R INDUSTRIAL [0] CONSTRUCTION [0] Pant land use(s)
Comments 3	NONE (0)	OPEN PASTURE, ROWGROP (I)] past 100m riparia	n. Riparian Maximum 10
Check ONE (ONLY!) Check ONE (ONLY!) Check ONE (ONLY!) Check ONE (ONLY!) POO	CHANNEL WIDTH leck ONE (Or 2 & average) LWIDTH > RIFFLE WIDTH [2] LWIDTH = RIFFLE WIDTH [1] LWIDTH < RIFFLE WIDTH [0]	CURRENT VELOCIT Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSI FAST [1] INTERSI MODERATE [1] IEDDIES Indicate for reach - pools and	Prim Secon (circle one	ation Potential ary Contact idary Contact and comment on back) Pool / Current Maximum
of riffle-obligate species		(Or 2 & average).		NO RIFFLE [metric=0]
RIFFLE DEPTH F	RUN DEPTH RIFFLE	<u> RUN SUBSTRATE RIF</u>	FLE / RUN EMBE	<u>DDEDNESS</u>

□ BEST AREAS > 10cm [2] □ MAXIMUM > 50cm [2] □ STABLE (e.g., Cobble, Boulder) [2] □ BEST AREAS 5-10cm [1] □ MAXIMUM < 50cm [1] □ MOD. STABLE (e.g., Earge Gravel) [1] □ BEST AREAS < 5cm □ UNSTABLE (e.g., Fine Gravel; Sand) [0] □ FOM [1]
□ NONE [3] Riffie (☐ MODERATE [0] EXTENSIVE [-1] Maximum Run Comments 6] GRADIENT (Lo, 1 ft/mi) ☐ VERY LOW = LOW [2-4] %POOL:(200 %GLIDE Gradient DRAINAGE AREA (1240 ml²) MODERATE [6-10] HIGH - VERY HIGH [10-6] Maximum %RIFFLE: %RUN: EPA 4520 71,502 7/16/08 06/11/08

□ €	and die imgreke de de	edy ederk sedinis	e) zaebeenupet n	8,21111)8	
OCIA		abitat Evaluati essment Field		HEI Score: [45
Stream & Location:	Des Plates River 7			81_3 Date: 071	
		orers Full Name &	Affiliation: Jee Ve	whisten EA Engli	neer, ing
River Code:	STORET #:	Lat./ Long.: (NAD 83 - decimal ")	<u>41.4629 18.</u>	8.1712	ice verified location
1] SUBSTRATE Check Control of the estimate	ONLY Two substrate TYPE BOXES; Which was a substrate TYPE BOXES; Which was a substrate TYPE BOXES;	.*	Check ONE (Or :	? & average)	
BEST TYPES BLDR/SLABS[10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5]	OL RIFFLE OTHER TYPES	USHA	DRIGIN ESTONE [1] S [1] S [1] LANDS [0] DPAN [0] DSTONE [0] RAP [0] USTRINE [0] LE [-1]	QUALITY -ZTHEAVY [-2] -MODERATE IN	8,5
TO STORY THE STORY OF THE STORY	D 2	452000000	LEINES [2]	(3)	
diameter log that is stable, w UNDERCUT BANKS [OVERHANGING VEG SHALLOWS (IN SLOV ROOTMATS [1] Comments	ETATION [1] ROOTWADS	water, or deep, well-defined in [2] 2 OXBOWS	ed, functional pools. BACKWATERS (f) MACKOPHYTES (1) WOODY DEBRIS (1)	Check ONE (Or 2 & a	[61] &[7] 3] 55% [1] er
				Man .	20
SINUOSITY DEVE	4 abocent	ATION STA	ABILITY GHIOI DERATE [2] W(1) Unfry	Chanr Maximu	مسبدرات
River right looking downstream REGSION NONE / LUTTLE [3] MODERATIE [2] HEAVY / SEVERE [1]	■ ■ MODERATE 10-50m [3]	FLOOD PL/ FOREST, SWAMP IS SHRUB, OR OLD FIE RESIDENTIAL PARI ENCED PASTURE	AIN QUALITY 13. C.	CONSERVATION TILL TURBAN OR INDUSTRI MINING/CONSTRUCT ate predominant land use	AL [0] 10N [0]
Comments 3	(),5	□ OPEN PASTURE R	past	100m riparian. Riparia Maximu 1	
MAXIMUM DEPTH Check ONE (ONLY!) Im [6] 0:7<\im [4]	CHANNEL WIDTH Check ONE (Or 2 & average) POOLWIDTH > RIFFLE WIDTH [2] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0]	□ FAST [1]	that apply	Recreation Pote Primary Conta Secondary Con (circle one and comment or	tact

		STORET #:	Lat./ Long.: 4	4629 188	1712	location
1] SUBSTRATE	Check ONLY Tw	vo substrate TYPE BOXES; ote every type present	.*	Check ONE (Or 2	g overage)	
BEST TYP		OTHED TYPES	DOOL DIETLE ORIG	•	QUAL	LITY -1.5
□□ BLDR/SLABS	3 [10]	U U HAKUPAN [4]		(E(1)	-ETHEAVY	
☐☐ BOULDER [9] ☐☐ COBBLE [8]	- -			SILT	MODER	
GRAVEL [7]		MUCK [2] 	— ☐WETLAND HARDPAN	A Company of the Comp	□ NORMA □ FREE I1	00000000000000000000000000000000000000
□ □ SAND [6]		🗆 🗆 ARTIFICIAL [0].	DSANDSTO			
□□ BEDROCK [5	TOT TYPES	(Score natural su	ubstrates; ignore RIP/RAP [[point-sources] LACUSTR	NE TO SEDUCO,	DEXTENS MODERA NORMA NONE [1	ATE [=1] Maximum
= 1.176 fort	SI IYPES:	□ 3 or less [0]	SHALE A		NONE	트UI 20
Comments	9	Control Section Section 2 and Transfer	□ GOAL EINI	ES [-2]	080000000000000000000000000000000000000	/
21 INSTREAM C	OVER Indicate	presence 0 to 3: 0-Absent: 1	رورج) Very small amounts or if more-	common of marair	-3	<u> </u>
	wildity.	2-Moderate amounts but not	of highest quality or in amall a	maunta of biobast		DUN I Dr 2 & average)
diameter log that is	stable, well deve	e or greater amounts (e.g., ve loped rootwad in deep / fast v	ory large boulders in deep or fa- water, or deep, well-defined, fur m [2] ———————————————————————————————————	st water, large nctional pools.	EXTENSIVE	MANAGEMENT WITH VALVANTANIA AND AND AND AND AND AND AND AND AND AN
UNDERGUT	BANKS [1]	POOLS > 70G	m [2] 🚾 OXBOWS.BAC	KWATERS [1]	MODERATE	E 25-75% [7]
	NG VEGETATIO IN SLOW WATE		1] 2-AQUATIC MACI	ROPHYTES[1] DYDERBISH1	SPARSE 5-	<25% [3] BSENT <5% [1]
ROOTMATS						Cover
Comments				6)	<u>(5)</u>	Maximum //
						20
3] CHANNEL MO SINUOSITY	<i>PRPHOLOGY</i> DEVELOPM	Check ONE in each categor	_ · ·			
☐ HIGH [4]	DEVELOPING DEVELOPING		<u>ATION</u> <u>STABILI</u> ☑ HIGH 31			
☐ MODERATE [3]	☐ G00D[5]	RECOVERED [4]	MODER	Carrier Contracts:		
Eow [2]	☐ FAIR [3] = ☐ POOR [1]	RECOVERING [3	I S TOM [1]			Channel
Comments		7 RECENTION NO	REGUVER (11)			Maximum 6.5
		- afacent of	o quarry + industr	¥-		20
4] BANK EROSI	ON AND RIP	ARIAN ZONE Check ON	in each category for EACH BA	NK (Or 2 per bank	(& average)	
River right looking do	wnstraam 🗀					
- <u> </u>	1 0	IPARIAN WIDTH	B FLOOD PLAIN O	LK		
EROSION NONE/LUTTL		IDE > 50m [4]	FOREST SWAMP 131	i d d	CONSERVATIO	N TILLAGE [1]
EROSION DE MODERATE I		IDE > 50m [4]	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW		URBAN OR INI	DUSTRIALION
EROSION NONE/LUTTL		TIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1]	FOREST, SWAMP. [3]. SHRUB OR OLD FIELD [2]. RESIDENTIAL PARK NEW. FENCED PASTURE [1].	FIELD [1]	URBAN OR INI MINING / CONS o predominant la	DUSTRIAL [0] BTRUCTION [0]
EROSION NONE / LITTLE MODERATE:: HEAVY / SEVE		TIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1]	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW	FIELD [1]	ÜRBAN ÖR INI MINING/CONS e predominant la DOm riparian	DUSTRIAL [0] STRUCTION [0] and use(s) Riparian
EROSION DE MODERATE I		TIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1]	FOREST, SWAMP. [3]. SHRUB OR OLD FIELD [2]. RESIDENTIAL PARK NEW. FENCED PASTURE [1].	FIELD [1]	ÜRBAN ÖR INI MINING/CONS e predominant la DOm riparian	DUSTRIAL [0] STRUCTION [0] and use(s)
EROSION NONE/LUTTE MODERATE/ HEAVY/SEVE Comments 5] POOL / GLIDI		DOE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E / RUN QUALITY	FOREST, SWAMP. [3]. SHRUB OR OLD FIELD [2]. RESIDENTIAL PARK NEW. FENCED PASTURE [1].	FIELD [1]	URBAN OR INI MINING (CONS e predominant le 00m riperien	OUSTRIAE [0] STRUCTION [0] and use(s) Riparian Maximum 10
EROSION NONE/LUTTE NONE/LUTTE MODERATE! HEAVY//SEVE Comments 5] POOL / GLIDI MAXIMUM DE	EAND RIFFL	DOE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E / RUN QUALITY CHANNEL WIDTH	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FENCED PASTURE [1] OPEN PASTURE ROWCR	/FiELD [1] Indicate operation	URBAN OR INI MINING / CONS e predominant le Orm riparian	DUSTRIAL [0]
EROSION NONE/LUTTE MODERATE/ HEAVY/SEVE Comments 5] POOL / GLIDI	E AND RIFFL PTH CAY) Che	DIDE > 50m [4] ODERATE 10.50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E / RUN QUALITY CHANNEL WIDTH OCK ONE (0r 2 & average)	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW EENCED PASTURE [1] OPEN PASTURE ROWCR CURRENT VELO Check ALL that ap	/FIELD.[1] Indicate OP [0] Indicate past 10	URBAN OR INI MINING / CONS a predominant le Dom riparian. Recreation Primary	DUSTRIAL [0] BIRUCTION [0] and use(s) Riparlan Maximum 10 Potential Contact
EROSION NONE/LUTTE NONE/LUTTE MODERATE : HEAVY/SEVE Comments 5] POOL / GLIDI MAXIMUM DE Check ONE (ON. 1m [6] 0.7< 1m [4]	EAND RIFFL PTH LYI) Che	DIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E / RUN QUALITY CHANNEL WIDTH ICK ONE (0r 2 & average) WIDTH > RIFFLE WIDTH [2] WIDTH = RIFFLE WIDTH [1]	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FENCED PASTURE [1] OPEN PASTURE ROWCR CURRENT VELO Check ALL that ap TORRENTIAL [1] VERY FAST [1]	PCITY ply DW [1] ERSTITIAL [3]	URBAN OR INI MINING / CONS a predominant le com riparian. Recreation Primary Secondar	DUSTRIAL [0]
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ROSION NONE / LUTTLE NONE / LUTTLE MODERATE HEAVY / SEVE	E AND RIFFL PTH LY() Che	DIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY, NARROW < 5m [1] ONE [0] E/RUN QUALITY CHANNEL WIDTH ack ONE (Or 2 & average) WIDTH = RIFFLE WIDTH [1] WIDTH < RIFFLE WIDTH [0]	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FENCED PASTURE [1] OPEN PASTURE ROWCR CURRENT VELO Check ALL that ap TORRENTIAL [-1] SLC VERY FAST [1] INT FAST [1] INT Indicate for reach - pools	CITY ply W(1) ERSTITIAL [-1] ERMITTENT [-2] DIES [1] and riffles.	Recreation Primary Secondar (circle one and co	Pool / Current Maximum 12
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EROSION NONE/LITTLE NONE/LITTLE NONE/LITTLE MODERATE] HEAVY/SEVE Comments 5] POOL / GLIDI MAXIMUM DE Check ONE (ON. Sim [6] 0.7 <sim 0.2="0.2m" 0.2<0.4m="" 0.4<0.7m="" [0]="" [1]="" [2]="" [4]="" areas="" best="" comments="" dep="" for="" indicate="" of="" rifele="" riffle-oblic=""> 10 BEST AREAS > 10 BEST AREAS > 10 Comments</sim>	E[3]	DIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E/RUN QUALITY CHANNEL WIDTH ICK ONE (Or 2 & average) WIDTH > RIFFLE WIDTH [1] WIDTH < RIFFLE WIDTH [0] Files; Best areas must Check O UN DEPTH RIFFLE RIMUM > 50cm [2] STABLE RIMUM < 50cm [1] MOD.	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK, NEW FENCED PASTURE [1] OPEN PASTURE ROWCR CURRENT VELO Check ALL that ap TORRENTIAL [3] SLC VERY FAST [1] INT FAST [1] INT Moderate [1] Decinicate for reach - pools be large enough to sup NE (Or 2 & average). E / RUN SUBSTRATE E (e.g., Cobble, Boulder) [2] STABLE (e.g., Large Grave)	PCITY Ply	Recreation Primary Secondar (circle one and co	DUSTRIAL [0] DIRUCTION [0] and use(s) Riparian Maximum 10 Description 10 Potential Contact y Contact y Contact y Current Maximum 12 RIFFLE [metric=0] EDNESS Riffle /
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EROSION NONE/LITTLE NONE/LITTLE MODERATE [] HEAVY/SEVE Comments 5] POOL / GLIDI MAXIMUM DE Check ONE (ON. Sim [6] 0.7 <im 0.2<0.4m="" 0.4<0.7m="" [1]="" [2]="" [4]="" areas="" best="" comments="" dep="" for="" indicate="" of="" rifele="" riffle-oblic=""> 10 BEST AREAS > 1</im>	E(31	DIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E/RUN QUALITY CHANNEL WIDTH ICK ONE (Or 2 & average) WIDTH > RIFFLE WIDTH [2] WIDTH > RIFFLE WIDTH [1] WIDTH < RIFFLE WIDTH [0] The check of the check	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK, NEW FENCED PASTURE [1] OPEN PASTURE ROWCR CURRENT VELO Check ALL that ap TORRENTIAL [-1] SEC VERY FAST [1] Moderate [1] Moderate for reach - pools be large enough to sup NE (Or 2 & average). E / RUN SUBSTRATE E (e.g., Cobble, Bouldar) [2] STABLE (e.g., Large Gravel) BBLE (e.g., Fine Gravel, Sand)	POCITY POW [1] ERSTITIAL [-1] ERMITTENT [-2] DIES: [1] and niffles. POOT a popula RIFFLE / RUI [1] [1] [2] WGL!DE	Recreation Primary Secondar (circle one and co	Pool / Current Maximum 12 RIFFLE [metric=0] ENERGY OF ACT OF AC
EROSION NONE/LITTL NONE/LITTL MODERATE] HEAVY/SEVE Comments 5] POOL / GLIDE MAXIMUM DE Check ONE (ON. 1m [6] 0.7<1m [4] 0.2<0.4m [1] 0.2<0.4m [1] 0.2<0.4m [1] Comments Indicate for of riffle-oblic RIFFLE DEP BEST AREAS 5-10	FAND RIFFL PTH CY) Che Pool Pool Pool Ref [1] MAX cm [2] MAX cm [2] MAX cm [3] MAX cm [4] MAX cm [4] MAX cm [5] MAX	DIDE > 50m [4] ODERATE 10-50m [3] ARROW 5-10m [2] ERY NARROW < 5m [1] ONE [0] E/RUN QUALITY CHANNEL WIDTH ICK ONE (Or 2 & average) WIDTH > RIFFLE WIDTH [2] WIDTH > RIFFLE WIDTH [0] The channel width 11 12 12 13 14 14 14 14 14 14 14	FOREST SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FENCED PASTURE [1] OPEN PASTURE ROWGR CURRENT VELO Check ALL that ap TORRENTIAL [-1] SLC VERY FAST [1] INT MODERATE [1] SLC INDICATE OF TRACE OF TR	PERIOLATION POPULAR PRINTENT [-2] DIES [1] and nifles. POPULATION POPULAR POP	Recreation Primary Secondar (circle one and co	DUSTRIAL [0] DIRUCTION [0] And use(s) Riparian Maximum 10 Description Potential Contact y Contact y Contact y Current Maximum 12 RIFFLE [metric=0] DNESS Riffle / Run Maximum 8 Gradient

	STOTINI GITG LOCAL COLY COLY			,
Crospa	Qualitative Habitat		QHEI Sco	re: [385]
Stream & Location: Des	Planes River - 281.0		RM: 2-81 © Date:	07////08
Burge formhal-Cand Burge	Co. & CF Frelustrips Scorers Fi	ıll Name & Affiliation:		
River Code:	STORET#:L	at./Long.: 41 . 45865		Office verified location
1] SUBSTRATE Check ONLY Two estimate % or not	e every fyne present	Check ON	E (Or 2 & average)	
BEST TYPES BEDR SLABS [10] GRAVEL [7] GRAVEL [7] BEDROCK [5] NUMBER OF BEST TYPES: Comments Coal fines Pr	LE OTHER TYPES POOL RII	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] GRIP/RAP [0] ICCS) LACUSTRINE [0] SHALE [-1] COAL-FINES [-2]	SILT MODES SILT MODES SILT MODES FREE STEN STEN STEN NORM	ZATE [-1] Substrate AL [0] SIVE [-2] AL [0] AL [0] -o.s
2] INSTREAM COVER Indicate quality; 2 quality; 3-Highest quality in moderate diameter log that is stable, well development of the coverage of	-Moderate amounts, but not of highes or greater amounts (e.g., very large b pped rootwad in deep / fast water, or d POOLS > 70cm [2] [1] ROOTWADS [1]	t quality or in small amounts of	highest check ONE (ols. EXTENSIV [1] MODERAT S [1] SPARSES	E 25-75% [7] <25% [3] BSENT <5% [1]
Comments		C	3 @	Cover Maximum 20
3] CHANNEL MORPHOLOGY		- ·	,	
SINUOSITY DEVELOPME HIGH[4] MODERATE [3] LOW[2] NONE [1] Comments	ITI NONE [6] RECOVERED [4] RECOVERING [3] RECENT OR NO RECOVE	volume volgende	·	Channel 5
4] BANK EROSION AND RIPA River right looking downstream			per bank & average)	
EROSION	DE >50m [4]	FLOOD PLAIN QUALITY ST, SWAMP [3] S OR OLD FIELD [2] ENTIAL PARK, NEW FIELD [1] ED PASTURE [1] PASTURE, ROWEROP [0]	Indicate amdominant	IDUSTRIAL [0] STRUCTION [0]
Comments (2.5)	6		rsk.	Maximum 2.5
5] POOL / GLIDE AND RIFFLE MAXIMUM DEPTH Check ONE (ONLY) Check ONE (ONLY) Check One (ONLY) Check One (ONLY) Check Chec	A CONTROL OF THE CONT	CURRENT VELOCITY Check ALL that apply RENTIAL [1] SLOW [1] FAST [1] INTERMITIEN ERATE [1] EDDIES [1] cate for reach - pools and riffles	Primary Secondal [clrcle one and c	n Potential Contact ry Contact comment on back) Pool / Current Maximum
Indicate for functional riff	es; Best areas must be large	enough to support a n	onulation	12
of riffle-obligate species: RIFFLE DEPTH RU □ BESTAREAS > 10cm 2 □ MAXII	Check ONE (Or 2 on the control of t	& average) NSUBSTRATE RIFFLE Obble Boulder (22)	NO	Riffle /

6] GRADIENT (< 0 (_ft/ml)

EPA 4520

DRAINAGE AREA

71,502

☐ VERY!LOW - LOW.[2:4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10:6]

ChoEA		tat Evaluation Index sment Field Sheet	QHEI Score: (43)
Stream & Location:	Des Plaines River	280,9°LB	RM: <u>2 8 0</u> 9 Date: <u>0 H LO</u> / 08
River Code:	STORET #:	rs Full Name & Affiliation: Lat./Long.: 41.457	Joe Vondenslie EA Engloses/ing 2 188.1668 Office verified location
BEST TYPES BEST TYPES BEST TYPES BEDR/SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7]	k ONLY Two substrate TYPE BOXES; late % or note every type present POOL RIFFLE OTHER TYPES HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2]	Check O ORIGIN DL RIFFLE D	NE (Or 2 & average) QUALITY HEAVY [-2] SILT NORMAL [0] EREE [1]
☐ SAND [6] ☐ BEDROCK [5] NUMBER OF BEST Comments		ates; ignore RIP/RAP 0 nt-sources LACUSTRINE 0 COALFINES -2	EXTENSIVE [2] MODERATE [:1] Maximum 20 NONE [1]
quality; 3-Highest quality diameter log that is stable UNDERCUT BANK OVERHANGING V SHALLOWS (INSI	EGETATION [1] ROOTWADS [1]	nighest quality or in small amounts o arge boulders in deep or fast water, er, or deep, well-defined, functional p	of highest Check ONE (Or 2 & average) large Check ONE (Or 2 & average) large EXTENSIVE > 75% [41] large MODERATE 25:75% [7] large SPARSE 5-25% [3]
3] CHANNEL MORPI SINUOSITY DEV HIGH [4]	HOLOGY Check ONE in each category (OVELOPMENT CHANNELIZATION CHANN	ON STABILITY High (3) Moderate (2) Low (4)	Channel 6
A] BANK EROSION River right looking downstre EROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE!	WIDE > 50m [4]	each category for EACH BANK (Or. FLOOD PLAIN QUALIT FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK, NEW FIELD [FINCED PASTURE [1] DPEN PASTURE ROWCROP [0]	Y CONSERVATION TILLAGE [1]
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (ONLY!) 1m [6] 0.7 < 1m [4] 0.4 < 0.7 m[2] 0.2 < 0.4 m [1] < 0.2 m [0] Comments	Check ONE (Or 2 & average) □ POOL WIDTH > RIFFLE WIDTH [2] □ POOL WIDTH = RIFFLE WIDTH [1] □ POOL WIDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERMITE MODERATE [1] EDDIES [1] Indicate for reach - pools and niffe	NT [-2]
Indicate for function of riffle-obligate RIFFLE DEPTH BESTAREAS > 10cm [BESTAREAS 5-10cm [BESTAREAS < 5cm [metric=0]	RUN DEPTH RIFFLE MAXIMUM > 50cm [2] STABLE(MAXIMUM < 50cm [1] MOD. STA	(Or 2 & average). / RUN SUBSTRATE RIFFI e.g. Cobble Boulder) [2]	POPULATION NO RIFFLE [metric=0] E / RUN EMBEDDEDNESS NONE [2] LOW [1] MODERATE [0] RIffle / Run MAXIMUM MAXIMUM 8
6] GRADIENT (< 0, DRAINAGE AREA	MODERATE [6-10] → MI2) □ HIGH = VERY HIGH [10-6]		RIFFLE: Gradient Maximum 10

Ofcera
Stream & Location:

QHEI Score: 45,5



Stream & Location:	Des Plaines River- 2		RM: <u>280.</u> 1 Date: <u>0</u> 1 1 (08
		rers Full Name & Affiliation:_	Joe Vondrisho GA Engineering
River Code:	STORET #:	Lat./Long.: 41 . 454	<u>4</u> 18 <u>8. 1 6 ₹9</u> Office verified location
1] SUBSTRATE Check ONL estimate %	Y Two substrate TYPE BOXES; or note every type present	Check O	NE (Or 2 & average)
BEST TYPES POOL	RIFFLE OTHER TYPES P	OOL RIFFLE ORIGIN	QUALITY
☐ ☐ BLDR /SLABS [10]/_	U LI HARDPAN [4]	LIMESIONE III	HEAVY[-2]
□ □ BOULDER [9]	□ □ DETRITUS [3] □ □ □ MUGK [2]	TILLS[1]	SILT MODERATE 1 Substrate
☐ ☐ GRAVEL [7]	Ø□\$iĿT[2] □	HARDPAN [0]	DEREE (1)
SAND [6]	ARTIFICIAL (0)	SANDSTONE [0]	FEDDEON MODERATE [-1] Maximum
NUMBER OF BEST TYPE	(Score natural sub S: 4 or more [2] sludge from p	point-sources) LACUSTRINE [0]	Maximum NORMAL [0] 20
Comments	□ 3 or less [0] ②	USHALE [-1]	"□ NONE[1] -/
upper 160 m clear gravel	Vorbble, then - 100 hards	Pan : rest silt & Jand	(-2)
21 INSTREAM COVER Ind	icate presence 0 to 3: 0-Absent: 1-	Very small amounts or if more commo	of marginal AMOUNT
quality: 3-Highest quality in mod	ierate or greater amounts (e.g. ven	of highest quality or in small amounts of highest quality or in small amounts by large boulders in deep or fast water,	or nignest Check ONE (Or 2 & average)
diameter log that is stable; well o	developed rootwad in deep / fast wa	ater, or deep, well-defined, functional	pools. TEXTENSIVE >75% [11]
OVERHANGING VEGETA		1 Z AQUATIC MACROPHY	
SHALLOWS (IN SLOW W			SECTION OF THE PROPERTY OF THE
ROOTMATS[1] Comments			(6) (2) Cover
Comments	· .	·	Maximum 8
31 CHANNEL MORPHOLO	GY Check ONE in each category	(Or 2 & average)	With the state of
SINUOSITY DEVELO			
TO THE RESIDENCE OF THE PROPERTY OF THE PROPER	LENT[7] NONE[6]	HIGH (3)	
☐ MODERATE [3] ☐ GOOD ☐ LOW [2] ☐ FAIR [3]	42-12-13-44-15-46-15-00 Transferred State Control of the Control o	☐ MODERATE [2] ✓ LOW [1]	
MONE[1] POOR			Channel
Comments		(2)	Maximum 7
AL BANK EDOCION AND	DIDADIAN ZONE OUT	in each calegory for EACH BANK (Or	
River right looking downstream	RIPARIAN WIDTH	In each category for EACH BANK (OF FLOOD PLAIN QUALIT	· - ·
	K	FOREST SWAMP (3)	
	MODERATE 10-50m [3] 🔲 🛭	SHRUB OR OLD FIELD 121	URBAN OR INDUSTRIAL [0]
HEAVY/SEVERE [1]	■ NARROW 5-10m [2]	RESIDENTIAL PARK, NEW FIELD FENCED PASTURE (1)	(16)
		OPEN PASI URE, ROWCROP (0)	Indicate predominant land use(s) past 100m riparian. Riparian
Comments 3	4	\mathcal{O}	Maximum 6
FI POOL / CLIDE AND BU	EELE / DUN OUNLITY		10
5] POOL / GLIDE AND RIF MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential
Check ONE (ONLY!)	Check ONE (Or 2 & average)	Check ALL that apply	Primary Contact
		TORRENTIAL ET SLOW [1]	Secondary Contact
		☐ VERY FAST [i] ☐ INTERSTIT ☐ FAST [i] ☐ INTERMIT	
☐ 0.2<0.4m [1]		☐ MODERATE [1] ☐ EDDIES [1]	Pool /
□≤0.2m [0] Comments		Indicate for reach - pools and riffl	es. Current 8
			12
Indicate for functiona of riffle-obligate spec	il riffles; Best areas must b	pe large enough to support a E (Or 2 & average)	population NO RIFFLE [metric=0]
RIFFLE DEPTH		E/RUNSUBSTRATE RIFF	Designation of the Control of the Co
☐ BEST AREAS > 10cm [2] ☐	MAXIMUM > 50cm [2] STABLE	e.g., Cobble, Boulder) [2]	□ NONE [2]
☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm	MAXIMUM < 50cm [1] ☐ MOD.S	TABLE (e.g.; Large Gravel) [1] BLE (e.g., Fine Gravel, Sand) [0]	LOW (1) UMODEPATE DI Riffle /
[metric=U]			MODERATE [0] Run EXTENSIVE [-1] Maximum
Comments			Maximum 8
6] GRADIENT (との、i ft/m		%POOL:(/00)	%GLIDE: Gradient
DRAINAGE AREA	☐ MODERATE [6-10]		
(?3,340 mi²	P) HIGH VERY HIGH [10-6]		oRIFFLE: 10
EPA 4520 >1,502	•	Pinkel	Ke 7/16/08 06/11/08

ofely.			itat Evaluation sment Field		HEI Sco	re: [43.5]
Stream & Location:	Des Planes	10ver - 280	.BLB	RM: 2	80 & Date:	071/0108
River Code: -	- STOR		ers Full Name & Ai Lat./ Long.: ਪ੍ਰ			Elt Enfreering Office verified —
11 SURSTRATE Check	ONLY Two substrate	YPE BOXES:	(NAD 83 - decimal *)	_ <u> </u>		location
DECT TVDEC	e % or note every typ	e present HER TYPES	ON RIFELE OR	Check ONE (Or:		LITY ()
☐☐ BLDR/SLABS [10]_ ☐☐ BOULDER [9]		HARDPAN [4] DETRITUS [3]		11	ØHEAVY □ MODEI	G TANK PROSESSES
☐ ☐ COBBLE [8] ☐ ☐ GRAVEL [7]		MUCK [2] SILT [2]	☐ ☐ ☐ WETLA		' ⊿NORM/ □ FREE [AL [O]
SAND [6] SAND [6] BEDROCK [5]		ARTIFICIAL [0] (Score natural subs	SANDS	TONE [0]	ON D MODE	SIVE [-2]
NUMBER OF BEST TY	PES: □ 4 or more	[2] sludge from p		TRINE [0]	NORM/	AL [0] Waxiii 20
Comments	(8)	(D)	COAL			3
2] INSTREAM COVER	Indicate presence 0	to 3: 0-Absent; 1-V	ery small amounts or if many finds or if many finds or in small amounts or in small the first or in small the	graphics of biobar	inal AM	OUNT
quality; 3-Highest quality in diameter log that is stable, v	moderate or greater a vell developed rootwa	mounts (e.g., very d in deep / fast wa	large boulders in deep o ter, or deep, well-defined	r fast water large	Check ONE ((Or 2 & average) E ≽75% [11]
UNDERGUT BANKS OVERHANGING VEG	[0]	POOLS > 70cm ROOTWADS [1]	[2] OXBOWS, B	ACKWATERS [1] ACROPHYTES [1]	MODERATE 5	
SHALLOWS (IN SLO ROOTMATS (1)	W.WATER) [1]	BOULDERS [1]		OODY DEBRIS [1]		BSENT <5% [1]
Comments	dagge (viggenor : there is a transporting to a 20 dags			3		Cover Maximum 20
3] CHANNEL MORPHO	`	,				Continued in the Contin
□ HIGH [4] □ EX	CELLENT [7] DIN	CHANNELIZATIONE [6]	<u>IION</u> STAE □ HIGH	SILITY (3)		
☐ MODERATE [3] ☐ GO ☐ LOW [2] ☐ FA	OD [5]	ECOVERED [4] ECOVERING [3]	□ Mod ☑'Low	ERATE [2] [1]		
NONE [1] PO		ECENT OR NO R	ECOVERY[1]	ingen errordingen bestel er er er er given bestellt in en		Channel 6
AL DANK EDOCION AN	ID DIDADIAN 70	NE OL LOUR		· · · · · · · · · · · · · · · · · · ·		20
4] BANK EROSION AN River right looking downstream	RIPARIAN	WIDTH R	FLOOD PLAIN		nk & average)	
EROSION NONE/LITTLE [3]	☑ ☐ WIDE > 50m [☐ ☑ MODERATE I	0-50m [3] 🗷 🗆	FOREST, SWAMP [3] SHRUB OR OLD FIELD) i2i 🔲 🗆	CONSERVATI	ON TILLAGE [1] IDUSTRIAL [0]
☐ ☐ MODERATE [2] ☐ ☐ HEAVY // SEVERE [1]	☐ ☐ NARROW 5-10 ☐ ☐ VERY NARRO)m [2] 👙 🔲 🔲	RESIDENTIAL, PARK, N FENGED PASTURE (1)	iEW.FIELD[1] □ □	MINING / CON ate predominant	STRUCTION [0]
Comments	□ □ NONE [O]		OPEN PASTURE ROW	ICROP [0] past	100m riparian.	Riparian 9,5
<u> </u>	<u> </u>) 	(2.5)			10 10
5] POOL / GLIDE AND MAXIMUM DEPTH	CHANNEL	WIDTH	CURRENT VE	LOCITY	Recreation	n Potential
Check ONE (ONLY!) 2 1m [6]	Check ONE (Or POOL WIDTH > RIP	FLEWIDTH [2]	Check ALL tha	t apply	7 II -	Contact
☐ 0:7:≤1m [4] ☐ 0:4:≤0:7m [2]	⊉POOL WIDTH = RIF □ POOL WIDTH < RIF	FLEWIDTH [1]	UVERY FAST [1] 🔲	INTERSTITIAL [+1] INTERMITTENT [-2]	(circle one and	comment on back)
□ 0.2≤0.4m [1] □ < 0.2m [0]			MODERATE [1]	EDDIES [1]		Pool / Current
Comments						Maximum 6
Indicate for function of riffle-obligate sp	onal riffles; Best pecies:	areas must be	e large enough to s E (Or 2 & average).	support a popul	ation ZNO	RIFFLE [metric=0]
RIFFLE DEPTH	RUN DEPTH	RIFFLE	/ RUN SUBSTRAT (e.g., Cobble, Boulder)	E RIFFLE / RU		EDNESS
BEST AREAS 5:10cm [1]	MAXIMUM < 50c	m[1] 🗆 MOD.ST	ABLE (e.g., Large Grav	ei) [1] 🔲	NONE [2] LOW [1]	Riffle /
BEST AREAS < 5cm [metric=0]		LIUNSIAB	LE (e.g., Fine Gravel, Sa		MODERATE [0] Extensive [-1	
AT ADADIENT	ft/mi) 🔲 VERY LOV	i awa		_		8
DRAINAGE AREA	☐ MODERAT		%POOL:	%GLID		Gradient 6
(**\frac{2\pi^2\pi_0}{2\pi^2\pi_0}\) EPA 4520	mi²) ப піснеVE	RY HIGH [10-6]	%RUN:	(108)%RIFFL		10 06/11/08

Orota		at Evaluation Index ment Field Sheet	QHEI Score: अ५.5
	les Plane Wer- 280.		M: 280 H Date: 071//108
adjacent to Amore Ch		Full Name & Affiliation:	Toe Vonduslen EA Erylageving
River Code:	STORET #:	Lat./Long.: 41 . 45 00	2 188. 16 43 location
	ote every type present	Check ON	E (Or 2 & average)
BEST TYPES DEDRISLABS [10] DE	HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] (Score patiral substrate	Elimes Tone [1] TILLS [1] WETLANDS [0] HARDPAN [0] Esandstone [0] es; ignore RIP/RAP [0] -sources) LACUSTRINE [0] SHALE [-1]	SILT MODERATE [-1] Substrate MODERATE [-1] Substrate MODERATE [-1] Substrate MODERATE [-1] Maximum MODERATE [-1] Moderate MODERATE [-1] Moderate MODERATE [-1] Moderate MODERATE [-1] Moderate MODERATE
oily" sedments	· • • • • • • • • • • • • • • • • • • •		(-4)
21 INSTREAM COVER Indicate	2-Moderate amounts, but not of hig e or greater amounts (e.g., very lan aloped rootwad in deep / fast water, POOLS > 70cm [2] N [1] ROOTWADS [1]	small amounts or if more common on thest quality or in small amounts of ge boulders in deep or fast water, la or deep, well-defined, functional po	highest check ONE (Or 2 & average) ols. ExTENSIVE >75% [11] MODERATE 25-75% [7] SPARSE 5-25% [3]
3] CHANNEL MORPHOLOGY	Check ONE in each category (Or	2 & average)	(marganita)
SINUOSITY DEVELOPN HIGH [4]	T[7] NONE[6] RECOVERED[4] RECOVERING[3] RECENTION NO REC	☐ HIGH [3] ☐ MODERATE [2] ☐ LOW [4] EVERY [1]	Channel Maximum 20
4] BANK EROSION AND RIF	ARIAN ZONE Check ONE in ea	ach category for <i>EACH BANK</i> (Or 2) FLOOD PLAIN QUALITY	oer bank & average)
R EROSION DE MODERATE (2) DE MODERATE (2) DE MODERATE (2) DE MODERATE (3) DE MODERATE (4) DE M	/IDE ≥ 50m [4]	PREST, SWAMP [3] IRUB OR OLD FIELD [2] SIDENTIAL, PARK, NEW FIELD [1] NCED PASTURE [1] PEN PASTURE, ROWCROP [0]	CONSERVATION TILLAGE [1] URBAN OR INDUSTRIAL [D] URBAN OR INDUSTRIAL [D] URBAN OR INDUSTRIAL [D] URBAN OR INDUSTRIAL [D] Indicate predominant land use(s) past 100m riparian. Riparian
<u> </u>	(a.5)	\mathcal{Q}	Maximum 10
Check ONE (<i>ONLYI</i>) Ch	CHANNEL WIDTH ack ONE (Or 2 & average) WIDTH > RIFFLE WIDTH (2)	CURRENT VELOCITY Check ALL that apply ORRENTIAL [-1] ZSLOW [1] ERY FAST [1] INTERSTITIAL AST [1] INTERMITIEN IODERATE [1] EDDIES [1] Indicate for reach - pools and riffles.	Pool / Current Maximum
Indicate for functional ri	ffles; Best areas must be la	arne enough to eupport a m	onulation 12
of riffle-obligate species RIFFLE DEPTH R □ BESTAREAS>:0cm/21 □ MA	: Check ONE (C UN DEPTH RIFFLE./ XIMUM> 50cm [2] ☐ STABLE (6, XIMUM< 50cm [1] ☐ MOD, STAB	or 2 & average). RUN SUBSTRATE RIFFLE D. Cobble Boulden (2)	NO RIFFLE [metric=0]
DRAINAGE AREA	VERY LOW : LOW [2-4] MODERATE [6-10] HIGH : VERY HIGH [10-6]		GLIDE: Gradient 6 Meximum 10
EPA 4520 >1,502_		D. 18.0 11	C 7/6/02 06/11/08

@ To IFA		Habitat Evaluation Indessessment Field Sheet	
Stream & Location:	Pes Plaves Niver	280,3 LB	RM: 2803 Date: 07/10/08
River Code:	STORET #:	Scorers Full Name & Affiliation Lat./Long.: 4 44 (NAD 83 - decimal 7 - 4 4 (S);	8 6 188 . 1 6 4 8 Office verified □
BEST TYPES POOL BEDR/SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] BEDROCK [5] NUMBER OF BEST TYPE Comments	or note every type present RIFFLE OTHER TYP HARDPAN DETRITUS SILT [2] Score natu S: 4 or more [2] sludge	Check ORIGIN [4] POOL RIFFLE [3] LIMESTONE [1] [3] WETLANDS [0] WHARDPAN [0] Form point-sources) RIP/RAP [0] SHALE [-1] COAL FINES [-2]	MODERATE 11 Maximum 20 None [1]
qua quality: 3-Highest quality in mod	lity; 2-Moderate amounts, buerate or greater amounts (e., leveloped rootwad in deep / POOLS > TION [1] ROOTWA		s of highest check ONE (Or 2 & average) or, large al pools. EXTENSIVE >75% [11] ERS [1] MODERATE 25-75% [7] YIES [1] SPARSE 6-25% [3]
3] CHANNEL MORPHOLO SINUOSITY DEVELO HIGH [4] MODERATE [3] LOW [2] NONE [1] Comments	PMENT CHANNE LENT [7] NONE [6] [5] REGOVERE]	LIZATION STABILITY HIGH 63 D 141 MODERATE 12	
River right looking downstream EROSION NONE //LITTLE [3] MODERATE [2] HEAVY // SEVERE [1]	RIPARIAN WIDTH WIDE > 50m [4] MODERATE 10.50m [3] NARROW.5:10m [2]	ONE in each category for EACH BANK (INTERPRETATION OF EACH BANK (INTERPRET	ITY GONSERVATION TILLAGE [1] GURBAN OR INDUSTRIAL [0] GURBAN OR INDUSTRIAL [0] GURBAN OR INDUSTRIAL [0] GURBAN OR INDUSTRIAL [0]
✓ >1m[6] □ PG □ 0.7<1m[4] ✓ PG	FLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & average OL WIDTH > RIFFLE WIDTH OL WIDTH = RIFFLE WIDTH OL WIDTH < RIFFLE WIDTH	[2]	Primary Contact Secondary Contact [circle one and comment on back] TENT [-2]
of riffle-obligate speci RIFFLE DEPTH BESTAREAS > 10cm [2] BESTAREAS 5-10cm [1] BESTAREAS < 5cm [metric=0] Comments	ies: Che RUN-DEPTH R MAXIMUM > 50cm [2] □S MAXIMUM > 50cm [1] □M □U	ust be large enough to support tok ONE (<i>Or 2 & average</i>). IFFLE / RUN SUBSTRATE RIF TABLE (e.g., Cobble, Böulder) [2] OD: STABLE (e.g., Large Gravel) [1] NSTABLE (e.g., Fine Gravel, Sand) [0]	a population NO RIFFLE [metric=0]
6] GRADIENT (<0.1 ft/mi) DRAINAGE AREA (27,240mi) EPA 4520 >1,502	☐ MODERATE [6-10]	701 002.000	%GLIDE: Gradient 6 %RIFFLE: Maximum 10 Act KC 7/16/01/08

	or mingrigation, c	in the serve	, <u> </u>	
OTO IPA	Qualitative Habita and Use Assessing		QHEI Scor	e: [5]
Stream & Location:		.orb	_RM: <u>280 o</u> Date:	071 11/08
		Full Name & Affiliation:	The Vondriske &	SH Engineer) ing
River Code:	STORET #:	Lat./Long.: 41 . 4452	<u>5 188.1684</u>	location 🗆
BEST TYPES POOL RIFFL	every type present E OTHER TYPES POOL	RIFFLE ORIGIN	ONE (Or 2 & average) QUA	
BLDR/SLABS[10] BOULDER [9]	HARDPAN [4]	☐ ☐ LIMESTONE [1]	SILT MODER	2. 20 C 3 C 3 C 3 C 3 C 3 C 3 C 3 C 3 C 3 C
COBBLE [8]	□ □ MUCK[2] □ □ SILT [2]	☐ ☐ WETLANDS [0] → HARDPAN [0]	SILI ⊿NORMA □ FREE (
☐ ☐ SAND [6]	☐ ☐ ARTIFICIAL [0]	SANDSTONE [0]	SEDDEON ☐ MODER	SIVE [2]
NUMBER OF BEST TYPES:	(Score natural substrate 4 or more [2] sludge from point-s	ources) LACUSTRINE[0]	NORMA	AL [0] 20
Comments	3 or less [0] (2)	□ SHALE [=1] □ COAL FINES [-2]	□nonei	という
2) INSTREAM COVER Indicate pr		mall amounts or it more commo	on of marrinal A BEC	シ
quality; 2-i quality: 3-Highest quality in moderate o	Moderate amounts, but not of high r greater amounts (e.g. verv lam	est quality or in small amounts a boulders in deep or fast water	of highest Check ONE (Or 2 & average)
diameter log that is stable, well develop UNDERCUT BANKS [1]	ed rootwad in deep / fast water, o	r deep, well-defined, functional OXBOWS, BACKWATE	pools. TI EXTENSIV	AND THE RESIDENCE OF THE PROPERTY OF THE PARTY OF THE PAR
OVERHANGING VEGETATION SHALLOWS (IN SLOW WATER)	1]ROOTWADS[1] .	/ AQUATIC MACROPHY / LOGS OR WOODY DE	TES[1] PSPARSE 5	
ROOTMATS [1]		EOGSORMOOD) DE		Cover
Comments	es de la companya de		(6) (5)	Maximum //
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPMEN	- 1			
☐ HIGH [4] ☐ EXCELLENT	7] NONE [6]	# HIGH [3]		
☐ MODERATE[3] ☐ GOOD[5] ☐ LOW[2] ☐ FAIR [3]	RECOVERED [4] RECOVERING [3]	☐ MODERATE [2] LOW [1]		
None[i] Poor[i] Comments	☐ RECENT OR NO RECO	VERYLII @		Channel 7
		in the second se		20
4] BANK EROSION AND RIPAI River right looking downstream RIF	RIAN ZONE Check ONE in eac ARIAN WIDTH	h category for <i>EACH BANK</i> (O		*
	E>50m (4)	REST, SWAMP (3) RUB OR OLD FIELD (2)	CONSERVATION OF IN	
☐ ☐ MODERATE [2] ☐ NAR	ROW 5-10m [2] 🔲 🔲 RES	SIDENTIAL PARK NEW FIELD	111 🔲 🔲 MINING/CON	
☐ HEAVY/SEVERE [1] ☐ ☐ VER		IGED PASTURE [1] EN PASTURE, ROWGROP [U]	Indicate predominant past 100m riparian.	land use(s) Riparian
Comments 3	<u> </u>	(1.5)	· ·	Maximum 8.5
5] POOL/GLIDE AND RIFFLE MAXIMUM DEPTH CH	/ RUN QUALITY IANNEL WIDTH	CURRENT VELOCITY	Recreatio	n Potential
Check ONE (ONLY!) Check	ONE (Or 2 & average)	Check ALL that apply	Primary	/ Contact
□ 0.7<1m [4] □ POOLW	DTH=RIFFLEWIDTH[1] 🗆 VE	RY FAST [1] DINTERSTIT	IAL 1-11 (circle one and c	ry Contact
☐ 0.4<0.7m [2] ☐ POOLW ☐ 0.2<0.4m [1]	□M	ST [1] UNTERMITI DERATE [1] DEDDIES [1]		Pool/
☐ ≤0,2m [0]. Comments		ndicate for reach - pools and rift	fles.	Current 8
1.				12

Comments	,	•	(b) (5)	Maximum //
3] CHANNEL MORPHOLOG SINUOSITY DEVELOP HIGH [4]	NT[7] NONE[6]			de conservation de la conservati
None[i] Poor[i Comments		overy [1]		Channel Maximum 20
River right looking downstream	PARIAN ZONE Check ONE in e RIPARIAN WIDTH	FLOOD PLAIN QUALI	TY L R	•
NONE ALIMILE (3) Z M	MODERATE 10-50m [3]	OREST, SWAMP [3] HRUB OR OLD FIELD [2] ESIDENTIAL PARK NEW FIELD ENGED PASTURE [4]	CHICAL .	NDUSTRIAL [0] NSTRUCTION [0]
	NONE[0] E o	PEN PASTURE ROWCROP (0)	Indicate predominant past 100m riparian.	Riparian Maximum 10
5] POOL / GLIDE AND RIFF MAXIMUM DEPTH Check ONE (ONLYI)	LE / RUN QUALITY CHANNEL WIDTH heck ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply		on Potential y Contact
1m [6] □ PO(□ 0.7≪1m [4] -□ PO(DEWIDTH > RIFFLE WIDTH (2)	TORRENTIAL [1] SLOW [1] VERY FAST [1] INTERSTI FAST [1] INTERMIT MODERATE [1] EDDIES [1	TIAL [:1] TENT [:2]	ry Contact
□≲0,2m [0] Comments	A Section 18	Indicate for reach - pools and ri	ffles.	Current Maximum 12
of riffle-obligate specie RIFFLE DEPTH	RUN DEPTH RIFFLE /	Or 2 & average). RUN SUBSTRATE RIFI	FLE / RUN EMBEDI	RIFFLE [metric=0]
☐ BEST AREAS > 10cm [2] ☐ M ☐ BEST AREAS 5-10cm [1] ☐ M ☐ BEST AREAS < 5cm [metric=0] Comments	AXIMUM > 50cm [2] ⊡ STABLE (6 AXIMUM < 50cm [1] ⊡ MOD. STAI ⊡ UNSTABLE	g., Cobble, Boulder) [2] 3LE (e.g., Large Gravel) [1] (e.g., Fine Gravel, Sand) [0]	□ NONE [2] □ LOW [1] □ MODERATE [0 □ EXTENSIVE [-	I Riffle / Run Maximum 8
6] GRADIENT (<u>∠ 0 . 1</u> ft/mi) DRAINAGE AREA (2 1,1/ 0 mi²)	☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]		%GLIDE: 50 %RIFFLE:	Gradient Maximum 10
EPA 4520 >1,507-		Prosper	KC 7/16/08	06/11/08
	\$.	ı	MV	VG13-15_108110

O TO EVA		at Evaluation Index ment Field Sheet	QHEI Score: 885
Stream & Location:	Des Planes Alver-	279.8LB R	M: 279.8Date: 07110108
River Code:	STORET #:	s Full Name & Affiliation: Lat./Long.: 41.44 20	Joe Vondersler Of Englacering 188. 168 Departure
DECT TVDEC	r note every type present	Check ON	E (Or 2 & average)
BEST TYPES	RIFFLE OTHER TYPES HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] SCORE natural substration of least [0] Silver [2] Silver [2] Silver [2] Silver [2] Silver [3] Silver [4] Silver [5] Silver [6] Sil	Climestone [1] Tilles[1] WetLANDS [0] HARDPAN [0] SANDSTONE [0]	QUALITY HEAVY [-2] O.5 MODERATE [-1] Substrate NORMAL [0] O.5 EXTENSIVE [-2] Maximum Company O.5 Moderate [-1] Maximum Company O.5 Moderate [-1] O.5
quality 3-Highest quality in mode		ghest quality or in small amounts of rge boulders in deep or fast water, la r, or deep, well-defined, functional po OXBOWS#BACKWATERS	highest rge Check ONE (<i>Or 2 & average</i>) ols. [1] EXTENSIVE >75% [11] [1] MODERATE 25-75% [7] [2] SPARSE 5-25% [3]
SINUOSITY DEVELOR HIGH [4] EXCELL MEDERATE [3] GOOD [6 LOW [2] FAIR [3] NONE [1] POOR [1 Comments	ENT [7] NONE [6] NECOVERED [4] RECOVERING [3] RECENTION NO REC	STABILITY HIGH [3] MODERATE [2] LOW [1] OVERY [1]	Channel Maximum 20
River right looking downstream R EROSION NONE/LITTLE [3] MODERATE [2] HEAVY/SEVERE [1]	MODERATE 10-50m [3]	FLOOD PLAIN QUALITY OREST, SWAMP, [3] HRUB OR OLD FIELD [2], ESIDENTIAL PARK, NEW FIELD [1] ENCED PASTURE [1] PEN PASTURE, ROWCROP, [0]	CONSERVATION TILEAGE [1] URBAN OR INDUSTRIAL [0] URBAN OR INDUSTRIAL [0] URBAN OR INDUSTRIAL [0] Indicate predominant land use(s) past 100m riperian. Riperian Maximum
Z >.1m [6] □ PO0 □ 0.7-≤1m [4] □ P O0	CHANNEL WIDTH Check ONE (Or 2 & average) CLWIDTH > RIFFLE WIDTH (1) CLWIDTH = RIFFLE WIDTH (1) CLWIDTH < RIFFLE WIDTH (0)	CURRENT VELOCITY Check ALL that apply TORRENTIALS[-1] SLOW [1] VERY FAST [1] SINTERSTITIAL FAST [1] SINTERMITTEN MODERATE [1] SEDDIES [1] Indicate for reach - pools and riffles	Pool / Pool
of riffle-obligate specie RIFELE DEPTH ☐ BEST AREAS > 10cm [2] ☐ M	RUN DEPTH RIFFLE / AXIMUM > 50cm [2] STABLE (e. AXIMUM < 50cm [1] MOD STAE	Or 2 & average). RUN SUBSTRATE RIFFLE C. Cobble Boulder 1/2	NO RIFFLE [metric=0]
6] GRADIENT (<0, ft/mi) DRAINAGE AREA (>2,2,40 mi2) EPA 4520 >1,500	☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]		GLIDE: 1 00 Gradient 6 Meximum 10 KC 7 (6 0 8 06/11/08





Stream & Location: _	Des Plates River -	279.7 RB	RM:2797 Date: 07/// 08
Distance Control	CTODET #.	_Scorers Full Name & Affiliat	0.55
River Code: -	STORET #: ONLY Two substrate TYPE BOX		4414 188.1700 Office verified Location
estima	te % or note every type present	Ci	neck ONE (Or 2 & average)
BEST TYPES P	OOL RIFFLE OTHER TY		
BOULDER [9]	DETRITUS		MODERATE LAT Substrate
COBBLE[8]	MUCK [2]	DWETLANDS	Management and Aller and A
☐ GRAVEL [7] SAND [6]	<u> </u>	☐ HARDPAN [[L[0] ☐ SANDSTONI	From Hextensive to 1 / 7
□ □ BEDROCK [5]	(Score nat	ural substrates: ignore CRIP/RAP [0]	SEDDEON D MODERATE LET
and the second s	YPES 4-or more [2] studge ☐ 3 or less [0]	From point-sources) ☐ LACUSTRIN ☐ SHALE [-1]	FINONELL
Comments (15)		□coal fines	[2]
21 INSTREAM COVER	Indicate presence 0 to 3: 0-Ah	sent; 1-Very small amounts or if more or	ommon of marginal
	auality: 2-Moderate amounts, h	ut not of highest quality or in small am g., very large boulders in deep or fast	ounts of highest
diameter log that is stable;	well developed rootwad in deep	fast water, or deep, well-defined, func	tional pools. EXTENSIVE >75% [11]
UNDERCUT BANKSOVERHANGING VEC	POOLS - POOLS	NOCM [2] —— OXBOWS BACK ADS [1] — / AQUATIC MACRO	
SHALLOWS (IN SLO		RS[1] / LOGS OR WOOD	PHYTES [1]
ROOTMATS [1]		(MANDER MANDEL M	Cover
Comments			(6) (3) Maximum 9
31 CHANNEL MORPHO	OLOGY Check ONE in each ca	itegory (Or 2 & average)	-
SINUOSITY DEVE	ELOPMENT CHANNI	LIZATION STABILIT	<u>Y</u>
	(CELLENT[7] ☐ NONE[6] DOD[5] ☐ RECOVER	上于HIGH [3]	Per contracts
	DOD [5]		
C		R NO RECOVERY [1]	Channel
Comments			Maximum 8
4] BANK EROSION A	ND RIPARIAN ZONE Chec	k ONE in each category for EACH BAN	IK (Or 2 per bank & average)
River right looking downstream	R MISSING TO LATE	L R FLOOD PLAIN QU	L K
NONE/LITTLE (3)	WIDE > 50m [4]	FOREST, SWAMP [3] SHRUB OR OLD FIELD [2]	☐ ☐ CONSERVATION TILLAGE[1] ☐ ☐ URBAN-OR INDUSTRIAL [0]
MODERATE [2]	I I NARROW 5-10m (2)	DECIDENTIAL DADIZ NEW P	IELD [1] [] MINING / CONSTRUCTION [0]
LI LI HEAVY//SEVERE [0]	VERY NARROW < 5m [1	I D EENCED PASTURE [1]	Indicate predominant land use(s)
Comments (2)		— — — — — — — — — — — — — — — — — — —	P[0] past 100m riparian. Riparian 8
(30)	<u> </u>	(15)	10
5] POOL / GLIDE AND MAXIMUM DEPTH	RIFFLE / RUN QUALITY CHANNEL WIDTH		Recreation Potential
Check ONE (ONLY!)	Check ONE (Or 2 & average	e) Check ALL that appl	[]
2 > 1m [6]	POOL WIDTH > RIFFLE WIDT	H[2] LITORRENTIALI-ILZISLOW	VIII Secondary Contact
□ 0.7<1m [4] □ 0.4<0.7m [2]	☑POOL WIDTH = RIFFLE WIDT ☐ POOL WIDTH < RIFFLE WIDT		(circle one and comment on back)
[] 0.2≪0.4m [1]	的特殊之子。 1966年之子與1973 (1964-1975) (1964-1975) (1964-1975) (1964-1975) (1964-1975) (1964-1975) (1964-1975) (1964-1975)	MODERATE [1] DEDDIE	S [1] Pool / Pool
□<0.2m[0] Comments		Indicate for reach - pools a	nd riffles. Current Maximum 10
	4 1 <i>PP</i> 4 3% ,		12
of riffle-obligate s	onal riffles; Best areas n	nust be large enough to supp eck ONE (Or 2 & average).	ort a population NO RIFFLE [metric=0]
RIFFLE DEPTH	RUN DEPTH F	RIEFLE / RUN SUBSTRATE I	RIFFLE / RUN EMBEDDEDNESS
BEST AREAS > 10cm [2]	MAXIMUM > 50cm [2]	TABLE (e.g., Cobble, Boulder) [2]	□NONE [2]
■ BEST AREAS 5-10cm [1] ■ BEST AREAS < 5cm		IOD: STABLE (e.g., Large Gravel) [1] NSTABLE (e.g., Fine Gravel, Sand) [0	LOW [1] MODERATE [0] Riffie
[metric=0] Comments	•		DEXTENSIVE [1] Run Ø
			8
6] GRADIENT (Lo,(4] %POOL:	%GLIDE: 100 Gradient
DRAINAGE AREA (7 8,1// 6	☐ MODERATE [6-10] mi²) ☐ HIGH - VERY HIGH I	10-6] %RUN:	%RIFFLE: Maximum 6
EPA 4520 >1, 502	Assas arrandada arrandada arrandada arranda arranda arranda arranda arranda arranda arranda arranda arranda ar	Walter Street	
- 1, 302		Prope	d KC 7/16/08 06/11/08

La San San			
Cholen		at Evaluation Index ment Field Sheet	QHEI Score: 60 5
Stream & Location: Des	Planes River 279.	5 LB . I	RM: 27-9,5 Date: <u>07-1101</u> 08
(cornerdes w/ MBI'S 2	179.5 zone) Scorer	s Full Name & Affiliation:	Joe Vondrush EA Enchooling
River Code:	STORET #:		7 188.1707 Office verified Location
1] SUBSTRATE Check ONLY To estimate % or r	note every type present	Check ON	IE (Or 2 & average)
BEST TYPES POOL RIF		LRIFFLE ORIGIN	QUALITY
□□ BOULDER [9]		TILLS[1]	☐ HEAVY/[-2] ☐ MODERATE [-1] Substrate
COBBLE[8]	MUCK[2] SILT [2]	□ WETLANDS [0] □ HARDPAN [0]	NORMAL [0] 19
SAND [6]		SANDSTONE [0]	EXTENSIVE [2]
□ □ BEDROCK[5]	(Score natural substrated or more [2] sludge from point	ates; ignore	MODERATE [-1] Maximur
Comments	☐ 3 or less [0]	☐ SHALE [-1] ☐ GOAL FINES [-2]	"Enone [i]
	(a)		<u> </u>
2] INSTREAM COVER Indicate quality	 7-Moderate amounts but not of hi 	ichaet quality or in amall amounts of	high and /
quality; 3-Highest quality in moderal diameter log that is stable, well deve	te or greater amounts (e.g., very la eloped rootwad in deep / fast water	rge boulders in deep or fast water, la , or deep, well-defined, functional po	Check ONE (Or 2 & average) pols. EXTENSIVE >75% [11]
UNDERCUT BANKS [1] /_OVERHANGING VEGETATION	POOLS > 70cm (2)	OXBOWS, BACKWATER: AQUATIC MACROPHYTE	S [1]
SHALLOWS (IN SLOW WATE ROOTMATS [1]		/ LOGS OR WOODY DEBR	
Comments		(Cover 9
Constant Section (1997) and the constant of th			20
3] CHANNEL MORPHOLOGY			
SINUOSITY DEVELOPN HIGH [4] EXCELLEN		<u>ON</u> <u>STABILITY</u> ☑HIGH BT	
☐ MODERATE[3] ☐ GOOD [5] ☐ LOW [2] ☐ FAIR [3]	☐ RECOVERED [4] *: RECOVERING [3]	MODERATE [2]	
MONE[I]	RECENT OR NO REC	☐ LOW[fi] OVERY[f]	Channel
Comments			Maximum 8
4] BANK EROSION AND RIP	PARIAN ZONE Check ONE in e	each category for EACH BANK (Or 2	per bank & average)
River right looking downstream	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	L R
NONE/LITTLE (3) TO M	MODERATE 10-50m [3] 🛮 🗘 🗀 Si	OREST, SWAMP (3) HRUB OR (OLD, FIELD (2)	☐ ☐ CONSERVATION TILLAGE [1] ☐ ☐ URBAN OR INDUSTRIAL [0]
	IARROW 5-10m [2]. 💛 🔛 🔲 🗀 R	ESIDENTIAL PARK NEW FIELD IT	☐ ☐ MINING#CONSTRUCTION [0]
		ENCED PASTURE [4] PEN PASTURE ROWCROP [0]	Indicate predominant land use(s) past 100m riparian. Riparian
Comments 3	<u>(4)</u>	(2.5)	Maximum 9.5
5] POOL / GLIDE AND RIFFL	E/RUN QUALITY		10
MAXIMUM DEPTH	CHANNEL WIDTH eck ONE (Or 2 & average)	CURRENT VELOCITY	Recreation Potential
Z ≥1m[6] □ POOL	WIDTH RIFFLE WIDTH [2]	Check ALL that apply TORRENTIAL [4] A SLOW [1]	Primary Contact Secondary Contact
	WIDTH = RIFFLE WIDTH [1]	VERY FAST [1] DINTERSTITIA FAST [1] DINTERMITTE	(circle one and comment on back)
□ 0.2<0.4m [1]		MODERATE (1) U EDDIES (1)	Pool /
□≲0.2m [0] Comments		Indicate for reach - pools and riffles	S. Current 9
	ffles: Rest areas must be I	arge enough to support a p	12 Vanulation
of riffle-obligate species	: Check ONE (Or 2 & average).	NO RIFFLE [metric=0]
	RUN DEPTH XIMUM > 50cm [2] STABLE (6	RUN SUBSTRATE RIFFL	
☐ BEST AREAS 5-10cm [1] ☐ MA	XIMUM < 50cm [4] □ MOD, STAE	BLE (e.g., Large Gravel) [1]	□ NONE [2] □ LOW[1]
□ BEST AREAS < 5cm [metric=0]		(e.g., Fine Gravel, Sand) [0]	□ MODERATE [0] Riffle / Run
Comments			Maximum 8

EPA 4520

71,502

Maximum 10 %RUN: 7/16/08

%GLIDE:(/00

%POOL:

Gradient

		กลมและ Evalu ssessment Fi		QHEI Scol	re: [60]
Stream & Location:	Des Plates River	279.4KB	R	И:2 <u>79</u> , <u>У</u> Date:	07/1/08
- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10		_Scorers Full Nam		ter Usadouska E	HEng/moeving- Office verified —
River Code:	STORET #:	Lat./Loi (NAD 83 - deci	<u> </u>	188.1724	location
PECT TYPES	or note every type present			(Or 2 & average)	LITY
□□ BLDR/SLABS [10] _/_	RIFFLE HARDPAN		ORIGIN LIMESTONE [1]	QUA ☐ HEAVY	LITY (2.5°)
D BOULDER [9] COBBLE [8]	DETRITUS		TILLS [1] WETLANDS [0]	SILT MODE	A PRODUCTION OF THE PROPERTY AND ADDRESS OF THE PARTY OF
GRAVEL [7]	🗆 🗆 SILT [2]		HARDPAN [0] SANDSTONE [0]	FREE	0
□ □ BEDROCK [5]		ural substrates: ignore	RIP/RAP (0)	DDEON DESTEN	ATEIN
2 CONTRACTOR STREET	S: 24 or more [2] sludge		SHALE [-1]	NORM	AL [0] 20
Comments 6	0		COAL FINES [-2]	310000000000000000000000000000000000000	P Cas
2] INSTREAM COVER India	cate presence 0 to 3: 0-Abs lity: 2-Moderate amounts, b	ent; 1-Very small amoun	ts or if more common of	marginal AM	DUNT
quality; 3-Highest quality in mode diameter log that is stable; well d	erate or oreater amounts (e	a very large houlders in	n deen or fact water lar	AD UNDCK UND I	Or 2 & average)
UNDERCUT BANKS [1] OVERHANGING VEGETA	Pools:	-70cm [2] OXB	OWS, BACKWATERS	[1] MODERAT	E 25:75% [7]
SHALLOWS (IN SLOW W.		RS [1] / V LOG	ATIC MACROPHYTES S OR WOODY DEBRIS		~25 % [5] BSENT <5% [1]
ROOTMATS [1] Comments			(බි ග	Cover 8
				<i>y</i>	20
3] CHANNEL MORPHOLO SINUOSITY DEVELOR		tegory (Or 2 & average) LIZATION	STABILITY		
☐ HIGH [4] ☐ EXCEL	ENT[7] NONE[6]	Į.	HIGH (8)		
☐ MODERATE [3] ☐ GOOD) ☐ LOW [2] ☐ FAIR [3	RECOVERI	NG (3)	MODERATE [2] LOW [1]		
FNONE[ii] POOR[Comments	1] RECENT O	R NO RECOVERY [1]	Keepingers (Co. 14 to 14		Channel 8
			100		20
4] BANK EROSION AND F River right looking downstream	<i>RIPARIAN ZONE</i> Chec RIPARIAN WIDTH		or EACH BANK (Or 2 p PLAIN QUALITY	er bank & average)	
	WIDE > 50m [4]	FORESTISWAI	MP (3)	L CONSERVATI	ON TILLAGE (1)
☐ MODERATE [2]	MODERATE 10-50m [3] NARROW:5-10m [2]	SHRUB OR OL RESIDENTIAL	PARK NEW FIELD HT	□ □ URBAN OR IN □ □ MINING/CON	IDUSTRIAL [0] STRUCTION [0]
☐ ☐ HEAVY//SEVERE [/] ☐ ☐ ☐ ☐	VERY NARROW < 5m [1] NONE [0]	L L FENCED PAST	URE[1]	Indicate predominant past 100m riparian.	land use(s)
Comments (3)				past 100m npanan.	Riparian Maximum /0
5] POOL/GLIDE AND RIF	FLE / RUN QUALITY		2		10
MAXIMUM DEPTH	CHANNEL WIDTH Check ONE (Or 2 & average		NT VELOCITY		n Potential
☑[>1m[6] □ PO	OL WIDTH > RIFFLE WIDT	H[2] TORRENTIAL	ALL that apply	Seconda	Contact
□ 0.4.<0.7m [2] □ PG	OL WIDTH = RIFFLE WIDT OL WIDTH < RIFFLE WIDT	H[]] □ VERY FAST [] H[]] □ FAST []]	I INTERSTITIAL INTERMITTEN	[2] (circle one and	comment on back)
□ 0.2<0.4m [1] □ < 0.2m [0]		☐ MODERATE [1] DEDDIES [1] each - pools and riffles.		Pool / Current
Comments			The second secon		Maximum 8
Indicate for functional	riffles; Best areas m	ust be large enou	gh to support a po	pulation	
of riffle-obligate speci RIFFLE DEPTH		eck ONE (Or 2 & average SIEELE / RUN SUBS		ميسينين جي	RIFFLE [metric=0] EDNESS
□ BEST AREAS > 10cm [2] □ □ □ BEST AREAS 5-10cm [1] □ □	MAXIMUM > 50cm [2] ∷ S MAXIMUM < 50cm [1] ⊡ N	TABLE (e.g., Cobble, B	oulder) (2)	☐ NONE [2]	
BEST AREAS < 5cm [metric=0]		NSTABLE (e.g., Fine Gr		□ LOW [1] □ MODERATE [0]	Riffie /
Comments	•			EXTENSIVE [4]	Maximum 8
6] GRADIENT (<0.1_ft/mi		4] %p	POOL: () %(LIDE: (100)	Gradient
DRAINAGE AREA (≥2,240 mi²)	☐ MODERATE [6-10]	/01		FFLE:	Maximum 6
EPA 4520 71,502		REGISTAL 701	Part ed		2 06/11/08

MBI MODIFIED

ChicEra

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

Stream & Location: Des Nones (Not - 234,2 LB RM: 284,2 Date: 071/0108
Scorers Full Name & Affiliation:
River Code: - STORET#: Lat./Long.: 18 Office verified location
SUBSTRATE Check ONLY Two substrate TYPE BOXES: estimate % or note every type present BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN OUALITY BLDR ISLABS [10]
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS > 70cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [11] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-25% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODLY DEBRIS [1] NEARLY ABSENT <5% [1] ROOTMATS [1] Cover Meximum [1]
SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY
A] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) River right looking downstream RIPARIAN WIDTH PEROSION WIDE > 50m [4] SHOULD PLAIN QUALITY FLOOD PLAIN QUALITY CONSERVATION TILLAGE [1] CONSERVATION TILLAGE [1] MODERATE 10-50m [2] NARROW 5-10m [2] RESIDENTIAL, PARK, NEW FIELD [1] RESIDENTIAL, PARK, NEW FIELD [1] Indicate predominant land use(s) past 100m riparian. Riparian Maximum Maximum Maximum 10
MAXIMUM DEPTH CHANNEL WIDTH CHECK ONE (ONLY!) Check ALL that apply Check A
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE BEST AREAS > 10cm [2]
6] GRADIENT (ft/ml) VERY LOW - LOW [2-4]
EPA 4520 2 2/16/20 06/11/08

QHEI Score: (37)

MBI MODIFIED

OrioERA	Qualitative Habitat and Use Assessm		QHEI Score:	50
Stream & Location: []es	Maines Wey - 284,4 K	B	RM: <u>284 4</u> Date: <u>0</u> ?	1 1 1 1 08
		iull Name & Affiliation:	Jue Venduska EA C	Frymon wing
River Code:	STORET#:	Lat./ Long.: NAD 83 - decimal ")		Office vertified
BEST TYPES POOL RIFFL	substrate <i>TYPE</i> BOXES; n every type present E <u>OTHER TYPES</u> POOL R	Check ON IFFLE <u>ORIGIN</u>	NE (Or 2 & average) QUALIT	Y
	HARDPAN [4] DETRITUS [3] SILT [2] ARTIFICIAL [0] Sor natural substrates; 4 or more [2] sludge from point-sc	☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ GANDSTONE [0] ☐ SIP/RAP [0] ☐ LACUSTRINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]	SILT MODERATE NORMAL (0) FREE (1) EXTENSIVE] [18] [18] [19] [19] [19] [19] [19] [19] [19] [19
2] INSTREAM COVER Indicate p quality; 2-quality; 3-Highest quality in moderate of diameter log that is stable, well develop undercut BANKS [1] OVERHANGING VEGETATION SHALLOWS (IN SLOW WATER ROOTMATS [1]	Moderate amounts, but not of higher or greater amounts (e.g., very large ced rootwad in deep / fast water, or POOLS > 70cm [2] ROOTWADS [1]	est quality or in small amounts o	highest Check ONE (Or 2 arge ods.	7& average) [5% [11] [-75% [7] [% [3]
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPME HIGH [4]	NT CHANNELIZATION	STABILITY High [3] MODERATE [2] LOW [1]		hannel ximum 20
EROSION	PARIAN WIDTH 15 > 50m [4]	Category for EACH BANK (Or 2 FLOOD PLAIN QUALIT EST, SWAMP [3] UB OR OLD FIELD [2] IDENTIAL, PARK, NEW FIELD [IDENTIAL, PARK, NEW FIELD [1] DED PASTURE [1] N PASTURE, ROWCROP [0]	Y	STRIAL [0] RUCTION [0]
Check ONE (ONLY) Check 1 1m [6] 0.7<1m [4] 0.4<0.7m [2] 0.2<0.4m [1] 0<0.2m [0] Comments	ANNEL WIDTH CONE (Or 2 & everage) CONE (OR 2 &	DERATE [1] DEDDIES [1] indicate for reachy pools and riffle ence of Justiana fill	ENT [-2] es. C Me	ontact Contact
of riffle-obligate species: RIFFLE DEPTH RU DESTAREAS>10cm (2) DMAXI	MUM > 50cm [2] □ STABLE (e.g. MUM < 50cm [1] □ MOD, STABLI	2 & average). UN SUBSTRATE RIFFI Cobble, Boulder) [2]	population	Riffie / g
DRAINAGE AREA	VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]			redient 6
EPA 4520	en e	Proper co	7/16/07	06/11/08

MBI MODIFIED

/201-E-VEID/

	and Use	<u>Assessmen</u>	<u>t Field Sheet</u>	unei duo	
Stream & Location:	Des Plaines River	- 384.5 43		RM: 284,5Date	: <u>0</u>
				: The Vandousia 6	a comment
River Code:	storet #:	(NAD 8	/Long.; 3-stecimal)		Office verified Location
BEST TYPES P BLDR /SLABS [46] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6]	☐ ☐ HARDP☐ ☐ DETRITE ☐ ☐ MUCK [☐ ☐ SILT [2] ☐ ☐ ARTIFIC	nt YPES POOL RIFFL AN [4] US [3] 2] CIAL [0] natural substrates; igno	ORIGIN ULIMESTONE [1] UTILLS [1] UVETLANDS [0] UHARDPAN [0] USANDSTONE [0] GRIP/RAP [0]	□ HEAV MODE SILT □ MODE NORM □ FREE □ EXTER SEDDEC MODE	RATE [-1] Substrate [-1] [0.5] ISIVE [-2] [0.5] RATE [-1] Maximum
Comments			☐ SHALE [-1] ☐ COAL FINES [-2]	" NONE	[1]
ouality: 3-Highest quality in	SETATION [1] ROOT	s, but not of highest qu (e.g., very large bout ap / fast water, or deep .S > 70cm [2]	iality or in small amount ders in deep or fast wat	s of highest er, large al pools. ERS [1] MODERA YTES [1] SPARSE	(OUNT (Or 2 & average) VE >75% [11] TE 25-75% [7] 5-<25% [3] ABSENT <5% [1]
Comments					Cover Maximum 9 20
SINUOSITY DEVI	CCELLENT [7]	NELIZATION 3] ERED [4]	STABILITY S HIGH [3] MODERATE [2] LOW [1]		Channel 3
4] BANK EROSION A River right looking downstream EROSION ONE / LITTLE [3] OHODERATE [2] OHEAVY / SEVERE [1] Comments		H FL CONTROL CONTRO	DOD PLAIN QUAL	LITY CONSERVAT URBAN OR I URBAN OR I URBAN OR I D [1] URBAN OR I	INDUSTRIAL [0] NSTRUCTION [0] or land use(s)
*MAXIMUM DEPTH Check ONE (CNLY!) [2 > 1m [6]	PRIFFLE / RUN QUALI CHANNEL WID1 Check ONE (Or 2 & ave POOL WIDTH > RIFFLE W POOL WIDTH < RIFFLE W POOL WIDTH < RIFFLE W [Manage of the company of the comp	TH CU vage) IDTH [2]] INTERMI	Primal Second (circle one on TTENT [-2]	on Potential ry Contact ary Contact d comment on back) Pool / Current Maximum 12
of riffle-obligate s RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS < 5cm [metric=0]	RUN DEPTH ☐ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1]	Check ONE (Or 2 & a RIFFLE / RUN STABLE (e.g., Cot MOD. STABLE (e.e	iverage). SUBSTRATE RIF ible, Boulder) [2]	t a population	ol Pittle /
Comments					Nexonan &
6] GRADIENT (DRAINAGE AREA	nikmi) ☐ VERY LOW - LOW ☐ MODERATE [6-4 ☐ HIGH - VERY HK	0]	%POOL: %RUN:) %GLIDE:)%RIFFLE:	Gradient 6
EPA 4620			Dangel	100 7/15/0D	06/11/08

MBI MODIFIED

Onder		at Evaluation Inde: ment Field Sheet	X QHEI Scor	e: 46
Stream & Location: Des	Plaines River - 284.	***************************************	_RM: <u>2 <u>8</u> 4 3 Date: (</u>	reproduct and the second second second
		Full Name & Affiliation:	Ta Vordander Ell	Crossnervers Office verified r
River Code:	STORET#:	Lat./Long.: NAD 83 - decimal 9	<u> </u>	location
	every type present OTHER TYPES HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] (Score natural substrates	RIFFLE ORIGIN	ONE (Or 2 & average) QUAI HEAVY MODER NORMA FREE II EXTENS MODER NORMA NONE II	[-2] ATE [-1] Substrat L [0] J. T.
2] INSTREAM COVER Indicate pro- quality; 2-N- quality; 3-Highest quality in moderate or diameter log that is stable, well develop UNDERCUT BANKS [1] OVERHANGING VEGETATION [1] SHALLOWS (IN SLOW WATER) ROOTMATS [1] Comments	loderate amounts, but not of higgreater amounts (e.g., very lar ed rootwad in deep / fast water, ————POOLS > 70cm [2] []ROOTWADS [1]	ghest quality or in small amounts ge boulders in deep or fast wate	of highest r, large Check ONE (6 I pools. EXTENSIVE ERS [1] MODERATI TES [1] SPARSE 5-	E 25-75% [7] <25% [3]
3] CHANNEL MORPHOLOGY CI SINUOSITY DEVELOPMEN HIGH [4]	<u>CHANNELIZATIO</u>	ON STABILITY		Channel H
EROSION	ARIAN WIDTH 1 > 50m [4]	ach category for EACH BANK (C FLOOD PLAIN QUALI DREST, SWAMP [3] HRUB OR OLD FIELD [2] ESIDENTIAL, PARK, NEW FIELD ENCED PASTURE [1] PEN PASTURE, ROWCROP [0]	TY CONSERVATION UNBAN OR IN Indicate preformation	DUSTRIAL [0] STRUCTION [0]
Check ONE (ONLY) Check S > 1m [6] □ POOL WI □ 0.7-<1m [4] □ POOL WI □ 0.4-<0.7m [2] □ POOL WI	ANNEL WIDTH ONE (Or 2 & average) OTH > RIFFLE WIDTH [2] OTH = RIFFLE WIDTH [1] OTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply FORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSIT FAST [1] INTERMIT MODERATE [1] EDDIES [1] Indicate for reach - pools and ri	Primary Secondai (circle one and c TENT [-2]	Pool / Current Maximum
□ BESTAREAS > 10cm [2] □ MAXIM	Check ONE () DEPTH RIFFLE / UM > 50cm [2] C STABLE (e UM < 50cm [1] C MOD. STAE	Or 2 & average). RUN SUBSTRATE RIFI .a., Cobble, Boulder'i [2]	a population	Riffle /
DRAMAGE AREA []	/ERY LOW - LOW [2-4] /ODERATE [6-10] HGH - VERY HIGH [10-6]	%POOL: %RUN:	%GLIDE: %RIFFLE:	Gradient 6
EPA 4520		Provide KS	7/16/08	06/11/08

MBI MODIFIED

Onder M		tat Evaluation Index sment Field Sheet	QHEI Score	e: (35)
Stream & Location: <u>()</u> (ans Rea - 2848 LB		RM: <u>284 &</u> Date: (27/10/08
	Score	rs Full Name & Affiliation:	Joe Vandauka GA	AND THE PROPERTY OF THE PROPER
River Code:	STORET#:	Lat./Long.:	<u></u>	Office verified
1] SUBSTRATE Check ONLY TO	vo substrate TYPE BOXES; ote every type present	Check C	DNE (Or 2 & average)	
BEST TYPES	OTHER TYPES POI HARDPAN [4] DETRITUS [3] DINUCK [2] DISILT [2] DIARTIFICIAL [0] (Score natural substi	OL RIFFLE	QUAL HEAVY [HEAVY [MODER! NORMAL FREE [1] EXTENS!	-2] ATE [-1] Substrate - [0] 8.5
2] INSTREAM COVER Indicate quality: 3-Highest quality in modera diameter log that is stable, well device undersummer to the comments of the comments (i) the comments (ii) Comments	Z-Moderate amounts, but not of a congreater amounts (e.g., very la cloped rootwad in deep / fast watsPOOLS > 70cm [2 POOLS > 70cm [2 POOLS > 70cm [1]ROOTWADS [1]	nighest quality or in small amounts arge boulders in deep or fast water	of highest check ONE (G pools.	r 2 & average) >75% [11] 25-75% [7] 25% [3]
3] CHANNEL MORPHOLOGY SINUOSITY DEVELOPM SINUOSITY DEVELOPM SINUOSITY DEVELOPM SINUOSITY DEVELOPM SINUOSITY DEVELOPM GOOD [5] LOW [2] SINUOSITY SINUOSITY DEVELOPM Comments	IENT CHANNELIZATI	ON STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel 3 Maximum 20
EROSION O O O O O O O O O O O O O O O O O O	RIPARIAN WIDTH MIDE > 50m [4]	FLOOD PLAIN QUALIT FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FIELD	Y	NUSTRIAL [0] TRUCTION [0]
Check ONE (ONLY!) Ch 2 > 1m [6] □ POOI 0.7<1m [4] □ POOI 0.4<0.7m[2] □ POOI 0.2<0.4m [1]	CHANNEL WIDTH eck ONE (Or 2 & average) . WIDTH > RIFFLE WIDTH [2] [2] . WIDTH = RIFFLE WIDTH [1] [2] . WIDTH < RIFFLE WIDTH [0] [2]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTIT FAST [1] INTERMITE MODERATE [1] EDDIES [1] Indicate for reach - pools and infi	(ENT [-2] (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	Contact y Contact
of riffle-obligate species RIFFLE DEPTH BEST AREAS > 10cm [2] MA BEST AREAS 5-10cm [1] MA BEST AREAS < 5cm [metric=0] Comments	: Check ONE UN DEPTH RIFFLE XMUM > 50cm [2] STABLE (XMUM < 50cm [1] MOD. ST	e.a., Cobble, Boulder) [2]	A population OND IND IND IND IND IND IND IND IND IND I	Riffle /
6] GRADIENT (ft/ml) DRAINAGE AREA (mi²)	☐ VERY LOW - LOW [2-4] ☐ NODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]	%POOL:	%GLIDE: %RIFFLE:	Gradient 6
EPA 4520	The second secon	1 A must	2/08- KT	06/11/08

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Chose

QHEI	Score:	49	3

Stream & Location: Des Plaires Nier - 2850 RS	RM: 285.0 Date: 07/ //	<i>]</i> 08
	Full Name & Affiliation:	
The state of the s	Lat./Long.: 18 . Office	verified location
1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present BEST TYPES POOL RIFFLE OTHER TYPES POOL F BLDR /SLABS [10]	Check ONE (Or 2 & average) RIFFLE	Substrate [8] Maximum 20
	est quality or in small amounts of highest boulders in deep or fast water, large Check ONE (Or 2 & ave	11 (7) (8) (1)
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 SINUOSITY DEVELOPMENT CHANNELIZATION HIGH [4] CEXCELLENT [7] NONE [6] RECOVERED [4] COMMENT RECOVERING [3] RECOVERING [3] RECENT OR NO RECOVERNED [4] REC	& average) STABILITY HIGH [3] MODERATE [2] LOW [1]	
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each River right looking downstream RIPARIAN WIDTH STORM [4] FOR STORM [5] STORM [6] STORM [6] STORM [7] STOR	FLOOD PLAIN QUALITY LEST, SWAMP [3]	GE [1] L [0] DN [0]
☐ 0.7- <m 0.2-<0.4m="" 0.2m="" 0.4-<0.7m="" <="" [-1]="" [0]="" [1]="" [2]="" [4]="" comments<="" fa="" impounded="" pdol="" pool="" riffle="" td="" ve="" width="" ☐=""><td>DDERATE [1]</td><td>act de S</td></m>	DDERATE [1]	act de S
☐ BEST AREAS > 10cm [2] ☐ MAXIMUM > 50cm [2] ☐ STABLE (e.g. ☐ BEST AREAS 5-10cm [1] ☐ MAXIMUM < 50cm [1] ☐ MOD. STABLE (e.g. ☐ MAXIMUM < 50cm [1] ☐ MOD. STABLE (e.g. ☐ MAXIMUM < 50cm [1] ☐ MOD. STABLE (e.g. ☐ MAXIMUM < 50cm [1] ☐ MOD. STABLE (e.g. ☐ MAXIMUM < 50cm [1] ☐ MOD. STABLE (e.g. ☐ MAXIMUM < 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM < 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [2] ☐ MOD. STABLE (e.g. ☐ MAXIMUM > 50cm [1] ☐ MOD. STABLE	2 & average). UN SUBSTRATE RIFFLE / RUN EMBEDDEDNES , Cobble, Boulder) [2] □ NONE [2] E (e.g., Large Gravel) [1] □ LOW [1] Low, Fine Gravel, Sand) [0] □ MODERATE [0] Run Run EXTENSIVE [-1] Meximum	<u>s</u>
6] GRADIENT (t/mil)	%POOL: %GLIDE: Gradien %RUN: %RIFFLE: MAXIMUM 11 PLAN 19 PCC 3//6/09 06	
EPA 4620	Proposed KC 2/16/08 00	EIHWD

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ORDER.

QHEI	Score:	Commence of

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Stream & Location:	Des Plates	1. 1. 1. 1. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.	and the second contract of the second contrac		******	<u>[{</u> _LDate: <u>0</u>	water many
		AN AND AND AND AND AND	_Scorers F	ull Name & Affiliat	ion: Jee 1/6	rbacku 1941	Office verified
River Code:	garger states distant belook belook	STORET#:	(I	Lat./ Long.: AD83::siccimal? *_		5.	locatio
عبدة كميم غيث بيثين مجيدة كالمدا كمنه كثنا	POOL RIFFLE	/ery type present OTHER TYI OTHER TY	PES POOL R [4]	ORIGIN LIMESTONE TILLS [1] WETLANDS HARDPAN [0] SANDSTONE GINDIE RIP/RAP [0]	[1] [0] SILT 1 1 (0) (DDED) E [0] ()	& average) QUALI HEAVY [-2 MODERAT NORMAL FREE [1] EXTENSIV MODERAT MODERAT MONE [1]	PI TE [-1] Substi [0] [1-4]
2] INSTREAM COVEI quality; 3-Highest quality is diameter log that is stable. UNDERCUT BANK! OVERHANGING VE SHALLOWS (IN SLI ROOTMATS [1] Comments	quality; Z-Mo n moderate or g , well developed 3 [1] :GETATION [1]	derate amounts, breater amounts (ell reater amounts (ell rootwad in deep POOLS ROOTW	out not of highe .g., very large / fast water, or > 70cm [2] _ ADS [1]	ist quality or in small ami boulders in deep or fast	ounts of highest water, large tional pools. WATERS [1] PHYTES [1]	Check ONE (Or Check ONE (Or Check ONE (Or Check One Check	2 & average) >75% [11] 25-75% [7] 25% [3]
HIGH [4]	IOLOGY Che ELOPMENT EXCELLENT [7] BOOD [5] AIR [3] BOOR [1]	CHANN NONE [6] RECOVER RECOVER	ELIZATION ED [4] ING [3] IR NO RECOV	STABILIT ☑ HIGH [3] ☐ MODERAT ☐ LOW [1]			Channel daximum 20
4) BANK EROSION A River right tooking downstree EROSION EROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE [1] Comments	M RIPA D WIDE: D MODE D NARR	RIAN WIDTH > 50m [4] RATE 10-50m [3] OW 5-10m [2] NARROW < 5m [ÜÖFORI □ □ SHRI □ □ RESI □ □ FENG	category for EACH BAN FLOOD PLAIN QU EST, SWAMP [3] UB OR OLD FIELD [2] DENTIAL, PARK, NEW F DED PASTURE [1] N PASTURE, ROWCRO	HELD [1]	CONSERVATION URBAN OR INDI MINING / CONST te predominant lar 00m riparian.	USTRIAL [0] IRUCTION [0]
5] POOL / GLIDE AN MAXIMUM BEPTH Check ONE (ONLY!)	CHA Check O ☐ POOL WID ☐ POOL WID	NNEL WIDTH NE (Or 2 & avera TH > RIFFLE WID' TH = RIFFLE WID' TH < RIFFLE WID'		CURRENT VELOC Check ALL that apple REENTIAL [-1] SLOV RY FAST [1] INTE ST [1] INTE DERATE [1] DEDO dicate for reach - pools a	N V [1] RSTITIAL [-1] RMITTENT [-2] ES [1]	Recreation Primary (Secondary (circle one and con	Contact Contact
of riffle-obligate RIFFLE DEPTH BEST AREAS > 10cm [2 BEST AREAS 5-19cm [1 BEST AREAS < 5cm [metric=0]	species: <u>RUN</u> g □MAXIMU g □MAXIMU	Ci <u>DEPTH</u> M > 50cm [2] [] M < 50cm [1] []	neck ONE (<i>Or</i> <u>RIFFLE / RI</u> STABLE (e.g., MOD, STABLE	. * *	RIFFLE / RU	ation NO R IN EMBEDDE NONE [2] LOW [1] MODERATE [0] EXTENSIVE [-1]	UFFLE (metric= DNESS
6] GRADIENT (DRAINAGE AREA	₹ DM	ERY LOW - LOW ODERATE [6-40] IGH - VERY HIGH	• •	%POOL: %RUN:	%GLID %RIFFL	E:(Gradient 6
EPA 4520				PARTA	red re	7/16/08	36/11/08

MBI MODIFIED

/PARACIDA

Qualitative Habitat Evaluation Index OUE Source 56

Sold Electrical No.	and	<u>Use Assess</u>	ment Field She	et ~′′′	Er Scure.	
Stream & Location:	Line Contraction	aser Breeze	a Tallwhy - EA	RM: <u>28</u>	도식 Date: 6主	/ 소설/ 08
X4444444444444444444444444444444444444		Scorer	s Full Name & Affilia	tion: Joe Van	dustra EAC	
River Code:		<i>ŒT#:</i>	Lat./Long.: 	/8	HEE MEY TO A	Office verified Location
BEST TYPES P.	e % or note every typ	HER TYPES HARDPAN [4] DETRITUS [3] SILT [2] ARTIFICIAL [0] (Score natural substrates [2] sludge from point	L RIFFLE ORIGIN LIMESTONE TILLS [1] WETLANDS HARDPAN [6] SANDSTON	[1] [0] SILT E [0] SILT E [0] (1) SILT	QUALITY HEAVY [-2] MODERATE NORMAL [0] FREE [1] EXTENSIVE	[-1] Substrat
2] INSTREAM COVER quality; 3-Highest quality in diemeter log that is stable; UNDERCUT BANKS OVERHANSING VEC SHALLOWS (IN SLO ROOTMATS [1] Comments	quality; 2-Moderate moderate or greater well developed rootwing [1]	amourits, but not of h amounts (e.g., very la ad in deep/fast water	y small amounts or if more c ighest quality or in small am rge boulders in deep or fast , or deep, well-defined, fund OXBOWS, BACK AQUATIC MACRO LOGS OR WOOD	ounts of highest water, large clional pools.	Check ONE (Or 2 EXTENSIVE >7: MODERATE 25- SPARSE 5-<259 NEARLY ABSEL	 & average) 5% [11] -75% [7] % [3]
☐ HIGH [4] ☐ EX ☐ MODERATE [3] ☐ GC ☐ LOW [2] ☐ FA	ELOPMENT (CELLENT [7] DOD [5] UR [3]	E in each category (Oi CHANNELIZATION NONE [6] RECOVERED [4] RECOVERING [3] RECENT OR NO REC Impounded [-1]	ON STABILIT HIGH [3] MODERAT LOW [1]	******		rannel
4] BANK EROSION A. River right looking downstream EROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE [1] Comments	RIPARIAN	WIDTH	Peach category for EACH BAIN OF FLOOD PLAIN OF COREST, SWAMP [3] CHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW PENCED PASTURE [1] REPEN PASTURE, ROWCRO	JALITY	ONSERVATION T RBAN OR INDUS INING I CONSTRI predominant land Im riparian. Rip	TRIAL [0] UCTION [0]
0.7~1m [4]	O RIFFLE / RUN (CHANNE) Check ONE (O) □ POOL WIDTH > RI □ POOL WIDTH < RI □ POOL WIDTH < RI	_ WIDTH - 2 & average) FFLE WIDTH [2] FFLE WIDTH [1] FFLE WIDTH [0] -		N [1] RSTITIAL [-1] RMITTENT [-2] IES [1]	C	ontact Contact
Indicate for funct of riffle-obligate s RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS < 5cm [metric=0] Comments	ipecies: <u>RUN DEPT</u> ☐ MAXIMUM > 50 ☐ MAXIMUM < 50	Check ONE H <u>RIFFLE</u> cm [2] ☐ STABLE (cm [1] ☐ MOD. STA	large enough to sup (Or 2 & average). / RUN SUBSTRATE a.g., Cobble, Boulder) [2] .BLE (e.g., Large Gravel) [E (e.g., Fine Gravel, Sand)	RIFFLE / RUN	LING RIF I EMBEDDED DNE [2] W [1]	Riffile / 🎺 💆
GJ GRADIENT (DRAINAGE AREA	MODER/)W - LOW [2-4] YTE [6-10] ERY HIGH [10-6]	%POOL:	%GLIDE %RIFFLE	- Million mineral mineral	adient 6 ximum 10

)HEI	Score:	67.5
		The second secon

Stream & Location:	Drs Platore Lives - Brandon Touthrofer ME RM: 285 5 Date: 6410108
River Code: -	Scorers Full Name & Affiliation: The Vendoche & Corporation STORET #: Lat./ Long.: 18 Office verified location
Seemen seeman	LY Two substrate TYPE BOXES:
estimate	Check ONE (Or 2 8 average) L RIFFLE OTHER TYPES POOL RIFFLE
quality; 3-Highest quality in m	ATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-<25% [3]
SINUOSITY DEVEL	[3] RECOVERING [3] LOW [1]
River right looking downstream REROSION NONE/LITTLE [3] MODERATE [2] HEAVY/SEVERE [1]	RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & everage) RIPARIAN WIDTH
MAXIMUM DEPTH Check ONE (ONLY!) □ > 1m [6] □ 0.7<1m [4]	CHANNEL WIDTH Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [2] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0] RECREATION Potential Primary Contact (circle one and comment on back) Recreation Potential Primary Contact (circle one and comment on back) Recreation Potential Primary Contact (circle one and comment on back)
Indicate for function of riffle-obligate spanished property of riffle-	rail riffles; Best areas must be large enough to support a population cies: Check ONE (Or 2 & average). RUN DEPTH MAXIMUM > 50cm [2] STABLE (e.g., Cobble, Boulder) [2] NONE [2] MAXIMUM < 50cm [1] MOD. STABLE (e.g., Large Gravel) [1] LOW [1] UNSTABLE (e.g., Fine Gravel, Sand) [0] MODERATE [0] Riffle / Run Maximum M
DRAINAGE AREA	mi)
EPA 4520	Printel 14 7/16/02 06/11/08

CICIA		at Evaluation Index ment Field Sheet	QHEI Score: (45.5)
Stream & Location:	Des Plaines Alver -	The second secon	RM: 278.0 Date: 07/1//08
420 m			Toe Von Lusten EA Chylosoding
River Code:	STORET #:	(NAD 83 - decimal *) 4 1 . 4 2 3	7 188. 19205 Office verified D
BEST TYPES BEST TYPES BEDDER [9] COBBLE [8] GRAVELS [7] BEDDROCK [5]	ote every type present	OL RIFFLE CRIGIN LIMESTONE [1] TILL'S [1] WETLANDS [0] LIMESTONE [0	SILT DEDICATE DESIGNATION OF THE AVY. [-2] Substrate NORMAL [0] DECEMBER 1 DECEMBER 1 DECEMBER 2 DE
2] INSTREAM COVER indicat	e presence 0 to 3: 0-Absent; 1-Ver	y small amounts or if more common ighest quality or in small amounts o	F blabast
quality, 3. Highest quality in modera diameter log that is stable, well deviced by the control of the control o	te or greater amounts (e.g., very la eloped rootwad in deep / fast wate POOLS > 70cm [2 N [1] ROOTWADS [1]	rge boulders in deep or fast water, I r, or deep, well-defined, functional p J OXBOWS, BACKWATER J AQUATIC MACROPHYTI LOGS OR WOODY DEBI	arge Check ONE (0.7.2 & average) pols.
3] CHANNEL MORPHOLOGY	COT L ONE	* bargo slip (washed) + nea	
SINUOSITY DEVELOPM HIGH [4] MODERATE [3] LOW [2] NONE [1] Comments	IENT CHANNELIZATI IT [7] NONE [6] RECOVERED [4] RECOVERING [3] RECENT OR NO REI	ON STABILITY HIGH (3) MODERATE (2) LOW (4)	Created by senten burges Channel Maximum 20
	RIPARIAN WIDTH	each category for EACH BANK (Or 2 FLOOD PLAIN QUALIT	
☑ Z NONE/LLT LE (3) □ □ N □ MODERATE [2] □ □ N □ HEAVY//SEVERE [1] □ □ N	10DERATE 10-50m [5] □ □ 3 IARROW 5-10m [2] □ □ 1 ERY NARROW < 5m [1] □ □ 1	OREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FIELD (1)	CONSERVATION TILLAGE [1]
Check ONE (ONLYI) Ch	CHANNEL WIDTH eck ONE (Or 2 & average) WIDTH > RIFFLE WIDTH [2] WIDTH = RIFFLE WIDTH [1]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW:[1] VERY FAST [1] INTERSTITI FAST [1] INTERMITTE MODERATE [1] EDDIES [1] Indicate for reach - pools and riffe	NT [2] Pool / Current Maximum
of riffle-obligate species RIFFLE DEPTH R □ BESTAREAS > 10cm [2] □ MA	: Check ONE UN DEPTH RIFFLE XIMUM > 50cm [2] ☐ STABLE ((XIMUM < 50cm [1] ☐ MOD. STA	a.g. Cobble Boulder) (2)	population ANO RIFFLE [metric=0] E / RUN EMBEDDEDNESS NONE [2] LOW [1] MODERATE [0] Riffle / Run Maximum 8
DRAINAGE AREA	□ VERY LOW - LOW [2-4] □ MODERATE [6-10] □ HIGH - VERY HIGH [10-6]		GRIPE: Gradient 6 Maximum 10 120 7((6(0)) 06/11/08

CICIFA	and Use Assessn	nent Field Sheet	QHEI Score: [39,5]
Stream & Location:	(A)	and the second s	M: 278. ODate: 07/10/08
All along to Exton/	mubil 5/16 Scorers		Toe Vondasha EA Engineering
River Code:	STORET #:	Lat./Long.: 4 1 . 4 2 23	18g. ⊥9⊥ß Office verified Location
1] SUBSTRATE Check ONLY To estimate % or n	iote every type present	Check ONE	(Or 2 & average)
BEST TYPES POOL RIF	FLE OTHER TYPES POOL	RIFFLE ORIGIN	QUALITY
BLDR/SLABS [10]	□ □ HARDPAN [4]	LIMESTONE [1]	HEAVY [-2] SILT MODERATE [-1] Substrate
COBBLE [8]		□ WETLANDS [0] PHARDPAN [0]	NORMAL[0] □ C
□ □ SAND [6] <u>ν</u> _	ARTIFICIAL [0]		
□ □ BEDROCK [5] NUMBER OF BEST TYPES;	(Score natural substrate Score natural substrate Score natural substrate Score natural substrate	s; ignore RIP/RAP [0] sources) LACUSTRINE [0]	DDED MODERATE [1] MODERATE [1] Maximum 20 NONE [1]
Comments	☐ 3 or less [0]	TI COME CINEOUS	- instrumental contraction - 1:5-
Sediment based on 150 m		ce of moved bases	00)
2] INSTREAM COVER Indicate quality	; 2-Moderate amounts, but not o f high	nest quality or in small amounts of t	nighest
quality: 3-Highest quality in moderate	te or greater amounts (e.g., very large eloped rootwad in deep / fast water, o	e boulders in deep or fast water, lar	de Check ONE (Or 2 & average)
UNDERGUT BANKS [1] OVERHANGING VEGETATION		2 OXBOWS, BACKWATERS AQUATIC MACROPHYTES	
SHALLOWS (IN SLOW WAT		LOGS OR WOODY DEBRI	
ROOTMATS [1] Comments		•	5 3 Cover 8
A control of the cont			20
■1.2.1.000 (1945 - 7940 (2011 1) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Check ONE in each category (Or 2	- ·	
SINUOSITY DEVELOPN HIGHIAI DEXCELLEN	WATER AND THE PARTY OF THE PART	N STABILITY ☑ HIGH (3)	
☐ MØDERATE [3] ☐ GØØD [5]	RECOVERED [4]	MODERATE [2]	
Prone [1] Poor [1]	RECOVERING [3] RECENT OR NO REGO	☑ LOW[I] VERY[I]	Channel
Comments		(2)	Maximum 5
4] BANK EROSION AND RIF	PARIAN ZONE Check ONE in each	ch category for EACH BANK (Or 2 p	per bank & average)
River right looking downstream	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	I. R
A DINONE/LITTLE (S)	/IODERATE 10-50m [3] 💹 🔲 SHI	REST; SWAMP [3] RUB OR OLD FIELD [2]	☐ ☐ CONSERVATION TILLAGE [1] ☐ ☐ URBAN OR INDUSTRIAL [0]
☐ ☐ MODERATE [2] ☐ ☐ N ☐ HEAVY/SEVERE [1] ☐ ☐ V	IARROW 5-10m [2]	SIDENTIAL, PARK, NEW FIELD [1] ICED PASTURE [1]	□ □ MINING/CONSTRUCTION [0]
		N PASTURE, ROWGROP [0]	Indicate predominant land use(s) past 100m riparian. Riparian
Comments 3	(B)	(B)	Maximum 3
5] POOL / GLIDE AND RIFFL	E/RUN QUALITY		
	CHANNEL WIDTH eck ONE (Or 2 & average)	CURRENT VELOCITY	Recreation Potential
>1m [6] □ POOL	WIDTH>RIFFLEWIDTH[2] □ TO	Check ALL that apply ORRENTIAL [-1] SLOW:[1]	Primary Contact Secondary Contact
	.WIDTH=RIFFLEWIDTH[1] □ VE .WIDTH <rifflewidth[0] fa<="" td="" □=""><td>RY FAST [1] □ INTERSTITIAL ST [1] □ INTERMITTEN</td><td>[1] (circle one and comment on back)</td></rifflewidth[0]>	RY FAST [1] □ INTERSTITIAL ST [1] □ INTERMITTEN	[1] (circle one and comment on back)
☐ 0.2<0.4m [1] ☐ < 0.2m [0]	□Me	DDERATE [1] DEDDIES [1] Indicate for reach - pools and riffles.	Pool/
Comments		ridioale foi readii - pools and fillies.	Maximum 8
Indicate for functional ri	ffles; Best areas must be la	rge enough to support a p	onulation
of riffle-obligate species	Check ONE (Or	2 & average)	NO RIFFLE [metric=0]
☐ BEST AREAS > 10cm [2] ☐ MA	XIMUM > 50cm [2] 🔲 STABLE (e.g.	RUN SUBSTRATE RIFFLE	□ NONE [2]
☐ BEST AREAS 5-10cm [1] ☐ MA☐ BEST AREAS < 5cm	XIMUM < 50cm [1] □ MOD.STABL	E (e.g., Large Gravel) [1] e.g., Fine Gravel, Sand) [0]	☐ LOW [1] ☐ MODERATE [0] Riffle /
[metric=0]		e.g., inc. oraver, oarror [0]	EXTENSIVE (1) Run Ø
Comments			8
	☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10]	%POOL:(200) %(GLIDE: Gradient
	HIGH - VERY HIGH [10-6]	%RUN: \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	IFFLE: Maximum 10
EPA 4520 > 1,50 2		Proper	ICC 7/16/08 06/11/08



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 127



Stream & Location:	Des Plaines River -			RM: 278.3Date:	
River Code: -	- STORET#:		ame & Affiliation:_` Long.: decimal 9 •	Joe Vandruska 6 18.	Office verified location
	k ONLY Two substrate TYPE BO	<u> </u>	decimal °) — — ° — — —		iocation Li
estim	ate % or note every type present	t	Check O	NE (Or 2 & average)	ALITY /
☐☐ BLDR/SLABS[10] ☐☐ BOULDER [9] ☑☐ COBBLE [8] ☐☐ GRAVEL [7] ☐☐ SAND [6] ☐☐ BEDROCK [5]	HARDPA HARDPA DETRITU MUCK [2] SILT [2] ARTIFIC (Score ne	US [3]	LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0] LACUSTRINE [0]	SILT MODE SILT MODE SILT NORM SECTION SECTION MODE SECTION MODE SECTION MODE SECTION MODE SECTION MODE MODE MODE MODE MODE MODE MODE MODE	RATE [-1] Substrate AL [0] J) SIVE [-2] RATE [-1] Maximum AL [0]
Comments	dinals present pate	10) (2). Hy macrophytes i	☐ SHALE[-1] ☐ COAL FINES [-2] (4 6	(-2)
quality: 3 Highest quality	R Indicate presence 0 to 3: 0-Al quality; 2-Moderate amounts, in moderate or greater amounts (s, well developed rootwad in deep [1] POOLS EGETATION [1] ROOT	but not of highest qual (e.g., very large boulde p / fast water, or deep, S>70cm [2] (0 WADS [1] A	lity or in small amounts or rs in deep or fast water,	n of marginal AM of highest Check ONE large Check ONE pools. DEXTENSINGS (1) MODERA ES (1) SPARSE	TE 25-75% [7]
SINUOSITY DEV	HOLOGY Check ONE in each VELOPMENT CHANN EXCELLENT 177 NONE (6)	VELIZATION	ge) STABILITY ☐ HIGH(3)		
MODERATE [3] D	GOOD [5] ☐ RECOVE FAIR [3] ☐ REGOVE	RED [4]	MODERATE [2]		Channel Maximum 20
4] BANK EROSION A	AND RIPARIAN ZONE CH		ory for <i>EACH BANK</i> (Or OD PLAIN QUALIT		
EROSION DINONE/LITTLE 33 MODERATE [2] HEAVY SEVERE [Comments		FOREST, S FOREST, S SHRUB OR D RESIDENTI	WAMP [3] OLD FIELD [2] AL: PARK: NEW FIELD [ASTURE [1] TURE: ROWCROP:[0]	CONSERVAT	NSTRUCTION (0)
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (ONLY!)	ID RIFFLE / RUN QUALIT CHANNEL WIDTI Check ONE (Or 2 & aver POOL WIDTH > RIFFLE WID POOL WIDTH = RIFFLE WID POOL WIDTH < RIFFLE WID	Y H age) CUR DTH [2]	RENT VELOCITY neck ALL that apply TAL [-1] SLOW [1] ST. [1] INTERSTITE INTERMITE TE [1] EDDIES [1] for reach - pools and rifff	Primar Seconda (circle one and	on Potential by Contact ary Contact comment on back) Pool / Current Maximum 12
Indicate for fund of riffle-obligate RIFFLE DEPTH	RUNDEPTH	Check ONE (Or 2 & ave RIFFLE / RUN SI	erage). UBSTRATE RIFF	AN CONTRACTOR	O RIFFLE [metric=0]
☐ BEST AREAS > 10cm[☐ BEST AREAS 5-10cm[☐ BEST AREAS < 5cm [metric=	1] □ MAXIMUM < 50cm [1] □ 0]	STABLE (e.g., Cobbl MOD: STABLE (e.g., UNSTABLE (e.g., Fin	Large Gravel) [1]	□ NONE [2] □ LOW [1] □ MODERATE [I □ EXTENSIVE [-	ij Riffle / Run Maximum 8
	A ☐ MODERATE [6-10 MODERATE [6-10] HIGH VERY HIGH	1	%RUN:	%GLIDE:	Gradient 6 Maximum 10
EPA 4520 > 1,50) <u>}</u>		Propped	100 7/16/10	8 06/11/08

ChicEPA	Qualitative Ha and Use Ass		
Stream & Location: De	s Planes Aver-	278,3 RS	·
River Code:	STORET #:	corers Full Na Lat./ L ——— (NAD 83 -)	ame & Affiliationg.: 4 . 4;
1] SUBSTRATE Check ONLY To	vo substrate TYPE BOXES; note every type present		Che
BEST TYPES POOL RIF	OTLIED TYPE	BOO! BIEE! E	ORIGIN
□ BLDR/SLABS [10]	☐☐ HARDPAN [4]	- FOOL RIFFLE	☐ LIMESTONE [
□ BOULDER [9]	DETRITUS [3]		
I ☐ COBBLE[8]	□ □ MUCK [2] □ □ SILT [2]		☐ WETLANDS [I
SAND [6]	☐ ☐ ARTIFICIAL [0	1	SANDSTONE
BEDROCK [5]	(Score natural	substrates: ignore	RIP/RAP[0]
UMBER OF BEST TYPES:	4 or more [2] sludge fro	m point-sources)	LACUSTRINE
comments 🦯 💆	☑ 3 or less [0]		☐ SHALE [-1]. ☐ COAL FINES
<u>a</u>	Ø		$ \sim$ \sim
INSTREAM COVER Indicate	e presence 0 to 3: 0-Absent;	1-Very small amo	ounts or if more cor
quality 3-Highest quality in modera	2-Moderate amounts, but n	ot of nignest qual verv large boulde	ity or in small amoi rs in deep or fast w
quality, 3 Highest quality in modera diameter log that is stable, well deve	eloped rootwad in deep / fas	t water, or deep, y	
UNDERGUT BANKS [1] OVERHANGING VEGETATION	POOLS ≥ 70 N [1]ROOTWADS		XBOWS, BACKW QUATIC MACROI
SHALLOWS (IN SLOW WAT			OGS OR WOODY
ROOTMATS [1]		SERVICE STATE OF THE PARTY OF T	
Comments			
			•
3) CHANNEL MORPHOLOGY			ge)
SINUOSITY DEVELOPM	MENT CHANNELL	ZATION.	STABILITY
HIGH [4]			□ HIGH [3]
MODERATE[3] [1 GOOD[5]	RECOVERED		MODERATE
LOW[2] EAIR[3] NONE[1] POOR[1]	RECOVERING RECENT OR N		i 🗆 (row [i])
		CONTROL TO THE PARTY OF THE PAR	連絡した しゅうしゃくしょくしゃ
Comments	a Comment of the Control of the Cont	and the second s	

QHEI Score: 52
RM: 2783 Date: 07/1/108
·35 /88. 1878 Office verified coaffor □
QUALITY HEAVY [-2] SILT MODERATE [-1] FREE [1] EXTENSIVE [2] Moderate [-1] Moderate [-1] Moderate [-1] Normal [0] None [1]
AMOUNT to of highest ter, large lail pools. EXTENSIVE >75% [11] MODERATE 25-75% [7] MERS [1] MEARLY ABSENT <5% [1] Cover Maximum 20
Channel Meximum 20
Or 2 per bank & average) LITY R CONSERVATION TILEAGE [1] Indicate predominant land use(s) past 100m riparian. Riparian Maximum 10
Recreation Potential Primary Contact Secondary Contact (circle one and comment on back) TIENT [-21] III. III. III. III. III. III. III. II
t a population NO RIFFLE [metric=0] FFLE / RUN EMBEDDEDNESS NONE [2] LOW [1] MODERATE [0] Run Maximum Maximum
%GLIDE: Gradient

CICIA		Habitat Evaluation Index ssessment Field Sheet	QHEI Score: 56
Stream & Location:	Des Plaines River-	- 278.4LB	RM:J 78.4 Date: ロチ / ロ 08
<u>390m</u>		_Scorers Full Name & Affiliation:	Joe Vonduska EA Engeering
River Code:	STORET #:	Lat./ Long.: 47 1 42	3 2 189.1857 Office verified □
1] SUBSTRATE Check	ONLY Two substrate TYPE BOX te % or note every type present	(ES;	ONE (Or 2 & average)
BEST TYPES	OOL RIFFLE OTHER TY HARDPAN DETRITU	PES POOL RIFFLE ORIGIN	QUALITY OF HEAVY [-2] SILT MODERATE [-1] Substrate NORMAL [0] FREE [1] EXTENSIVE [-2] MODERATE [-1] Maximum
. N. C. and C.	YPES: 4 or more [2] sludg	LI SHALE [7]	LINDNE DESCRIPTION
Comments	(19) (0)	☐ COAL FINES (2)	
quality: 3-Highest quality in diameter log that is stable, UNDERCUT BANKS OVERHANGING VE SHALLOWS (IN SEC ROOTMATS [1]	quality; 2-Moderate amounts, in moderate or greater amounts (e.well developed rootwad in deep [1] POOLS GETATION [1] ROOTM BOULD	sent; 1-Very small amounts or if more commobut not of highest quality or in small amounts e.g., very large boulders in deep or fast wate / fast water, or deep, well-defined, functiona >70cm [2] OXBOWS BACKWATE AGUATIC MACROPHY ERS [1] / LOGS OR WOODY DE	of highest r, large pools Check ONE (Or 2 & average) EXTENSIVE >75% [d1] MODERATE 25.75% [7] SPARSE 5~25% [3]
SINUOSITY DEVI	KGELLENT [7] NONE [6] COD [5] RECOVER AIR [3] RECOVER COR [1] RECENTION	ELIZATION STABILITY HIGH [3] MODERATE [2] HIGH [3] MODERATE [2] HIGH [3] HI	Channel 7 Maximum 20
4] BANK EROSION A River right fooking downstrea	RIPARIAN WIDTH WIDE > 50m [4] MODERATE 10-50m [3] MARROW 5-10m [2]	RESIDENTIAL PARK NEW FIELD	TY R CONSERVATION TILL AGE [1] URBAN OR INDUSTRIAL [0] I I I I I I I I I
Comments 3	a dignicus P	□ □ open pasture roweropijoj ③	past 100m riparian. Riparlan /0 Maximum 10
5] POOL / GLIDE AND MAXIMUM DEPTH Check ONE (ONLY!) > 1m.[6] 0.7<1m.[4] 0.4<0.7m[2] 0.2<0.4m[1] <0.22m[0] Comments	O RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & avera □ POOL WIDTH > RIFFLE WID POOL WIDTH = RIFFLE WID POOL WIDTH < RIFFLE WID	CURRENT VELOCITY ge) Check ALL that apply TH [2] TORRENTIAL [-1] SLOW [1] TH [1] VERY FAST [1] INTERSTITING MODERATE [1] EDDIES [-1] Indicate for reach - pools and right.	Primary Contact Secondary Contact (circle one and comment on back) FENT [-2] Inles. Pool / Current Maximum 12
of riffle-obligate s RIFFLE DEPTH BESTAREAS > 10cm [2] BESTAREAS > 5cm [metric=0] Comments	species: CI RUN DEPTH □ MAXIMUM > 50cm [2] □ □ MAXIMUM < 50cm [1] □	must be large enough to support heck ONE (Or 2 & average). RIFFLE / RUN SUBSTRATE RIFF STABLE (e.g., Cobble, Boulder) [2]. MOD, STABLE (e.g., Large Gravel) [1] UNSTABLE (e.g., Fine Gravel, Sand) [0]	NO RIFFLE IMETRIC=UI
6] GRADIENT (<0.) DRAINAGE AREA	_ft/ml) VERY_LOW-LOW. MODERATE [6:10]	/// OOL: (7) O	%GLIDE: Gradient
(>3,24	⊖ ml²) ☐ HIGH - VERY HIGH	200-21-22-20074	%RIFFLE: Maximum 10
EPA 4520 > 1,50	2.	Proof	ted 12C 7/16/08 06/11/08

	5 5		Her-
Ofoly	·	at Evaluation Index ment Field Sheet	QHEI Score: \$\begin{align*} 47.5
Stream & Location:	Des Plaines River - 2	78.48B	RM: <u>278</u>
			Joe Valusta EA Engineering
River Code: -	- STORET #: NLY Two substrate TYPE BOXES;		5 188.1834 Office verified Location
estimate	% or note every type present	Check Of ORIGIN	NE (Or 2 & average) QUALITY - 0;
□ □ BLDR/SLABS [10]	OOL RIFFLE OTHER TYPES POOL	ULIMESTUNE[I]	☐ HEAVY [:2]
□ □ BOULDER [9] □ □ GOBBLE [8]	□ □ □ DETRITUS [3] □ □ MUCK [2]	TILLS (1) WETLANDS (0)	SILT MODERATE [-1] Substrate
☐ GRAVEL[7] ☐ SAND [6]		HARDPAN (0) SANDSTONE (0)	FREE [1]
□ □ BEDROCK[5]	(Score natural substr	ates; ignore RIP/RAP [0]	MODERATE [-1] Maximum
NUMBER OF BEST TY Comments	PES: 4 or more [2] sludge from points 3 or less [0]	□SHALE[:1]	NONE [1] 20
<u>(3</u>	@	□ COAL FINES [-2]	a
	Indicate presence 0 to 3: 0-Absent; 1-Ver quality: 2-Moderate amounts; but not of h	ighest quality or in small amounts o	f highest
quality; 3-Highest quality in r diameter log; that is stable, w	noderate or greater amounts (e.g., very la vell developed rootwad in deep / fast wate	irge boulders in deep or fast water, I r, or deep, well-defined, functional p	arge Check ONE (07 2 & average) ools. ☐ EXTENSIVE ≥75% [11]
UNDERCUT BANKS [_/_/OVERHANGING VEG	1]]OXBOWS BACKWATER	S[1] [MODERATE 25-75% [7]
SHALLOWS (IN SLO)	THE PROPERTY OF THE PROPERTY O	LOGS OR WOODY DEBI	NEARLY ABSENT <5% [1]
Comments		re to A	© Cover Maximum 8
and the state of t		la barge.	slip 20
	LOGY Check ONE in each category (CLOPMENT CHANNELIZATI	**A. A. A	
☐ HIGH [4] ☐ EX	DELLENT [7] NONE [6]	☐ (HIGH [3]	
MODERATE[3] GO	R [3] RECOVERING [3]	Ø MODERATE [2] □ LOW [1]	Charles and the control of the contr
PNONE[1] PO Comments	OR [1] RECENT OR NO RE	COVERY((1)	Channel 6
			20
4] BANK EROSION AN River right looking downstream	ID RIPARIAN ZONE Check ONE in RIPARIAN WIDTH	each category for EACH BANK (Or 2 FLOOD PLAIN QUALIT	•
L ROSION MONE/EITHE/31	□ 2 WIDE > 50m [4] □ 2	OREST, SWAMP [3]	CONSERVATION TILLAGE [1]
■	□ NARROW 5-10m [2]	SHRUB OR OLD FIELD [2] RESIDENTIAL PARK, NEW FIELD [☐ ☑ URBAN OR INDUSTRIAL [0] ☐ ☐ MINING / CONSTRUCTION [0]
	☑ ☑ VERY NARROW < 5m [/] ☑ ☑ F	ENCED PASTURE [1] PEN PASTURE, ROWCROP [0]	Indicate predominant land use(s)
Comments			Maximum 6.5
51 POOL/GLIDE AND	RIFFLE / RUN QUALITY	(1.5)	
MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY	Recreation Potential
. 1m [6] C	POOL WIDTH > RIFFLE WIDTH [2]	Check ALL that apply TORRENTIAL [-1] SLOW [1]	Primary Contact Secondary Contact
□ 0.7-<1m [4]		VERY FAST [1] ☐ INTERSTITION FAST [1] ☐ INTERMITTE	(circle one and comment on back)
☐ 0.2<0.4m [1] ☐ < 0.2m [0]		MODERATE[1] DEDDIES[1] Indicate for reach - pools and riffle	Pool/
Comments		, , , , , , , , , , , , , , , , , , ,	Maximum 12
Indicate for function	onal riffles; Best areas must be	large enough to support a	population NO RIFFLE [metric=0]
of riffle-obligate s _i RIEELE DEPTH	RUN DEPTH RIFFLE	(Or 2 & average). // RUN/SUBSTRATE RIFFL	E / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1]	MAXIMUM ≥ 50cm [2] STABLE (MAXIMUM < 50cm [1] MOD. STA	e.g., Cobble, Boulder) [2]	
☐ BEST AREAS < 5cm [metric=0]		E (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0] RIFFIE
Comments			DEXTENSIVE [21] Maximum

EPA 4520

71,502

%POOL:(/00) %GLIDE: Gradient Maximum 10 %RUN:)%RIFFLE: 7/16/08 06/11/08

OTOTA		nbitat Evaluation In essment Field She		ore: [53.5]
Stream & Location:	Des Planes River .	278.7 LB	RM: 2787 Dat	
		orers Full Name & Affilia	tion: Toe Vondrus	ka EA Engloperio
River Code:	STORET #:	Lat./ Long.: 41. (NAD 83-decimal ツ ユリ・_	<u>4286 188. 1810</u>	Office verified Liocation
1] SUBSTRATE Check estima	CONLY Two substrate TYPE BOXES; ate % or note every type present	· C	heck ONE (Or 2 & average)	
BEST TYPES BLDR/SLABS[10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6]	POOL RIFFLE HARDPAN [4] DETRITUS [3] MUCK [2] ARTIFICIAL [0]	POOL RIFFLE ORIGIN LIMESTONE TILLS [1] WETLANDS HARDPANIL SANDSTON Ubstrates; Ignore RIP/RAP [0] n point-sources) LACUSTRIN SHALE [-1]	QUI QUI HEAN [1] HEAN [0] SILT MODE [0] GREE [0] GREE [0] MODE [0] MODE [0] MODE [0] NON	ERATE [-1] Substrate MAL [0] [1] [NSIVE [-2] ERATE [-1] MAL [0]
	\mathcal{O}			7)
quality: 3 Highest quality in	GETATION [1] ROOTWADS	ot of highest quality or in small am ery large boulders in deep or fast water, or deep, well-defined, fund imi[2] ————————————————————————————————————	ounts of highest water, large chional pools. Check ONI EXTENS WATERS [1] SPARSE PHYTES [1] SPARSE	MOUNT E (Or 2 & average) IVE >75% [11] ATE 25.75% [7] 5<25% [3] ABSENT <5% [1] Cover
Comments			③ ④	Maximum 10
SINUOSITY DEV HIGH [4] MODERATE [3] LOW [2] E	OLOGY Check ONE in each catego ELOPMENT CHANNELIZ XGELLENT [7] NONE [6] OOD [5] RECOVERED [4 AIR [3] RECOVERING [OOR [1] RECENT OR NO	ATION STABILIT HIGH (3) MODERAT LOW (1)	E[2]	Channel Maximum 20
4] BANK EROSION A River right looking downstrea EROSION NONE/LITTLE [3] MODERATE [2] HEAVY/SEVERE [1]	Narrow 5-10m [2]	R FLOOD PLAIN QU POREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW TO FENCED PASTURE [11]	ALITY CONSERVA CURBANOR CHEED (1)	TION:TILLAGE[1] INDUSTRIAL-[0] ONSTRUCTION[0]
Comments 3		OPEN PASTURE, ROWCRO	past room npanan	Maximum 10
MAXIMUM DEPTH Check ONE (ONLY!) ≥ 1m. [6]	D RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [1] POOL WIDTH = RIFFLE WIDTH [1] ROOL WIDTH < RIFFLE WIDTH [0]	CURRENT VELOC Check ALL that app TORRENTIAL FILE SLOV	y Prima Second (circle one as EST-114 [-2] EST-114	ry Contact lary Contact di comment on back) Pool / Current Maximum 12
of riffle-obligate s RIFELE DEPTH ☐ BEST AREAS > 10cm [2]	RUN DEPTH RIFF	DNE (Or 2 & average). LE / RUN SUBSTRATE LE (e.g. Cobble, Boulder) (2)	RIFFLE / RUN EMBED	O RIFFLE [metric=0]
☐ BEST AREAS 5-10cm [1] ☐ BEST AREAS < 5cm [metric=0]	□UNST	STABLE (e.g., Large Gravel) [1 ABLE (e.g., Fine Gravel, Sand) [

Comments

EPA 4520

6] GRADIENT (< O. | ft/mi)

DRAINAGE AREA

71,502

VERY LOW - LOW [2-4]
MODERATE [6-10]
HIGH - VERY HIGH [10-6]

RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS

STABLE (e.g., Cobble, Boulder) [2] NONE [2] NONE [2]

MOD STABLE (e.g., Large Gravel) [1] Low [1] Riffle / Run Maximum 8

UNSTABLE (e.g., Fine Gravel, Sand) [0] MODERATE [0] Riffle / Run Maximum 8

W [2-4] %POOL: //OO %GLIDE: Gradient 6

GH [10-6] %RUN: %RIFFLE: Maximum 10

MWG13-15_108130

		itat Evaluation Inde sment Field Sheet		e: [41,5]
Stream & Location:	Des Plaines River - 27	8,9 RB	RM: 278.9 Date:	e711108
<u>350m</u>		ers Full Name & Affiliation		Office worldad
River Code:	STORET #:	Lat./Long.: 41.43	<u> 24 188. 1791</u>	location D
estimate %	or note every type present	OPIGIN	ONE (Or 2 & average) QUAL	ITY
DE BLER (SLABS [10]	RIFFLE HARDPAN (4)	OL RIFFLE LIMESTONE [1]	⊅ HĒĀVY I	(2)
□ □ BOULDER [9]	DETRITUS [3]4	∠ □TILLS [1] □ WETLANDS [0]	SILT MODER	CANADA CALLANDA CALLA
GRAVEL[7]		HARDPAN (D) SANDSTONE (D)	□ FREE () ZEXTENS	
□ □ BEDROCK [5]	(Score natural subs	trates ignore DRIP/RAP (0)	SEDDEON I MODER	ATE [-1] Maximum
NUMBER OF BEST TYPE Comments	S: 4 or more [2] sludge from po	USHALE [-1]	☐ NONE (I	
	B @	□ COAL FINES [-2]	" (<u>-2</u>)	
2] INSTREAM COVER Ind	icate presence 0 to 3: 0-Absent; 1-V ality: 2-Moderate amounts, but not o	ery small amounts or if more comm		DUNT
quality: 3-Highest quality in mod	lerate or greater amounts (e.g., very developed rootwad in deep / fast wa	large boulders in deep or fast water	er, large Check ONE (C	Or 2 & average) ≣ >75% [11]
UNDERGUT BANKS [1] OVERHANGING VEGETA	POOLS > 70cm	[2]OXBOWS, BACKWAT	ERS[1] MODERATE	
SHALLOWS (IN SLOW W	Control of the Contro	LOGS OR WOODY DE	A STATE OF THE PARTY OF THE PAR	BSENT <5% [1]
ROOTMATS[1] Comments				Cover 5
	i de la companya de l		<u> </u>	20
3] CHANNEL MORPHOLO SINUOSITY DEVELO	OGY Check ONE in each category (DPMENT CHANNELIZAT		,	
☐ HIGH [4] ☐ EXCEL	LENT [7] NONE [6]	☐ HIGH[3]		
☑ MODERATE [3] ☑ GOOD ☑ LOW [2] ☑ FAIR [MODERATE [2	1	
☑NONE[i] ☑ POOR Comments	Andrews Comments - Back at the same and a second se	ECOVERY (I)	P004	Maximum 6
and Mangalinian and A. Sair Sair and A.	0			20
4] BANK EROSION AND River right looking downstream	RIPARIAN ZONE Check ONE I	n each category for <i>EACH BANK</i> (FLOOD PLAIN QUAL	. •	
and the second s	WIDE > 50m [4]	FOREST SWAMP (3)	CONSERVATION	
☑ MODERATE [2] □	MODERATE 10-50m [3]	SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FIEL	URBAN OR INDUSTRIES DIEST TO MINING / CON:	
☐ ☐ HEAVY//SEVERE [1] ☐ ☐	■ VERY NARROW < 5m [1] ☑ ☑ NONE [0]	FENGED PASTURE [1] OPEN PASTURE: ROWGROP [0	Indicate predominant l	
Comments	Hannatan Marian		Water Control of the	Maximum 6.5
5] POOL/GLIDE AND RI	FELF/RUN QUALITY	<u> </u>	<u>5-)</u>	70
MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY		n Potential
Check ONE (ONLY!) ∰ > 1m.[6] □ P	Check ONE (Or 2 & average) OO⊑WIDTH >RIFFLEWIDTH [2]	Check ALL that apply TORRENTIAL [-1] SLOW [1]	Secondar	Contact Contact
	OOLWIDTH=RIFFLEWIDTH[1]	□ VERY FAST (1) □ INTERST □ FAST (1) □ INTERMI	ITIAL [-1] (circle one and c	comment on back)
☐ 0.2<0.4m [1]		MODERATE [1] D EDDIES Indicate for reach - pools and	1]	Pool / g
□≤0.2m [0] Comments		mulcate for reach - pools and t	mies.	Maximum 12
Indicate for functions	al riffles; Best areas must b	e large enough to support	a population	
of riffle-obligate spec		E (Or 2 & average).	ZINO	RIFFLE [metric=0]
☐ BEST/AREAS > 10cm [2] ☐	MAXIMUM > 50cm [2] STABLE	(e.g., Cobble, Boulder) [2]	□ NONE [2]	
☐ BEST AREAS < 5cm	MAXIMUM < 50cm [1] □ MOD:S □ UNSTAE	TABLE (e.g., Large Gravel) [1] BLE (e.g., Fine Gravel, Sand) [0]	LOW [1]	Riffle /
[metric=0] Comments	957721-41-44774555533300	and the second second sections of the second second second section of the second secon	□ EXTENSIVE [:1]	Maximum Maximum
6] GRADIENT (< 0.1 ft/m	ni) VERY LOW LOW [2-4]	WEDDI - Class) NOT IDE	Constitution of the consti
DRAINAGE AREA	☐ MODERATE [6-10]	%POOL:(05) %RUN:) %GLIDE:())%RIFFLE:()	Gradient 6
EPA 4520 >1,502	i ²) HIGH VERY HIGH [10-6]		J.C.L.N.	06/11/08
LFA 4020 21, 102		1	KF 7116102	00,1,,00

	ampiore in 191497 aces			
				,
OTOINA		abitat Evaluationsessment Field		IEI Score: 56
Stream & Location:	Des Planes Alvert	249, IRB	RM: 27	9.1 Date: 071 1 1/ 08
	s	corers Full Name & A		
River Code:	STORET #:	Lat./ Long.:	<u>41.4338 188</u>	. <u>1758</u> Office verified □
1] SUBSTRATE Check ON estimate S	ILY Two substrate TYPE BOXES; % or note every type present		Check ONE (Or 2 d	⊋average)
	OL RIFFLE OTHER TYPE	POOL RIFFLE COM	RIGIN STONE [1]	QUALITY HEAVY [-2]
BEDR/SLABS[10]	☐ HARDPAN [4]		SITI SUT	☐ MODERATE [:1] Substrate
COBBLE[8]		3:31 - 12:23 -	LANDS [0] SILT DPAN [0]	NORMAL [0]
SAND [6]	🗆 🗆 ARTIFICIAL [)]	Company Company	
NUMBER OF BEST TYP	Score natural	substrates; ignore RIP/I om point-sources) LAC	STONE [0] PAP [0] STRINE [0]	ID RECENSIVE CONCERNS CONTROL CONT
Comments	—— □ 3 or less [0]	⊔SHAI	E[-1] LFINES [-2]	MONE[1]
$\boldsymbol{\varphi}$	Karingan (B)	109.575.062		<u>-2</u>)
• • • • • • • • • • • • • • • • • • •	ndicate presence 0 to 3: 0- Absent uality: 2-Moderate amounts , but r	ot of highest quality or in s	mail amounts of highest	al AMOUNT Check ONE (Or 2 & average)
diameter log that is stable, we	oderate or greater amounts (e.g., If developed rootwad in deep / fas	t water, or deep, well-defin	ed, functional pools.	EXTENSIVE >75% [11]
UNDERGUT BANKS (1 OVERHANGING VEGE	POOLS:>// TATION[1] ROOTWAD	DCM [2] ——— OXBOWS	BACKWATERS[1] [Macrophytes[1] [☐ MODERATE 25-75% [7] SPARSE 5-<25% [3]
SHALLOWS (IN SLOW	CENTRAL DESCRIPTION OF THE PROPERTY OF THE PRO	STATES AND		NEARLY ABSENT <5% [1]
ROOTMATS [1] Comments			7	3 Cover 10
		·		20
・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・	OGY Check ONE in each categ	والساب المراجع والشواد الشواد الشواد الشواد الشواد	OH ITY	
	<u>OPMENT</u> <u>CHANNEL</u> LLENT 77 □ NONE [6]		<u>(BILITY</u> SHIBI	
☐ MODERATE [3] ☐ GOO ☐ LOW [2] ☐ FAIR			DERATE [2] W [1]	
NONE [1] POO		O RECOVERY[1]		Channel
Comments		/	(2)	Maximum 7
4] BANK EROSION AND	RIPARIAN ZONE Check C			& average)
River right looking downstream	RIPARIAN WIDTH		IN QUALITY L B	
D NONE/CITTLE [3]	I III MODERATE 10-50m [3] □	L	LD [2] 🔲 🔲 🗓 [ONSERVATION TILLAGE [1] IRBAN OR INDUSTRIAL [0]
Moderate [2]	 ☑ NARROW.5-10m [2] ☑ VERY NARROW < 5m [1] 	RESIDENTIAL PARK		MINING/CONSTRUCTION [0]
		DE OPEN PASTURE, RO	WCROP [0] past 10	
Comments ③	\mathcal{A}	(3)	•	Maximum 10
5] POOL / GLIDE AND R			<u> </u>	[5.4.5.4.6]
MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT \ Check ALL 1		Recreation Potential Primary Contact
• • • • • • • • • • • • • • • • • • • •	POOLWIDTH > RIFFLE WIDTH () POOLWIDTH = RIFFLE WIDTH (I DTORRENTIAL [-1]	ZSLOW MI	Secondary Contact
□ 0.4<0.7m [2] □	POOLWIDTH < RIFFLE WIDTH (D] □ FAST[f] [INTERMITTENT [-2]	(circle one and comment on back)
□ 0.2<0.4m [1] □ < 0.2m [0]		☐ MODERATE [n] [Indicate for reach		Pool / Current
Comments				Maximum 12
Indicate for function	nal riffles; Best areas mus	st be large enough to	support a popula	tion NO RIFFLE [metric=0]
of riffle-obligate spe RIEELE DEPTH	Check RUN DERTH RIE	ONE (Or 2 & average): FLE / RUN SUBSTR	ATE: RIFFLE / RUI	

O ledya			nt Field Shee		IEI Scor	e: 61,5
Stream & Location:	Des Plaines R	ver - 279	1.1LB	RM: 🎝 🕽	79./ Date:	07110108
port along Treats Is			II Name & Affiliation		Vonduska	Eff Englicertry
River Code: - 11 SUBSTRATE Check O	STORET #:	- 170 m (NA)	at./Long.: 4 1 9	33 /88	1739	Office verified Office verified
estimate	% or note every type presen	nt	41,43 Che	ck ONE (8,23		0/5 <i>5</i> 1≈+ 1.1 T 2
□ □ BLDR/SLABS [10]	OL RIFFLE DIHER I	YPES POOL RIF	FLE ORIGIN	1	QUA HEAVY	
□□ BOULDER[9] <u>\</u> Ø□ COBBLE[8] <u>\</u>	D DETRIT		ZTIELS [1] UNETLANDS [0	SILT	✓ MODER ✓ NORMA	CONTRACTOR
GRAVEL[7]			☐ ☐ HARDPAN [0] ☐ SANDSTONE [[FREE]	18
□□ BEDROCK [5]	(Score	natural substrates: io	nore CRIP/RAP [0]	SEDDEDA	MODER	ATE[1] Maximum
NUMBER OF BEST TY Comments	PES: A for more [2] sid	age nom pontesour	☐ SHALE [-1]	ш	Ý E NORMA E NONE [CE [0] 20 1]
	<u> </u>		□ COAL FINES [21)	(
2] INSTREAM COVER	quality: 2-Moderate amounts	s, but not of highest	rome lleme or in willeun	nte of highest		DUNT
quality; 3-Highest quality in n diameter log that is stable, w	noderate or greater amounts ell developed rootwad in de	e.g., very large bo) p / fast water, or de	oulders in deep or fast wa eep, well-defined, functio	ater, large nal pools.	Check ONE(EXTENSIV	Or 2 & average) E >75% [11]
UNDERCUT BANKS [OVERHANGING VEGE	i]	S > 70cm [2] WADS [1]/	OXBOWS BACKWA AQUATIC MACROP	THE STREET STREET	MODERAT	
SHALLOWS (IN SLOV		DERS[n] /	LOGS OR WOODY		THE PROPERTY OF THE PERSON OF	BSENT<5%[1]
Comments	25.134.4-0-24,002.20,1-2-2-1-2-0.00			6	Q	Cover Maximum
3] CHANNEL MORPHO	OGV Check ONE in each	catagon (Or 2 P o	worana)			20
		NELIZATION	STABILITY			
	ELLENT[7] NONE[6 DD[5] RECOVI		HIGH [3] MODERATE	121		
□ LOW [2] □ FAIR □ NONE [1] □ FAIR	RECOVI	RING [3] OR NO REGOVER	□ LOW (1)			Channel
Comments			Zelen:			Maximum 8
4] BANK EROSION AN	D RIPARIAN ZONE CI	neck ONE in each c	ategory for EACH BANK	(Or 2 per hank	(anerane)	
River right looking downstream	RIPARIAN WIDT	L LR E	LOOD PLAIN QUA	LITY		LONGS, 100 (MOSHO) LANS THE LINE WATER 2 TO SEE.
MONE/(LITTLE [3]	WIDE > 50m [4] 	3] 🗗 🗆 SHRUB	T, SWAMP [3] BOR OLD FIELD [2]		JRBAN OR IN	ON TILLAGE [1] DUSTRIAL [0]
☐ MODERATE [2] ☐ ☐ HEAVY/SEVERE [1] ☐	NARROW 5-10m [2] VERY NARROW < 5m	[1] \square Fence	NTIAL PARK NEW FIE D:PASTURE [1]	Indicate	AINING"/. EON predominant	STRUCTION [0]
Comments [□ NONE [0]	□ □ openi	PASTURE, ROWCROP	[0] past 10	0m riparian.	Riparian O
<u> </u>	<u>O</u>		(2.5)			Maximum 7, 3
- 51 POOL / GLIDE AND I						
MAXIMUM DEPTH	<i>RIFFLE / RUN QUALIT</i> CHANNEL WIDT		URRENT VELOCIT	ΓY	Recreatio	n Potential
MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDT Check ONE (Or 2 & ave	H C	Check ALL that apply		Primary	n Potential Contact
MAXIMUM DEPTH Check ONE (ONLY!) > 1m [6] 0.7<1m [4]	CHANNEL WIDT Check ONE (Or 2 & eve POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI	<u>H</u> <u>C</u> rage) DIH[2] □ TORR DTH[1] □ VERY	Check ALL that apply ENTIAL [:1] ZSLOW [FAST [1] UINTERS	— 1]. TITIAL [:1]	Primary Secondar	
MAXIMUM DEPTH Check ONE (ONLY!) > Im [6] □ 0.7<1m [4] □ 0.4<0.7m [2] □ 0.2<0.4m [1]	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFEEWI	H <u>C</u> rage) DTH [2] □ TORR DTH [1] □ VERY DTH [0] □ FAST MODE	Check ALL that apply ENTIAL [-1] ZSLOW [FAST [1] DINTERS [1] DINTERN RATE [1] DEDDIES	1] TITIAL [-1] IITTENT [-2] [1]	Primary Secondar	Contact ry Contact comment on back)
MAXIMUM DEPTH Check ONE (ONLY!) > Im [6] □ 0.7<1m [4] □ 0.4<0.7m [2]	CHANNEL WIDT Check ONE (Or 2 & eve POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI	H <u>C</u> rage) DTH [2] □ TORR DTH [1] □ VERY DTH [0] □ FAST MODE	Check ALL that apply ENTIAL [-1] SLOW [FAST [1] INTERS [1] INTERN	1] TITIAL [-1] IITTENT [-2] [1]	Primary Secondar	Contact ry Contact comment on back) Pool / Current Maximum
MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI POOL WIDTH < RIFFLE WI	H C rage) DIH [2]	Check ALL that apply ENTIAL [-1] ZSLOW [FAST [1] INTERN [1] EDDIES cate for reach - pools and	1]. TITIAL [:1] IITIAL [:2] IITIAL [:2] I riffles.	Primary Secondar (circle one and o	Pool / Current Maximum 12
MAXIMUM DEPTH Check ONE (ONLY!) > 1m 6	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH < RIFFLE WI POOL WIDTH < RIFFLE WI RI	TH C Tage) DTH [2]	Check ALL that apply ENTIAL [-1]	1] TITIAL [-1] IITTENT [-2] [1] I riffles.	Primary Secondal (circle one and o	Contact ry Contact ry Contact romment on back) Pool / Current Maximum 12 RIFFLE [metric=0]
MAXIMUM DEPTH Check ONE (ONLY!) 1m 6i	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH < RIFFLE WI POOL WIDTH < RIFFLE WI RI	H C Tage) DTH [2]	Check ALL that apply ENTIAL [-1] ZSLOW[FAST [1] INTERN ENTIAL [-1] ZSLOW[FAST [1] INTERN ENTIAL [-1] EDDIES CALE for reach - pools and enough to support average). SUBSTRATE RI Obbie Boulder 121	1] TITIAL [-1] IIITENT (-2] [1] Inffles. rt a populat	Primary Secondai (circle one and o	Contact ry Contact ry Contact romment on back) Pool / Current Maximum 12 RIFFLE [metric=0]
MAXIMUM DEPTH Check ONE (ONLY!) 2 1m [6]	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI POOL WIDTH < RIFFLE WI nal riffles; Best areas ecies: RUN DEPTH MAXIMUM > 50cm [2] [MAXIMUM > 50cm [1] [H C Tage) DTH [2]	Check ALL that apply ENTIAL [-1] ZSLOW[FAST [1] INTERN ENTIAL [-1] ZSLOW[FAST [1] INTERN ENTIAL [-1] EDDIES CALE for reach - pools and enough to support average). SUBSTRATE RI Obbie Boulder 121	1] TITIAL [-1] IITIAL [-1] IIT	Primary Secondar (circle one and c	Contact ry Contact ry Contact romment on back) Pool / Current Maximum 12 RIFFLE [metric=0] EDNESS
MAXIMUM DEPTH Check ONE (ONLY!) 1m [6]	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI POOL WIDTH < RIFFLE WI nal riffles; Best areas ecies: RUN DEPTH MAXIMUM > 50cm [2] [MAXIMUM > 50cm [1] [H C Tage) DTH [2]	Check ALL that apply ENTIAL [-1] ZSLOW] FAST [1] INTERN [1] INTERN ENTIAL [-1] INTERN ENTAR [-1] INTERN ENTIAL [-1] INTERN ENTERN [-1] INTERN ENTIAL [-1] INTERN ENTI	1] TITIAL [-1] IITIAL [-1] IIT	Primary Secondai (circle one and o	Contact ry Contact ry Contact romment on back) Pool / Current Maximum 12 RIFFLE [metric=0] EDNESS
MAXIMUM DEPTH Check ONE (ONLY!) 1m 6i	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI POOL WIDTH < RIFFLE WI nal riffles; Best areas ecies: RUN DEPTH MAXIMUM < 50cm [2] [MAXIMUM < 50cm [1] [H Crage) DTH [2]	Check ALL that apply ENTIAL [-1] SLOW [FAST [1] INTERS [1] INTERN ENTIAL [-1] EDDIES cate for reach - pools and enough to support average). ISUBSTRATE RI obble, Boulden, [2] e.g., Large Gravel, [1] Fine Gravel, Sand) [0]	1] TITIAL [-1] IITIAL [-1] IIT	Primary Secondar (circle one and continuous embedde) N EMBEDD ONE [2] OW [4] ODERATE [0] OTENSIVE [-1]	Contact ry Contact ry Contact romment on back) Pool / Current Maximum 12 RIFFLE [metric=0] EDNESS Riffle / Run Maximum 8
MAXIMUM DEPTH Check ONE (ONLY!) 1m [6]	CHANNEL WIDT Check ONE (Or 2 & ave POOL WIDTH > RIFFLE WI POOL WIDTH = RIFFLE WI POOL WIDTH < RIFFLE WI RI	H C rage) DTH [2]	Check ALL that apply ENTIAL [-1] ZSLOW] FAST [1] INTERN [1] INTERN ENTIAL [-1] INTERN ENTAR [-1] INTERN ENTIAL [-1] INTERN ENTERN [-1] INTERN ENTIAL [-1] INTERN ENTI	1] TITIAL [-1] IITIAL [-1] IIT	Primary Secondai (circle one and o	Contact ry Contact ry Contact romment on back) Pool / Current Maximum 12 RIFFLE [metric=0] EDNESS





Stream & Location:	Des Plaines	River, 405-	Treats I	stand side chinne	RM: 27	9.4 Date:	<u>4 28 08 :</u>
				l Name & Affiliation		ontruder a	Office verified
River Code:	V ON V Two su	STORET #:	(NAI	nt./ Long.: 4 1 4 3	12 188.	1663	location
estim	ate % or note e	very type present		Chec	k ONE (<i>Or 2</i> &		LITY
BEST TYPES BLDR /SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5]	POOL RIFFLE	OTHER TYPE HARDPAN [4] DETRITUS [3] MUCK [2] SILT: [2] ARTIFICIAL: (Score nature	0]	☐ LIMESTONE [1] ☐ TILLES [1] ☐ WETLANDS [0] ☐ HARDFAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0]	SILT J. SEDDEON	NORMA FREE 1 EXTENS	[2] ATE [:1] Substrate LE[0] Ji SIVE [:2] ATE [:1] Mayinum
A CONTRACTOR OF THE STATE OF TH		or more [2] sludge fr or less [0]	om point-sour	ces) □ LACUSTRINE (□ SHALE [-1]	1 3	Ý ZNORMA □ NONE [
Comments		<u>@</u>		GOAL FINES [2		o de constante de la constante	2)
2] INSTREAM COVE	R Indicate pres	sence 0 to 3: 0-Absen	t; 1-Very small	amounts or if more com	mon of margin	al AMC	DUNT
quality; 3-Highest quality diameter log:that is stable UNDERCUT BANK / OVERHANGING V SHALLOWS (IN SI ROOTMATS [1]	in moderate or (, well developed S[1] EGETATION[1]	greater amounts (e.g., d rootwad in deep / fa POOLS≥7 ROOTWAD	, very large bo st water, or de 0cm [2] S [1] 3	quality or in small amour ulders in deep or fast wa ep, well-defined, function OXBOWS_BACKWA AQUATIC MACROPF LOGS OR WOODY D	ter, large nal pools. TERS [1] INTES [1]	Check ONE (CARTENSIVE MODERATE SPARSE 5-1 NEARLY AL	Or 2 & average) E >75% [11] E 25-75% [7]
Comments	t (p	inurly relarass)		,	5	+9	Cover Maximum /4
extensive macrophy	te growth for	near clove wh	<u> </u>	elsae + duckweel			20
☐ HIGH [4] ☐ MODERATE [3] ☐ LOW [2] ☐	VELOPMENT EXCELLENT (7) GOOD (5) FAIR (3) POOR (1)	CHANNEL	ZATION [4] [3]	STABILITY HIGH(3) MODERATE(21		Channel Maximum 20
4] BANK EROSION						& average)	
EROSION INONE/LITTLE [3] IMODERATE [2] IMODERATE [2] IMODERATE [2]	Ø □ Wide □ □ Mode	OW 5:10m [2] NARROW < 5m [1]	FORES SHRUB RESIDE SPENCE	LOOD PLAIN QUAI F, SWAMP [3] OR OLD FIELD [2] NITAL PARK NEW FIELD PASTURE [1] ASTURE ROWCROP [IRBAN OR IN	Rinarian
Comments 3)	(4)		(LS)			Maximum 8,5
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (ONLYI)	CHA Check C POOLWID	RUN QUALITY NNEL WIDTH ONE (Or 2 & average) TH > RIFFLE WIDTH TH = RIFFLE WIDTH TH < RIFFLE WIDTH	21 ☐ TORR 11 ☐ VERY 01 ☐ FAST ☐ MODE		 	Primary Secondar (circle one and c	Pool / Current Maximum 12
Indicate for fund	tional riffles	; Best areas mu	st be large	enough to suppor	t a populat	ion 🖼	
of riffle-obligate RIFFLE DEPTH BESTAREAS>10cm; BESTAREAS 5-10cm; BESTAREAS < 5cm; [metric=] Comments	RUN 2] □MAXIMU 1] □MAXIMU	<u>DEPTH</u> <u>RIF</u> M > 50cm [2] □ STA M < 50cm [1] □ MO	\BLE (e.g., Co D: STABLE (e	SUBSTRATE RII			Riffie /
6] GRADIENT (ZO.		ERY LOW - LOW [2-4 ODERATE [6-10]		%POOL: 100) %GLIDE		Gradient
DRAINAGE AREA	_ 2020	GH = VERY HIGH (10	-61	%RUN:)%RIFFLE		Maximum &
EPA 4520 >1,5	07			Propol K	C 7/16	108	06/11/08

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ChicEx		bitat Evaluation l ssment Field Sh	2 第 条 内で おいな おいな おいな おいな まいな まいな まいな まいな まいな まいな まい まま	1 Score: \$50.5)
Stream & Location:		72.33.1. <u>CG</u>		7.1 Date: 67/11/08
		orers Full Name & Affili	iation: \mathcal{J}_{ec} \mathcal{V}_{ec} (e.	
River Code:	STORET #:	Lat./Long.:		Office verified Location
1] SUBSTRATE Check ONLY estimate % or	Two substrate TYPE BOXES: note every type present		Check ONE (Or 2 & a)	verage)
BEST TYPES POOL R BLDR /SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPES Comments	OTHER TYPES HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] DARTIFICIAL [0] (Score natural si	POOL RIFFLE ORIG	IN NE [1] DS [0] SILT DS [0] DI SILT DS [0] DI SILT DS [0] DI SILT DS [0] DS [0	QUALITY HEAVY [-2] MODERATE [-1] Substrate NORMAL [0] FREE [1] 17
2] INSTREAM COVER Indice quality: 3-Highest quality in moder diameter log that is stable, well de UNDERCUT BANKS [1] OVERHANGING VEGETAT SHALLOWS (IN SLOW WAROOTMATS [1] Comments	y; 2-Moderate amounts, but no ale or greater amounts (e.g., w veloped rootwad in deep / fast ——— FOOLS > 70c ION [1] ROOTWADS	t of highest quality or in small a erry large boulders in deep or fa water, or deep, well-defined, fu em [2]OXBOWS, BAC [1]AQUATIC MAC	emounts of highest coast water, large concional pools.	AMOUNT heck ONE (Or 2 & average) EXTENSIVE >75% [11] MODERATE 25-75% [7] SPARSE 5-<25% [3] NEARLY ABSENT <5% [1] Cover Maximum 20
3] CHANNEL MORPHOLOG SINUOSITY DEVELOP HIGH [4] DEVCELLI MODERATE [3] GOOD [6 LOW [2] FAIR [3] NONE [1] POOR [1] Comments	MENT CHANNELIZ ENT [7] NONE [6] [] RECOVERED [4] [] RECOVERING [ATION STABIL High [3] MODER STABIL MODER MO] ATE [2]	Channel Maximum 44
☐ ☐ NONE / LITTLE [3] ☐ ☐ ☐ MODERATE [2] ☐ ☐ ☐ ☐ HEAVY / SEVERE [1] ☐ ☐	RIPARIAN WIDTH WIDE > 50m [4] MODERATE 10-50m [3] NARROW 5-10m [2] VERY NARROW < 5m [1]	FLOOD PLAIN (FOREST, SWAMP [3] SHRUB OR OLD FIELD (2) RESIDENTIAL, PARK, NEI	QUALITY CO US	average) INSERVATION TILLAGE [1] IBAN OR INDUSTRIAL [6] INING / CONSTRUCTION [0] In redominant land use(s) In riparian. Riparian Maximum 10
> 1m [6]	LE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & average) DL WIDTH > RIFFLE WIDTH [2] DL WIDTH = RIFFLE WIDTH [1] DL WIDTH < RIFFLE WIDTH [0] THE WIDTH (1)	☐ VERY FAST [1] ☐ IN' ☐ FAST [1] ☐ IN'	pply OW [1] TERSTITIAL [-1] TERMITTENT [-2] DDIES [1]	Recreation Potential Primary Contact Secondary Contact (circle one and comment on back) Pool / Current Meximum 12
of riffle-obligate specie	RUN DEPTH RIFF MAXIMUM > 50cm [2] STAE MAXIMUM < 50cm [1] MOD.	ONE (<i>Or 2 & average</i>). <u>FLE / RUN SUBSTRATE</u> ILE (e.u., Cobble, Boulder) [2	RIFFLE / RUN]	ON NO RIFFLE [metric=0] EMBEDDEDNESS VE [2]
6] GRADIENT (trmi) DRAINAGE AREA (ml²)	MODERATE [6-10]	%POOL: 1 %RUN:	%GLIDE (Gradiem 6
EPA 4520	and the second s	Paus de K	r 7//6/5	2 06/11/08

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<u>Choff</u>			:valuation inde: :nt Field <mark>Sheet</mark>	QHE! Scol	re: (36)
Stream & Location:	Des Mons	aux - 28 3.5		_RM: _283,	27/19/08
***************************************			Il Name & Affiliation.		GH Costreel for Office verified —
River Code:	- STORET	¥:	at/Long.: 1985-darimati	<u> </u>	iogation []
DECT TVDEC	Y Two substrate TYPE or note every type pred OTHER	sent	OPIGIN	ONE (Or 2 & averaga) QUA	LITY
☐☐ BLDR /SLABS [10] ☐☐ BOULDER [9] ☐☐ COBBLE [8] ☐☐ GRAVEL [7] ☐☐ SAND [6] ☐☐ BEDROCK [5] NUMBER OF BEST TYPE Comments	HARE	DPAN [4] NTUS [3] ([2] FICIAL [0] re natural substrates; ig	☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0]	SILT MODER MODER FREE EXTEN MODER MODER MODER NONE	RATE [-1] Substrate AL [0] 1] SIVE [-2] RATE [-1] Maximum AL [0] 20
2] INSTREAM COVER Ind quality; 3-Highest quality in mod diameter log that is stable, well u — UNDERCUT BANKS [1] — OVERHANGING VEGETA SHALLOWS (IN SLOW W ROOTMATS [1]	ality: 2-Moderate amouserate or greater amoused eveloped rootwad in composition [1] PO	nts, but not of highes nts (e.g., very targe b feep / fast water, or d	l quality or in small amounts oulders in deep or fast wate	of highest Check ONE- t, large Check ONE- I pools. EXTENSIN ERS [1] MODERAN TES [1] SPARSE S	re 25-75% [7]
3] CHANNEL MORPHOLO SINUOSITY DEVELO HIGH [4] EXCEL MODERATE [3] GOOD LOW [2] FAIR [3] NONE [1] POOR Comments	PMENT CHA LENT [7] □ NONE [5] □ RECO B] □ RECO [1] □ RECE	NNELIZATION	STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel 3
☐ NONE / LITTLE [3] ☐ ☐ ☐ MODERATE [2] ☐ ☐ ☐ HEAVY / SEVERE [1] ☐ ☐	R RIPARIAN WID WIDE > 50m [4] MODERATE 10-50n NARROW 5-10m [2]	<u>1TH</u>	category for EACH BANK (C FLOOD PLAIN QUAL ST, SWAMP [3] B OR OLD FIELD [2] ENTIAL, PARK, NEW FIELD ED PASTURE [1] PASTURE, ROWCROP [0]	TY CONSERVAT UBAN OR II UI] MINING / COI	NDUSTRIAL [0] NSTRUCTION [0]
□ 0.7<1m [4] □ P· □ 0.4<0.7m [2] □ P· □ 0.2<0.4m [1]	FFLE / RUN QUAI CHANNEL WII Check ONE (0r2 & a 00L WIDTH > RIFFLE 00L WIDTH = RIFFLE 00L WIDTH < RIFFLE Impounded [-1]	DTH Inverage) WIDTH [2]	CURRENT VELOCITY Check ALL that apply RENTIAL [-1] Z SLOW [1] Y FAST [1] INTERSTI I [1] INTERMIT PERATE [1] DEDDIES [1] Reate for reach - pools and in	Primar Seconda TIAL [-1] (ctricls one and TENT [-2]	on Potential y Contact ary Contact lonument on back! Pool/ Current Maximum 12
Indicate for functions of riffle-obligate specing RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS < 5cm [metric=0] Comments	cies: <u>RUN DEPTH</u> MAXINUM > 50cm [2	Check ONE (<i>Or</i> 2 RIFFLE / RU ☐ STABLE (e.g., 0 ☐ MOD, STABLE	& average). N SUBSTRATE RIF	a population	n Rime/
6] GRADIENT (MODERATE (i-10]	%POOL:	%GLIDE:	Gradient 6
EPA 4520	- Parameter and Delivery and De	ern dem Haffertagen er et til Till Alla Manta er tigge	freeze de 110	9/18/02	08/11/08

Electroni Filmign or Receiveder Checkins Office 04/20/2020

MBI MODIFIED

		at Evaluation Index ment Field Sheet	GMEI Score	: (31.5)
Stream & Location: 1/e: /	14-15 Kiver 283.8		RM; 28 38 Date: 0	7-1//1ng
stredin & Coudion		s Full Name & Affiliation:	- was seen seen per	a comme months arrows
River Code: " *	STORET #:	Lat./Long.: (NAD 83 -decimal 9)*	/8 .	Office verified Location
	substrate TYPE BOXES:			and the state of t
estimate % or note BEST TYPES POOL RIFFL BOULDER [9] COBBLE [8]	OTHER TYPES HARDPAN [4] HOUCK [2] SILT [2] ARTIFICIAL [0] (Score natural substra	LRIFFLE ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0]	ONE (Or 2 & average) QUALI HEAVY F. MODERA FREE [1] EXTENSIB MODERA NORMAL NORMAL NONE [1]	Z] TE [-1] Substrate [0]
2] INSTREAM COVER Indicate properties of quality; 2-4 quality; 3-Highest quality in moderate of diameter log that is stable, well developed undercut banks [1] OVERHANGING VEGETATION [SHALLOWS (IN SLOW WATER)] ROOTMATS [1] Comments	viderate amounts, but not of he regreater amounts (e.g., very la ed rootwad in deep / fast wate POOLS > 70cm [2 1] ROOTWADS [1]	ighest quality or in small amounts	of highest check ONE (Or pools. EXTENSIVE RS [1] MODERATE [15] SPARSE 5-< BRIS [1] NEARLY AB	r 2 & average) >75% [11] 25-75% [7]
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPME! HIGH [4]	<u>CHANNELIZATI</u>	ON STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel 2 deximum 20
EROSION DOMINIO	PARIAN WIDTH E > 50m [4]	FLOOD PLAIN QUALI OREST, SWAMP [3] SHRUB OR OLD FIELD [2] SESIDENTIAL PARK NEW FIELD	TY CONSERVATION CONSERVATION	USTRIAL [0] TRUCTION [0]
Check ONE (ONLY!) Check	IANNEL WIDTH ONE (Or 2 & everage) IDTH > RIFFLE WIDTH [2] IDTH = RIFFLE WIDTH [1]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTIT FAST [1] INTERMIT MODERATE [1] EDDIES [1] Indicate for reach - pools and rif	TENT [-2]] Mes.	Contact Contact
□ BEST AREAS > 10 cm [2] □ MAXIII □ BEST AREAS 5-10 cm [1] □ MAXIII □ BEST AREAS < 5 cm [metric=0] Comments	Check ONE V DEPTH RIFFLE NUM > 50cm [2] STABLE (NUM < 50cm [1] MOD. STA	(Or 2 & average), / RUN SUBSTRATE RIFF e.g., Cobble, Boulder) [2]	a population	Riffle / (
DRAINAGE AREA []	VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]		%KIFFLE:\	Gradient 6 Maximum 10
EPA 4520		Parcheel	-116/08 K	06/11/08

MBI MODIFIED

OnoElla

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

	Marijani paramenta di karamenta karamenta karamenta karamenta karamenta karamenta karamenta karamenta karamenta				w. waste				######################################
Stream & Location:	<u> </u>	Marris River	- 203-61	E		RM: 28	رِ Date: عِلْ	07/10	/ 08
			Scorers	Full Name &	Affiliation:	Der Va	ulanta és	a Ercji	acerris.
River Code: -	**	STORET#:		Lat./Long.		/8 .		Office v	rerified -
BEST TYPES BLDR /SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5]	POOL RIFFLE	every type present OTHER TY HARDPA DETRITU DETRITU DETRITU DETRITU DETRITU DETRITU DETRITU DETRITU	PES POOL N [4] S [3] AL [0] Alural substrate	RIFFLE	Check (ORIGIN MESTONE [1] LS [1] ETLANDS [0] RDPAN [0] NDSTONE [0] PIRAP [0]	SILT	QUAL ☐ HEAVY [☐ MODER: ☐ NORMA: ☐ FREE [1] ☐ EXTENS	[-2] ATE [-1] S L [0] J IVE [-2] ATE [-1] ,	Substrat 14 Maximun 20
2] INSTREAM COVE. quality; 3-Highest quality is diameter log that is stable	quality; 2-h n moderate or , well develop S [1] :GETATION [°	loderate amounts, greater amounts (ed rootwad in deep POOLS ROOTV	but not of high e.g., very large e/ fast water, c e> 70cm [2]	nest quality or in e boulders in de or deep, well-de ————OXBOW ———AQUATI	i small amounts eep or fast water fined, functional /S. BACKWATE	of highest r, farge i pools.	Check ONE (C EXTENSIVE MODERATE SPARSE 5- NEARLY AS	Or 2 & overa 2 >75% [11] 2 25-75% [7 <25% [3]	
☐ HIGH [4] ☐ E ☐ MODERATE [3] ☐ G ☐ LOW [2] ☐ F	IOLOGY CI IELOPMEN EXCELLENT (1 BOOD (5) FAIR (3) POOR (1)	T CHANN	IELIZATIOI RED [4] RING [3] DR NO RECO	<u>s</u> <u>s</u>	TABILITY HIGH [3] MODERATE [2] LOW [1]			Channel Maximum 20	
4] BANK EROSION A River right looking downstrop EROSION D NONE / LITTLE [3] D MODERATE [2] D HEAVY / SEVERE [1] Comments	"" RIP WIDE MOD NAR	ARIAN WIDTH 5 > 50m [4] ERATE 10-50m [3 ROW 5-10m [2] (NARROW < 5m		FLOOD PI REST, SWAMP RUB OR OLD F SIDENTIAL, PAI NCED PASTUR	LAIN QUALI [3] PIELD [2] RK NEW FIELD		ONSERVATION IRBAN OR INI INING / GONS predominant li Om riparian,	DUSTRIAL STRUCTION	A [0] [0]
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (CNLY!) S.> 1m [6] 0.7-<1m [4] 0.4-<0.7m [2] 0.2-<0.4m [1] <0.2m [0] Comments	CH Check POOL WII POOL WII	RUN QUALIT ANNEL WIDTH ONE (07 2 & avere OTH > RIFFLE WID OTH = RIFFLE WID OTH < RIFFLE WID oth < RIFFLE WID ded [-1]	<u>I</u> 1969) 114 [2] □ TC 114 [1] □ VI 114 [0] □ FA	Check AL DRRENTIAL [-1] ERY FAST [1] AST [1] ODERATE [1]	☐ ÎNTERSTI ☐ INTERMIT	TIAL [-1] TENT [-2]	Secondar (cirste one ænd c	Contact y Contac	ot l
Indicate for function of riffie-obligate RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS < 5cm [metric=0] Comments	species: <u>RUA</u> 3 □MAXIM] □MAXIM	C <u>DEPTH</u> UM > 50cm [2]] UM < 50cm [1]]	heck ONE (O RIFFLE / F STABLE (e.g MOD, STABI	r 2 & averaga). RUN SUBST L. Cobble, Bou	<u>RATE</u> <u>RIFI</u> Ider) [2] Gravel) [1]	FLE / RUM El No El LO El Ma	ION NO I EMBEDD ONE [2] OW [1] ODERATE [6] ITENSIVE [-1]	RIFFLE [m EDNESS	
6] GRADIENT (DRAINAGE AREA		/ERY LOW - LOW MODERATE [6-10] MGH - VERY HIGH	~ ~	·%P 0 %RU	January (%GLIDE		Gradient Meximum 10	(6)
EPA 4520			- "3	PA			116/08		11/08

QHEI Score: [42]

MBI MODIFIED

	,	at Evaluation Index	GHEI Score: (34,5
	and Use Assessi		42,124	
Stream & Location: <u>Des</u>	Plaines River - 283	20.4.7.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	RM: 283 S Date: 071	<u> </u>
River Code: * *	STORET#:	Full Name & Affiliation: Lat./Long.:	<u>Joe Verdanska EA (</u> 18 :	Office verified
1] SUBSTRATE Check ONLY Two		(NAD 83 - tlecimāl*) *		location L.
BEST TYPES POOL RIFFL BEST TYPES POOL RIFFL COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPES:	every type present	RIFFLE ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] es: ignore RIP/RAP [0]	ONE (Or 2 & averege) QUALITY HEAVY [-2] MODERATE [NORMAL [0] FREE [1] EXTENSIVE [MODERATE [MODERATE [NORMAL [0] NONE [1]	[-1] Substrati
2] INSTREAM COVER Indicate propulative 2-quality: 3-Highest quality in moderate of diameter log that is stable, well developed and the covered and the covered and stable and the covered and stable and the covered and the c	Moderate amounts, but not of hig r greater amounts (e.g., very lan yed routwad in deep / fast water, ———— POOLS > 70cm [2] [1] ROOTWADS [1]	ghest quality or in small amounts he boulders in deep or fast water	of highest check ONE (Or 2 & pools. DEXTENSIVE >75 RS [1] MODERATE 25-1 TES [1] SPARSE 5-<25% BRIS [1] NEARLY ABSEN	% [11] 75% [7] , [3]
3] CHANNEL MORPHOLOGY CONTROL SINUOSITY DEVELOPME HIGH [4]	NT CHANNELIZATIO	STABILITY HIGH [3] MODERATE [2]	Cha	ennel 2
EROSION	PARIAN WIDTH E > 50m [4]	FLOOD PLAIN QUALI PREST, SWAMP [3] HRUB OR OLD FIELD [2] SIDENTIAL PARK NEW FIELD	TY CONSERVATION THE CONSERVATION THE CONSTRUCTION TO CONSTRUCTION TO CONSTRUCT THE CONSTRUCTION TO CONSTRUCT THE CONSTRUCTION TO CONSTRUCT THE CONSTRUCT TH	TRIAL [0] ICTION [0]
Check ONE (CNLYI) Check	ANNEL WIDTH ONE (Or 2 & average) IDTH > RIFFLE WIDTH [2] IDTH = RIFFLE WIDTH [1] IDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply FORRENTIAL [-1] S SLOW [1] FERY FAST [1] INTERSTITE FAST [1] INTERMIT MODERATE [1] EDDIES [1] Indicate for reach - pools and rit	FIAL [-1] TENT [-2] THESE Primary Consequence Secondary Consequence Licitocle one and common	ntact entact
☐ BEST AREAS > 10cm [2] ☐ MAXII	Check ONE (4 N DEPTH RIFFLE / MUM > 50cm [2] STABLE (e, MUM < 50cm [1] MOD. STAB	Or 2 & average). RUN SUBSTRATE RIFI .g., Cobble, Boulder) [2]	FLE / RUN EMBEDDEDN	ime/{
6] GRADIENT (itimi) [VERY LOW - LOW [2-4]	%P00L:()	%GLIDE:() Gra	dient 7
DRAINAGE AREA []	MODERATE [6-10] HIGH - VERY HIGH [10-6]	%RUN:	· · · · · · · · · · · · · · · · · · ·	imum (6 10
EPA 4520		Paneral	Ke Wolfe	06/11/08

MBI MODIFIED

		oitat Evaluation Index	QHEI Score: 47.5
See Broken 15	and Use Asses	ssment Field Sheet	WILLI SCOLE. TATE
Stream & Location:	Des Moines Aver-	1283.3 4.8	RM: 2833 Pate: 07/19/08
		rers Full Name & Affiliation:	Joe Verdinsky 68 fresharing
River Code:	STORET #:	Lat./Long.:	/8 · · · · · · · · · · · · · · · · · · ·
estimate % or note	every type present		NE (Or 2 & average)
BEST TYPES POOL RIFFL	.E <u>OTHER TYPES</u> P □ □ □ HARDPAN [4]	OOL RIFFLE ORIGIN	QUALITY □ HEAVY [-2]
□ □ BOULDER [9]			SUT [MODERATE [-1] Substrate
□□ COBBLE [8]			□ NORMAL [0] □ FREE [1]
☐☐ SAND [6]	_ ☐ ☐ ARTIFICIAL [0] _ (Score natural sub	SANDSTONE [0] SANDSTONE [0]	GEODEON DEXTENSIVE [-2] MODERATE [-1] Meximum OUT NORMAL [0]
NUMBER OF BEST TYPES: []	4 or more [2] sludge from p	point-sources) LACUSTRINE [0]	
Comments	3 or less [0]	☐ SHALE [-1] ☐ COAL FINES [-2]	"☐ NONE [1]
	commence and the second se	and the second control of the second	Takkakkanassa sacessa sakakanas kana kana sara sara sara sara sara sara sara s
2] INSTREAM COVER Indicate pr quality; 2-1	Moderale amounts, but not c	of highest quality or in small amounts :	of highest teaching
quality; 3-Highest quality in moderate o diameter tog that is stable, well develop	⊭ed rootwad in deep / fast wa	ater, or deep, well-defined, functional;	pools. EXTENSIVE >75% [11]
UNDERCUT BANKS [1]OVERHANGING VEGETATION ([2] OXBOWS, BACKWATE] AQUATIC MACROPHYT	
SHALLOWS (IN SLOW WATER) ROOTMATS [1]		LOGS OR WOODY DEB	
Comments			Cover Maximum 5
			20
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPMEN			
☐ HIGH [4] ☐ EXCELLENT [THE PERSON NAMED AND PARTY OF THE PERSON	<u>J HIGH [3]</u>	
☐ MODERATE [3] ☐ GOOD [5] ☐ FAIR [3]	☐ RECOVERED [4] ☐ RECOVERING [3]	☐ MODERATE [2] ☐ LOW [1]	
MONE [1] DOOR [1]	RECENT OR NO F	RECOVERY [1]	Channel
Comments	[mpounded [-1]]		Məximum 20
4] BANK EROSION AND RIPAI			
	<u>'ARIAN WIDTH</u> E > 50m [4] 白 ら	FLOOD PLAIN QUALIT FOREST, SWAMP [3]	Y D CONSERVATION TILLAGE [1]
☐ ☐ MONE/LITTLE [3] ☐ ☐ MOR	DERATE 10-50m [3] 🔲 🗌	I SHRUB OR OLD FIELD 121	□ □ urban or industrial [0]
☐ ☐ HEAVY / SEVERE [1] ☐ ☐ VER	tROW 5-10m [2] ☐ ☐ ☐ ☐ ☐ Y NARROW < 5m [1] ☐ ☐	I RESIDENTIAL, PARK, NÉW FIELD I FENCED PASTURE (1)	[1] MINING / CONSTRUCTION [0] Indicate predominant land use(s)
□□Non		OPEN PASTURE, ROWCROP [0]	past 100m riparian. Riparian
Comments			Maximum 7.2
5) POOL / GLIDE AND RIFFLE		Commence of the contract of th	
	IANNEL WIDTH ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	Recreation Potential Primary Contact
2 > 1m [6] ☐ POOLW	IDTH > RIFFLE WIDTH [2]	TORRENTIAL [-1] IT SLOW [1]	Secondary Contact
		☐ VERY FAST [1] ☐ INTERSTITE ☐ FAST [1] ☐ INTERMITE	
☐ 0,2<0,4m [1] ☐ < 0,2m [0]	nded [-1]	☐ MODERATE [1] ☐ EDDIES [1] indicate for reach - pools and rife	Pool / P
Comments	***************************************	manusia io rotos podo massis	Maximum 6
indicate for functional riffle	es; Best areas must t	e large enough to support a	nonibion
of riffle-obligate species:	Check ON	IE (Or 2 & average).	TIMO KILLE [measc=n]
☐ BEST AREAS > 10cm [2] ☐ MAXIN	1UM > 50cm [2] 🖂 STABLI	E (e.g., Cobble, Boulder) [2]	LE / RUN ENBEDDEDNESS DNONE [2]
☐ BEST AREAS 5-10cm [1] ☐ MAXIN	11UM < 50cm [1] □ MOD. S	TABLE (e.g., Large Gravel) [1]	Orowij and Comment
☐ BEST AREAS < 5cm [metric=0]	lj und iai	BLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [8] Run ☐ EXTENSIVE [1] Meximum
Comments			Waxinish
	VERY LOW - LOW [2-4] MODERATE [6-10]	%POOL:	%GLIDE: Gradient /
	MOVERALE (6-10) HIGH - VERY HIGH [10-6]	%RUN: ()%	GRIFFLE: Maximum 6

EPA 4520

06/11/08

Proped Ke 7/15/08

MBI MODIFIED

Ondera	Qualitative land Use Ass			QHEI Scor	e: Mus
Stream & Location:	Des Maines dive	r - 2-83.2 K	<u> </u>	RM: 283 ,2 Date:	071///08
		······································	me & Affiliation:	w Nieste Chap attent from	enable finance that have breaked
River Code;	_STORET#:	Lat./L NAD85-d	ong.:	/8 <u></u>	Office verified Liocation
1] SUBSTRATE Check ONLY Two sestimate % or note	substrate <i>TYPE</i> BOXES			ONE (Or 2 & average)	
BEST TYPES	OTHER TYPE OHARDPAN [4] OHARDPAN [4] OHARDPAN [4] OHARDPAN [4] OHARDPAN [4]	0] i substrates; ignore om point-sources)	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0] LACUSTRINE [0] SHALE [-1] COAL FINES [-2]	QUAI HEAVY SILT MODER ONORMA OFREE [1] EXTENS WODEN MODER	[-2] LATE [-1] Substrete LL [0] SIVE [-2] LATE [-1] Maximum LL [0]
2] INSTREAM COVER Indicate programmer quality; 3-Highest quality in moderate of diameter log that is stable, well develop undercut banks [1] OVERHANGING VEGETATION [SHALLOWS (IN SLOW WATER)] ROOTMATS [1] Comments	voderate amounts, but r greater amounts (e.g., led rootwad in deep / fa POOLS > 7 1] ROOTWAD	not of highest qualit very large boulders st water, or deep, w 0cm [2] O> S [1] Ac	y or in small amounts s in deep or fast water	of highest Large Check ONE (pools. EXTENSIVI ERS [1] MODERATI TES [1] SPARSE 5-	E 25-75% [7]
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPME! HIGH [4]	VT CHANNEL 7] □ NONE [6] □ RECOVERED □ RECOVERING	IZATION [4] [3] 40 RECOVERY [1]	BY STABILITY STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel 3
EROSION	PARIAN WIDTH E > 50m [4] DERATE 10-50m [3] SROW 5-10m [2] Y NARROW < 5m [1]	FLOC FOREST, SW SHRUB OR C RESIDENTIA FENCED PA	ID PLAIN QUALI VAMP [3] DLD FIELD [2] L, PARK, NEW FIELD	TY	IDUSTRIAL [0] STRUCTION [0]
Check ONE (ONLYI) Check ☐ > 1m [6] ☐ POOL W ☐ 0.7<1m [4] ☐ POOL W ☐ 0.4<0.7m [2] ☐ POOL W	/ RUN QUALITY IANNEL WIDTH ONE (Or 2 & average) IDTH > RIFFLE WIDTH IDTH = RIFFLE WIDTH IDTH < RIFFLE WIDTH IDTH < RIFFLE WIDTH	Che Che Che Che Che Che Che Che	UINTERMIT	Final Primary Seconda (circle one and february [-2]	on Potential / Contact ry Contact comment on back) Pool/ Current Maximum 12
□ BESTAREAS > 10cm [2] □ MAXIN	Chec <u>V DEPTH</u> RII AUM > 50cm [2] STI AUM < 50cm [1] [] MC	k ONE (<i>Or</i> 2 & aver FFLE / RUN SU ABLE (e.g., Cobble	age). BSTRATE RIFI , Boulder) [2] .arge Gravel) [1]	a population	RIFFLE [metric=0] DEDNESS
DRAINAGE AREA (m/2)	VERY LOW - LOW [2-4 MODERATE [6-40] HIGH - VERY HIGH [10		%POOL:	%GLIDE:	Gradient 6 Maximum 10
EPA 4520		P_{λ}	wastl KA	7/16/08	JUI 1 1/UO

MBI MODIFIED

Onell's		tat Evaluation Inde: sment Field Sheet	GHEI Scor	e: (45.5)
Stream & Location:	Des Moines Riser -	283048	RM: 283.0Date:	27//2/08
		rs Full Name & Affiliation:	<u>Joe Verloude s</u>	Office verified
River Code:	STORET #:	Lat./Long.: BAD83-decimal	<u>/8</u>	iocation L
DECT TYDEC	or note every type present RIFFLE OTHER TYPES POR HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] SCOre natural substi	OL RIFFLE ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0]	SILT HEAVY MODER MODER	RATE [-1] Substrate [-1] Substrate [-1] [-1] [-1] [-1] [-1] [-1] [-1] [-1]
quai - cuality: 3-Highest quality in morte	rion [1] Rootwads [1]	highest quality or in small amounts arms houlders in deen or fast water	of highest, large Check ONE (pools. EXTENSIV RS [1] MODERAT TES [1] SPARSE 5	E 25-75% [7]
SINUOSITY DEVELO	ENT [7] NONE [6] 5] RECOVERED [4] CONTROL RECOVERING [3]	ION STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel Maximum 20
River right looking downstream Report Report	MODERATE 10-50m [3]	FLOOD PLAIN QUALI' FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] PESIDENTAL DARK MEIN EIELD	IY ☐ ☐ CONSERVATI ☐ ☐ URBAN OR M	IDUSTRIAL [0] ISTRUCTION [0]
7 im [6]	CHANNEL WIDTH Check ONE (Or 2 & avarage) OL WIDTH > RIFFLE WIDTH [2] OL WIDTH = RIFFLE WIDTH [1] OL WIDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTIT FAST [1] INTERMIT MODERATE [1] EDDIES [1] Indicate for reach - pools and rif	Primar) Seconda (chole one and	on Potential y Contact y Contact comment on back) Pool / Current Maximum / 12
of riffle-obligate specing RIFFLE DEPTH BEST AREAS > 10cm	RUN DEPTH RIFFLE MAXIMUM > 50cm [2] STABLE (MAXIMUM < 50cm [1] MOD, STA	(Or 2 & average). / RUN SUBSTRATE RIFF (e.g., Cobble, Boulder) [2]	a population -LE / RUN EMBEDE None [2] LOW [1] MODERATE [0] EXTENSIVE [4]	1 Rime/()
6] GRADIENT (North	MODERATE [6-10]	%POOL:	%GLIDE:	Gradieni 6
roi?	☐ HIGH - VERY HIGH [10-6]	%RUN: ()	%RIFFLE:(10 Secret
EPA 4520		Pagness 1	40 2/16/02	06/11/08

MBI MODIFIED

Orioth.

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

Stream & Location: Des flaines River - 2829 RB RM: 2829 Date: 07/1/108
Scorers Full Name & Affiliation: Jee Vindade & Ch Unificating
River Code: - STORET #: Invas deling 1 / /8 focation 1
SUBSTRATE Check ONLY Two substrate TYPE BOXES: estimate % or note every type present BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE BLDR /SLABS [10] HARDPAN [4] LIMESTONE [1] HEAVY [-2] BOULDER [9] DETRITUS [3] TILLS [1] MODERATE [-1] Substrate GRAVEL [7] SILT [2] HARDPAN [0] FREE [1] GRAVEL [7] ARTIFICIAL [0] SANDSTONE [0] EXTENSIVE [-2] BEDROCK [5] Score natural substrates; ignore RIP/RAP [0] RIP/RAP [0] MODERATE [-1] NUMBER OF BEST TYPES: 4 or more [2] sludge from point-sources) LACUSTRINE [0] SHALE [-1] NONE [1] Comments Cook ONE (Or 2 & everage) Check ONE (Or 2 & everage) Ch
2] INSTREAM COVER Indicate presence 0 to 3: 9-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS > 70cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [7] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-425% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] NEARLY ABSENT <5% [1] ROOTMATS [1] Cover Maximum 20
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY 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] Comments Impounded [-1]
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) River right tooking downstream RIPARIAN WIDTH BROSION WIDE > 50m [4] WIDE > 50m [4] WIDE > 50m [4] WIDE > 50m [3] WIDE > 50m [3] WIDE > 50m [3] WIDE > 50m [4]
Solution
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE DEST AREAS > 10cm [2] DEST AREAS > 10cm [2] DEST AREAS > -10cm [1] DEST AREAS > -10
6] GRADIENT (it/mi) VERY LOW - LOW [2-4]
EPA 4520 Purped Re 7/4/2 36/11/08

OHEI Score: 345

Electroni Filmijn grane ceivethr Chenkins Office 04/2023

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... 179

Oneir	-	bitat Evaluation Inde ssment Field Sheet	T The state of the	: 137.5
Stream & Location: Des	flaines live - 28	2.6 C8 orers Full Name & Affiliation	RM: 28% & Date: 0	7110108
River Code:	STORET #:	Lat./ Long.:	/8 .	Office verified location
1] SUBSTRATE Check ONLY Two : estimate % or note	substrate TYPE BOXES; every type present	(NAD 83 -decim ³) °	ONE (Or 2 & average)	ушишто обобору у до тогором 40° до 10° бого цер. (СС 10°).
☐ BLDR /SLABS [10] ☐ BOULDER [9] ☐ COBBLE [8] ☐ GRAVEL [7] ☐ SAND [6] ☐ BEDROCK [5] MIMBER OF BEST TYPES: ☐	HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0]	☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0]	JEDDEON □ MODERA' S □ NORMAL □ NONE [1]	TE [-1] Substrate [0]
2] INSTREAM COVER Indicate properties of quality; 2-quality; 3-Highest quality in moderate of diameter log that is stable, well developed under the covered by the covered	Moderate amounts, but not or greater amounts (e.g., very ped rootwad in deep / fast POOLS > 70c	t of highest quality or in small amoun sry large boulders in deep or fast wal water, or deep, well-defined, function im [2]OXBOWS, BACKWA [1]AQUATIC MACROPH	to or nignest check one (O) ter, large check one (O) EXTENSIVE EXTENSIVE MODERATE IYTES [1] SPARSE 5-4 EBRIS [1] NEARLY ABS	r 2 & average) >75% [11] 25-75% [7]
3] CHANNEL MORPHOLOGY COMMENTS SINUOSITY DEVELOPME DEVELOPME GOOD [5] FAIR [3] POOR [1] Comments	NT CHANNELIZ	ATION STABILITY HIGH [3] MODERATE [3] LOW [1] RECOVERY [1]		Channel Maximum 20
EROSION ONE/LITTLE [3] ONO	PARIAN WIDTH DE > 50m [4] □ DERATE 10-50m [3] □ RROW 5-10m [2] □ RY NARROW < 5m [1] □	FLOOD PLAIN QUA	LITY	DUSTRIAL [0] TRUCTION [0]
Check ONE (ONLYI) Check	F / RUN QUALITY HANNEL WIDTH IK ONE (Or 2 & everage) VIDTH > RIFFLE WIDTH [2] VIDTH = RIFFLE WIDTH [1] VIDTH < RIFFLE WIDTH [0] LINDER [-1]	UVERY FAST [1] UNTERS	Primary 1] Secondar TITIAL [-1] (circle one and or [1] [1] I riffles.	Contact y Contact
of riffle-obligate species: RIFFLE DEPTH RL DEST AREAS > 10cm [2] MAX	Check IN DEPTH RIF MUM > 50cm [2] ☐ STAI MUM < 50cm [1] ☐ MOE	t be large enough to suppo ONE (<i>Gr 2 & average</i>). FLE / RUN SUBSTRATE R BLE (e.g., Cobble, Boulder) [2] D. STABLE (e.g., Large Gravel) [1] TABLE (e.g., Fine Gravel, Sand) [0]	rt a population	Riffle /
DRAINAGE AREA] VERY LOW - LOW [2-4]] MODERATE [6-10]] HIGH - VERY HIGH [10-		%GLIDE:() %RIFFLE:()	Gradient 6
EPA 4520	n managa di Salam katang Kapabatan da 196 Managa ang kitang dan da anakan anakan sa katang kanan -	Parke	1 100 -106/02	Z6/11/08

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onoek.		itat Evaluation Inde> sment Field Sheet	QHEI Score: 3	7, S
Stream & Location:	Des Meines River - 1	762.5 RB	RM: 782 5 Date: 07 //	/ 08
((1))		ers Full Name & Affiliation:	- many many and black many many many many	**
River Code: -	. STORET#:	Lat./Long.:	oince.	verified location
estimate 9 BEST TYPES POO BLOWN SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPE Comments	HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] (Score natural subsemble of the company o	Check CORIGIN ORIGIN LIMESTONE [1] HARDAN [0] SANDSTONE [0] CHARLE [-1] COAL FINES [-2]	ONE (Or 2 & average) QUALITY HEAVY [-2] MODERATE [-1] NORMAL [0] FREE [1] EXTENSIVE [-2] MODERATE [-1] MODERATE [-1] NORMAL [0] NONE [1]	Substrate Maximum 20
q quality: 3-Hiphest quality in mo	ration [1] rootwads [1]	highest quality or in small amounts large boulders in deep or fast water ter, or deep, well-defined, functional [2] —— OXBOWS, BACKWATE	of highest Check ONE (Or 2 & ave pools. RS [1]	1] [7] [% [1]
SINUOSITY DEVEL	[3] RECOVERING [3]	TION STABILITY HIGH [3] MODERATE [2] Low [1]	Channe Maximum 20	2 - 3
River right looking downstream EROSION NONE LETTLE [3] MODERATE [2] HEAVY / SEVERE [1]		FLOOD PLAIN QUALI FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL PARK NEW FIELD		L [0] ON [0]
□ 0.7-<1m [4] □	CHANNEL WIDTH Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [2] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTI FAST [1] INTERMIT MODERATE [1] EDDIES [1] Indicate for reach - pools and ri	Primary Contact Secondary Contact (circle one and comment on a tentile of the contact of the con	act back)
of riffle-obligate sp <u>RIFFLE DEPTH</u> ☐ BEST AREAS > 10cm [2]	RUN DEPTH RIFFL MAXIMUM > 50cm [2] STABLE MAXIMUM < 50cm [1] MOD. S	E (<i>Or 2 & average</i>). E / RUN SUBSTRATE RIFI E (e.g., Cobble, Boulder) [2]	a population NO RIFFLE [FLE / RUN EMBEDDEDNES NONE [2] LOW [1] MODERATE [0] EXTENSIVE [-1] MAximu	(metric=0)
**************************************	(mi) VERY LOW - LOW [2-4]	%POOL:	%GLIDE: Gradier	nt [
DRAMAGE AREA	☐ MODERATE [6-10] mi²) ☐ HIGH - VERY HIGH [10-6]		WESTER E. Meximum	- 3 Ph
EPA 4520		Prayel se	7//6/08 00	6/11/08

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		L'ID		LC LGD			
Chala				raluation in it Field She		4El Score	: (39
Stream & Location:	<u> </u>	5 Plous R	in - 287	-3 48	RM: <u>2</u>	<u> </u>	4/20/08
				Name & Affilia		bareliniste CA	Office verified.
River Code:	AND ADDRESS AND SOME SOME	TORET #:		:/Long.: 83_decimal?		<u>* ***********************************</u>	locetion
BEST TYPES BLDR /SLABS [10] BOULDER [9] GOBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5]	POOL RIFFLE	y type present OTHER TYP! HARDPAN [- DETRITUS [- MUCK [2] SILT [2] ARTIFICIAL (Score nature more [2] sludge f	POOL RIFFI	LE ORIGII □ LIMESTONE □ TILLS [1] □ WETLANDS □ HARDPAN [□ SANDSTON	[1] SILT [0] SILT 0] SILT E [0] SODEO	QUAL HEAVY - MODERA NORMAL FREE (1) EXTENSI	2] TE [-1] Substra [0] VE [-2] TE [-1] Maximus [0]
2] INSTREAM COVE quality. 3-Highest quality diameter log that is stable — UNDERCUT BANK — OVERHANGING V SHALLOWS (IN SI ROOTMATS [1] Comments	quality; 2-Mode in moderate or gre s, wall developed a (S [1] EGETATION [1]	rate amounts, but ater amounts (e.g oolwad in deep / fa	nol of highest q ., very large bou ast water, or dee 70cm [2] OS [1]	uality or in smal l an Iders in deep or fast	iounts of highest t water, large ctional pools, WATERS [1] OPHYTES [1]	Check ONE (O) EXTENSIVE MODERATE SPARSE 5-4 NEARLY ABS	7 2 & average) >75% [11] 25-75% [7]
☐ HIGH [4] ☐ ☐ MODERATE [3] ☐ ☐ LOW [2] ☐	HOLOGY Check VELOPMENT EXCELLENT [7] GOOD [5] FAIR [3] POOR [1]	CHANNEI □ NONE [6] □ RECOVERED □ RECOVERIN	LIZATION (4) G [3] NO RECOVERS	STABILIT HIGH [3] MODERAT LOW [1]			Channel 3.
A) BANK EROSION River right looking downstre EROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE [Comments	MIPAR RIPAR DE NOTES SE DE NATIONES SE DE NATIONES DE	IAN WIDTH 50m [4] XTE 10-50m [3] V 5-10m [2] XRROW < 5m [1]	FL FOREST	OOD PLAIN QI , SWAMP [3] OR OLD FIELD [2] ITIAL PARK, NEW	UALITY	CONSERVATION URBAN OR IND MINING / CONS' te predominant la 00m riparian.	USTRIAL [0] TRUCTION [0]
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (ONLY!)	U CHAN Check ONI □ POOL WIDTH □ POOL WIDTH	NEL WIDTH E (Or 2 & everage > RIFFLE WIDTH = RIFFLE WIDTH < RIFFLE WIDTH	[2] ☐ TORRE [1] ☐ VERY F [0] ☐ FAST [☐ MODE	1] DINTE	oly W [1] :RSTITIAL [-1] :RMITTENT [-2] IES [1]	Recreation Primary (Secondary (circle one and con	Contact Contact
Indicate for fund of riffle-obligate RIFFLE DEPTH □ BEST AREAS > 10cm □ BEST AREAS < 5-10cm □ BEST AREAS < 5cm [metric=	Species: RUN D AND MAXIMUM MAXIMUM	Chei <u>EPTH</u> <u>Ri</u> > 50cm [2] ☐ 51 < 50cm [1] <u></u> Mac	ck ONE (<i>Or 2 &</i> <u>FFLE / RUN</u> ABLE (e.g., Co DD. STABLE (e.	enough to sup average). SUBSTRATE bble, Boulder) [2] g., Large Gravel) [Fine Gravel, Sand)	RIFFLE / RL	ation INO F IN EMBEDDE NONE [2] LOW [1] MODERATE [0] EXTENSIVE [-1]	RIFFLE (metric=0 DNESS
6] GRADIENT (DRAINAGE ARE	A D MOI	Y LOW - LOW [2- PERATE [6-10] H - VERY HIGH [1	*	%POOL: %RUN:	%GLID %RIFFL		Gradient (S Vlaximum 10
EPA 4520				Λ .	1	5/1/100	/ 06/11/08

MBI MODIFIED
Qualitative Habitat Evaluation Index and Use Assessment Field Sheet QHEI Score: 43.5
Stream & Location: Des Plaines Rivey - 282,2 RB RM: 282.2Date: 071/1/08
Scorers Full Name & Affiliation: Joe Vendusky Ch Congressity
River Code: STORET #: Lat./Long.: /8 Office verified Jocation
1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present Check ONE (Or 2 & average)
BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY
TO BOUNDER DO TO THE PITTING BY THE STATE OF
COBBLE [8] CO
GRAVEL [7]
□□ BEDROCK [5] (Score natural substrates; ignore □ RIP/RAP [0] (Score natural substrates) Maximum
NUMBER OF BEST TYPES: 4 or more [2] sludge from point-sources) LACUSTRINE [0] NORMAL [0] 20 NORMAL [1]
Comments Governments Governments Governments
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest characteristics. The property of the pr
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)
SINUCSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4] D EXCELLENT [7] D NONE [6] T HIGH [3]
☐ MODERATE [3] ☐ GOOD [5] ☐ RECOVERED [4] ☐ MODERATE [2]
MINONE [1] POOR [1] RECENT OR NO RECOVERY [1] Channel
Comments Impounded [-1] Maximum 20
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)
River right looking downstream RIPARIAN WIDTH REFLOOD PLAIN QUALITY
EROSION Wide > 50m [4] Forest, swamp [3] Conservation tillage [1] SHRUB OR OLD FIELD [2] URBAN OR INDUSTRIAL [0] Indicate predominant land use(s) past 100m riparian. Riparian Maximum Maximum
5] POOL / GLIDE AND RIFFLE / RUN QUALITY
MAXIMUM DEPTH CHANNEL WIDTH Check ONE (ONLY) Check ONE (Or 2 & average) Check ALL that apply Primary Contact
Ø> 1m [6] □ POOL WIDTH > RIFFLE WIDTH [2] □ TORRENTIAL [-1] Ø SLOW [1] Secondary Contact
□ 0.4-<0.7m [2] □ POOL WIDTH < RIFFLE WIDTH [0] □ FAST [1] □ INTERMITTENT [-2]
□ 0.2<0.4m [1] □ MODERATE [1] □ EDDIES [1] Pool / □ (0.2m [0]
Comments Meximum (**)
Indicate for functional riffles; Best areas must be large enough to support a population
of riffle-obligate species: Check ONE (Or 2 & average).
RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS ☐ BEST AREAS > 10cm [2] ☐ MAXIMUM > 50cm [2] ☐ STABLE (e.g., Cobble, Boulder) [2] ☐ NONE [2]
☐ BEST AREAS 5-10cm [1] LIMAXIMUM < 50cm [1] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☐ LOW [1]
BEST AREAS < 5cm [UNSTABLE (e.g., Fine Gravel, Sand) [0] [MODERATE [0] Run R
Comments Maximum 8
5] GRADIENT (funi) [] VERY LOW - LOW [2-4] %POOL: () %GLIDE: () Gradient ()
DRAINAGE AREA Moderate [5-10] Maximum 6 Maximum 10 Maximum 6 Maximum 10 Maxi

EPA 4520

06/11/08

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Ono. Pa		at Evaluation Inde) <u>ment Field Sheet</u>	GHEI Scor	e: (31)
Stream & Location: 1/05	Mores Krew 2821	0 43	PM: <u>28</u> ৯এDate:	27/10/08
		Full Name & Affiliation:		Office verified
River Code: " " "	STORET #:	Lat./Long.: =:MAD:83::Mclmili	<u>18</u>	iocetion E
1] SUBSTRATE Check ONLY Two : estimate % or note BEST TYPES POOL RIFFL	every type present	Check C RIFFLE <u>ORIGIN</u>	ONE (Or 2 & average) QUA	LITY
☐ BLDR /SLABS [10] ☐ BOULDER [9] ☐ COBBLE [8] ☐ GRAVE [7] ☐ SAND [6] ☐ BEDROCK [5] NUMBER OF BEST TYPES: ☐	HARDPAN (4) DETRITUS [3] DIMUCK [2] DISTIT [2] DIARTIFICIAL [0] (Score natural substrate	☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0]	SILT MODER MODER	ATE [-1] Substrat LL [0] J. SIVE [-2] ATE [-1] Maximum LL [0] 20
2] INSTREAM COVER indicate programmers of quality; 3-Highest quality in moderate of diameter log that is stable, well develop— UNDERCUT BANKS [1] OVERHANGING VEGETATION [SHALLOWS (IN SLOW WATER) ROOTMATS [1] Comments	inderate amounts, but not of hit r greater amounts (e.g., very lan ed rootwad in deep / fast water, POOLS > 70cm [2] ROOTWADS [1]	ghest quality or in small amounts de boulders in deen or fast water	of highest Check ONE (in pools. SEXTENSIVI) RS [1] MODERATIONS [1] SPARSE 5-	E 25-75% (7)
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPMEN HIGH [4]	<u>CHANNELIZATIO</u>	STABILITY HIGH [3] MODERATE [2] LOW [1]	овине до јамен и на	Channel Amaximum 2
BROSION	ARIAN WIDTH E > 50m [4]	ach category for EACH BANK (OF FLOOD PLAIN QUALITOREST, SWAMP [3] HRUE OR OLD FIELD [2] ESIDENTIAL, PARK, NEW FIELD ENCED PASTURE [1] PEN PASTURE, ROWCROP [0]	<u>IY</u> □ □ conservatik □ □ Urban or in	DUSTRIAL [0] STRUCTION [0]
Check ONE (ONLY) Check	ANNEL WIDTH ONE (Or 2 & average) DTH > RIFFLE WIDTH [2] DTH = RIFFLE WIDTH [1] DTH < RIFFLE WIDTH [0] DTH < RIFFLE WIDTH [0]	CURRENT VELOCITY Check ALL that apply CORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTIT CAST [1] INTERMITA MODERATE [1] EDDIES [1] Indicate for reach - pools and rife	Primary Secondai [AL [-1] (circle one end of	n Potential r Contact ry Contact comment on tackt Pool/ Current Maximum 12
☐ BEST AREAS > 10cm [2] ☐ MĀXĪÑ	Check ONE (0 I DEPTH RIFFLE / UM > 50cm [2] ☐ STABLE (e, UM < 50cm [1] ☐ MOD, STAE	Or 2 & average). RUN SUBSTRATE RIFF on. Cobble. Bouldar) [2]	a population \[NO	RIFFLE [metric=0] EDNESS
DRAINAGE AREA 🔲	/ERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]	%POOL:	%GLIDE:	Gradient Maximum
EPA 4520	a man a cashes a garage	Purted	6C 7/160	06/11/08

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Qualitative Habitat Evaluation Index

	and Use Assessment Field Sh	eet <i>Unii</i> Score: <u>Liil</u>
Stream & Location:	Des Molnes Muse - 2049 RB	RM: 28) \$ Date: 07/// 08
	Scorers Full Name & Affilia	
River Code:	STORET #: Lat./Long.:	/8 . Office verified location 口
BEST TYPES PICE BOULDER [9] COBBLE [8] CRAVEL [7]	ONLY Two substrate TYPE BOXES: In % or note every type present OOL RIFFLE OTHER TYPES OOL RIFFLE ORIGII ONLY O	E[1]
•	SETATION [1] ROOTWADS [1] AQUATIC MACR	mounts of highest it water, targe Check ONE (Or 2 & everage) citional pools. ☐ EXTENSIVE >75% [11] COPHYTES [1] ☐ MODERATE 25-75% [7]
SINUOSITY DEVE HIGH [4] EX MODERATE [3] GC LOW [2] FA	DLOGY Check ONE in each category (Or 2 & average) ELOPMENT CHANNELIZATION STABILIT CCELLENT [7] NONE [6] HIGH [3] DOD [5] RECOVERED [4] MODERA AR [3] RECOVERING [3] LOW [1] DOR [1] RECENT OR NO RECOVERY [1]	onessanda.
River right fooking downstroam REROSION NONE / LITTLE [3] MODERATE [2]	☐ WIDE > 50m [4] ☐ FOREST, SWAMP [3] ☐ SHRUB OR OLD FIELD [2] ☐ NARROW 5-10m [2] ☐ RESIDENTIAL PARK, NEW	UALITY CONSERVATION TILLAGE [1] URBAN OR INDUSTRIAL [0] FIELD [1] MINING / CONSTRUCTION [0]
MAXIMUM DEPTH Check ONE (ONLY!) >> 1m [6] 0.7~1m [4] 0.4~0.7m [2] 0.2~0.4m [1]		ply Primary Contact Secondary Contact Sestimate [-1] Secondary Contact Settimate (-1) Secondary Contact Settimate (-1) Secondary Contact Settimate (-1) Secondary Contact Settimate (-1) Secondary Contact Seconda
Indicate for function of riffle-obligate seat the seat of the seat	ional riffles; Best areas must be large enough to sup pecies: Check ONE (Or 2 & average). RUN DEPTH MAXIMUM > 50cm [2] STABLE (e.g., Cobble, Boulder) [2] STABLE (e.g., Large Gravel) [2] UNSTABLE (e.g., Fine Gravel, Sand)	RIFFLE / RUN EMBEDDEDNESS NONE [2] LOW [1]
6] GRADIENT (DRAINAGE AREA	it/mi)	%GLIDE: Gradient 6 %RIFFLE: Maximum 10
EPA 4520	Various Cel	Ke 2/16/2 06/11/08

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Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Sco	re: (31)	
M: 28 / 2Date	: 07/0/08	

Stream & Location: Des Places Rice - 281.728	RM: 28/17 Date: 27/10/08
Scorers Full Name & Affiliation:	Office verified
River Code: - STORET #: Lat./ Long.:	18 Jocation I
1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present Check C	DNE (Or 2 & average)
BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE UMBSTONE [1]	QUALITY [] HEAVY [-2]
□ BOULDER [9] □ DETRITUS [3] □ TILLS [1] □ COSBLE [8] □ MUCK [2] □ WETLANDS [0]	SILT MODERATE [-1] Substrate
☐ GRAVEL [7] ☐ SILT [2] ☐ HARDPAN [0] ☐ SAND [6] ☐ ARTIFICIAL [0] ☐ SANDSTONE [0]	TREE [I] EXTENSIVE [-2]
□□ BEDROCK [5] (Score natural substrates: ignore □ RIP/RAP [0]	☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☐ MAXIMUM 20 ☐ NONE [1]
NUMBER OF BEST TYPES: 4 or more [2] sludge from point-sources) ACUSTRINE [0] Comments SHALE [-1]	M MONE [1]
COAL FINES [-2]	
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more commo quality; 2-Moderate amounts, but not of highest quality or in small amounts quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional	of highest Check ONE (Or 2 & average)
UNDERCUT BANKS [1] POOLS > 70cm [2] OXBOWS, BACKWATE	RS [1]
OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHY SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEE	* *
ROOTMATS [1]	Cover
Comments	Maximum 20
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)	por conference and company and conference of the state of
SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4] EXCELLENT [7] NONE [6] HIGH [3]	
☐ MODERATE [3] ☐ GOOD [5] ☐ RECOVERED [4] ☐ MODERATE [2]	
ZLOW [2]	Channel
Comments [-1]	Maximum 3
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (O. River right looking downstream RIPARIAN WIDTH FLOOD PLAIN QUALIF	
EROSION	
☐ ☐ NONE / LITTLE [3] ☐ ☐ MODERATE 10-50m [3] ☐ ☐ SHRUB OR OLD FIELD [2] ☐ ☐ MODERATE [2] ☐ ☐ NARROW 5-10m [2] ☐ ☐ RESIDENTIAL, PARK, NEW FIELD	☐ ☐ URBAN OR INDUSTRIAL [8] [1] ☐ ☐ MINING / CONSTRUCTION [8]
☐ ☐ HEAVY / SEVERE [1] ☐ ☐ VERY NARROW < 5m [1] ☐ ☐ FENCED PASTURE [1] ☐ ☐ NONE [0] ☐ ☐ OPEN PASTURE, ROWCROP [0]	Indicate predominant land use(s)
Comments	past 100m riparian. Riparian Maximum 10
5] POOL / GLIDE AND RIFFLE / RUN QUALITY	The second secon
MAXIMUM DEPTH CHANNEL WIDTH CURRENT VELOCITY Check ONE (ONLY) Check ONE (Or 2 & average) Check ALL that apply	Recreation Potential Primary Contact
Ø> 1m [6] □ POOL WIDTH > RIFFLE WIDTH [2] □ TORRENTIAL I-11 Ø SLOW H1	Secondary Contact
☐ 0.4<0.7m [2] ☐ POOL WIDTH < RIFFLE WIDTH [0] ☐ FAST [1] ☐ INTERMIT	IAL [-1] (circle one and commant on back)
□ 0.2<0.4m [1] □ MODERATE [1] □ EDDIES [1] □ c 0.2m [0]	Pool / Current
Comments	Maximum C
Indicate for functional riffles; Best areas must be large enough to support of riffle-obligate species: Check ONE (Or 2 & average).	· · · · · · · · · · · · · · · · · · ·
RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIF	FLE / RUN EMBEDDEDNESS
BEST AREAS > 10cm [2] MAXIMUM > 50cm [2] STABLE (e.g., Cobble, Boulder) [2] BEST AREAS 5-10cm [1] MAXIMUM < 50cm [1] MOD. STABLE (e.g., Large Gravel) [1]	INONE [2] ILOW [1]
☐ BEST AREAS < 5cm ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] [0]	☐ MODERATE [0] RIFIE / Run ☐ EXTENSIVE [-1] Meximum
Comments	Maximum 8
6] GRADIENT (RVmi) [VERY LOW - LOW [2-4] %POOL:	%GLIDE: Gradient 7
DRAINAGE AREA MODERATE [6-10] mi2) HIGH - VERY HIGH [10-6] %RUN:	%RIFFLE: Maximum 10
EPA 4520 Prosts & K	e -1/16/08 06/11/08

Electronic Filmigner Received resemble 05/2023

		itat Evaluation Inde> ssment Field Sheet	QHEI Score: 32
Stream & Location:	Das Ildnes Wase -	: アをハルードリ rers Full Name & Affiliation:	RM: <u>18), 6 Date: 0 f 1 / 1 / 08</u> Jec Walsolm & El Corporation
River Code:	STORET #:	Lat./Long.:	18 . Office verified location
11 SUBSTRATE Check ONLY Two s	ubstrate TYPE BOXES:		AND THE RESIDENCE OF THE PROPERTY OF THE PROPE
BEST TYPES POOL RIFFLI BLOR /SLABS [10] BOULDER [9] COBBLE [8] SAND [6] BEDROCK [5] NUMBER OF BEST TYPES: Comments	OTHER TYPES P OTHER TYPES P HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] Score natural sub	OOL RIFFLE ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] Strates; ignore RIP/RAP [0] Coint-sources) SHALE [-1] COAL FINES [-2]	LI NONE [1]
2] INSTREAM COVER Indicate proguelity; 3-Highest quality in moderate of diameter log that is stable, well develop UNDERCUT BANKS [1] OVERHANGING VEGETATION [SHALLOWS (IN SLOW WATER) ROOTMATS [1] Comments	Abderate amounts, but not of control of the control of the contro	of highest quality or in small amounts y large boulders in deep or fast water ater, or deep, well-defined, functional [2]OXBOWS, BACKWATE AQUATIC MACROPHY	of highest (Check ONE (Or 2 & average) (large pools EXTENSIVE >75% [11] RS [1] MODERATE 25-75% [7] SPARSE 5-<25% [3]
3] CHANNEL MORPHOLOGY CINE SINUOSITY DEVELOPMENT DEVEL	JT CHANNELIZA	TION STABILITY HIGH [3] MODERATE [2]	Channel 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EROSION DOME / LITTLE [3] DOME / LITTLE [3] DOME / LITTLE [2]	ARIAN WIDTH E > 50m [4]	in each category for EACH BANK (O) FLOOD PLAIN QUALI FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW FIELD FENCED PASTURE [1] OPEN PASTURE, ROWCROP [0]	TY P P P P P P P P P
Check ONE (ONLY) Check → 1m [6]	IANNEL WIDTH ONE (Or 2 & sverage) DTH > RIFFLE WIDTH [2] DTH = RIFFLE WIDTH [1]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTIT FAST [1] INTERMIT MODERATE [1] EDDIES [1] Indicate for reach - pools and rif	TENT [-2] Pool/
of riffle-obligate species: RIFFLE DEPTH RUI DESTAREAS > 10cm (2) CIMAXIM	Check Of Che	De large enough to support NE (<i>Or 2 & average</i>), E / RUN SUBSTRATE RIFF E (e.g., Cobble, Boulder) [2] STABLE (e.g., Large Gravel) [1] BLE (e.g., Fine Gravel, Sand) [0]	a population
DRAWAGE AREA D	VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]	%POOL:	%GLIDE: Gradient 6 %RIFFLE: Maxmum 6
EPA 4520 ·			KC 7/16/08 06/11/08

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Qualitative Habitat Evaluation Index

Chalim					iuation Inde) F <mark>ield Sheet</mark>	(QH	El Scor	e: [3	3
Stream & Location:	Des Hwares	Kiver	281,3 L	8		RM: 28		27/10	/ 08
			Scorers	Full Na	me & Affiliation:	Ja Ve	rebusta E	A L'ergin	e pir
River Code: -		RET#:		Lat/L	.ong.:	/8 .		Office I	verified ocation \Box
1] SUBSTRATE Check Of	/LY Two substrate	TYPE BOXES	; ;			NE (0- 2 P		Mark St. St. Colored Arterior Co. P. Start Arterior St.	************
BEST TYPES POOR		HER TYPE HARDPAN [4 DETRITUS [2 MUCK [2] SILT [2] ARTIFICIAL (Score nature [2] Sludge [6]	[0]	s; ignore sources)	ORIGIN ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIPIRAP [0] LACUSTRINE [0] SHALE [-1] COAL FINES [-2]	SILT	QUAI □ HEAVY □ MODER □ NORMA □ PREE [1	7-2] ATE [-1] L [0] J IVE [-2] ATE [-1] L [0]	Substrate Maximum 20
2] INSTREAM COVER in a quality; 3-Highest quality in m diameter log final is stable, we undercut banks [1] OVERHANGING VEGE SHALLOWS (IN SLOW ROOTMATS [1] Comments	uality; 2-Moderate pdarate or greater II developed rootw I TATION [1]	amounts, but amounts (e.g. ad in deep / fa	not of high very large ast water, o 70cm [2])S [1]	rest qualities boulder or deep, w O	ty or in small amounts s in deep or fast water	of highest; large pools, [RS [1] [TES [1] [Check ONE (6 EXTENSIVE MODERATE SPARSE 5-	Dr 2 & over 5 >75% [11 5 25-75% [<25% [3]	7)
□ нідн [4] □ ехої	OPMENT	E in each cate CHANNEI NONE [6] RECOVERED RECOVERIN RECENT OR	IZATION P[4] G [3] NO RECO	1	STABILITY HIGH [3] MODERATE [2] LOW [1]		·	Channel Maximum 20	
□ □ MODERATE [2] □ □ □ □ HEAVY / SEVERE [1] □	RIPARIAN WIDE > 50m MODERATE NARROW 5-	<u> WIDTH</u> [4] 10-50m [3] 10m [2]	D D SMI	FLOC REST, SV RUB OR SIDENTIA ICED PA	ry for Each Bank (O DD PLAIN QUALI VAMP [3] OLD FIELD [2] L. PARK, NEW FIELD STURE [1] URE, ROWCROP [0]	IY	ONSERVATION IRBAN OR IN INING / CON predominant I Om riparian.	DUSTRIA! STRUCTIO	. [0]
□ 0.7 <im [a]="" td="" □<=""><td>RIFFLE / RUN CHANNE Check ONE (C POOL WIDTH > R POOL WIDTH = R POOL WIDTH < R [Impounded [-1]</td><td>L WIDTH 1 2 & sverage; IFFLE WIDTH IFFLE WIDTH IFFLE WIDTH</td><td>[2] D TO</td><td>Cho DRRENTI ERY FAS' NST [1] ODERAT</td><td>☐ INTERMIT</td><td>TENT [-2]]</td><td>Recreatio Primary Secondai (errole ente and c</td><td>Contac y Conta</td><td>et en</td></im>	RIFFLE / RUN CHANNE Check ONE (C POOL WIDTH > R POOL WIDTH = R POOL WIDTH < R [Impounded [-1]	L WIDTH 1 2 & sverage; IFFLE WIDTH IFFLE WIDTH IFFLE WIDTH	[2] D TO	Cho DRRENTI ERY FAS' NST [1] ODERAT	☐ INTERMIT	TENT [-2]]	Recreatio Primary Secondai (errole ente and c	Contac y Conta	et en
☐ SESTAREAS 5-10cm [1] ☐ BESTAREAS < 5cm [metric=0] Comments		Chec [<u>H</u> <u>RI</u> Icm [2] □ ST Icm [1] □ M(X ONE (O) <u>FFLE / F</u> ABLE (e.g DD, STABL	r 2 & ave <u>RUN SU</u> Cobble .E (e.g., l	rege). I <u>BSTRATE</u> <u>RIFI</u> 5. Boulder) 121	FLE / RUN ON OLK OLK OLK	TENSIVE [-1	\ e/#\\$	
DRANAGE AREA	☐ MODER	DW - LOW [2- ATE [6-10] /ERY HIGH [1	*		%POOL:	%GLIDE %RIFFLE	January Comment	Gradiem Maximum 10	6
EPA 4520				12.		5/:1/	NÎZ	98/	11/08

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Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

<u>Ohoska</u>			Muation Inde: <u>Field Sheet</u>	^K QHEISco	re: (HO)
Stream & Location:	Des Messes William	-201 <u>-3 </u>	V,	_RM: <u>28/_3</u> Date	*: <i>0</i> {1/1/108
River Code: *	STORET #:		ame & Affiliation: Long.:	The Vertical E	A- Engloceting Office verified ,—
1] SUBSTRATE Check ONL	Contraction of the contraction o	<u> (NAD 83 -</u>	deciudis	<u> </u>	location L
estimate %	or note every type present RIFFLE OTHER TYI HARDPAN DETRITUS DMUCK [2] DSILT [2] ARTIFICIA (Score nate	POOL RIFFLE [4] [3] L [0] ural substrates; ignore	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0]	HEAV	RATE [-1] Substrate IAL [0] [1] [1] SSIVE [-2] RATE [-1] IAL [0] Substrate Adaptinum 20
2] INSTREAM COVER ind que quality; 3-Highest quality in mod diameter log that is stable, well undercut banks [1] OVERHANGING VEGETA SHALLOWS (IN SLOW WROOTMATS [1] Comments	ality: 2-Moderate amounts, b lerate or greater amounts (e developed rootwad in deep / POOLS: ATION [1] ROOTW.	ut not of highest qua .g., very large boulde fast water, or deep, > 70cm [2] C ADS [1] A	lity or in small amounts	of highest r, large Check ONE i pools. Check ONE EXTENSION CONTROL CON	COUNT (Or 2 & average) VE >75% [11] TE 25-75% [7] 5-425% [3] ABSENT <5% [1] Cover Maximum // 20
3] CHANNEL MORPHOLO SINUOSITY DEVELO HIGH [4]	PMENT CHANNE LENT [7] NONE [6] [5] RECOVERI	ELIZATION ED [4] NG [3] R NO RECOVERY [4	STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel 3.5
☐ ☐ NONE / LITTLE [3] ☐ [☐ ☐ MODERATE [2] ☐ [☐ ☐ HEAVY / SEVERE [1] ☐ [RIPARIAN ZONE Check RIPARIAN WIDTH WIDE > 50m [4] MODERATE 10-50m [3] NARROW 5-10m [2] VERY NARROW < 5m [1] NONE [0]	FLO FOREST, S SHRUB OR RESIDENTI	<u>OD PLAIN QUALI</u> WAMP [3] : OLD FIELD [2] AL, PARK, NEW FIELD	TY	INDUSTRIAL [0] NSTRUCTION [0] It land use(s)
0.7~4m [4] P6	FFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & everage DOL WIDTH > RIFFLE WIDT DOL WIDTH = RIFFLE WIDT DOL WIDTH < RIFFLE WIDT Impounded [-1]	CUR (e) CH (I2] TORRENT (H [1] VERY FAS (H [0] FAST [1] (MODERA)	RENT VELOCITY neck ALL that apply TAL [-1] S SLOW [1] ST [1] INTERSTI INTERMIT TE [1] D EDDIES [1] for reach - pools and rif	Primas Second [circle one sand	on Potential y Contact ary Contact I somment on back) Pool / Current Maximum 12
Indicate for functions of riffle-obligate spectal RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS < 5cm [metric=0] Comments	ies: Ch	eck ONE (<i>Or 2 & ave</i> <u>RIFFLE / RUN SI</u> STABLE (e.g., Cobbl	erage). <u>UBSTRATE</u> <u>RIFI</u> le, Boulder) [2] Large Gravel) [1]	a population FLE / RUN EMBED INONE [2] ILOW [1] IMODERATE [1] EXTENSIVE [-1]	O RIFFLE [metric=0] DEDNESS DI Riffle / D
6] GRADIENT (tom DRAINAGE AREA (mi	MODERATE [6-10]	-	%POOL:	%GLIDE:(%RIFFLE:(Gradient 6
EPA 4520		14,	- 14C	7/14/02	06/11/08

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Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

	: 2 2 W	a see the see a second	**************************************	a seemed messioners		· Washington and Control of the Cont
Stream & Location:	Des Maines	Run - 281	o RB		RW: 281 O Date	: 07/1/1/08
		S	corers Full M	ama & Affiliation	· Too Vine Broken &	The Freezeway : 100
River Code: -	- S				18	Office verified (
1] SUBSTRATE Check estimate stimate st	ONLY Two substite % or note ever COL RIFFLE YPES: 4 or 1 or	TORET #: rate TYPE BOXES; y type present OTHER TYPE:] HARDPAN [4]] DETRITUS [3]] MUCK [2]] SILT [2] [Score natural more [2] sludge fro less [0] ce 0 to 3: 0-Absent rate amounts, but n atter amounts (e.g., notwad in deep / fas	Lat./ (NAO 93-	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0] LACUSTRINE [0] SHALE [-1] COAL FINES [-2] COAL FINES [-2]	ONE (Or 2 & sverage) QU/ HEAV SILT MODE NORM FREE NORM NORM NORM NORM NORM NORM NORM NORM	ALITY Y [-2] IAL [0] INSIVE [-2] IAL [0] IAL [0] Maximu IAL [0]
Comments	<u></u>					Maximum 4 20
HIGH [4] EX MODERATE [3] GO LOW [2] FA ANNE [1] PO COMMENTS 4] BANK EROSION AI River right tooking downstream REROSION MODERATE [2] MODERATE [2] HEAVY / SEVERE [1] Comments	ELOPMENT CELLENT [7] DOD [6] IR [3] IR [3] IN RIPARIAN	CHANNELI NONE [6] RECOVERED RECOVERING RECENT OR N Impounded [- V ZONE Check O AN WIDTH Om [4] Om [4] OTE 10-50m [3] V 5-10m [2] RROW < 5m [1]	ZATION [4] [3] O RECOVERY [1 The in each category in the cat	STABILITY HIGH [3] MODERATE [2] LOW [1] OTY for EACH BANK (COD PLAIN QUALINAMP [3] OLD FIELD [2] AL, PARK, NEW FIELD	Or 2 per bank & average) TY CONSERVAT URBAN OR 1 [1] MINING / CO	NSTRUCTION [0] If land use(s)
☐ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0] Comments Indicate for functi	CHANI Check ONE Check ONE POOL WIDTH POOL WIDTH POOL WIDTH (impounded)	NEL WIDTH (Or 2 & average) > RIFFLE WIDTH [3 = RIFFLE WIDTH [4 < RIFFLE WIDTH [4 [-1]]	Charles Charle	☐ INTERMIT IE [1] ☐ EDDIES [1] for reach - pools and ri ough to support	Primar Second (circle one and	on Potential ry Contact ary Contact c comment on back) Pool / Current Adaximum 12 O RIFFLE [metric=1]
of riffle-obligate s <u>RIFFLE DEPTH</u> ☐ BEST AREAS > 10cm [2] ☐ BEST AREAS < 5cm [metric=0] Comments	RUN DE	<u>PTH RIF</u> > 50 cm [2] □ STA < 50 cm [1] □ MOI). STABLE (e.g.,	<u>JBSTRATE</u> <u>RIFI</u> e. Boulderi (2)	FLE / RUN EMBED ONONE [2] OLOW [1] OMODERATE [1] EXTENSIVE [-	DEDNESS
6] GRADIENT (DRAINAGE AREA	ON D	Y LOW - LOW [2-4] ERATE [6-10] I - VERY HIGH [10-		%POOL: %RUN:	%GLIDE:	Gradient 6
EPA 4520	agen and a sharehold of the sharehold of		Prin	gud KC	516618	06/11/08

QHEI Score: 3/5

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Qualitative Habitat Evaluation Index

	an	io use as	sessment	rieid pueei			
Stream & Location:	Des Plan	es Mires	2808 LB		RM: 280	.? Date: 07/	<u>/2/08</u>
	nanconneces anno anno anno anno anno anno anno ann	**************************************		ame & Affiliation	i: Joe Van	A COLOR OF THE PERSON NAMED IN COLOR OF THE P	70000000
River Code:	MANY COURSE VISION NAMES AND THE	TORET#:	Lat./ 	Long.;	/8		iffice verified D
BEST TYPES P BLDR /SLABS [19] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [6]	OOL RIFFLE	y type present OTHER TYP HARDPAN DETRITUS MUCK [2] SILT [2] ARTIFICIAL (Score nature) more [2] studge	S;	Check ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0]	I E SEDVEON	QUALITY QUALITY HEAVY [-2] MODERATE [
2] INSTREAM COVER quality; 3-Highest quality in diameter log that is stable,	quality; 2-ivious moderate or gre well developed n [1] GETATION [1]	rate amounts, bu aler amounts (e.g potwed in deep /	n not of nignest quage, very large bould fast water, or deep, 70cm [2] DS [1]	uny or in smaii amoun ers in deep or fast wat	ts of nighest Cer, large Cal pools.	AMOUNT heck ONE (Or 2 & EXTENSIVE >75' MODERATE 25-7 SPARSE 5-<25% NEARLY ABSEN Co	average) % [11] % [7] [3] T <5% [1]
☐ HIGH [4] ☐ E3 ☐ MODERATE [3] ☐ G4 ☐ LOW [2] ☐ F4	OLOGY Check ELOPMENT KCELLENT [7] OOD [5] NR [3] DOR [1]	CHANNE ☐ NONE [6] ☐ RECOVERE ☐ RECOVERE	ELIZATION ED [4] NG [3] R NO RECOVERY	STABILITY HIGH [3] MODERATE [:	2]	Che Mexi	minel 2
A] BANK EROSION A River right tooking downstrea EROSION D NONE / LITTLE [3] D MODERATE [2] D HEAVY / SEVERE [1] Comments	RIPAR	<u>IAN WIDTH</u> 50m [4] ATE 10-50m [3] N 5-10m [2] ARROW < 5m [1]	FLC FOREST, : SHRUB O RESIDENT	OOD PLAIN QUAI SWAMP [3] R OLD FIELD [2] TAL, PARK, NEW FIEI		DNSERVATION TII RBAN OR INDUST NING / CONSTRU predominant lend u m riparian. Rip	TRIAL [0] ICTION [0]
5] POOL / GLIDE ANI MAXIMUM DEPTH Check ONE (ONLY!) >> 1m [6] 0.7~1m [4] 0.4~0.7m [2] 0.2~0.4m [1] <	CHAN Check ON POOL WIDTH	INEL WIDTH E (Or 2 & averag I > RIFFLE WIDT I = RIFFLE WIDT I < RIFFLE WIDT	9) CUI 9) C H[2] ☐ TORREN H[1] ☐ VERY FA H[0] ☐ FAST [1] ☐ MODER	□ INTERM		Cu	ntact ontact
Indicate for function of riffle-obligate RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS < 5cm [metric=0] Comments	species: RUN D I	Ch <u>EPTH</u>	eck ONE (Or Ž & a RIFFLE / RUN S STABLE (e.g., Cob JOD, STABLE (e.g	veregē). SUBSTRATE RI	FFLE / RUN UNC CLO CLO	ENBEDDED! NE [2] W [1]	unie / 🌠 🎉
6] GRADIENT (DRAINAGE AREA	₹ : □ MO	SY LOW - LOW [DERATE [6-10]		%POOL:	%GLIDE	<u> </u>	adjent 6
EPA 4520			Prani	red KC	3/16/) E	06/11/08

OHEI Score: 37-

	Qualitative Hal and Use Asse		3	QHEI Scor	e: (39,5)
Stream & Location: <u>lo</u>	Maines River - 2	90,7 KB	RIVI;	280 7 Date:	<u>071 1 11</u> 08
		rers Full Name & A	Affiliation: <u></u> ្សិខ	<u>Vardinika s</u>	Office verified
River Code:	STORET #:	Lat./Long.: 		<u>}</u>	location L
1] SUBSTRATE Check ONLY Two sestimate % or note BEST TYPES POOL RIFFL BLDR /SLABS [10] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPES: Comments	OTHER TYPE	LIME: TILLS WETI HARI SAND Distrates; ignore RIP/R point-sources) LACU	ANDS [0] DPAN [0] DSTONE [0] AP [0] STRINE [0]	T 2 & everage) QUAI QHEAVY HEAVY MODER FREE [1 EXTENS MODER NORMA	[-2] ATE [-1] Substrate L [0]
2] INSTREAM COVER Indicate or quality; 3-Highest quality in moderate o diameter log that is stable, well develop UNDERCUT BANKS [1] OVERHANGING VEGETATION [SHALLOWS (IN SLOW WATER) ROOTMATS [1]	docerate amounts, but not r greater amounts (e.g., ve led rootwad in deep / fast ve POOLS > 70cr	of highest quality or in si ry targe boulders in deep vater, or deep, well-defini n [2]OXBOWS, 1]AQUATIC	mall amounts of fligh or fast water, large ed, functional pools.	Check ONE (Check ONE (EXTENSIVE MODERATION SPARSE 5-	E 25-75% [7]
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPMENT HIGH [4] EXCELLENT [MODERATE [3] GOOD [5] LOW [2] FAIR [3] NONE [1] POOR [1] Comments	NT CHANNELIZA	ATION STA	DDERATE [2] W [1]		Channel 3
EROSION	ARIAN WIDTH E > 50m [4] DERATE 10-50m [3] ROW 5-10m [2] Y NARROW < 5m [1]	FLOOD PLA FOREST, SWAMP [3] SHRUB OR OLD FIE RESIDENTIAL PARK	AIN QUALITY I LD [2] C, NEW FIELD [1] [1]	bank & average) CONSERVATK URBAN OR IN MINING / CON dicate predominant st 100m riparian.	IDUSTRIAL [0] STRUCTION [0]
Check ONE (ONLYI) Check	/ RUN QUALITY IANNEL WIDTH CONE (Or 2 & average) IDTH > RIFFLE WIDTH [2] IDTH = RIFFLE WIDTH [1] IDTH < RIFFLE WIDTH [0] Inded [-1]	CURRENT \ Check ALL ! TORRENTIAL [-1] VERY FAST [1] FAST [1] MODERATE [1] Indicate for reach	that apply Stow [1] INTERSTITIAL [- INTERMITTENT [EDDIES [1]	Primary Seconda (circle one sad	Pool/Current Maximum 12
☐ BEST AREAS > 10cm [2] ☐ MAXII	Check C <u>N DEPTH</u> <u>RIFF</u> MUM > 50cm [2] ☐ STAB MUM < 50cm [1] ☐ MOD.	NE (Or Ž & sveregē). <u>LE / RUN SUBSTR</u> LE (e.g., Cobble, Bould	ATE RIFFLE / er) [2] ravel) [1]	Dulation NO RUN EMBEDS NONE [2] LOW [1] MODERATE [8] EXTENSIVE [-1]	Riffle / f
6] GRADIENT ((1/ml) DRAINAGE AREA DRAINAG	VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]	%POO %RUN		IDE:(Gradient 6
EPA 4520	and the state of t	P	mysil K	7 7/16)원 06/11/08 ·

MBI MODIFIED

Qualitative Habitat Evaluation Index

	-		iluation Index Field Sheet	CHEI Sco	r e: [37,5]
Stream & Location:		challenda semanarian da Sel delendratura		ras. oo a la Cari	
oneam & Lucaton.	<u>Ves Mowes Kung -</u>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ame & Affiliation:	RM: 2801 Date	El Elghanner
River Cade: .	- STORET#:		Long.:	78 .	Office verified C
1] SUBSTRATE Check C	NVLY Two substrate TYPE BOX	======================================	***************************************		and the second s
BEST TYPES DEST TYPES DEST STATE BOULDER [9] DEST COBBLE [8] DEST COBBLE [8] DEST COBBLE [7] D	9% or note every type present OL RIFFLE OTHER TYP OTHER	[4] [3]L[0]	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0]	HEAV	RATE [-1] Substrate (AL [0]
ouality: 3-Highest quality in r	ETATION [1] ROOTW	ul not of highest qua g., very large boulde fast water, or deep, > 70cm [2] C ADS [1]	lity or in small amounts are in deen or fast unter	of highest Check ONE , large Check ONE pools. RS [1] MODERA TES [1] SPARSE	IOUNT (Or 2 & average) WE >75% [11] VE 25-75% [7] 5-<25% [3] ABSENT <5% [1] Cover Maximum 8
SINUOSITY DEVE ☐ HIGH [4] ☐ EXC	DELLENT [7] NONE [6] OD [6] RECOVERI R [3] RECOVERI	ELIZATION ED [4] NG [3] R NO RECOVERY [STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel Maximum 20
River right looking downstream EROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE [1] Comments	ID RIPARIAN ZONE Check RIPARIAN WIDTH WIDE > 50m [4] MODERATE 10-50m [3] MARROW 5-10m [2] MODERATE 10-50m [2] MODERATE 10-50m [2] MODERATE 10-50m [2]	FLO	OD PLAIN QUALI WAMP [3] COLD FIELD [2] IAL, PARK, NEW FIELD	TY CONSERVATE CONSERVA	INDUSTRIAL [0] NSTRUCTION [0] of land use(s)
MAXIMUM DEPTH Check ONE (ONLY!) 7 > 1m [6] 0.7<1m [4]	RIFFLE / RUN QUALITY CHANNEL WIDTH Check ONE (Or 2 & averag POOL WIDTH > RIFFLE WIDT POOL WIDTH = RIFFLE WIDT POOL WIDTH < RIFFLE WIDT [Impounded [-1]]	CUF (e) C (H [2] C TORREN' (H [1] C VERY FA (H [0] C FAST [1] (H MODERA		Prima Second [clrcle one ar	ion Potential ry Contact lary Contact d commont on back) Pool / Current Maximum 12
Indicate for function of riffle-obligate space obligate space of riffle-obligate space obligate space obli	<u>RUN DEPTH</u> ☐ MAXIMUM > 60cm [2] ☐ ☐ ☐ MAXIMUW < 50cm [1] ☐	leck ONE (Or 2 & av <u>RIFFLE / RUN S</u> STABLE (e.a., Cobb	erege). <u>UBSTRATE</u> <u>RIFF</u> le, Boulder) [2] . Large Gravel) [1]	a population ON ENBED ON PROPERTY OF THE PROPE	IO RIFFLE [metric=0] DEDNESS [0] Riffle / (6) All Maximum (7)
6] GRADIENT (DRAINAGE AREA	fami)		%POOL: %RUN:	%GLIDE:(%RIFFLE:(Gradient (c) Maximum 10
EPA 4520			Vari 150	100 7/16h	06/11/03

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Qualitative Habitat Evaluation Index

<u> Challa</u>		ualitative 1 <mark>d Use A</mark> s					1Ei Scoi	v. (2	8.5
Stream & Location:	Oes_	Maines Live	<u>v - 28</u>	0.4 83		_RM: 2	<u> </u>	<u>0411</u>	_/ 08
			Scorers	Full Name &		: <u> </u>	lendrus 46		ecceptic;
River Code:	the freeze windle states states	TORET#:		Lat./Long.	<u>:*</u>	/8	*	Ome	verified — location —
BEST TYPES □ BLDR /SLABS [10] □ BOULDER [0] □ COBBLE [0] □ GRAVEL [7] □ SAND [6] □ BEDROCK [5]	on the event of the state of th	ny type present OTHER TYF HARDPAN DETRITUS MUCK [2] SILT [2] ARTIFICIAL (Score netu	POOL I	ULM UTIL UWE UHA USA Signore URIF	ORIGIN MESTONE [1] LS [1] ETLANDS [0] RDPAN [0] NDSTONE [0] PRAP [0]	ONE (Or 2	QUA ☐ HEAVY ☐ MODEI ☐ NORMI ☐ FREE!	RATE [-1] AL [0] 1] SIVE [-2] RATE [-1]	Substrate
Comments	——— □ 3 or	more [2] sludge less [9]		□sн □cc	ALE [-1] AL FINES [-2]	<i>w</i>	"□ NONE		20
2] INSTREAM COVER quality; 3-Highest quality in a diameter log that is stable, w UNDERCUT BANKS (OVERHANGING VEG SHALLOWS (IN SLOV ROOTMATS [1] Comments	quality; 2-Mode moderale or gre /ell developed r [1] ETATION [1]	erate amounts, bi valer amounts (e. ootwad in deep /	ut not of high g., very large fast water, o · 70cm [2] _ \DS [1]	est quality or in boulders in de r deep, well-de OXBOW	i small amount eep or fast wali fined, functioni	s of highest er, large al pools. 'ERS [1] YTES [1]	Check ONE	'E >75% [1 'E 26-75% -<25% [3]	1] (7) % (1)
☐ HIGH [4] ☐ EX	LOPMENT CELLENT [7] OD [5] IR [3]	CHANNE NONE [6] RECOVERE RECOVERE	ELIZATION ED [4] NG [3] R NO RECO		TABILITY HIGH [3] MODERATE [2 LOW [1]		aragan digitari na manananananananan digitari (Pad	Channe Meximum 20	121
☐ ☐ MODERATE [2] ☐ ☐ HEAVY / SEVERE [1]	RIPAR	IAN WIDTH 50m [4] ATE 10-50m [3] W 5-10m [2] ARROW < 5m [1]			LAIN QUAL [3] FIELD [2] RK, NEW FIEL E [1]		k & average) CONSERVATI URBAN OR II MINING / COI te predominant 00m riparian.	VDUSTRIA NSTRUCTIO	L [0] ON [0]
(0.7-<1m [4]	CHAN Check ON POOL WIDTH POOL WIDTH	INEL WIDTH E (Or 2 & everag I > RIFFLE WIDT I = RIFFLE WIDT I < RIFFLE WIDT	H [2]		☐ INTERST ☐ INTERMI ☐ EDDIES	-] 	Recreation Primar Seconda (circle one and	y Contac rry Conta	#
Indicate for function of riffle-obligate specifies and specifies are specifies as a specifies and specifies are specifies as a specifies are specifies are specifies as a specifies are specifies as a specifies are specified are specifies are specified are specifies are specifies are specified are specified are specifies are specified are spec	pecies: <u>RUN D</u> ⊡MAXMUM	Ch <u>EPTH F</u> > 50cm [2] ☐ 5 < 50cm [1] ☐ 6	eck ONE (O) REFLE / F STABLE (e.g #OD, STABL	r 2 & average), <u>RUN SUBST</u> Cobble, Bou	RATE Rif Ider) [2] Gravel) [1]	FLE /RL	ation UNI IN EMBEDI IONE [2] LOW [1] MODERATE [CEXTENSIVE [-	n Rifflo	S /{******
Comments	necessarian construction of the second construct	eri assiras analysis parentalis ang salah		international desiration of the state of the	·	***************************************	creechiodiliriididididididididididididididididid		e Samuel
6] GRADIENT (DRAINAGE AREA	_ D MOI	IY LOW + LOW () DERATE [8-10] H - VERY HIGH (•	%PO %RU) %GLID)%RIFFL	January	Gradien Maximun 10	
EPA 4520				0,	and seek	KC >	116/08	96	1/11/08

Cheera		abitat Evaluation Inde essment Field Sheet		: 41.5
Stream & Location:	Des Mains Rive	4 - 281 <u>3 02</u>	RM: 280,3 Date: 0	27111108
		orers Full Name & Affiliation	1: Jul Vardagle EA	Commented
River Code:	STORET#:	Lat./ Long.:		Office verified Incession
1] SUBSTRATE Check ONLY Two estimate % or note BEST TYPES POOL RIFFL	every type present	Check	ONE (Or 2 & average)	ITY
BLDR /SLABS [10] BOULDER [9] COBBLE [8] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPES:	HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] (Score natural)	☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0]	SILT MODERA NORMAL FREE [1] EXTENSI MODERA NORMAL NONE [1]	Substrate Subs
2] INSTREAM COVER Indicate p quality; 2-quality; 3-Highest quality in moderate of diameter log that is stable, well develong undercut banks [4] OVERHANGING VEGETATION SHALLOWS (IN SLOW WATER ROOTMATS [4] Comments	randerate amounts, but no regreater amounts (e.g., \cdot \cd	of of highest quality or in small amoun very large boulders in deep or fast wat water, or deep, well-defined, function cm [2]OXBOWS, BACKWAT [1]AQUATIC MACROPH	ts of nignest en, large check ONE (O es, large el pools.	or 2 & everage) >75% [11] : 25-75% [7] :25% [3]
3] CHANNEL MORPHOLOGY SINUOSITY DEVELOPME SINUOSITY DEVELOPME HIGH [4]	NT CHANNELI [7] NONE [6] RECOVERED [RECOVERING	ZATION STABILITY HIGH [3] 4] MODERATE [3] C RECOVERY [1]		Channel American
EROSION	PARIAN WIDTH DE > 50m [4] DERATE 10-50m [3] RROW 5-10m [2] RY NARROW < 5m [1]	FLOOD PLAIN QUAI FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW FIEL	LITY CONSERVATIO URBAN OR INI LD [1] MINING / CONS Indicate predominant le past 100m riparian.	DUSTRIAL [0] STRUCTION [0]
Check ONE (OWLY) Check	A PUN QUALITY HANNEL WIDTH K ONE (Or 2 & average) MDTH > RIFFLE WIDTH [2 MDTH = RIFFLE WIDTH [7 MDTH < RIFFLE WIDTH [7 INDTH < RIFFLE WIDTH [7]	U VERY FAST (1) U INTERS	Primary Secondar [Glacks one anc. cc [Clacks one anc. cc [T] [T] [T] [T]	n Potential Contact y Contact
of riffle-obligate species: RIFFLE DEPTH RU DESTAREAS > 10cm [2] DMAX	Check N DEPTH RIF MUM > 50cm [2] STA MUM < 50cm [1] MOI	st be large enough to suppor ONE (Or 2 & average). FLE / RUN SUBSTRATE RI BLE (e.g., Cobble, Boulder) [2] D. STABLE (e.g., Large Gravel) [1] STABLE (e.g., Fine Gravel, Sand) [0]	t a population	Riffie / 《
6] GRADIENT (timi) E DRAINAGE AREA (mi²) E			%GLIDE:)%RIFFLE:	Gradient 6
EPA 4520		Properly	Ke 7/16/08	06/11/08

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Qualitative Habitat Evaluation Index

	and Use Asses	<u>ssment riela bne</u>	<u> et </u>	
Stream & Location:	Des Planes Row = 3	280.0 (18	RM: 280 Date	: 23/1// 08
	SG01	rers Full Name & Affiliati	ion: <u>Joe Verdaska s</u>	JA Crydwaryny
River Code:	STORET #:	Lat./ Long.:		Office verified location
1] SUBSTRATE Check ONLY estimate % o BEST TYPES POOL I DEUT (SLABS [10] COBBLE [8] COBBL	r note every type present RIFFLE OTHER TYPES HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] (Score natural sub	OOL RIFFLE ORIGIN LIMESTONE TILLS [1] WETLANDS [HARDPAN [0]	[1]	RATE [-1] Substri AL [0] [1] [0.5] ISIVE [-2] Maximu AL [0] 20
quality; 3-Highest quality in mode	ity; 2-Moderate amounts, but not c rate or greater amounts (e.g., ven eveloped roofwad in deep / fast wi POOLS > 70cm FION [1] ROOTWADS [1	of highest quality or in small amoy large boulders in deep or fast in ater, or deep, well-defined, fund in [2]OXBOWS, BACKV AQUATIC MACRO	Nunts of highest water, large ional pools. CATENS! VATERS [1] MODERA PHYTES [1] SPARSE	OUNT (Or 2 & everage) VE >75% [11] TE 25-75% [7] 5<25% [3] ABSENT <5% [4] Cover Maximum 20
3] CHANNEL WORPHOLOG SINUOSITY DEVELOG HIGH [4]	PMENT CHANNELIZA ENT [7] NONE [6] 5] RECOVERED [4] CHANNELIZA PROVERED [4] CHANNELIZA PROVERING [3]	TION STABILIT HIGH [3] MODERAT LOW [1]	•	Channel 3
River right looking downstream] MODERATE 10-50m [3] □ [] NARROW 5-10m [2] □ [] VERY NARROW < 5m [1] □ [in each category for EACH BAN FLOOD PLAIN QU FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW F FENCED PASTURE [1] OPEN PASTURE, ROWCRO	ALITY CONSERVATION URBAN OR ULD [1] MINING / CO	INDUSTRIAL [0] WSTRUCTION [0] It land use(s)
Ø> 1m [6]	CHANNEL WIDTH CHECK ONE (Or 2 & everage) OL WIDTH > RIFFLE WIDTH [2] OL WIDTH = RIFFLE WIDTH [1] OL WIDTH < RIFFLE WIDTH [0] MDOUNDED THE WIDTH [0]		Prima V [1] Second (circle one and RSTITIAL [-1] RMITTENT [-2] ES [1]	ion Potential ry Contact lary Contact d comment on back) Pool / Current Maximum 12
of riffle-obligate speci RIFFLE DEPTH ☐ BEST AREAS > 10cm (2) ☐	RUN DEPTH RIFFL MAXIMUM > 50cm [2] STABL MAXIMUM < 50cm [1] MOD. 5	NE (Or 2 & average). LE / RUN SUBSTRATE E (a.g., Cobble, Boulder) [2]	RIFFLE / RUN EMBED None [2]	ID RIFFLE (metric= DEDNESS
6] GRADIENT (n/m' DRAINAGE AREA (m/2	MODERATE [6-10]	%POOL: %RUN:	%GLIDE: %RIFFLE:	Gradient 6 Maximum 6

OMEI Score: 45

Electroni Filiting Received resemble 04/2020

	MBI I	MODIF'IED		
Cholia		tat Evaluation Index sment Field Sheet	QHEI Score: 52.5	
Stream & Location:	economica de la companya de la comp		RM: 219 8 Date: 07/ 10/08 Toe Vondryke EA Englisher	
River Code:	STORET #:	rs Full Name & Affiliation:_ Lat./Long.: (NAD 83 -decimal*)	18 Office verific tocation	ii Mr.,
BEST TYPES	every type present	Check Of ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] ates: icnore RIP/RAP [0]	NE (Or 2 & average) QUALITY HEAVY [-2] SILT MODERATE [-1] Subs NORMAL [0] FREE [1] FREE [1] MODERATE [-1] MAXIF NONE [1]	mum
2] INSTREAM COVER Indicate properties of quality: 3-Highest quality in moderate of diameter log that is stable, well developed the control of	Mederate amounts, but not of it or greater amounts (e.g., very it led rootwad in deep / fast wate POOLS > 70cm [2 [1] ROOTWADS [1]	nighest quality or in small amounts o arge boulders in deep or fast water.	f highest Check ONE (Or 2 & average)	
3] CHANNEL MORPHOLOGY COSINUOSITY DEVELOPME HIGH [4] EXCELLENT MODERATE [3] GOOD [5] LOW [2] FAIR [3] NONE [1] POOR [1] Comments	<u>NT CHANNELIZATI</u>	ON STABILITY #HIGH [3] MODERATE [2] LOW [1]	Channel Maximum 20	
EROSION	PARIAN WIDTH E > 50m [4]	each category for EACH BANK (Or FLOOD PLAIN QUALIT FOREST, SWAMP [3] SHRUE OR OLD FIELD [2] RESIDENTIAL, PARK, NEW FIELD [FENCED PASTURE [1] OPEN PASTURE, ROWCROP [0]	Y R CONSERVATION TILLAGE [1] CONSERVATION TILLAGE [1]	
Check ONE (ONLY) Check	IANNEL WIDTH ONE (Or 2 & sverage) IDTH > RIFFLE WIDTH [2] IDTH = RIFFLE WIDTH [1]	CURRENT VELOCITY Check ALL that apply TORRENTIAL [-1] SLOW [1] VERY FAST [1] INTERSTITE FAST [1] INTERMITT MODERATE [1] EDDIES [1] Indicate for reach - pools and riffle	ENT [-2]	
of riffle-obligate species: RIFFLE DEPTH RU DEST AREAS > 10cm [2] MAXI	Check ONE N DEPTH RIFFLE WUM > 50cm [2] STABLE (WUM < 50cm [1] MOD. STA	e.a., Cobble, Boulder) [2]	population	· ·=0]

Comments G GRADIENT (

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DRAINAGE AREA

mir) 🗍 HIGH - VERY HIGH [10-6]

%GLIDE:

|%RIFFLE:

%POOL:

%RUN:

06/11/08

Gradient

Maximum: 10

ChicEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet QHEI Score: 51
Stream & Location: Des Plaines Ribber - 2797 RB RM: 279,7 Date: 071 1/108 Scorers Full Name & Affiliation: Joe Valada & Engineering
River Code: STORET E: Lat./Long.: 19 Office yerlied -
1] SUBSTRATE Check ONLY two substrate TYPE BOXES: estimate % or note every type present BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY
BLDR /SLABS [16]
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY 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] Comments Impounded [-1]
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & everage) River right looking downstream EROSION NONE / LITTLE [3] MODERATE 10-50m [3] MODERATE [2] MODERATE [2] MODERATE [2] MODERATE [2] MODERATE [2] MODERATE [2] MODERATE [3] MODERATE [4] MODERATE [4] MODERATE [4] MODERATE [5] MODERATE [6] MODERATE [7] MODERATE [7] MODERATE [8] MODERATE [9] MODERATE [1] M
Signature Pool GLIDE AND RIFFLE RUN QUALITY
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE SIFFLE / RUN EMBEDDEDNESS SIFFLE /
6] GRADIENT (fi/mi) VERY LOW LOW [2-4]
wy al 10 7/16/08

MRI MODIFIED
Qualitative Habitat Evaluation Index and Use Assessment Field Sheet QHEI Score: 54.5
Stream & Location: Des Plaines Rusy - 275.5 LB RM: 279.5 Date: 07/10/08
Scorers Full Name & Affiliation: The Undusk Est Engineering
River Code: " " STORET#: Lat./Long.: 18 . Office verified location
1] SUBSTRATE Check ONLY Two substrate TYPE BOXES:
BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN BLDR /SLABS [10]
Comments SHALE [-1] SHALE [-1] SHALE [-1] SHALE [-1] COAL FINES [-2]
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent: 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1]
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4]
A] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) Rivex right tooking downstream RIPARIAN WIDTH BROSION WIDE > 50m [4] WIDE > 50m [4] SHRUB OR OLD FIELD [2] MODERATE [2] MODERATE [2] RESIDENTIAL, PARK, NEW FIELD [1] RIPARIAN WIDTH FLOOD PLAIN QUALITY FROM CONSERVATION TILLAGE [1] RESIDENTIAL, PARK, NEW FIELD [1] RIPARIAN WIDTH FROM CONSERVATION TILLAGE [1] RIPARIAN WIDTH FLOOD PLAIN QUALITY FLOOD PLAIN QUALITY
Solution Pool GLIDE AND RIFFLE RUN QUALITY
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS 5-10cm [1] BEST AREAS 5-5cm [metric=0] Comments Indicate for functional riffles; Best areas must be large enough to support a population Check ONE (Or 2 & average). RIFFLE / RUN EMBEDDEDNESS NONE [2] NONE [2] NONE [2] MAXIMUM > 50cm [1] Mod. STABLE (e.g., Cobble, Boulder) [2] LOW [1] LOW [1] BEST AREAS < 5cm [metric=0] Comments
6] GRADIENT (ft/mi)
DRAINAGE AREA MODERATE [6-10] %RUN: %RIFFLE: Maximum 10 Ma

EPA 4520

96/11/08

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MBI MODIFIED

EPA 4520

Ontalia				luation Index Field Sheet	(QHL	El Score	54
Stream & Location:	Das Moines	3004 - 23	24 K B		RW: 219	_/_Date: A	<u> 21 / / / 08</u>
Announced account from the first the	annian annia			me & Affiliation:	Jue Von	laujus CA	Freinselie
River Code:		ORET#:	Lat/l 		/8		location
Stord State State and a miles of the State State State	POOL RIFFLE C	type present THER TYPES ARTHUS [3] MUCK [2] SILT [2] ARTHICIAL [0] (Score natural sure [2] sludge from	ibstrates: ignore	ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0]	SILT	QUAL HEAVY I- MODERA NORMAL FREE [1] EXTENSI MODERA NONE [1]	72] TE [-1] Substra [0] 20
2] INSTREAM COVE quality; 3-Highest quality is diameter log that is stableUNDERCUT BANKSOVERHANGING VESHALLOWS (IN SLIROOTMATS [1] Comments	quality; 2-Modera n moderate or great , well developed roo \$ [1] :GETATION [1]	ate amounts, but not er amounts (e.g., ve when in deep / fast POOLS > 70c ROOTWADS	t of highest quali ery large boulder water, or deep, v m [2]O [1] A	ty or in small amounts is in deen or fast water	of highest ; large pools. IRS [1] ITES [1]	Check ONE (O) EXTENSIVE MODERATE SPARSE 5-4 NEARLY ABS	7 2 & <i>average</i>) >75% [11] 25-75% [7] 25% [3]
☐ HIGH [4] ☐ E ☐ MODERATE [3] ☐ G ☐ LOW [2] ☐ F	ELOPMENT EXCELLENT [7] SOOD [5] FAIR [3]	ME in each categor CHANNELIZ NONE [6] RECOVERED [4] RECOVERING [6] RECENT OR NO Impounded [-1	ATION I RECOVERY [1	STABILITY Z'HIGH [3] MODERATE [2] LOW [1]		*.	Channel 4
4) BANK EROSION A River right tooling downstree EROSION One / LITTLE [3]	RIPARIA RIP	N WIDTH m [4] □ E 10-50m [3] □ 5-10m [2] □ RROW < 5m [1] □	FLOCE FOREST, SU SHRUB OR RESIDENTIA FENCED PA	OD PLAIN QUALI NAMP [3] OLD FIELD [2] N. PARK, NEW FIELD		ONSERVATION RBAN OR IND INING / CONS oredominant le m riparian.	TRUCTION [0]
5] POOL/GLIDE AN MAXIMUM DEPTH Check ONE (ONLY) 27 > 1m [6] 0.7<1m [4] 0.4<0.7m [2] 0.2<0.4m [1] < 0.2m [0] Comments	CHANN Check ONE POOL WIDTH:	IEL WIDTH (Or 2 & average) • RIFFLE WIDTH [2] • RIFFLE WIDTH [7] • RIFFLE WIDTH [0]	Ch ☐ TORRENT ☐ VERY FAS ☐ FAST [1] ☐ MODERAT	RENT VELOCITY eck ALL that apply IAL [-1] SLOW [1] T [1] INTERSTITE INTERMIT E [1] EDDIES [1] For reach - pools and ris	TIAL [-1] TENT [-2]]	Recreation Primary Secondary (clacks and said co	Contact / Contact
Indicate for function of riffle-obligate RIFFLE DEPTH BEST AREAS > 10cm [BEST AREAS 5-10cm [BEST AREAS < 5cm [metric=0]	species: RUN DE RUN DE RUN DE RUN GENERALE RUN DE	Check € PTH RIFF 50cm [2] □ STAB 50cm [1] □ MOD.	ONE (Or $\bar{2}$ & ave LE / RUN St LE (e.g., Cobbl STABLE (e.g.,	JESTRATE RIFI e. Boulder) [2]	FLE / RUN Ono Ollo Olko	EMBEDDE NE [2]	RIFFLE (metric=1)
6] GRADIENT (DRAINAGE AREA		LOW - LOW (2-4) ERATE (6-10) - VERY HIGH [10-6	*	%POOL:	%GLIDE		Gradient 6

06/11/08

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet QHEI Score: 46
Stream & Location: Des Plates Kury; Low 405 - Treck Tolord stop char RM: 239,4 Date: 07/08/08
Scorers Full Name & Affiliation: Jot Jondan & & Committee Programmed Lat./ Long.: 18
BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BLDR ISLABS [10]
2] INSTREAM COVER Indicate presence 0 to 3: 6-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS > 70cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [7] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-<25% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] NEARLY ABSENT -5% [1] Cover Meximum (Application of the control of the contr
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & everage) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4] EXCELLENT [7] NONE [6] HIGH [3] MODERATE [3] GOOD [5] RECOVERED [4] MODERATE [2] LOW [2] FAIR [3] RECOVERING [3] LOW [1] MONE [1] POOR [1] RECENT OR NO RECOVERY [1] Comments Meximum Meximum Meximum 20
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) River right leaking downstream RIPARIAN WIDTH RIPARIAN
5] POOL / GLIDE AND RIFFLE / RUN QUALITY MAXIMUM DEPTH Check ONE (ONLY) Check ALL that apply TORRENTIAL [-1] COUNTY Check ALL that apply TORRENTIAL [-1] CHECK ALL that apply TORRENT CONTACT Secondary Contact [circle one and comment on back] Secondary Contact [circle one and comment on back] CHECK ALL that apply TORRENTIAL [-1] TORR
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE SEST AREAS > 10cm [2]
6] GRADIENT (n/mi) VERY LOW - LOW [2-4] %POOL: %GLIDE: Gradient 6-10] MODERATE [6-10] %RUN: %RIFFLE: MAXIMUM 10 10 10 10 10 10 10 10 10 10 10 10 10
EPA 4520 Part of ICC 7//6/12 VOTTIONS

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Onder A

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI	Score:	Section of the sectio

Stream & Location: Des Alores (Nex - 279.1 LB RM: 279.1 Date: 07110108
Scorers Full Name & Affiliation: The United the Corporation
River Code: STORET #: Lat/Long.: 18 . Office verified location L
1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE BELOR SLABS [10]
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS > 76cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [7] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-<25% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] NEARLY ABSENT <5% [1] ROOTMATS [1] Cover Maximum 20
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4] EXCELLENT [7] NONE [6] HIGH [3] MODERATE [3] GOOD [5] RECOVERED [4] MODERATE [2] LOW [2] FAIR [3] RECOVERING [3] LOW [1] POOR [1] POOR [1] RECENT OR NO RECOVERY [1] Channel Maximum Impounded [-1]
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & everage) River right looking downstream EROSION NONE / LITTLE [3] NONE / LITTLE [3] NARROW 5-10m [2] RESIDENTIAL, PARK, NEW FIELD [1] RIPARIAN WIDTH FLOOD PLAIN QUALITY CONSERVATION TILLAGE [1] RIPARIAN OR INDUSTRIAL [0] RIPARIAN WIDTH FLOOD PLAIN QUALITY FLOOD PLAIN QUALITY CONSERVATION TILLAGE [1] RIPARIAN WIDTH FROOD PLAIN QUALITY FLOOD PLAIN QUALITY FLOOD PLAIN QUALITY FLOOD PLAIN QUALITY CONSERVATION TILLAGE [1] RIPARIAN WIDTH FROOD PLAIN QUALITY FLOOD PLAIN QUAL
Solution Pool GLIDE AND RIFFLE RUN QUALITY
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS BEST AREAS > 10cm [2]
6] GRADIENT (hml) VERY LOW - LOW [2-4]
EPA 4520 DADTION KG 7/15 08 06/11/08

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Qualitative Habitat Evaluation Index

		Habitat Eval ssessment i		K OHEIS	Score: 👹	<i>io</i>
Stream & Location:		- 279.116		RM: 229,1	depetat todate, enclose on	// 08
			me & Affiliation:	The Venetu		weer wy, o varified —
River Code:	STORET #:	Lat./L b_csdbsi_	.ong.: :::::::::::::::::::::::::::::::::::		***************************************	iocation
BEST TYPES P	ONLY Two substrate TYPE BOX e % or note every type present OOL RIFFLE OTHER TY	ES. PES POOL RIFFLE	Check (ONE (Or 2 & avera	ge) QUALITY HEAVY [-2]	
☐	☐ ☐ HARDPAN ☐ DETRITUS ☐ MUCK [2] ☐ SILT [2]	3 [3]	☐ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0]	salt E	MODERATE [-1] NORMAL [0] FREE [1]	Substrate
□□ sand [6] □□ bedrock [5] NUMBER OF BEST T	☐ ARTIFICIA (Score nated to the property of	ural substrates: lonore	☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTRINE [0]	PEDNEON []	ÉXTÉÑSÍVÉ (-2) MODERATE (-1) NORMAL (0)	Maximum 20
Comments	3 or less [0]		☐ SHALE [-1] ☐ COAL FINES [-2]	w SŌ:	NONE [1]	•••
quality: 3-Highest quality in diameter big that is stable, UNDERCUT BANKS OVERHANGING VEC SHALLOWS (IN SLO	* *	out not of highest quality.g., very large boulder / fast water, or deep, w > 70cm [2] O (ADS [1] A	ly or in small amounts s in deep or fest wele refl-defined, functional	of highest Check r, large Check I pools. ☐ EXT ERS [1] ☐ MO TES [1] ☐ SPA	AMOUNT ONE (Or 2 & ave TENSIVE >75% [1 DERATE 25-75% ARSE 5-<25% [3] ARLY ABSENT <5	1] [7]
ROOTMATS [1] Comments					Cover Maximun 20	1101
SINUOSITY DEVI	(CELLENT [7] NONE [6] DOD [5] RECOVER NR [3] RECOVER	ELIZATION ED [4] ING [3] OR NO RECOVERY [1]	STABILITY HIGH [3] MODERATE [2] LOW [1]		Cha nne Maximun 20	413 I
River right booking downsfreas EROSION NONE / LITTLE [3] MODERATE [2]	ND RIPARIAN ZONE Che RIPARIAN WIDTH RIPARIAN WIDTH MIDE > 50m [4] MODERATE 10-50m [3] MODERATE 10-50m [2] MODERATE 10-50m [2] MODERATE 10-50m [2] MODERATE 10-50m [2]	FLOC	DD PLAIN QUALI VAMP [3] OLD FIELD [2] JL, PARK, NEW FIELD	TY CONSI	ERVATION TILLA N OR INDUSTRIA G / CONSTRUCTI Ominant land use(s	ON (O)
5] POOL / GLIDE AND MAXIMUM DEPTH Check ONE (CNLYI) 27 > 1m [6]	CHANNEL WIDTH Check ONE (Or 2 & evera POOL WIDTH > RIFFLE WID POOL WIDTH = RIFFLE WID POOL WIDTH < RIFFLE WID POOL WIDTH < RIFFLE WID MIDTH = RIFFLE WID MIDTH = RIFFLE WID	CURI Ge) Ch TH [2] TORRENTI TH [1] VERY FAS TH [0] FAST [1] MODERAT	RENT VELOCITY eck ALL that apply AL [-1] SLOW [1] T [1] INTERSITE INTERMITE [1] EDDIES [1] or reach - pools and in	THAL [-1] Sections TENT [-2]	creation Poten rimary Contac condary Cont cone and comment on Pool Curren Maximum 1	ct act bech
Indicate for function of riffle-obligate: RIFFLE DEPTH BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS (5cm [metric=0])	RUN DEPTH ☐ MAXIMUM > 50cm [2] ☐ ☐ MAXIMUM < 50cm [1] ☐	heck ONE (<i>Or 2 & ave</i> <u>RIFFLE / RUN SL</u> STABLE (e.g., Cobbl	<i>rage</i>). IBSTRATE RIF a. Boulder) [2] Large Gravel) [1]	FLE / RUN EN ONE I	2]] !ATE (0) Riffie	<u>S</u>
Comments				Same Same	SIVE [-1] Aleximu	m (Tours)
6] GRADIENT (DRAINAGE AREA	fi/mi) ☐ VERY LOW - LOW ☐ MODERATE [6-10] mi²) ☐ HIGH - VERY HIGH		%POOL: %RUN:	%GLIDE: %RIFFLE:	Gradier Maximus	m ()
EPA 4520			Drosfeed 1	<< 7/18	10000	6/11/08

Qualitative Habitat Evaluation Index QHEI Score: 36.5 and Use Assessment Field Sheet	T.
Stream & Location: Ves Plaines River - 378.9 RB RW: 278.9 Date: 07/11/108	
Scorers Full Name & Affiliation: Jee Verdustic of to the series of the s	led -
1] SIPSTRATE Check ONLY Two substrate TYPE BOXES:	ũn ⊶
BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE ORIGIN QUALITY BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFL	strate O imum eo
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality; 1-Moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS 70cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [7] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-<25% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] NEARLY ABSENT <5% [1] ROOTMATS [1] Cover Maximum 20	
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4] EXCELLENT [7] NONE [6] HIGH [3] MODERATE [3] GOOD [5] RECOVERED [4] MODERATE [2] LOW [2] FAIR [3] RECOVERING [3] LOW [1] Channel Maximum Comments [Impounded [-1]] Channel Maximum Maximum 20	
A] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) River right looking downstream RIPARIAN WIDTH BROSION BRIDGE Som [4] BROSION BROWN [4] BROSION BROWN [4] BROSION BRIDGE SOM [4] BROSION BRIDGE SOM [4] BROSION BRIDGE SOM [4] BROSION BRIDGE SOM [4] BRIDGE SOM [4] BROSION BROSION BRIDGE SOM [4] BROSION BROSION BROSION BROSION BRIDGE SOM [4] BROSION BRIDGE SOM [4] BROSION BRIDGE SOM [4] BROSION BRIDGE SOM [4] BROSION	
Solution Pool Fool Foo	
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS BEST AREAS > 10cm [2] MAXIMUM > 50cm [2] DSTABLE (e.g., Cobble, Boulder) [2] NONE [2] BEST AREAS < 10cm [1] MAXIMUM < 50cm [1] MOD. STABLE (e.g., Large Gravel) [1] DLOW [1] Comments Comments	o=1)
6] GRADIENT (frmi) [] VERY LOW - LOW [2-4] %POOL: %GLIDE: Gradient	(2)
DRAINAGE AREA MODERATE [8-10] Maxomum Ma	
EPA 4520 PMI + POLITICAL KC 7/16/11/0	8

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	MBL	MODIFIED	
Ongen		bitat Evaluation Index ssment Field Sheet	QHEI Score: 44.5
Stream & Location:	Des Plaines Usier - :	278.7 44	PM: 276. 20ate: 07/10/08
	Sco	orers Full Name & Affiliation:	Joe Vardinsla Et Expressing
River Code:	STORET#:	Lat./Long.:	78 - Office verified Location
estimate %		POOL RIFFLE ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] shyrates; ignore RIP/RAP [0]	ONE (Or 2 & average) QUALITY HEAVY [-2] SILT MODERATE [-1] Substrate NORMAL [0] FREE [1] (2.5) EXTENSIVE [-2] Maximum Meximum
NUMBER OF BEST TYP Comments	☐ 3 or less [0]	point-sources)	B □ NORMAL [0] 20 □ NONE [1]
quality; 3-Highest quality in modiameter tog that is stable, well undercut banks [1] OVERHANGING VEGET SHALLOWS (IN SLOW) ROOTMATS [1]	usitiy; 2-inoderate amounts, but not derate or greater amounts (e.g., ve iderate or greater amounts (e.g., ve iderate or greater amounts (e.g., ve iderate or greater amounts > 70c > 70c TATION [1]	t of highest quality or in small amounts ery large boulders in deep or fast water water, or deep, well-defined, functional m [2]OXBOWS, BACKWATE [1]OXBOWS MACROPHY	of highest check CNE (Or 2 & average) (large pools. STENSIVE >75% [11] (III) (
Comments			Maximum 10
SINUOSITY DEVEL	[3] RECOVERING [3]	ATION STABILITY HIGH [3] MODERATE [2] LOW [1] RECOVERY [1]	Channel And Maximum 20
River right booking downstream	RIPARIAN ZONE Check ON RIPARIAN WIDTH	E in each category for EACH BANK (O FLOOD PLAIN QUALI FOREST, SWAMP 131	

INSTREAM COVER Indicate presence 0 to 5: D-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality or in small amounts of highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / last water, or deep, well-defined, functional pools. UNDERCUT BANKS [1]	
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4] EXCELLENT [7] NONE [6] HIGH [2] MODERATE [3] GOOD [6] RECOVERED [4] MODERATE [2] LOW [2] FAIR [3] RECOVERING [3] LOW [1] NONE [1] POOR [1] RECENT OR NO RECOVERY [1] Comments [Impounded [-1]]	
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) River right booking downstream RIPARIAN WIDTH STRONG INDICATE [1] INDICATE TO SOM [4] INDICATE TO SOM [4	
MAXIMUM DEPTH CHANNEL WIDTH CHECK ONE (ONLY) Check ONE (Or 2 & everage) Check ALL that apply Check ALL	
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species; Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE SEST AREAS > 10cm [2]	:0)
6] GRADIENT (R/mi) VERY LOW - LOW [2-4]	

Chois	Qualitative Habitat E and Use Assessmer		QHEI Scor	e: 42.5
Stream & Location:	Des Maines Ruer - 278,7 RI		RM: 278 A Date:	ACCESS CONTROL NOTES CONTROL
River Code: *		I Name & Affiliation: nt./ Long.: nss-decimal*i*	- Jak Verdaska ER 18 :	Office verified location
1] SUBSTRATE Check estimates	ONLY Two substrate TYPE BOXES; ste % or note every type present OTHER TYPES POOL RIFFLE OTHER TYPES	Check C	ONE (Or 2 & average) QUA	en e
☐ BLDR /SLABS [10] ☐ BOULDER [9] ☐ COBBLE [8] ☐ GRAVEL [7] ☐ SAND [6] ☐ BEDROCK [5]	HARDPAN [4] DETRITUS [3] MUCK [2] SILT [2] ARTIFICIAL [0] (Score natural substrates; igr YPES; 4 or more [2] sludge from point-sourc	LIMESTONE [1]	SILT MODER SILT MODER NORMA FREE [I EXTENS MODER WODER NONE [ATE [-1] Substrat LL [0] /3 SIVE [-2] ATE [-1] Maximum LL [0] 20
" quality; 3-Highest quality i	GETATION [1] ROOTWADS [1]	quality or in small amounts ulders in deep or fast water, ep, well-defined, functional	of highest Check ONE (pools. EXTENSIVI RS [1] MODERAT FES [1] SPARSE 5.	E 25-75% [7]
SINUOSITY DEV HIGH [4]	OLOGY Check ONE in each category (Or 2 & et ELOPMENT CHANNELIZATION XCELLENT [7] NONE [6] RECOVERED [4] AIR [3] RECOVERING [3] RECENT OR NO RECOVER [MIDDEN] Impounded [-1]	STABILITY HIGH [3] MODERATE [2] LOW [1]		Channel Maximum 3
4] BANK EROSION A River right tooking downstre EROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE [1] Comments		LOOD PLAIN QUALI' T, SWAMP [3] S OR OLD FIELD [2] ENTIAL, PARK, NEW FIELD	IY □ ☐ CONSERVATI □ □ URBAN OR IN	IDUSTRIAL [0] STRUCTION [0]
5] POOL / GLIDE AN MAXIMUM DEPTH Check ONE (ONLY!) > 1m [6] 0.7~1m [4] 0.4~0.7m [2] 0.2~0.4m [1] <	Check ONE (Or 2 & average) POOL WIDTH > RIFFLE WIDTH [2] POOL WIDTH = RIFFLE WIDTH [1] POOL WIDTH < RIFFLE WIDTH [0] FAST MODE	CHRENT VELOCITY Check ALL that apply ENTIAL [-1] Z SLOW [1] FAST [1] INTERSTIT [1] INTERMITE ERATE [1] EDDIES [1] cete for reach - pools and nil	Primary Seconda (circle one and 1ENT [-2]	Pool / Current Maximum 42
Indicate for function of riffle-obligate RIFFLE DEPTH BEST AREAS > 10cm [: BEST AREAS 5-10cm [: BEST AREAS < 5cm [metric=t	RUN DEPTH RIFFLE / RUN MAXIMUM > 50cm [2] STABLE (e.g., Cr MAXIMUM < 50cm [1] MOD. STABLE (e.g., Cr UNSTABLE (e.g., Cr	k everage). <u>N SUBSTRATE</u> <u>RIFF</u> obble. Boulder) [2]	a population ONC FLE / RUN EMBEDE ONONE [2] OLOW [1] OMODERATE [6] OEXTENSIVE [4]	Rittle / (****
6] GRADIENT (DRAINAGE ARE/			%GLIDE: %RIFFLE: \$\frac{1}{2} \rightarrow \frac{1}{2}	Gradient 6 Maximum 10
EPA 4520		~ 0 \sim \sim \sim	110 - 111 1 . 1	06/11/08

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Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI	Score:		50	224
		46,60	the second contract	W

Stream & Location: Des Plaines Riser - 278.4 LB RM: 278 4 Date: 07/ 10/08
Scorers Full Name & Affiliation: Jee Vordenske EA Connectory Bivor Code: STORET #: Lat/Long.: 18 Office verified
River Code: STORET #: INAB 3-decimal 16 location L
1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present BEST TYPES POOL RIFFLE OTHER TYPES POOL RIFFLE BLDR /SLABS [10]
2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS > 70cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [7] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-<25% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] NEARLY ABSENT <5% [1] Cover Maximum 200
3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)
SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4]
☐ ☐ MODERATE [2] ☐ ☐ NARROW 5-10m [2] ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐ ☐ MINING / CONSTRUCTION [0] ☐ HEAVY / SEVERE [1] ☐ ☐ VERY NARROW < 5m [1] ☐ ☐ FENCED PASTURE [1] ☐ Indicate predominant land use(s) past 100m riperian. Riparian Maximum Maximum 10
5] POOL / GLIDE AND RIFFLE / RUN QUALITY MAXIMUM DEPTH CHANNEL WIDTH Check ONE (ONLY!) Check ONE (ONLY!) Check ONE (Or 2 & average) > 1m [6]
Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS BEST AREAS > 10cm [2] BEST AREAS 5-10cm [1] BEST AREAS 5-10cm [1] BEST AREAS < 5cm [metric=0] Comments Indicate for functional riffles; Best areas must be large enough to support a population Indicate for functional riffles; Best areas must be large enough to support a population Indicate for functional riffles; Best areas must be large enough to support a population Indicate for functional riffles; Best areas must be large enough to support a population Indicate for functional riffles; Best areas must be large enough to support a population Indicate for functional riffles; Indicate for functional
6] GRADIENT (R/mi) [] VERY LOW - LOW [2-4] %POOL: %GLIDE: Gradient Gradient (Maximum (Maximum () 10)
EPA 4520 (April 2 / CC 7/16) 2 06/11/08

Ontolina	Qualitative Habitat Ev and Use Assessmen	t Field Sheet	OHEI Score: 46	
Stream & Location:	Des Maines Kins - 278.3 K		M: 278 3 Date: 07/1/108 To Vordricke EA Engrossing	
River Code: - *		Name & Affiliation: / Long.: 3-decimal	18 . Office verified tocation	
11 SUBSTRATE Check ONLY	Two substrate TYPE BOXES;		(Or 2 & average)	
BEST TYPES POOL BLOR /SLABS [10] BOULDER [9] GRAVEL [7] SAND [6] BEDROCK [5] NUMBER OF BEST TYPE Comments	— LJ 3 or less [0]	E ORIGIN LIMESTONE [1] TILLS [1] WETLANDS [0] HARDPAN [0] SANDSTONE [0] RIP/RAP [0] SI) LACUSTRINE [0] SHALE [-1] COAL FINES [-2]	GUALITY HEAVY [-2] MODERATE [-1] Substruction FREE [1] MODERATE [-2] MODERATE [-1] MODERATE [-1]	
quality; 3-Highest quality in mode diameter log that is stable, well d UNDERCUT BANKS [1] OVERHANGING VEGETA		uality or in simall amounts of t ders in deep or fast water, lar	ignest Check ONE (Or 2 & average) ols. ☐ EXTENSIVE >75% [11] [1] ☐ MODERATE 25-75% [7] [1] ☐ SPARSE 5-<25% [3]	
SINUOSITY DEVELO	ENT [7] NONE [6] 5] RECOVERED [4] CRECOVERING [3]	STABILITY HIGH [3] MODERATE [2] LOW [1]	Channel 5 Maximum 5 20	
River right looking downstream REROSION NONE / LITTLE [3] MODERATE [2] HEAVY / SEVERE [1]	WIDE > 50m [4]	OOD PLAIN QUALITY SWAMP [3] OR OLD FIELD [2] ITIAL, PARK, NEW FIELD [1]	cer bank & average) CONSERVATION TILLAGE [1] URBAN OR INDUSTRIAL [0] URBAN OR INDUSTRIAL [0] UNINING / CONSTRUCTION [0] Indicate predominant land use(s) past 100m riparian. Riparian Maximum 10	
□ 0.7<1m [4] □ PC □ 0.4<0.7m [2] □ PC □ 0.2<0.4m [4]	CHANNEL WIDTH Check ONE (Or 2 & average) OCL WIDTH > RIFFLE WIDTH [2] OCL WIDTH = RIFFLE WIDTH [1] OCL WIDTH < RIFFLE WIDTH [0] FAST [1] OCL WIDTH < RIFFLE WIDTH [0] OCC WIDTH < RIFFLE WIDTH < RIFF	IJ " DINTERMITTEN	[-2] Pool / (***********************************	
of riffle-obligate spec <u>RIFFLE DEPTH</u> ☐ BEST AREAS > 10cm 21 ☐	RUN DEPTH RIFFLE / RUN MAXIMUM > 50cm [2] STABLE (e.g., Col MAXIMUM < 50cm [1] MOD. STABLE (e.	average). SUBSTRATE RIFFLE bble, Boulder) [2]	opulation	
6] GRADIENT (N/M DRAINAGE AREA (M/M	MODERATE [6-40]		GLIDE: Gradient & Maximum 10	
EPA 4520		Propos Ke	7/15/12 06/11/08	

MBI MODIFIED

Qualitative Habitat Evaluation Index

Ondla	Qualitative Hab and Use Asses		2 3 8000 B	El Score: (43.44	5 3
Stream & Location: Uks flotes		touth of Jackson Ge ers Full Name & Affili	, A	3 Date: 6710911	
River Code: - *	STORET #:	Lat./ Long.:	18	Office ver	
1) SUBSTRATE Check ONLY Two s		(SECIND			recondice
BEST TYPES POOL RIFFL BLDR /SLASS [10] BOULDER [9] GRAVEL [7] GRAVEL [7] BEDROCK [5] NUMBER OF BEST TYPES:	every type present	OL RIFFLE ORIG	NE [1] PS [0] PS	QUALITY HEAVY [-2] MODERATE [-1] Sa NORMAL [0] FREE [1] EXTENSIVE [-2]	bstrati 195 eximum 20
2] INSTREAM COVER Indicate properties of quality: 3-Highest quality in moderate of diameter log that is stable, well develop undercut banks [1] OVERHANGING VEGETATION [SHALLOWS (IN SLOW WATER)] ROOTMATS [1] Comments	#dderate amounts, but not of or greater amounts (e.g., very ed rootwad in deep / fast wa POOLS > 70cm ROOTWADS [1]	highest quality or in small e large boulders in deep or fe ter, or deep, well-defined, fu [2]OXBOWS, BAC AQUATIC MAC	amounts of highest of the water, large conditional pools.	AMOUNT Theck ONE : Or 2 & everage EXTENSIVE >75% [11] MODERATE 25-75% [7] SPARSE 5~25% [3] NEARLY ABSENT <5% [Cover Maximum 20	
3] CHANNEL MORPHOLOGY C SINUOSITY DEVELOPMEN HIGH [4] EXCELLENT [MODERATE [3] GOOD [5] LOW [2] FAIR [3] NONE [1] POOR [1] Comments	I <u>T</u> CHANNELIZAT	TION STABIL HIGH [3] MODER LOW [1]	I ATE [2]	Channel Maximum 20	5
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Qualitative Habitat Evaluation Index

and Use Assessment Field Sheet QHEI Score: 35.5
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Scorers Full Name & Affiliation: Jee Verlanke Et Engineering
River Code: STORET #: Lat./ Long.: /8 . Office verified focation
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2] INSTREAM COVER Indicate presence 0 to 3; 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools. UNDERCUT BANKS [1] POOLS > 70cm [2] OXBOWS, BACKWATERS [1] MODERATE 25-75% [7] OVERHANGING VEGETATION [1] ROOTWADS [1] AQUATIC MACROPHYTES [1] SPARSE 5-<25% [3] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] NEARLY ABSENT <5% [1] ROOTMATS [1] Cover Maximum 20
3] CHANNEL MORPHOLOGY Check ONE in each category (or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY HIGH [4]
4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & everage) River right looking downstream EROSION NONE / LITTLE [3] MODERATE 10-50m [3] MODERATE 2] MARROW 5-10m [2] RESIDENTIAL, PARK, NEW FIELD [1] RESIDENTIAL, PARK, NEW FIELD [1] MODERATE [2] NONE [0] PENCED PASTURE [1] MINING / CONSTRUCTION [0] Indicate predominant land use(s) past 100m riparian. Riparian Riparian Alaximum Maximum Maximum 10
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MBI MODIFIED Qualitative Habitat Evaluation Index

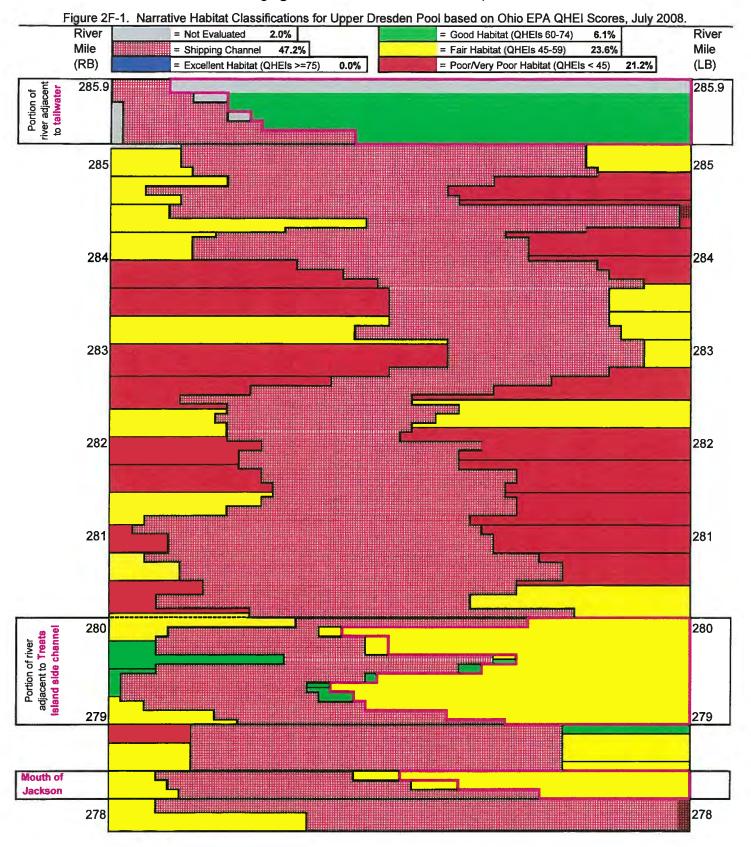
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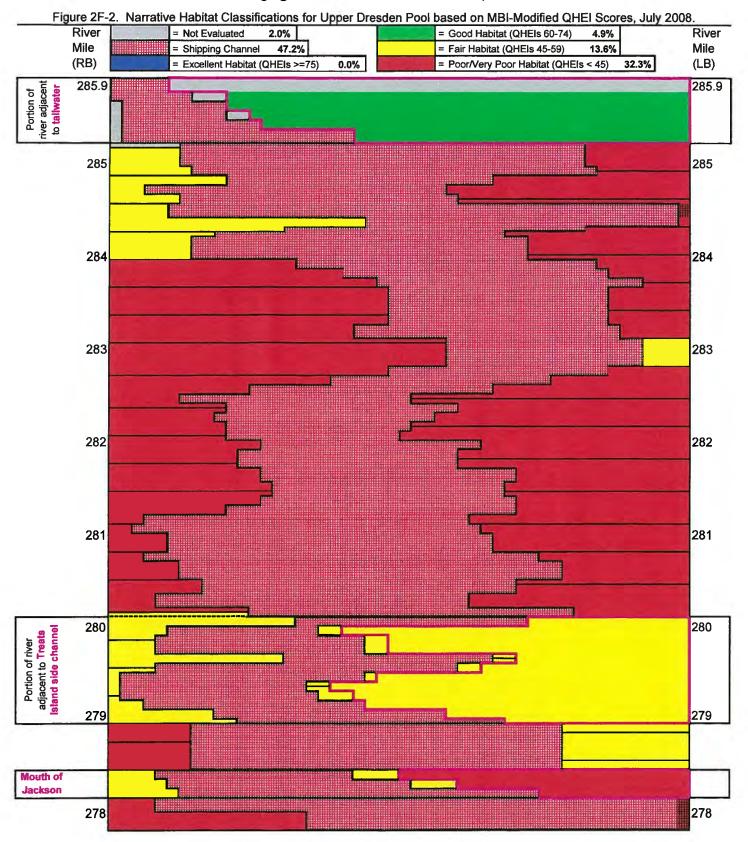
ATTACHMENT 2F

Figures showing QHEI score distributions for the July 2008 study

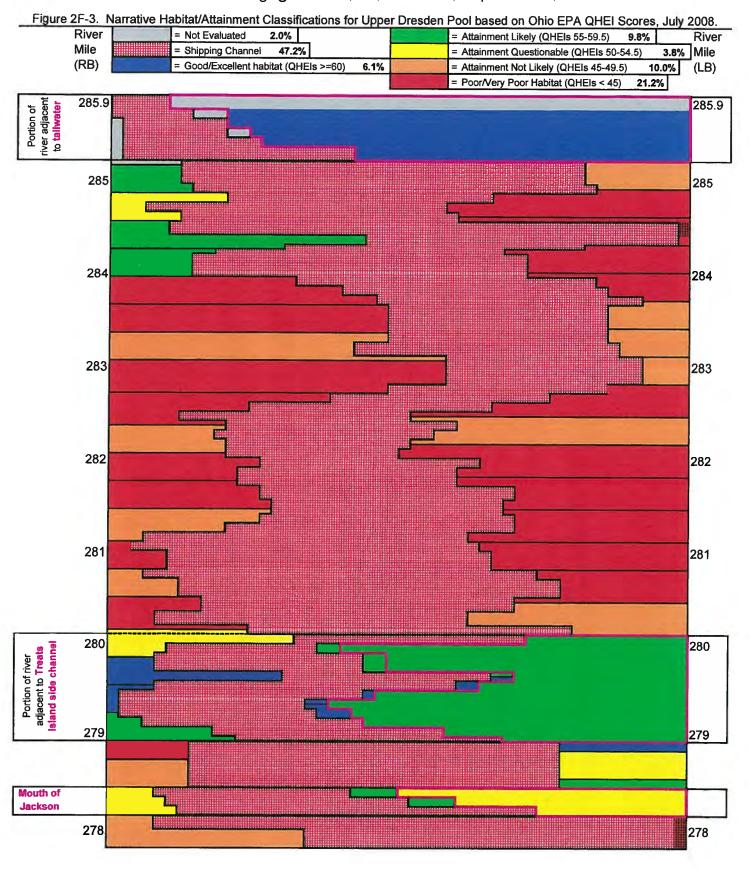
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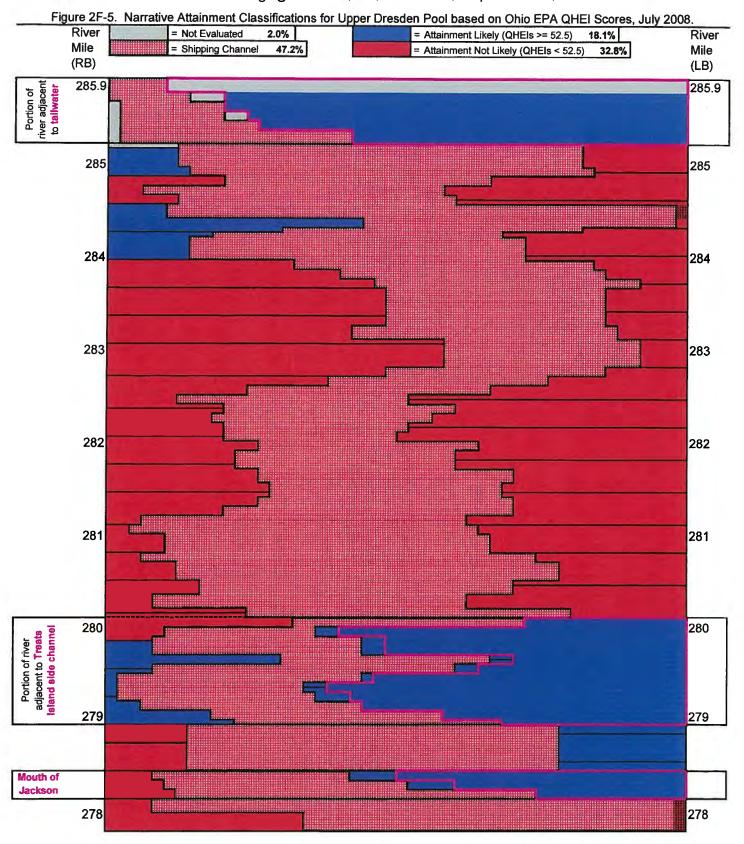
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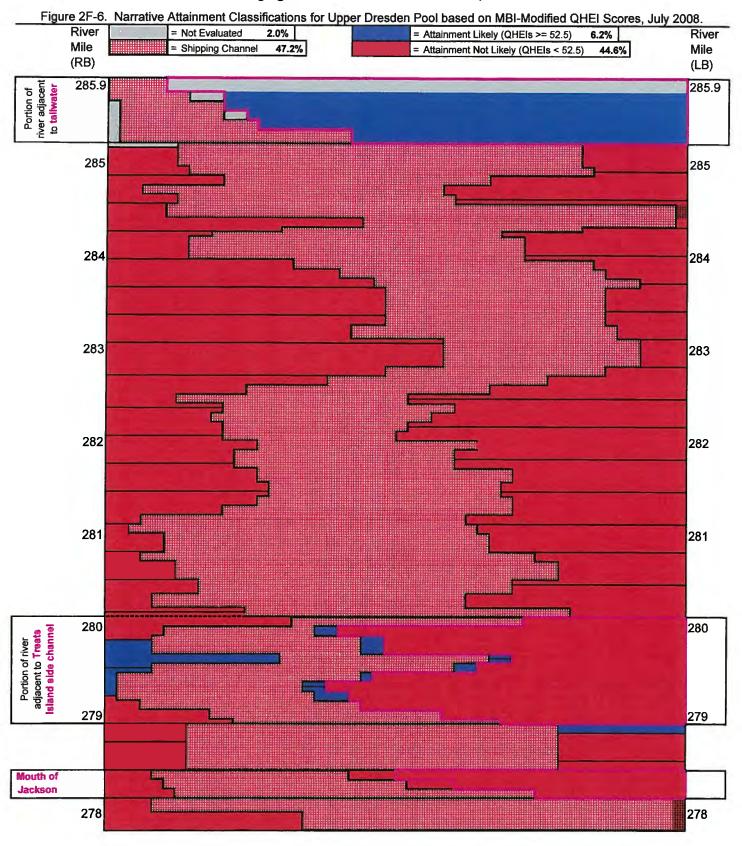
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ATTACHMENT 3

Santucci, V.J., S.R. Gephard, and S.M. Pescitelli. 2005. Effects of multiple low-head dams on fish, macroinvertebrates, habitat, and water quality in the Fox River, Illinois. North American Journal of Fisheries Management 25:975-992.

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North American Journal of Fisheries Management 25:975-992, 2005 © Copyright by the American Fisheries Society 2005 DOI: 10.1577/M03-216.1

[Article]

Effects of Multiple Low-Head Dams on Fish, Macroinvertebrates, Habitat, and Water Quality in the Fox River, Illinois

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Abstract.—We examined the effects of low-head dams on aquatic biota, habitat, and water quality in a 171-km reach of a midwestern warmwater river that was fragmented by 15 dams into a series of free-flowing and impounded habitats. Dams impounded 55% of the river's surface area within the study reach and influenced distributions of 30 species of fish by restricting upstream movements. Values for the Illinois index of biotic integrity (IBI) were higher in free-flowing areas (mean IBI = 46 out of a possible 60 at below-dam and midsegment free-flowing locations) than impounded areas (mean IBI < 31 for above-dam and midsegment impounded locations). Likewise, scores from a macroinvertebrate condition index (MCI) were higher at stations in free-flowing reaches (mean MCI > 415 out of a possible 700) than in nearshore areas of impounded reaches (mean MCI < 210). Ponar dredge samples taken only from open-water impounded areas showed an offshore invertebrate community that consisted almost entirely of tolerant oligochaetes and chironomid larvae. Qualitative habitat evaluation index (QHEI) scores indicated good-quality habitat in free-flowing areas (mean QHEI > 70 out of a possible 100) and severely degraded habitat at impounded sites (mean QHEI < 45). In impounded reaches, dissolved oxygen and pH showed wide daily fluctuations (2.5-18.0 mg/L and 7.0-9.4 units) and often failed to meet Illinois water quality standards. In free-flowing portions of river, fluctuations in these parameters were less extreme and water quality standards typically were met. We found little evidence of cumulative effects of dams; however, our data suggest that low-head dams adversely affect warmwater stream fish and macroinvertebrate communities by degrading habitat and water quality and fragmenting the river landscape. These results should aid river managers and stakeholders in determining appropriate restoration practices (i.e., dam removal versus fish passage structures) for warmwater rivers and streams that contain low-head dams.

Free-flowing rivers have been characterized as having a gradient of physical conditions that elicit gradual changes in biotic communities from headwaters to the river mouth (river continuum concept; Vannote et al. 1980). Due to disruptions in natural flow caused by dams and their associated impoundments, few U.S. rivers remain free flowing throughout their lengths (Ward and Stanford

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^{1983).} Past ecological research related to dams has focused on lotic reaches directly below dams (Ward and Stanford 1979; Bain et al. 1988; Ligon et al. 1995; De Merona and Albert 1999), mainstem reservoirs directly above dams (Ellis 1941; Hall 1971; Hall and Van Den Avyle 1986), fish communities upstream of impoundments (Martinez et al. 1994), fish and invertebrate migration (Clay 1995; Benstead et al. 1999; Pringle et al. 2000), and environmental impacts from hydroelectric development (Efford 1975; Baxter 1977). From this large body of work, we know that dams can have dramatic effects on rivers and aquatic biota by altering water quality and habitat, disrupting nutrient cycling and sediment transport, and blocking fish and invertebrate movements.

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976 SANTUCCI ET AL.

However, past studies have typically examined large dams and impoundments on large riverine ecosystems that often supported coldwater salmonid species. Whereas the general effects of dams may remain the same for rivers of different sizes (i.e., conversion of lotic habitat to lentic habitat and the blocking of migration), the magnitude of the effect and the degree to which biotic communities are impacted may change with river size and temperature regime (Ward and Stanford 1983) or with dam size and function (Poff and Hart 2002).

The ecological consequences of low-head dams (<15 m) are poorly understood (Benstead et al. 1999), and few studies have examined their effects on smaller warmwater rivers and streams. Singh et al. (1995) found that high phytoplankton biomass and sediment oxygen demand in an impounded reach of a warmwater river produced substandard dissolved oxygen (DO) levels and may have reduced the river's natural waste assimilation capacity. Filter-feeding macroinvertebrates are abundant directly below surface-discharging dams in warmwater streams (Spence and Hynes 1971a; Parker and Voshell 1983), and these abundant invertebrates may influence food resources available to downstream communities (Parker and Voshell 1983). Dams may influence warmwater stream fishes by restricting movements (Porto et al. 1999), altering assemblages in impoundments and lotic reaches above impoundments (Spence and Hynes 1971b), and causing extirpation of species from the watershed upstream of dams (Winston et al. 1991). Although important, these studies were limited to evaluations of single dams and one or two ecological parameters (i.e., fish, invertebrates, habitat, or water quality). Evaluation of multiple dams and parameters concurrently within a river system may lead to additional understanding of the cumulative effects of dams and the dynamics of directional transport in rivers and streams (Ward and Stanford 1983).

Like other temperate-zone locales (Dynesius and Nilsson 1994), northeastern Illinois contains flowing waters where dams are prevalent; many of these dams are remnant or rebuilt milldams from the 1800s. Safety concerns and old age (many dams are > 50 years old) are driving a need for structural improvements at many dams in the region. However, most dams lack a present-day function, and those with a practical purpose (e.g., hydroelectric generation and drinking water supply) need functional fish passage facilities (Santucci and Gephard 2003). To make informed decisions

regarding the repair, removal, or modification of dams that are publicly owned like many of those in northeastern Illinois, river managers and public stakeholders require information on the effects that these structures may have on river ecosystems (Smith et al. 2000).

We investigated the effects of 15 low-head dams on several biotic and abiotic components of the Fox River, a sixth-order warmwater river that drains portions of Wisconsin and Illinois. Fish, macroinvertebrates, and habitat quality were sampled concurrently at 40 stations located in freeflowing areas directly below dams, impounded areas directly above dams, and free-flowing or impounded midsegment areas between dams. Water quality was monitored at a subset of 22 biotahabitat stations. We compared water quality variables among stations from free-flowing and impounded habitats and across the upstream-downstream gradient to identify effects of low-head dams and assess whether effects of multiple dams were cumulative. Historic and current fisheries survey data also were examined to evaluate the effects of river fragmentation by dams on fish distribution patterns. Based on our results, we highlight the need for and benefits of potential damrelated river restoration practices to assist managers and stakeholders faced with dam repair, removal, or modification decisions.

Study Area

The Fox River flows in a southwestern direction for 298 km from its source near Waukesha, Wisconsin, to its confluence with the Illinois River at Ottawa, Illinois. It drains about 2,435 km2 in southeastern Wisconsin and 4,453 km2 in northeastern Illinois. The study area included 171 river kilometers (rkm) and 15 dams between the Chain of Lakes and Dayton, Illinois (Figure 1). Agricultural land (66%), urban or residential land (18%), woodlands (9.2%), wetlands (4.5%), and lakes and streams (2.3%) were the predominant land cover types in the Illinois portion of the watershed (IDNR 1998). The central region (Elgin to Montgomery) had the highest concentration of urban/residential land, whereas row crops and rural grasslands predominated in the more northerly and southerly areas. The river gradient is flat from Chain of Lakes to Algonquin (average slope = 0.06 m/km), steepest between St. Charles and Yorkville (0.85 m/km), and moderate from Algonquin to St. Charles (0.38 m/km) and downstream of Yorkville (0.51 m/km). Recent average daily flow (1980-2000) at Dayton, Illinois, ranged from Stratton Dam

Algonquin Dam

St. Charles Dam

North Batavia Dam South Batavia Dam

Carpentersville Dam

Nippersink Cr



FIGURE 1.—Map of the Fox River watershed, Illinois, showing the locations of major tributaries (drainage area > 50 km²), main-stem and selected tributary dams (squares), and numbered stations that were sampled for fish, macroinvertebrates, and habitat during summer and fall 2000. Stations marked by asterisks were sampled for water quality during summer and fall 2001.

Yorkville Dam

5.9 to 1,319 m³/s (USGS 2001). River hydrology is typically dominated by winter snowfall and summer rainfall, but summer low flows are maintained by the controlled release of 2.7 m³/s of water from the Chain of Lakes (Stratton Dam) and discharges of processed groundwater from numerous municipal wastewater treatment facilities (IDNR 1998).

Illinois

All dams were run-of-river, low-head structures located in the main stem between 9.2 km (Dayton Dam) and 159.1 km (Stratton Dam) above the river mouth (Figure 1). Dams ranged from 44 to 183 m long and from 0.8 to 9.0 m high and impounded 47% of the river's length and 55% of its surface area within the study reach (Santucci and Gephard 2003). Impounded areas formed upstream of dams

977

were small (2–346 ha), narrow (76–189 m; less than twice the width of adjacent free-flowing areas), and shallow (mean depths < 2.1 m), and their storage volume, turnover rate, and morphology were more similar to a those of a low-velocity canal than to those of a natural lake or large reservoir.

Methods

Fish, macroinvertebrates, and habitat quality.— We sampled fish and macroinvertebrate communities and evaluated habitat quality at 40 stations from mid-July through early September 2000 (Figure 1). Biota and habitat were sampled concurrently at each station, and stations were visited in consecutive order beginning with station 1. All stations were about 0.8 km in length and encompassed the entire width of the river and adjacent riparian areas. Thirty stations were located within 1 km of Fox River dams; 15 of these stations were sited upstream of dams in impounded areas, and 15 were sited downstream of dams in free-flowing areas. Safety considerations precluded sampling within 100 m of each dam. Ten additional stations were located in middle reaches of five betweendam river segments (two additional stations per segment). Midsegment stations were located at about 30% and 60% of total segment length in either free-flowing or impounded habitat.

Fish were sampled with a pulsed-DC boat electroshocker, a generator-powered backpack electroshocker, and a 3.2-mm-mesh bag seine (30.5 m long × 1.8 m deep). Boat electrofishing runs began at upstream boundaries of each station and proceeded downstream for 30 min along each bank of the river (total time = 1 h/station). We targeted wadable habitat (riffles, runs, and shoreline areas) with the backpack electroshocker and sampled these habitats in relative proportion to their abundance at each station for a total of 30 min/station. Seining took place at three locations within each station and sampled habitats of wadable depth with silt, sand, or gravel substrates. The seine was deployed in a single 30.5-m arc along the riverbank before being retrieved to shore. All fish larger than 200 mm total length (TL) were identified to species, measured (nearest mm TL), weighed (nearest g), and examined for anomalies in the field. Smaller fish were preserved in 10% buffered formalin and were returned to the laboratory for processing.

We characterized fish communities based on biological integrity and harvestable-sized sport fish abundance. Community integrity was estimated for each station with a version of the index of biotic

integrity (IBI) developed for warmwater streams and rivers in Illinois (Karr 1981; Bertrand et al. 1996). The IBI has been shown to accurately reflect the biological integrity and ecological health of stream ecosystems (Fausch et al. 1990). Values for the IBI range from 12 to 60; higher scores indicate better biotic integrity. Illinois uses the IBI to classify stream segments into A (IBI scores = 51-60), B (41-50), C (31-40), D (21-30), and E (12-20) categories that represent unique, highly valued, moderate, limited, and restricted aquatic resources, respectively (Bertrand et al. 1996). To provide a measure of the relative availability of sport fish species to anglers, we estimated sport fish abundance for each station by summing boat electrofishing catch rates for all sport species larger than designated harvestable-size length minima (Bertrand et al. 1996). The index included top predators (percids Sander spp., yellow perch Perca flavescens, pikes Esox spp., black basses Micropterus spp., flathead catfish Pylodictis olivaris, catfishes Ictalurus spp., rock basses Ambloplites spp., crappies Pomoxis spp., and temperate basses Morone spp.), sunfishes Lepomis spp., bullheads Ameiurus spp., buffalo Ictiobus spp., redhorses Moxostoma spp., common carp Cyprinus carpio, and freshwater drum Aplodinotus grunniens.

Data from the present study and 14 other fish community surveys conducted between 1980 and 1999 were used to examine whether dams affected fish distributions by acting as barriers to upstream movement. Previous studies included periodic whole-basin surveys and bi-annual sampling of the river main stem by the Illinois Department of Natural Resources (IDNR; Bertrand et al. 1982; Sallee and Bergmann 1986; Day et al. 1992; Pescitelli and Rung, unpublished data) and site-specific research efforts (Heidinger 1993; Santucci 1994). Combined data from 112 Fox River main-stem and tributary sampling stations were used in the analysis. To identify species with distributions limited by dams, we first determined presence of species within each between-dam river segment (including tributaries) and then visually examined distribution patterns for the entire study area.

Macroinvertebrates were sampled from wadable habitats by kick-netting and hand picking for 1 collector-hour at each station. Kick nets were 250-mm × 457-mm rectangular steel frames fitted with 1.5-m handles and 500-μm-mesh bags. Nets were used to sample small substrates (silt, sand, and gravel), the water surface, and the water column. Forceps were used when picking invertebrates from arbitrarily selected submerged rocks and

979

TABLE 1.—Macroinvertebrate community index (MCI; maximum score = 700) and component metric scores for downstream free-flowing, midsegment free-flowing, midsegment impounded, and upstream impounded stations on the Fox River between McHenry and Dayton, Illinois. Macroinvertebrates were sampled by kick-netting and hand picking at 40 stations during July-September 2000. The MCI was developed with Fox River data based on USEPA rapid bioassessment procedures (Barbour et al. 1999). Values are means (SEs). For each comparison, ANOVA F-statistics and F-values are shown (df = 3, 36 for all tests). Different letters designate significant differences among station types for each metric (Tukey's multiple comparison test: F < 0.05).

Index and metrics	Downstream free-flowing	Midsegment free-flowing	Midsegment impounded	Upstream impounded	F	P
MCI	417.5 (28.6) z	473.5 (41.1) z	205.8 (42.5) y	203.0 (15.7) y	21.95	0.001
Richness measures (N)						
Taxa richness	27.7 (1.0)	33.0 (2.5)	25.5 (3.0)	25.8 (1.6)	2.86	0.05
EPT taxa ^a	6.4 (0.7) z	9.2 (1.3) z	2.2 (1.3) y	3.1 (0.6) y	11.36	0.001
Composition measures (%)						
EPT individualsa	44.2 (5.5) z	37.9 (4.6) z	3.6 (2.3) y	3.8 (1.0) y	25.28	0.001
Chironomidae	19.6 (3.8)	17.0 (3.0)	19.7 (4.5)	20.5 (3.3)	0.24	0.87
Folerance measures						
Intolerant taxa (N)	5.5 (0.3) y	8.7 (1.3) z	3.0 (0.9) y	3.0 (0.4) y	14.81	0.001
Macroinvertebrate biotic index	6.3 (0.2) z	5.9 (0.2) z	6.7 (0.4) yz	7.3 (0.2) y	7.45	0.001
Habit measures (%)						
Clinger organisms	46.8 (5.8) z	42.0 (6.2) z	5.7 (0.9) y	4.3 (0.9) y	24.11	0.001

^a Ephemeroptera, Plecoptera, and Trichoptera.

woody debris pulled from the water. We allocated sampling time to various macrohabitats (i.e., riffles, runs, and shoreline areas) based on visual estimates of the aerial coverage of these habitats within a station (except impounded stations). Because wading was limited to nearshore areas of impoundments, we sampled deeper, offshore habitat at most impoundment stations (N = 16) with a petite ponar dredge (152-mm × 152-mm opening) deployed from a canoe. Three impoundment stations were excluded from offshore sampling because they had large gravel and cobble substrates that were not sampled effectively with the ponar dredge. Five substrate grabs were taken along one upstream and one downstream transect at each station (N = 10 grabs/station). Transects ran perpendicular to the river's thalweg in water over 1.5 m deep. Grab contents were combined and washed through a sieve with a mesh size of 500 µm.

Samples from wadable and open-water habitats were preserved in 5% solutions of buffered formalin and were returned to the laboratory, where all organisms were sorted from sediments and debris prior to enumeration and identification. We identified all individuals in each sample (typically to genus) except for chironomid larvae (Diptera), which were subsampled for identification. We identified a minimum of one-third of the chironomids in samples with more than 15 individuals and all chironomids from samples containing 15

or fewer larvae by examining mouth parts and other body parts with a compound microscope. Identities were assigned to all chironomids in a sample based on the taxa proportions in the corresponding identified subsample.

A multimetric macroinvertebrate community index (MCI) was used to characterize macroinvertebrate communities sampled from wadable habitats. Illinois does not have a standardized community index for macroinvertebrates (a statewide index is currently in development), so we developed a seven-metric MCI for the Fox River based on Environmental Protection Agency (USEPA) rapid bioassessment protocols (Barbour et al. 1999; see Table 1 for a list of metrics). The intolerant taxa metric was made up of organisms with a tolerance rating of 4 or less (range = 0-11) based on the latest Illinois macroinvertebrate tolerance list (Hite and Brockamp 1992). The Illinois MBI, a version of the Hilsenhoff biotic index (Hilsenhoff 1987), provided an overall community tolerance rating based on the mean of tolerance values weighted by organism abundance (Hite and Brockamp 1992). Values of MBI greater than or equal to 7.5 represent limited or restricted aquatic resources and a benthic community with limited diversity, few intolerant forms, and a predominance of tolerant organisms (Bertrand et al. 1996). Clinger organisms were filter-feeding insects permanently attached to substrates and were consid-

TABLE 2.—Qualitative habitat evaluation index (QHEI; maximum score = 100) and component metric scores for downstream free-flowing, midsegment free-flowing, midsegment impounded, and upstream impounded stations on the Fox River between McHenry and Dayton, Illinois. Habitat was evaluated at 40 stations during July–September 2000. Values are means (SEs). For each comparison, ANOVA F-statistics and P-values are shown (df = 3, 36 for all tests). Different letters designate significant differences among station types for each metric (Tukey's multiple comparison test: P < 0.05).

	Station type					
Index and metrics	Downstream free-flowing	Midsegment free-flowing	Midsegment impounded	Upstream impounded	F	P
QHEI Habitat rating	71.9 (2.9) z Good quality	76.0 (4.1) z Good quality	42.9 (3.9) y Severely degraded	35.8 (2.1) y Severely degraded	45.92	0.001
Component metrics ^a						
Substrate (20)	16.9 (0.4) z	15.8 (0.6) zx	11.8 (1.4) yx	9.1 (0.8) y	28.82	0.001
Instream cover (20)	13.5 (0.9) zx	16.2 (0.9) z	10.8 (0.8) yx	8.8 (0.8) y	10.77	0.001
Channel morphology (20)	11.3 (0.9) zx	13.3 (1.2) z	7.2 (0.6) yx	5.4 (0.4) y	17.21	0.001
Riparian zone and bank crosion (10)	4.2 (0.5)	6.4 (0.7)	4.4 (0.9)	4.7 (0.5)	1.74	0.18
Pool-glide quality (12)	9.9 (0.4) z	9.5 (1.2) z	1.8 (0.2) y	1.6 (0.4) y	74.66	0.001
Riffle-run quality (8)	6.3 (0.5) z	4.8 (1.0) z	0.0 y	0.0 y	49.04	0.001
Gradient (10)	9.7 (0.3) z	10.0 (0.0) z	7.0 (1.0) y	6.1 (0.1) y	48.69	0.001

a Maximum scores.

ered intolerant of poor water quality conditions (Merritt and Cummins 1996; Barbour et al. 1999). The range of values for the MCI was 0–700, wherein higher scores indicated a higher-quality macroinvertebrate community. The MCI was not appropriate for making comparisons to other studies or gauging ecological health relative to other rivers because only Fox River data were used in its development. However, the index provided a useful measure for documenting relative differences in macroinvertebrate communities among Fox River sample stations. The MCI scores also were positively correlated with IBI scores (Pearson's product-moment correlation: r = 0.83, P = 0.001).

We assessed habitat quality with the qualitative habitat evaluation index (QHEI), a visual observation habitat index designed to provide empirical, quantified evaluations of lotic macrohabitat characteristics important to fish communities (OEPA 1989). The QHEI includes seven principal metrics (see Table 2) and a number of metric components, and it has been shown to generate scores that are strongly correlated with fisheries assessment data (Rankin 1989). We used the QHEI to evaluate habitat quality in impounded as well as free-flowing areas because impounded areas retained characteristics of a slow-flowing river, habitat indices are not yet available for impoundments, and freeflowing conditions will be restored if dam removal is selected as a river restoration alternative.

To enhance accuracy and precision, two crew-

members completed a 1-d QHEI training course before fieldwork began and followed developed protocols when evaluating habitat during the study (OEPA 1989). Each station was surveyed twice by canoeing or wading, first to draw a map of macrohabitat features and then to score individual metric components. Index scores greater than 60 (maximum score = 100) indicate good-quality habitat that typically supports diverse fish communities, whereas scores less than 46 indicate severely degraded habitat that typically supports poor-quality fish communities (E. Rankin, Ohio EPA, personal communication). Scores between 46 and 60 indicate degraded habitat that may or may not meet warmwater criteria for supporting aquatic life.

Water quality.—We used continuous, point, and grab sampling to monitor water quality at 11 downstream free-flowing stations and 11 upstream impounded stations (Figure 1). Sampling took place during August 6-17, 2001, when water temperatures were high (>20°C) and flow rates were low (<20 m³/s at Algonquin). Continuous sampling with Hydrolab Datasonde water quality monitors measured temperature, DO, and pH every 15 min for 40 h at each station. Monitoring began at 1600 hours on the first day and concluded at about 0800 hours on the third day. Datasonde monitors were calibrated and deployed midchannel at depths ranging from 30 to 60 cm above the river bottom. During evening and early-morning extremes in the diel oxygen cycle (1800-2000 and 0600-0800 hours), we took point measurements with a calibrated Datasonde monitor from the surface, middepth, and near-bottom depth at midchannel (same as deployed Datasonde locations), left-of-center, and right-of-center sites along a cross-channel transect that bisected each station. Point measurements also were made at Datasonde monitoring depths when units were set and retrieved to assess instrument drift (none occurred) and at grabsample depths to provide precise measures of temperature, DO, and pH for comparison with water chemistry data.

Grab samples (N = 44; one morning and one evening sample per station) were collected at each midchannel site and were analyzed for turbidity, total phosphorus (TP), total nitrogen (TN), and chlorophyll a. Two clean, 1.9-L plastic bottles were filled with water from a depth of 30 cm and placed on ice in a dark cooler. Within 30 min of collection, water samples either were processed in the field (turbidity and chlorophyll a) or were transferred to clean, pre-labeled polyethylene bottles and preserved for later laboratory analysis (TP and TN). Turbidity was measured in the field with a portable turbidimeter. Chlorophyll-a samples were filtered through glass microfiber filters that were wrapped in aluminum foil, labeled, and frozen before being transferred to the Illinois EPA laboratory for analysis. The USEPA Region 5 Central Regional Laboratory analyzed nutrient sam-

Effects of dams and impoundments were assessed by comparing individual water quality variables between free-flowing and impounded areas within river segments, across time periods, and among vertical and horizontal sample locations (temperature, DO, and pH only). Because we sampled 4-6 stations at one time, above-below dam comparisons were made for four dams (Algonquin, Elgin, North Aurora, and Yorkville) to assess the direct effects of these structures on river DO levels. In addition, we compared measured variables to accepted Illinois EPA ambient water standards (temperature, DO, and pH) or recommended guidelines (TP, TN, chlorophyll a, and turbidity; USEPA 2000; Robertson et al. 2001) for midwestern rivers and streams (see Table 3).

Statistical analyses.—We compared fish (IBI and harvestable-size sport fish abundance), macroinvertebrate (MCI), and habitat (QHEI) indices and individual metric scores among station types (i.e., downstream free-flowing, midsegment free-flowing, midsegment impounded, and upstream impounded) with one-way analysis of variance

(ANOVA) and Tukey's multiple comparison test. An arcsine transformation was used on percentages to normalize the variance before statistical analysis (Steel and Torrie 1980). Pearson's productmoment correlation analysis was used to assess the relation between fish and macroinvertebrate communities and habitat quality. Repeated-measures ANOVA was used to compare water quality parameters between habitat types (free-flowing versus impounded) and among vertical (surface, middepth, and bottom) and horizontal (left, mid-, and right channel) sample locations. The model included habitat type (or location) and sample time period as main effects and a habitat type (or location) × time period interaction term. To assess whether effects of multiple dams were cumulative, we used linear regression to examine the relation between upstream-downstream distance (representing increasing numbers of dains) and several measured variables (IBI, MCI, QHEI, TP, TN, and chlorophyll α). A statistical significance level α of 0.05 was used for all analyses.

Results

Fish Communities

The quality of the fish community as determined by IBI score was higher in free-flowing reaches of river than in impounded areas above dams (Table 4), but communities did not differ within freeflowing (Tukey's multiple comparison test: P =0.98) or impounded habitats (P = 0.96). On average, free-flowing reaches were characterized as highly valued B-quality streams and impounded reaches were characterized as limited-value, Dquality streams. Mean catch rates of harvestablesized sport fish also were higher at downstream free-flowing and midsegment free-flowing stations than at midsegment impounded and upstream impounded stations (Table 4), and catches were similar within free-flowing (P = 0.40) and impounded areas (P = 0.48). Relative to impoundments, freeflowing areas had higher species richness, substantially higher overall and harvestable-sized sport fish abundance, and more sucker species and intolerant fish species (Table 4). Samples from free-flowing areas also contained a higher percentage of insectivorous minnows, such as spotfin shiners Cyprinella spiloptera and sand shiners Notropis stramineus. In contrast, stations in impounded areas had a predominance of tolerant and omnivorous species, such as the common carp, bluntnose minnow Pimephales notatus, quillback Carpiodes cyprinus, and green sunfish.

982

SANTUCCI ET AL.

Table 3.—Water quality parameter means (SEs) and results of repeated-measures ANOVA (df = 1, 20 for all tests; $\alpha = 0.05$) examining the effects of habitat type, time period, and habitat \times time interactions on water quality in the Fox River between McHenry and Dayton, Illinois. Water samples were collected during August 6–17, 2001, in free-flowing and impounded habitats during morning (0600–0800 hours) and evening (1800–2000 hours) time periods. Illinois Environmental Protection Agency ambient water quality standards exist for temperature, dissolved oxygen, and pH, whereas guidelines have been developed for total P and total N (Robertson et al. 2001) and for chlorophyll a and turbidity (USEPA 2000).

Parameter	Standard or	Habitat type						
	guideline	Free-flowin	g Impo	unded	F	P		
Temperature (°C)	≤33.7	26.2 (0.6) 26.2	(0.6)	0.01	0.98		
Dissolved oxygen (mg/L)	≥5.0	7.4 (0.3) 8.0	(0.8)	0.75	0.40		
pH (units)	6.5-9.0	8.6 (0.1	8.7	(0.1)	0.39	0.54		
Turbidity (NTU) ^a	9.9	43.2 (1.5	40.5	(1.7)	1.14	0.30		
Chlorophyll a (µg/L)	7.3	136.0 (9.0	148.1	(9.7)	0.75	0.40		
Total P (mg/L)	0.11	0.42 (0.0	3) 0.42	2 (0.03)	0.01	0.96		
Total N (mg/L)	1.75	2.83 (0.1	2) 2.74	1 (0.12)	0.16	0.69		

a Nephelometric turbidity units.

Dams appeared to have altered distributions of nearly one-third of Fox River fishes by acting as barriers to upstream movement. Fifteen species had truncated distributions, and another 15 species had discontinuous distributions (Figure 2). Species with truncated distributions were found only in the lower portions of the river. Ten species were not found above the lowermost dam in Dayton, Illinois, whereas five additional species, including the river redhorse Moxostoma carinatum (listed as threatened by the state of Illinois), had populations that persisted above the Dayton Dam but were limited to the lower Fox River in Illinois. Species with discontinuous distributions were found in the upper and lower river, but only occasionally or not at all in the central region between the St. Charles and Montgomery dams. This highly urbanized section of river has a high density of dams (eight dams in 22 rkm) compared to other parts of the Fox River in Illinois (one dam every 15.3 rkm).

Macroinvertebrate Communities

Free-flowing habitat supported higher-quality macroinvertebrate communities than did impounded waters above dams. Mean MCI scores were similar for stations within free-flowing (Tukey's multiple comparison test: P=0.59) or impounded habitats (P=0.84), but scores for downstream free-flowing and midsegment free-flowing stations were more than twice as high as scores from midsegment impounded and upstream impounded stations (Table 1). Samples from the free-flowing river had higher percentages of Ephemeroptera—Plecoptera—Trichoptera (EPT) individuals and clinger organisms and higher EPT taxa richness than the wadable portions of impounded areas.

Overall taxa richness and percentages of chironomids were similar among station types (Table 1), whereas mean numbers of intolerant taxa were higher at midsegment free-flowing stations than at free-flowing stations closer to dams or at stations in impounded areas. Stations below dams often contained extremely high densities of filter feeders, such as certain chironomid taxa and hydropsychid caddisflies (Trichoptera). Stations in impounded areas typically had the highest MBI scores (indicating lower-quality communities), and 8 of 15 upstream impounded stations had scores of 7.5 or greater, indicating limited or restricted invertebrate assemblages. Macroinvertebrates were extremely limited in open-water impounded areas. Ponar samples showed an openwater community consisting of relatively few taxa (N = 34) and a numerical predominance (mean \pm SE = $96.4\% \pm 0.8\%$) of tolerant oligochaetes and chironomid larvae.

Aquatic Habitat Quality

The quality of aquatic habitat available to fish and invertebrate communities differed substantially between free-flowing and impounded portions of river. Mean QHEI scores were higher at downstream free-flowing and midsegment free-flowing stations than midsegment impounded and upstream impounded stations (Table 2), but scores were similar within free-flowing (Tukey's multiple comparison test: P=0.74) and impounded habitats (P=0.57). Stations in free-flowing areas were characterized as having good habitat quality, whereas stations in impounded areas were characterized as severely degraded. Contributing to the severely degraded rating in impoundments was the

TABLE 3.—Extended.

		Habitat × time interaction				
Parameter	Morning	Evening	F	P	F'	P
Temperature (°C)	25.3 (0.6)	27.1 (0.6)	75.00	0.001	0.01	0.92
Dissolved oxygen (mg/L)	5.9 (0.3)	9.4 (0.6)	46.15	0.001	7.24	0.01
pH (units)	8.5 (0.1)	8.8 (0.1)	70.66	0.001	0.35	0.56
Turbidity (NTU)a	42.4 (1.5)	41.3 (1.8)	0.27	0.61	0.02	0.90
Chlorophyll a (µg/L)	127.5 (6.3)	156.6 (10.9)	6.80	0.02	0.41	0.53
Total P (mg/L)	0.42 (0.03)	0.41 (0.03)	0.85	0.37	0.97	0.34
Total N (mg/L)	2.86 (0.12)	2.71 (0.12)	3.26	0.09	3.22	0.09

TABLE 4.—Illinois index of biotic integrity (IBI; maximum score = 60), biological stream characterization, harvestable-sized sport fish abundance, and IBI component metric scores for downstream free-flowing, midsegment impounded, and upstream impounded stations on the Fox River between McHenry and Dayton, Illinois. Fish were sampled by boat electrofishing, backpack electrofishing, and seining at 40 stations during July-September 2000. Values are means (SEs). For each comparison, ANOVA F-statistics and P-values are shown (df = 3, 36 for all tests). Different letters designate significant differences among station types for each metric (Tukey's multiple comparison test: P < 0.05).

Index and metrics	Downstream free-flowing	Midsegment free-flowing	Midsegment impounded	Upstream impounded	F	P
IBI Biological stream characterization	46.1 (1.2) z B stream (highly valued resource)	46.0 (2.3) z B stream (highly valued resource)	29.5 (2.5) y D stream (limited resource)	30.8 (0.8) y D stream (limited resource)	41.95	0.001
Harvestable-sized sport fish abun- dance (N/h)	86.8 (6.0) z	73.5 (3.1) z	38.8 (4.4) y	33.3 (3.9) y	26.26	0.001
		IBI compor	ient metrics			
Fish species composition	on (N)					
All species	28.9 (0.9) z	25.3 (2.1) z	16.2 (3.5) y	17.7 (0.9) y	21.93	0.001
Sucker species	4.5 (0.5) z	4.2 (0.8) z	1.2 (1.0) y	0.9 (0.2) y	16.74	0.001
Sunfish species	3.9 (0.3)	3.0 (0.8)	3.5 (0.6)	3.3 (0.3)	0.94	0.43
Darter species	3.0 (0.3) z	2.7 (0.7) z	1.5 (0.6) zx	0.7 (0.2) x	13.73	0.001
Intolerant species	7.3 (0.6) z	6.7 (1.1) z	3.2 (0.6) y	3.1 (0.3) y	14.70	0.001
Trophic composition (%	6)					
Green sunfisha	2.1 (0.3) z	4.0 (3.1) zy	5.5 (2.1) zy	12.5 (3.3) y	4.77	0.007
Omnivores	17.8 (2.4) z	19.7 (3.9) z	45.2 (6.7) y	25.5 (2.6) z	7.16	0.001
Insectivorous min- nows	37.0 (4.7) z	43.7 (7.9) z	3.3 (0.8) y	10.8 (3.4) y	14.06	0.001
Top carnivores	15.0 (2.2) zy	11.7 (2.5) z	14.1 (1.8) zy	22.8 (2.3) y	3.81	0.001
Fish condition (%)						
Hybrids	0.6 (0.4)	0.1 (0.1)	0.6 (0.6)	1.3 (0.6)	0.89	0.46
DELT anomalies ^b	2.5 (0.5) zy	1.2 (0.3) z	4.7 (2.3) y	1.2 (0.3) z	4.04	0.014
Relative abundance (N/	h)					
All fish species	821.6 (110.6) z	756.2 (181.2) z	137.0 (41.5) y	201.2 (26.0) y	12.28	0.001

^a Lepomis cyanellus.

^b Deformities, erosions, lesions, and tumors.

984

SANTUCCI ET AL.

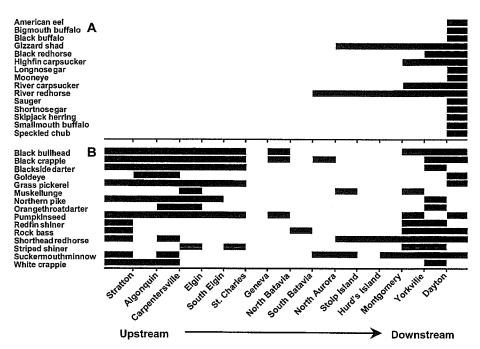


FIGURE 2.—Fox River (Illinois) fishes with (A) truncated distributions (restricted to the lower portion of the study area), namely American eel Anguilla rostrata, bigmouth buffalo Ictiobus cyprinellus, black buffalo I. niger, gizzard shad Dorosoma cepedianum, black redhorse Moxostoma duquesnei, highfin carpsucker Carpiodes velifer, longnose gar Lepisosteus osseus, mooneye Hiodon tergisus, river carpsucker C. carpio, river redhorse M. carinatum, sauger Sander canadensis, shortnose gar L. platostomus, skipjack herring Alosa chrysochloris, smallmouth buffalo I. bubalus, and speckled chub Macrhybopsis aestivalis and (B) discontinuous distributions (typically absent from the middle portion of the study area), namely, black bullhead Ameiurus melas, black crappie Pomoxis nigromaculatus, blackside darter Percina maculata, goldeye H. alosoides, grass (redfin) pickerel Esox americanus, muskellunge E. masquinongy, northern pike E. lucius, orangethroat darter Etheostoma spectabile, pumpkinseed Lepomis gibbosus, redfin shiner Lythrurus umbratilis, rock bass Ambloplites rupestris, shorthead redhorse Moxostoma macrolepidotum, striped shiner Luxilus chrysocephalus, suckermouth minnow Phenacobius mirabilis, and white crappie Pomoxis annularis. Data are from 112 main-stem and tributary stations sampled from 1980 through 2000 (Bertrand et al. 1982; Sallee and Bergmann 1986; Day et al. 1992; Heidinger 1993; Santucci 1994; Pescitelli and Rung, unpublished data; present study). Note that distances between dams are not to scale.

absence of important riffle and run habitat from these areas (Table 2). To account for the absence of riffles and runs, we recalculated the QHEI without the riffle/run metric and still found higher scores at downstream free-flowing (mean \pm SE = 65.6 \pm 2.6) and midsegment free-flowing (71.2 \pm 3.2) stations than at midsegment impounded (42.9 \pm 3.9) and upstream impounded stations (35.7 \pm 2.2; ANOVA: $F_{3,36} = 38.46$, P = 0.001). Good-quality instream habitat was typically available throughout free-flowing portions of the river, even in downtown areas, where banks often were stabilized with concrete and where riparian vegetation was degraded or absent.

Habitat quality was an important factor affecting aquatic biota in the Fox River. A strong positive relationship existed between QHEI and IBI scores (Pearson's product-moment correlation: r = 0.89,

P = 0.001) and QHEI and MCI scores (r = 0.84, P = 0.001). These strong relations attest to the usefulness of QHEI as a subjective stream habitat assessment tool and underscore the importance of habitat quality to lotic fish and macroinvertebrate communities.

Water Quality

Dissolved oxygen and pH varied on a daily basis at all stations, but the magnitude of the daily oxygen fluctuations was higher at stations in impounded reaches than at those in free-flowing reaches (Figure 3). Dissolved oxygen ranged from 2.5 to 18 mg/L (>200% saturation) in impounded areas and from 5 to 10 mg/L in free-flowing areas. On average, DO maxima were higher in impounded areas (13.8 \pm 0.8 mg/L) than in free-flowing areas (9.8 \pm 0.4 mg/L) (repeated-measures

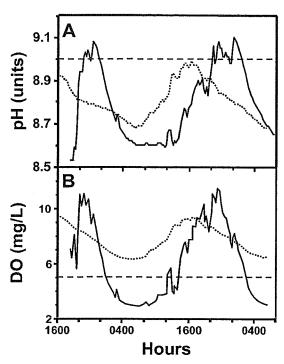


FIGURE 3.—Comparison of (A) pH and (B) dissolved oxygen (DO) between free-flowing (dotted lines) and impounded (solid lines) areas of the Fox River, Illinois, from the North Aurora Dam to the Stolp Island Dam. Similar patterns in DO and pH were observed between free-flowing and impounded reaches of 10 other between-dam river segments monitored during the study. Variables were measured with continuously recording Hydrolab Datasonde water quality monitors over a 40-h period in August 2001. Horizontal dashed lines represent Illinois Environmental Protection Agency ambient water quality standards.

ANOVA: $F_{1,10}=26.13$, P=0.001), and DO minima were lower in impounded areas (4.2 \pm 0.7 mg/L) than in free-flowing areas (5.7 \pm 0.7 mg/L; $F_{1,10}=6.88$, P=0.02). Mean maximum pH also was higher in impounded areas (9.0 \pm 0.08 units) than in free-flowing areas (8.8 \pm 0.07 mg/L) ($F_{1,10}=7.35$, P=0.02), but minimum pH ($F_{1,10}=0.03$, P=0.86), maximum temperature ($F_{1,10}=0.40$, P=0.54), and minimum temperature ($F_{1,10}=3.90$, P=0.54) were similar among impounded and free-flowing locations.

Effects of habitat type, time period, and the habitat × time period interaction varied among water quality variables. Dissolved oxygen was the only variable with a significant interaction effect (Table 3), which resulted because differences in DO between morning and evening sample periods were greater for stations in impoundments than for sta-

tions in free-flowing areas. Mean DO also decreased from surface to bottom in impounded areas (repeated-measures ANOVA: $F_{2,20} = 20.71$, P = 0.001) but was similar among vertical locations (surface, middepth, and bottom) in free-flowing areas ($F_{2,20} = 2.14$, P = 0.15) and among horizontal locations (left, mid-, and right channel) in free-flowing ($F_{2,20} = 1.30$, P = 0.30) and impounded areas ($F_{2,20} = 2.92$, P = 0.08). Temperature, pH, and chlorophyll a were higher in the evening than during the morning, but none of these variables showed significant habitat effects (Table 3). Turbidity, TP, and TN did not differ between habitat types or sample periods.

Substandard water quality conditions were common in the Fox River (Table 3). Total P and TN were elevated above recommended guidelines at all but the most upstream station (Stratton Dam), and TP was extremely high at all stations below Elgin, Illinois (>0.4 mg/L). High nutrient concentrations led to the development of excessive algal biomass, as indicated by chlorophyll-a and turbidity measures that were elevated above recommended guidelines (Table 3). Temperature did not exceed the Illinois water quality standard during the monitoring period, but DO and pH often failed to meet standards in impounded areas. Substandard DO and pH were recorded in 8 of 11 impounded areas, and these conditions often lasted for several hours in a 24-h period (>15 h for substandard DO at two stations). In contrast, DO and pH in free-flowing areas failed to meet standards at only two and one station, respectively.

Concurrent measurements upstream and downstream of dams showed that these structures moderated extremes in DO that developed in impoundments by the physical de- and re-aeration of water flowing over their spillways. Dams oxygenated the river at night, when DO was low in upstream impounded areas, but oxygen was released to the atmosphere during the day as oxygen-supersaturated waters from impoundments flowed over dams. For example, DO decreased by about 5 mg/L each day (1600-1800 hours) and increased by about 3 mg/ L each night (0400-0600 hours) as water flowed over the North Aurora Dam (Figure 4). The overall effect of water flowing over dams during a 24-h period was a net reduction in DO from the river and a loss of surplus oxygen produced by daytime algal photosynthesis that then was unavailable to respiring algae at night.

Cumulative Effects of Dams

Patterns in biotic and habitat indices along the upstream-downstream gradient were examined

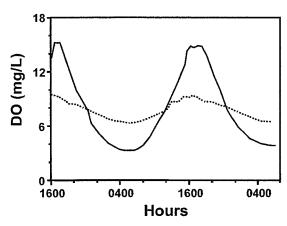


FIGURE 4.—Dissolved oxygen (DO) concentrations upstream (solid line) and downstream (dotted line) of the North Aurora Dam on the Fox River, Illinois. Similar patterns were observed at three additional dams monitored for DO. Concurrent upstream and downstream measurements were made with continuously recording Hydrolab Datasonde water quality monitors over a 40-h period in August 2001. Data were transformed based on point sampling to reflect surface concentrations.

separately for free-flowing and impounded areas because means for these variables varied between habitat types (Tables 1, 2, and 4). The variables TP, TN, and chlorophyll α were similar in freeflowing and impounded areas (Table 3), so we pooled data across habitat type for these variables. Scores for the IBI and QHEI did not vary significantly with increasing distance downstream for free-flowing (linear regression for IBI: r = 0.38, P = 0.17; QHEI: r = 0.43, P = 0.11) or impounded areas (IBI: r = 0.02, P = 0.93; QHEI: r = 0.15, P = 0.60; Figure 5). The absence of strong patterns in fish and habitat measures as downstream distance and numbers of dams increased indicates that effects of multiple low-head dams were not cumulative for these variables. The TP (r = 0.68, P)= 0.001), TN (r = 0.32, P = 0.03), chlorophyll a (r = 0.33, P = 0.03), and MCI scores from impounded (r = 0.62, P = 0.01) and free-flowing (r = 0.62, P = 0.01)= 0.50, P = 0.06) areas showed positive correlations with downstream distance. Although these positive relations could reflect the influence of multiple dams, patterns in the data relative to dam location and density (Figure 5) provided no strong evidence that the effects of dams were cumulative.

Discussion

Our results show that low-head dams adversely affected the biotic integrity of the Fox River on local and landscape scales. Local effects were

largely related to the impoundments that formed upstream of each dam, whereas landscape-level effects arose from fragmentation of the river basin and restricted movements of fish. We found that the use of impoundments by important macroinvertebrate and fish taxa was limited by degraded habitat and poor summer water quality conditions. Abundance, richness, and biotic integrity of fish and invertebrate assemblages were consistently lower in impoundments than in the free-flowing river. Degraded habitat, water quality, and biotic communities were found throughout impoundments, not just in the most impacted areas immediately above dams. Conversely, good habitat quality, water quality, macroinvertebrate assemblages, and sport fish and nongame fish communities occurred throughout free-flowing reaches, not just in areas immediately below dams. Differences in fish and invertebrate assemblages might be expected between free-flowing and impounded river reaches, but the magnitude and consistency of differences that we observed indicate that even low-head dams with relatively small impoundments can have profound detrimental effects on the biotic integrity of warmwater rivers.

By impounding water and altering flow patterns, dams modify upstream habitats and elicit changes in the composition of aquatic biota (Hynes 1970; Baxter 1977). The absence of erosional benthic invertebrate taxa and the predominance of tolerant depositional forms (e.g., oligochaetes and chironomids) in Fox River impoundments are typical responses of aquatic invertebrates to impoundment in temperate rivers (Nursall 1952; Paterson and Fernando 1969; Stanley et al. 2002). Fish assemblages also change with impoundment, but unlike the Fox River many impoundment fisheries consist of abundant lake-adapted species that frequently produce high fish yields and exceptional sportfishing and commercial fishing (Ellis 1941; Baxter 1977). Low sport fish abundance in impoundments of the Fox River may reflect the quasi-riverine characteristics of these areas or degraded habitat and water quality conditions. Although the history of impoundment fisheries in the Fox River is not known, present degraded conditions suggest that major habitat restoration (e.g., renovation back to free-flowing conditions) will be necessary if these impoundments are to support high-quality fish assemblages and fishing in the future. Main-stem impoundments also are known to support large populations of facultative riverine species (e.g., gizzard shad Dorosoma cepedianum, common carp, and freshwater drum) that invade tributaries

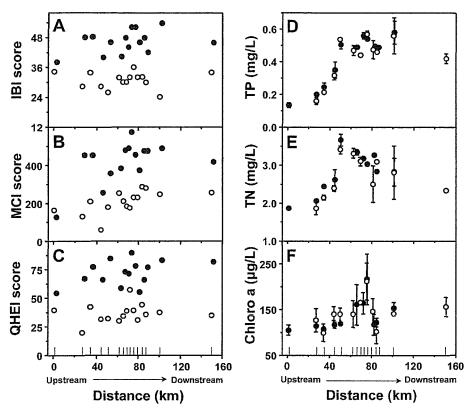


FIGURE 5.—Relations between upstream—downstream distance and (A) index of biotic integrity (IBI), (B) macroinvertebrate community index (MCI), (C) qualitative habitat evaluation index (QHEI), (D) total phosphorus (TP), (E) total nitrogen (TN), and (F) chlorophyll a (chloro a) for stations in free-flowing (solid circles) and impounded (open circles) areas in the Fox River, Illinois. Biota and habitat were sampled during July-September 2000, and water quality was sampled during August 2001. Values for chlorophyll a, TP, and TN are means \pm SEs of morning and evening samples. Vertical lines above the x-axis indicate dam locations.

and upstream free-flowing reaches of rivers during spring and summer (Ellis 1941; Ruhr 1956; Rodriguez-Ruiz and Granado-Lorencio 1992). Common carp and freshwater drum were abundant at many stations in free-flowing and impounded reaches of the Fox River, possibly reflecting the abundance of impounded habitat created by numerous dams.

Habitat quality appeared to be an important variable in explaining differences in faunal assemblages between free-flowing and impounded areas. We found strong correlations between habitat quality and fish and invertebrate community quality, and index scores were consistently higher in free-flowing reaches than in impoundments. Differences in habitat quality reflected differences in habitat diversity between free-flowing and impounded areas. Free-flowing areas were made up of a variety of physical features (i.e., riffles, runs, and natural

pools) that provided a wide array of water depths, current velocities, substrate types, and cover characteristics. In contrast, impoundment habitat was more homogeneous and typically consisted of extensive, deeper open-water areas; lower and more uniform current velocities; and substrates dominated by deposited fine silts and sands. Habitat heterogeneity is important to the conservation of aquatic biodiversity in rivers and streams because abundance and distribution of stream fishes (Rabeni and Jacobson 1993) and benthic invertebrates (Rabeni and Minshall 1977; Reice 1980) are strongly affected by individual or combinations of microhabitat variables. By creating impoundments with limited habitat heterogeneity, Fox River dams restricted the distributions of many fish and invertebrate taxa to free-flowing areas during the important summer-fall growing season. By impounding nearly half of the Fox River's length in

Illinois, the 15 dams likely had a negative effect on the abundance and diversity of aquatic biota in the river.

Little published literature is available on the ecological effects of impoundments formed by low-head dams, but there is existing evidence that our findings are not unique. Habitat quality and IBI scores were substantially lower in an impoundment than in free-flowing sections of the Milwaukee River, Wisconsin (Kanehl et al. 1997). Similarly, Stanley et al. (2002) found that macroinvertebrate communities in impoundments of another Wisconsin river were more degraded than those in free-flowing reaches. Impoundments formed by low-head dams in other northeastern Illinois rivers also have been shown to adversely affect aquatic habitat, fishes, and macroinvertebrates (Pescitelli and Rung 1998; Hammer and Linke 2003). Studies such as these indicate that adverse effects of low-head dams and impoundments may be common, at least for moderate-sized rivers in the Midwest. However, additional descriptive research and manipulative studies (e.g., dam removal studies) that include sampling over multiple seasons and years are necessary to further explain potential variation in the effects of dams within and among river systems and across seasons and years.

Impoundments may play an important role in the development of degraded water quality in rivers with low-head dams. Others have shown that algal abundance is positively related to TP and TN in aquatic systems (Soballe and Kimmel 1987) and that impoundments enhance phytoplankton development in rivers by reducing hydraulic flushing and algal washout and allowing more time for growth in suspension (Talling and Rzoska 1967; Soballe and Kimmel 1987; Lohman and Jones 1999). Phosphorus and nitrogen loading from numerous potential sources (e.g., municipal wastewater treatment plants, fertile native bed material, agricultural fertilizers, and nonpoint urban runoff) has made the Fox River below Elgin, Illinois, among the most enriched rivers in the Midwest (Robertson et al. 2001). In combination with the presence of numerous impoundments, high nutrient input has created an environment that supports excessive algal growth. Daily cycles of photosynthesis and respiration by abundant phytoplanktonic algae, in turn, produced large fluctuations in DO and pH that often resulted in substandard water quality conditions in impoundments.

Large dams and impoundments can have significant effects on the flow regime, geomorphol-

ogy, and ecology of downstream reaches of rivers (Ward and Stanford 1979; Ligon et al. 1995; Poff et al. 1997). In some cases, changes in temperature and transported organic matter below large dams may reset environmental variables and invertebrate communities to conditions found in upstream tributaries or headwaters (Hauer and Stanford 1982; Soballe and Bachmann 1984). Although smaller low-head dams affected downstream areas in the Fox River by moderating the algae-induced extremes in DO that developed in impoundments, we found no evidence of a resetting of invertebrate assemblage structure to tributary or headwater conditions. On the contrary, small run-of-river dams contributed to higher turbidity (i.e., by continually releasing algae from upstream impoundments) and poorer invertebrate quality in downstream free-flowing areas than were found in freeflowing reaches away from dams. Invertebrate assemblages immediately below dams were influenced by high densities of a few tolerant filterfeeding taxa, such as the caddisflies Cheumatopsyche and Hydropsyche (Gordon and Wallace 1975), which probably were thriving on abundant algae and other suspended matter released from impoundments (Spence and Hynes 1971a; Parker and Voshell 1983).

It has been suggested that environmental variables respond differently when multiple dams and impoundments occur in a river (Ward and Stanford 1983). Because river transport is largely unidirectional, effects of impoundment might be expected to increase with downstream flow past consecutive dams. However, we found no evidence that multiple dams had cumulative effects (good or bad) on water quality or the quality of fishes, invertebrates, and habitat. In fact, dams affected these parameters in a remarkably similar fashion throughout the river. Current dam theory tells us that response among abiotic and biotic parameters will vary with dam size and function (storage versus run-of-river dams; Poff and Hart 2002) and location within a river system (e.g., low-order headwaters versus high-order alluvial river; Ward and Stanford 1983). The lack of variation in our results may be due to the size and function of the dams examined (i.e., small run-of-river structures with surface spillways and small, shallow impoundments) and the consistent stream order that occurred throughout the study area. When variation did occur, it appeared to be related more to site-specific morphology and habitat characteristics than to downstream location within the series of impoundments. For example, fish and invertebrate assemblages were more similar upstream and downstream of Stratton Dam, possibly because it was the only dam in the low-gradient northern section of river with generally similar habitat characteristics at above- and below-dam stations. The absence of cumulative effects suggests that low-head dams and impoundments may influence rivers more as localized perturbations than cumulative disruptors of downstream transport processes, even when dams are numerous and closely spaced.

Although downstream cumulative effects were lacking, multiple dams seemed to cause upstream cumulative effects on fish movement and distribution patterns within the drainage. Historical fisheries data indicated that dams currently maintain restricted distributions for nearly one-third of fish species known from the Fox River basin. Migration routes in the Fox River have been blocked for species including American eels Anguilla rostrata, buffalo, redhorses, carpsuckers Carpiodes spp., and skipjack herring Alosa chrysochloris. A number of species have isolated populations at the upstream-most reaches of their distributions because of dams, whereas several species may be functionally isolated by the long distance and numerous dams occurring between upstream and downstream populations. The Dayton Dam has isolated all fish populations in the Fox River watershed by preventing the influx of new genetic material from outside sources (e.g., other streams in the upper Illinois River watershed). The temporal and geographic scales at which genetic isolation by dams becomes detrimental to fish populations (i.e., through inbreeding depression) currently are not known, but theoretical population modeling of white sturgeon Acipenser transmontanus suggests that increased fragmentation by dams can substantially reduce the likelihood of persistence and can erode genetic diversity within and among surviving populations (Jager et al. 2001). In addition, by acting as barriers to movement, multiple dams prevented recolonization by fishes and freshwater mussels (through the connection between fish hosts and mussel glochidia; Watters 1992, 1996) to additional habitats that may allow for population growth and range expansion within the watershed.

Management Considerations

There is extensive evidence that fish need to move among a wide array of habitats during their life cycle (Schlosser 1991; Schlosser and Angermeier 1995; Pringle et al. 2000; Fausch et al. 2002), and recent studies suggest that directional

movement is commonplace, even among species previously thought to be nonmigratory (Schmutz and Jungwirth 1999; Bunt et al. 2001). In their natural form, river ecosystems provide a spatially continuous mosaic of habitats available to specific species and life stages of fish and invertebrates (Fausch et al. 2002). The detrimental consequences of dam blockage of fish movements (i.e., risk of extinction and local extirpations) are well documented for hundreds of species of obligate riverine fishes and invertebrates throughout the Western Hemisphere (see individual species accounts in Pringle et al. 2000).

The widespread detrimental effects of multiple dams and impoundments on the Fox River suggest that the watershed would benefit from reconnection and restoration efforts aimed at removing or modifying main-stem and tributary dams. Options for reconnecting the river include removing dams completely, building rocky ramps at dams, constructing traditional fishways (e.g., Denil fishways), and constructing more natural fish and canoe bypass channels (Santucci and Gephard 2003). Dam removal is the best option when the ecological health of the river is of prime consideration, because it will eliminate barriers to migration for all types and life stages of fish, restore high-quality free-flowing habitat, and improve water quality. In addition, dam removal is less expensive than the other options presented, and it reduces safety risks (e.g., drownings) and maintenance costs by eliminating the structure (Born et al. 1998). The ramping of dams provides for reconnection of the river by allowing fish to pass upstream and downstream, but it does little to improve degraded water quality and habitat because the impoundment remains. Fishways and bypass channels will improve connectivity in the river by allowing many species and life stages of fish to navigate over or around dams (Bunt et al. 2001). However, these options will do nothing to improve habitat and water quality because, as with rocky ramps, the dam and impoundment remain. Fishways and bypass channels also have associated operational costs and maintenance requirements, and building them is more expensive than dam removal (Santucci and Gephard 2003). For these reasons, fishways and bypass channels should be considered only when dam removal is ruled out as a river restoration option.

By examining multiple low-head dams in the Fox River, we have provided clear evidence that these small structures may adversely affect many biotic and abiotic components of rivers and

streams on local and landscape scales. Decisions regarding public dams are often complex, involving numerous stakeholder groups and a variety of economic, social, political, and environmental issues. Our results emphasize the importance of environmental concerns in this decision-making process and provide scientific data to river managers and other stakeholders entrusted with the choice of repairing, removing, or retrofitting existing dams with fish passage structures.

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References

- Bain, M. B., J. T. Finn, and H. E. Booke. 1988. Stream-flow regulation and fish community structure. Ecology 69:382–392.
- Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadable rivers: periphyton, benthic macroinvertebrates, and fish, 2nd edition. U.S. Environmental Protection Agency, Office of Water, EPA 841-B-99-002, Washington, D.C.
- Baxter, R. M. 1977. Environmental effects of dams and impoundments. Annual Review of Ecology and Systematics 8:255-283.
- Benstead, J. P., J. G. March, C. M. Pringle, and F. N. Scatena. 1999. Effects of a low-head dam and water abstraction on migratory tropical stream biota. Ecological Applications 9:656-668.
- Bertrand, W. A., H. Brown, J. Ferencak, and J. Langbein. 1982. 1981 electrofishing survey of the Fox River. Illinois Department of Natural Resources, Springfield.

- Bertrand, W. A., R. L. Hite, and D. M. Day. 1996. Biological stream characterization (BSC): biological assessment of Illinois stream quality through 1993. Illinois Environmental Protection Agency, Springfield.
- Born, S. M., K. D. Genskow, T. L. Filbert, N. Hernandez-Mora, M. L. Keefer, and K. A. White. 1998. Socioeconomic and institutional dimensions of dam removals: the Wisconsin experience. Environmental Management 22:359-370.
- Bunt, C. M., B. T. van Poorten, and L. Wong. 2001. Denil fishway utilization patterns and passage of several warmwater species relative to seasonal, thermal, and hydraulic dynamics. Ecology of Freshwater Fish 10:212–219.
- Clay, C. H. 1995. Design of fishways and other fish facilities, 2nd edition. CRC Press, Boca Raton, Florida.
- Day, D. M., H. Brown, K. Clodfelter, J. Ferencak, J. Langbein, and R. Miller. 1992. The Fox River: temporal and spatial relationships in the fish community of an increasingly urbanized watershed (1978– 1990). Illinois Department of Natural Resources, Springfield.
- De Merona, B., and P. Albert. 1999. Ecological monitoring of fish assemblages downstream of a hydroelectric dam in French Guiana (South America). Regulated Rivers: Research and Management 15: 339-351.
- Dynesius, M., and C. Nilsson. 1994. Fragmentation and flow regulation of river systems in the northern third of the world. Science 266:753-762.
- Efford, I. E. 1975. Assessment of the impact of hydrodams. Journal of the Fisheries Research Board of Canada 32:196-209.
- Ellis, M. M. 1941. Freshwater impoundments. Transactions of the American Fisheries Society 71:80-93.
- Fausch, K. D., J. Lyons, J. R. Karr, and P. L. Angermeier. 1990. Fish communities as indicators of environmental degradation. Pages 123-144 in S. M. Adams, editor. Biological indicators of stress in fish. American Fisheries Society, Symposium 8, Bethesda, Maryland.
- Fausch, K. D., C. E. Torgersen, C. V. Baxter, and H. W. Li. 2002. Landscapes to riverscapes: bridging the gap between research and conservation of stream fishes. Bioscience 52:483-498.
- Gordon, A. E., and J. B. Wallace. 1975. Distribution of the family Hydropsychidae in the Savannah River Basin of North Carolina, South Carolina, and Georgia. Hydrobiologia 46:405-423.
- Hall, G. E., editor. 1971. Reservoir fisheries and limnology. American Fisheries Society, Special Publication 8, Bethesda, Maryland.
- Hall, G. E., and M. J. Van Den Avyle, editors. 1986. Reservoir fisheries management: strategies for the 80's. Reservoir Committee, Southern Division, American Fisheries Society, Bethesda, Maryland.
- Hammer, J., and R. Linke. 2003. DuPage River fish passage feasibility study. Final report of The Con-

- servation Foundation to the Illinois Department of Natural Resources, Springfield.
- Hauer, F. R., and J. A. Stanford. 1982. Ecological responses of hydropsychid caddisflies to stream regulation. Canadian Journal of Fisheries and Aquatic Sciences 39:1235–1242.
- Heidinger, R. 1993. Aquatic survey of the Fox River between Elgin Dam and South Elgin Dam. Report of Southern Illinois University at Carbondale to Hyatt Development Corporation, Elgin, Illinois.
- Hilsenhoff, W. L. 1987. An improved biotic index of organic stream pollution. Great Lakes Entomologist 20:31-39.
- Hite, R. L., and D. W. Brockamp. 1992. Effects of livestock wastes on small Illinois streams: lower Kaskaskia River basin and upper Wabash River basin. Illinois Environmental Protection Agency, Report IEPA/WPC/92-114, Springfield.
- Hynes, H. B. N. 1970. The ecology of running waters. University of Toronto Press, Toronto.
- IDNR (Illinois Department of Natural Resources). 1998. Fox River area assessment, volume 1. Geology; volume 2. Water resources; and volume 3. Living resources. Illinois Department of Natural Resources, Springfield.
- Jager, H. L., J. A. Chandler, K. B. Lepla, and W. Van Winkle. 2001. A theoretical study of river fragmentation by dams and its effects on white sturgeon populations. Environmental Biology of Fishes 60: 347-361.
- Kanelil, P. D., J. Lyons, and J. E. Nelson. 1997. Changes in the habitat and fish community of the Milwaukee River, Wisconsin, following removal of the Woolen Mills Dam. North American Journal of Fisheries Management 17:387-400.
- Karr, J. R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6(6):21-27.
- Ligou, F. K., W. E. Dietrich, and W. J. Trush. 1995. Downstream ecological effects of dams. Bioscience 45:183-192.
- Lohman, K., and J. R. Jones. 1999. Nutrient-sestonic chlorophyll relationships in northern Ozark streams. Canadian Journal of Fisheries and Aquatic Sciences 56:124-130.
- Martinez, P. J., T. E. Chart, M. A. Trammell, J. G. Wullschleger, and E. P. Bergersen. 1994. Fish species composition before and after construction of a main-stem reservoir on the White River, Colorado. Environmental Biology of Fishes 40:227-239.
- Merritt, R. W., and K. W. Cummins. 1996. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Company, Dubuque, Lowa
- Nursall, J. R. 1952. The early development of a bottom fauna in a new power reservoir in the Rocky Mountains of Alberta. Canadian Journal of Zoology 30: 387-409.
- OEPA (Ohio Environmental Protection Agency). 1989. Biological criteria for the protection of aquatic life. volume III. Standardized biological field sampling and laboratory methods for assessing fish and mac-

- roinvertebrate communities. Ohio Environmental Protection Agency, Columbus.
- Parker, C. R., and J. R. Voshell, Jr. 1983. Production of filter-feeding Trichoptera in an impounded and freeflowing river. Canadian Journal of Zoology 61:70– 87.
- Paterson, C. G., and C. H. Fernando. 1969. Macroinvertebrate colonization of the marginal zone of a small impoundment in eastern Canada. Canadian Journal of Zoology 47:1229-1238.
- Pescitelli, S., and B. Rung. 1998. Effects of Hoffman Dam on local fish communities in the Des Plaines River. Illinois Department of Natural Resources, Plano.
- Poff, N. L., J. D. Allen, M. B. Bain, J. R. Karr, K. L. Prestegaard, B. D. Richter, R. E. Sparks, and J. C. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. Bioscience 47:769-784.
- Poff, N. L., and D. D. Hart. 2002. How dams may vary and why it matters for the emerging science of dam removal. Bioscience 52:659-668.
- Porto, L. M., R. L. McLaughlin, and D. L. G. Noakes. 1999. Low-head barrier dams restrict the movements of fishes in two Lake Ontario streams. North American Journal of Fisheries Management 19: 1028–1036.
- Pringle, C. M., M. C. Freeman, and B. J. Freeman. 2000. Regional effects of hydrologic alterations on riverine macrobiota in the new world: tropical-temperate comparisons. Bioscience 50:807-823.
- Rabeni, C. F., and R. B. Jacobson. 1993. The importance of fluvial hydraulics to fish-habitat restoration in low-gradient alluvial streams. Freshwater Biology 29:211-220.
- Rabeni, C. F., and G. W. Minshall. 1977. Factors affecting microdistribution of stream benthic insects. Oikos 29:33–43.
- Rankin, E. T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Ohio Environmental Protection Agency, Columbus.
- Reice, S. R. 1980. The role of substrate in benthic macroinvertebrate microdistribution and litter decomposition in woodland stream. Ecology 61:580-590.
- Robertson, D. M., D. A. Saad, and A. M. Wieben. 2001. An alternative regionalization scheme for defining nutrient criteria for rivers and streams. U.S. Geological Survey, Water Resources Investigations Report 01-4073 Middleton, Wisconsin.
- Rodriguez-Ruiz, A., and C. Granado-Lorencio. 1992. Spawning period and migration of three species of cyprinids in a stream with Mediterranean regimen (SW Spain). Journal of Fish Biology 41:545-556.
- Ruhr, C. E. 1956. Effect of stream impoundment in Tennessee on the fish populations of tributary streams. Transactions of the American Fisheries Society 86: 144-157.
- Sallee, R. D., and H. W. Bergmann. 1986. 1982 Fox River basin fisheries assessment. Illinois Department of Natural Resources, Aledo.
- Santucci, V. J., Jr. 1994. Assessment of fish populations in the Fox River between Algonquin and Elgin, II-

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992 SANTUCCI ET AL.

linois. Max McGraw Wildlife Foundation, Fisheries Research Report, Dundee, Illinois.

- Santucci, V. J., Jr., and S. R. Gephard. 2003. Fox River fish passage feasibility study. Final Report of the Max McGraw Wildlife Foundation to the Illinois Department of Natural Resources, Springfield.
- Schlosser, I. J. 1991. Stream fish ecology: a landscape perspective. Bioscience 41:704-712.
- Schlosser, I. J., and P. L. Angermeier. 1995. Spatial variation in demographic processes of lotic fishes: conceptual models, empirical evidence, and implications for conservation. Pages 392—401 in J. L. Nielsen, editor. Evolution and the aquatic ecosystem: defining unique units in population conservation. American Fisheries Society, Bethesda, Maryland.
- Schmutz, S., and M. Jungwirth. 1999. Fish as indicators of large-river connectivity: the Danube and its tributaries. Archiv für Hydrobiologia 115:329–348.
- Singh, K. P., T. A. Butts, H. V. Knapp, D. B. Shackleford, and R. S. Larson. 1995. Considerations in water use planning for the Fox River. Illinois State Water Survey, Contract Report 586, Champaign.
- Smith, L. W., E. Dittmer, M. Prevost, and D. R. Burt. 2000. Breaching of a small irrigation dam in Oregon: a case history. North American Journal of Fisheries Management 20:205-219.
- Soballe, D. M., and R. W. Bachmann. 1984. Influence of reservoir transit on riverine algal transport and abundance. Canadian Journal of Fisheries and Aquatic Sciences 41:1803-1813.
- Soballe, D. M., and B. L. Kimmel. 1987. A large-scale comparison of factors influencing phytoplankton abundance in rivers, lakes, and impoundments. Ecology 68:1943-1954.
- Spence, J. A., and H. B. N. Hynes. 1971a. Differences in benthos upstream and downstream of an impoundment. Journal of the Fisheries Research Board of Canada 28:35-43.
- Spence, J. A., and H. B. N. Hynes. 1971b. Differences in fish populations upstream and downstream of a

- mainstream impoundment. Journal of the Fisheries Research Board of Canada 28:45-46.
- Stanley, E. H., M. A. Luebke, M. W. Doyle, and D. W. Marshall. 2002. Short-term changes in channel form and macroinvertebrate communities following low-head dam removal. Journal of the North American Benthological Society 21:172–187.
- Steel, R. G. D., and J. H. Torrie. 1980. Principles and procedures of statistics: a biometrical approach. McGraw Hill, New York.
- Talling, J. F., and J. Rzoska. 1967. The development of plankton in relation to hydrological regime in the Blue Nile. Journal of Ecology 55:637-662.
- USEPA (U.S. Environmental Protection Agency). 2000. Nutrient criteria technical guidance manual: rivers and streams. U.S. Environmental Protection Agency, EPA-822-B-00-002, Washington, D.C.
- USGS (U.S. Geological Survey). 2001. Water resources data: Illinois water year 2000. USGS, Denver.
- USGS (U.S. Geological Survey). 2002. Water resources data: Illinois water year 2001. USGS, Denver.
- Vannote, R. L., G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. Cushing. 1980. The river continuum concept. Canadian Journal of Fisheries and Aquatic Sciences 37:130-137.
- Ward, J. V., and J. A. Stanford, editors. 1979. The ecology of regulated streams. Plenum, New York.
- Ward, J. V., and J. A. Stanford. 1983. The serial discontinuity concept of lotic ecosystems. Pages 29-42 in T. D. Fontain and S. M. Bartell, editors. Dynamics of lotic ecosystems. Ann Arbor Science, Ann Arbor, Michigan.
- Watters, G. T. 1992. Unionids, fishes, and the speciesarea curve. Journal of Biogeography 19:481-490.
- Watters, G. T. 1996. Small dams as barriers to freshwater mussels (Bivalvia, Unionida) and their hosts. Biological Conservation 75:79-85.
- Winston, M. R., C. M. Taylor, and J. Pigg. 1991. Upstream extirpation of four minnow species due to damming of a prairie stream. Transactions of the American Fisheries Society 120:98-105.

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