BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

MIDWEST GENERATION, LLC Petitioner, v. ILLINOIS ENVIRONMENTAL PROTECTION AGENCY Respondent.	))))))))	PCB _____

NOTICE OF FILING

To:

Don Brown, Clerk of the Board Illinois Pollution Control Board James R. Thompson Center, Suite 11-500 100 W. Randolph Street Chicago, IL 60601 don.brown@illinois.gov (via electronic mail)	Joanne Olson Illinois Environmental Protection Agency 1021 North Grand Avenue East P.O. Box 19276 Springfield, IL 62794-9276 joanne.olson@illinois.gov
Eric Lohrenz Illinois Department of Natural Resources One Natural Resources Way Springfield, IL 62702-1271 eric.lohrenz@illinois.gov	

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board the Appearance of Susan M. Franzetti, the Appearance of Vincent R. Angermeier, and a Petition to Approve Alternative Thermal Effluent Limitations with Exhibits (Demonstration Study hand delivered to IPCB), copies of which are herewith served upon you.

Dated: January 26, 2018

MIDWEST GENERATION, LLC

By: /s/ Susan M. Franzetti

Susan M. Franzetti
Vincent R. Angermeier
NIJMAN FRANZETTI LLP
10 South LaSalle Street Suite 3600
Chicago, IL 60603
(312) 251-5590

CERTIFICATE OF SERVICE

The undersigned, an attorney, certifies that a true copy of the foregoing Notice of Filing, Appearance of Susan M. Franzetti, Appearance of Vincent R. Angermeier, and Petition to Approve Alternative Thermal Effluent Limitations with Exhibits (Demonstration Report hand delivered to IPCB) was electronically filed on January 26, 2018 with the following:

Don Brown, Clerk of the Board
Illinois Pollution Control Board
James R. Thompson Center, Suite 11-500
100 W. Randolph Street
Chicago, IL 60601
don.brown@illinois.gov

and that copies were mailed via U.S. Postal Service on January 26, 2018 to the parties listed above.

Dated: January 26, 2018 /s/ Susan M. Franzetti

Susan M. Franzetti
Vincent R. Angermeier
Nijman Franzetti LLP
10 S. LaSalle Street, Suite 3600
Chicago, IL 60603
(312) 251-5590

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

MIDWEST GENERATION, LLC Petitioner,	)	
v.	)	PCB _____
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY Respondent.	)	

ENTRY OF APPEARANCE OF SUSAN M. FRANZETTI

NOW COMES Susan M. Franzetti, of Midwest Generation, LLC, and hereby enters her appearance as counsel in this matter on behalf of Midwest Generation, LLC. This appearance shall also serve as consent to service via email.

Respectfully submitted,

/s/Susan M. Franzetti

Susan M. Franzetti
Attorney
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(312) 251-5590
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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

MIDWEST GENERATION, LLC Petitioner,	)	
	)	PCB _____
v.	)	
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY Respondent.	)	

ENTRY OF APPEARANCE OF VINCENT R. ANGERMEIER

NOW COMES Vincent R. Angermeier, of Midwest Generation, LLC, and hereby enters his appearance as counsel in this matter on behalf of Midwest Generation, LLC. This appearance shall also serve as consent to service via email.

Respectfully submitted,

/s/Vincent R. Angermeier
Vincent R. Angermeier
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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

MIDWEST GENERATION, LLC	)	
Petitioner,	)	
v.	)	PCB _____
ILLINOIS ENVIRONMENTAL	)	
PROTECTION AGENCY	)	
Respondent.	)	

PETITION TO APPROVE ALTERNATIVE THERMAL EFFLUENT LIMITATIONS

Pursuant to 35 Ill. Adm. Code Section 304.141(c), 35 Ill. Adm. Code Part 106, Subpart K, and Section 316(a) of the Clean Water Act ("CWA"), (33 U.S.C. § 1326(a), Midwest Generation, LLC ("MWGen") requests that the Illinois Pollution Control Board ("Board") determine that the alternative thermal effluent limitations proposed in this petition should apply to discharges from the Will County Generating Station ("WCGS" or "the Station") in the Chicago Sanitary and Ship Canal ("CSSC") in lieu of those imposed by 35 Ill. Adm. Code 302.408(c) through (f), and (h), (collectively, the "2018 Thermal Standards"). As part of the proposed alternative thermal effluent limitations, MWGen also requests an alternative zone of passage requirement in lieu of the otherwise applicable zone of passage provisions in 35 Ill. Adm. Code 302.102(b)(8).

I. INTRODUCTION

Pursuant to a National Pollution Discharge Elimination System ("NPDES") permit, the WCGS discharges treated wastewater, including condenser cooling water, to the CSSC. As the result of the Board's decision in R08-09, Subdocket D, a new set of thermal water quality standards for the CSSC will become applicable on July 1, 2018. During the Board's deliberations in R08-09, MWGen noted that the 2018 Thermal Standards were more stringent than necessary to protect the CSSC aquatic community and that the WCGS cannot consistently meet the numerical and narrative provisions of the 2018 Thermal Standards. The Station could only avoid violations by shutting down or derating, and this would be especially likely during summer and winter weather extremes when public power demands are at their greatest levels. The Board provided a three-year effective date to allow adversely affected thermal dischargers, like MWGen's WCGS,

time to conduct the necessary additional demonstration studies pursuant to 35 Ill. Adm. Code Part 106, Subpart K (the "Subpart K regulations") and CWA Section 316(a) to support a request for alternative thermal effluent limitations. MWGen has conducted those studies, based on a Detailed Study Plan reviewed and approved by the Illinois Environmental Protection Agency ("IEPA" or "the Agency), and the findings of those studies support this request for alternative thermal effluent limitations and a modified zone of passage requirement for the allowed WCGS thermal mixing zone.

The 2018 Thermal Standards were adopted from the existing Illinois General Use thermal water quality standards that are used to protect waters that meet or have the capability of meeting CWA aquatic life goals. The CSSC cannot meet those goals, which is why the Board designated it as a part of the "Chicago Area Waterway System and Brandon Pool Aquatic Life Use B Waters" rather than a General Use water. *See* 35 Ill. Adm. Code 303.240. It is a man-made, anthropogenically-influenced and manipulated system that is inherently limited by physical factors, including a lack of suitable habitat, which fundamentally limits the types of aquatic life species that the CSSC is capable of supporting. Hence, the 2018 Thermal Standards will be more stringent than necessary to assure the protection and propagation of the CSSC's balanced, indigenous community (BIC) in the area affected by the WCGS thermal discharge.

MWGen is proposing alternative thermal effluent limits for the WCGS that will assure the protection and propagation of the BIC of the CSSC in the area affected by the WCGS thermal discharge as required by applicable law and regulations. The extensive WCGS 316(a) Demonstration Report, prepared pursuant to the requirements of the Illinois Subpart K regulations and Section 316(a) of the Clean Water Act, is submitted with and in support of this petition. The Report contains all the relevant studies, data and information which support the relief requested for the WCGS thermal discharge. It demonstrates that the requested, less stringent alternative thermal effluent limitations (limitations that are, nonetheless, stricter than currently applicable standards in the CSSC) along with a modified zone of passage requirement are capable of supporting the BIC of aquatic life in WCGS's receiving waters.

MWGen has diligently pursued the steps necessary to prepare this Petition since the adoption of the 2018 Thermal Standards. Within six months of their adoption, MWGen completed both the "Early Screening" requirements of Subpart K Section 106.1115 and the preparation and submittal to IEPA and the Illinois Department of Natural Resources (IDNR)

of the Section 106.1120 Detailed Plan of Study for the WCGS (the "Detailed Study Plan"). The IEPA approved the Detailed Study Plan by letter dated March 3, 2016. (See Exhibit 1.) IDNR's questions regarding certain aspects of the Detailed Study Plan were satisfactorily addressed and the IDNR also approved it by email dated June 9, 2016. (See Exhibit 2.)

The implementation of the Study Plan began immediately. Because it typically takes at least two years to conduct the studies described in the Detailed Plan of Study, and the new 2018 Thermal Standards would become effective on July 1, 2018, MWGen obtained the approval of IEPA, in consultation with the United States Environmental Protection Agency Region 5 (U.S. EPA), for two changes to the Detailed Study Plan that expedited the schedule for completing the studies. One change allowed use of the two years of recently collected fisheries data (2015 and 2016) instead of using data collected during 2016 and 2017, as proposed in the originally approved Detailed Study Plan. The other change allowed the use of the new 2016 habitat data and previously collected habitat data in the thermal limit development process, replacing the requirement to collect additional habitat data from these same locations in 2017. (Exhibit 3.) Upon the completion of the 316(a) Demonstration Report, it was submitted to the IEPA for review and comment prior to the filing of this petition. The revised version of the 316(a) Demonstration Report submitted with this petition addresses all comments received from the Agency. A copy of the revised Demonstration Report also was recently submitted to the U.S. EPA for its review and comment.[1]

II. LEGAL STANDARDS APPLICABLE TO RELIEF

Although heat is regarded as a "pollutant" under the Clean Water Act, 33 U.S.C. § 1362(6), lawmakers have made a policy choice to allow for regulatory relief to thermal dischargers that other kinds of dischargers do not receive. Section 316(a) of the Clean Water Act allows for a point source with thermal discharge to obtain relief—called an alternative effluent limit, or "AEL"—from otherwise applicable thermal effluent limits:

> With respect to any point source otherwise subject to the provisions of section 1311 of this title or section 1316 of this title, whenever the owner or operator of any such source, after opportunity for public hearing, can demonstrate to the satisfaction of the Administrator (or, if appropriate, the State) that any effluent limitation proposed for the control of the thermal component of any

[1] As of the filing of this Petition, the U.S. EPA has not yet provided any comments or questions on the Demonstration Report. The Demonstration Report attached to and incorporated by this Petition is substantively identical to the version provided to the U.S. EPA on January 10, 2018.

> discharge from such source will require effluent limitations more stringent than necessary to assure the projection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made, the Administrator (or, if appropriate, the State) may impose an effluent limitation under such sections for such plant, with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water.

Clean Water Act § 316(a) (codified at 33 U.S.C. § 1326(a)).

Section 304.141(c) of the Illinois Water Pollution Regulations authorizes the Board to determine that different thermal effluent standards should apply to a particular discharger instead of those imposed by the generally applicable thermal water quality standards. Section 304.141(c) provides:

> The standards of this Chapter shall apply to thermal discharges unless, after public notice and an opportunity for public hearing, in accordance with section 316 of the CWA, applicable federal regulations, and procedures in 35 Ill. Adm. Code 106, Subpart K, the Board has determined that different standards shall apply to a particular thermal discharge.

In 2014, the Board adopted the new procedures for applying for AELs, codified in the Subpart K regulations and referenced in Section 304.141(c). Dischargers petitioning for an AEL first go through an early screening process with the Agency, where they provide basic information about the nature of their discharge and a broad outline of how they intend to demonstrate that a proposed AEL will protect the local aquatic community. 35 Ill. Adm. Code 106.1115. The discharger then submits a "Detailed Plan of Study" to the Agency, for its review and approval, which puts the planned demonstration into sharper focus so that the Agency has the opportunity to recommend potential improvements. *Id.* at 106.1120. Upon the Agency's approval (which occurred here), or after 90 days have passed with no Agency response, the discharger implements the Detailed Plan of Study. *Id.* at 106.1120 (f) and (g).

Once the study is complete, the discharger initiates the AEL proceeding by formally petitioning the Board for an AEL. *Id.* at 106.1125. In evaluating the merits of the petition, the Board applies standards that mirror those in Section 316(a) of the Clean Water Act. Although predictive studies are typically a necessary part of a thermal demonstration for new dischargers,

existing dischargers are allowed to forego those studies if they can otherwise demonstrate using retrospective studies of the waterway that the AEL will assure the protection and propagation of the BIC. *Id.* at 106.1160(d). Nothing, however, prevents existing dischargers from relying on both retrospective and predictive studies.

The petitioner has the burden of proof to demonstrate that the generally applicable thermal water quality standard is more stringent than necessary to assure the protection and propagation of a balanced and indigenous community of shellfish, fish, and wildlife in and on the receiving water. *See* 35 Ill. Adm. Code 106.1160(a)-(b). The petitioner must also demonstrate that the requested alternative thermal effluent limitation assures the protection and propagation of a balanced and indigenous community of shellfish, fish, and wildlife in the receiving water. *See id.* at 106.1160(c). Petitioner's demonstration considers not only the impact of its thermal discharge but also the cumulative impact with all other significant impacts on the species affected. *Id.*

Ultimately, the key question is whether the thermal demonstration submitted by the petitioner provides a "reasonable assurance" of the protection and propagation of a BIC in the receiving waterbody. The U.S. EPA's 1974 draft guidance manual on Section 316(a) demonstrations, notes that "[m]athematical certainty" is not required, and suggests that the risks to the environment from AELs (even if one assumes some kind of error rates) are low—the AELs must be renewed during the permitting cycle, and additional protections can be added at that time, if needed. U.S. EPA. *Draft 316(a) Technical Guidance—Thermal Discharges*, at 8 (Sept. 30, 1974).

III. REQUIRED CONTENTS OF PETITION

Pursuant to the requirements of 35 Ill. Adm. Code 106.1130(a)-(c), MWGen provides the following WCGS information and a description of the WCGS 316(a) Demonstration Report included with and incorporated as part of this Petition.

A. General Plant Description (Section 106.1130(a))

1. Generating Capacity and Type of Fuel Used (Section 106.1130(a)(1)-(2))

WCGS is a coal-fired steam electric generating facility located on the CSSC in Romeoville, Illinois at River Mile 295.6. Historical station operation included four coal-fired generating units with a total capacity of 1,163 megawatts (MW). Units 1 and 2, 167MW each, started commercial

service in 1955; both units were retired in late 2010. Unit 3 (278 MW) began commercial service in 1957. It was deactivated in early 2015, but may be re-activated in the future. The remaining generating unit, Unit 4 (551 MW), began commercial operation in 1963 and is currently the sole operating unit at the station. Thus, compared to pre-2010 historical operations, the current rated capacity of the WCGS is substantially less, by approximately fifty percent, than its previous maximum total rated capacity. (Ex. 4, at Appendix D, pps. D-1 to D-4)

2. Operating Characteristics of the Condenser Cooling System (Section 106.1130(a)(3))

WCGS operates in an open-cycle cooling mode. Under its current single-unit operation, Unit 4 draws water from an intake structure in the lower Lockport Pool of the CSSC at River Mile 295.6. When in operation, Unit 3 draws water from a separate, but immediately adjacent, intake structure. Both intakes are flush with the canal shoreline and are designed to withdraw water from the entire water column.

Once drawn, this water passes through the Station's heat exchangers and discharges directly back into the CSSC through a short discharge canal which is oriented downstream. The Station discharges wastewater in accordance with NPDES Permit No. IL0002208, issued by the Agency on May 15, 2014, as modified April 24, 2017. A copy of the WCGS NPDES Permit is included in Exhibit 5. The thermal discharge from WCGS is designated in the NPDES Permit as "Outfall 001." The thermal discharge is subject to the thermal limitations provided in Special Condition 4 of its NPDES Permit. (Ex. 5 at p.8). The thermal discharge is allowed a 26-acre mixing zone and the currently effective ALU B thermal water quality standards apply at the edge of the mixing zone. (*Id.* at Special Conditions 4.A. and D.1.)

There are no supplemental cooling mechanisms at WCGS. WCGS has consistently met the currently effective ALU B thermal water quality standards (formerly known as, the "Secondary Contact and Indigenous Aquatic Life" standards) at the edge of the allowed 26-acre mixing zone without the need for supplemental cooling. Due to the limited amount of open property on site, there is not sufficient space for the installation of the number of helper towers necessary to provide a significant reduction in discharge temperature to meet the new thermal water quality standards

that become applicable on July 1, 2018.[2] In addition, due to the presence of a large amount of electrical transmission infrastructure (owned and operated by Commonwealth Edison Company), there are few, if any feasible locations for the construction of supplemental cooling technologies. A 2011 study was performed by Sargent and Lundy to explore the feasibility of installing supplemental cooling at the Station.[3] That study, which included broad assumptions regarding the cost of relocating infrastructure and other site-specific concerns, concluded that the estimated order of magnitude capital cost to provide closed-cycle cooling for WCGS Units 3 and 4, (which would still not assure 100% compliance with the General Use thermal limitations under all conditions), was approximately $257 million (2011) dollars. This estimate does not include significant annual operation and maintenance or the auxiliary power costs associated with running such a system.

3. Load Factor for Past 5 and Next 5 Years (Section 106.1130(a)(4)-(5))

The history of the WCGS load factor for the past 5 years is as follows:

Year	2013	2014	2015	2016	2017**
Load Factor	58.1%	61.1%	54.7%	47.2%	9.6%
Number of Units Operating	2	2	1-2*	1	1

* – Unit 4 operated throughout 2015. Unit 3 ceased operations in April 2015.

** – Unit 4 began an outage on April 29, 2017, which continues to the present, to address an issue regarding the low-pressure steam turbine rotors. The outage explains why the 2017 load factor is significantly lower than the load factors for 2013 through 2016. Unit 4 is expected to be returned to service before the end of February 2018.

The projected load factors for the WCGS for the next 5 years are as follows:

Year	2018	2019	2020	2021	2022
Load Factor	40.0%	45.2%	38.8%	28.5%	28.6%

[2] The Board has previously noted that while all provisions of the 2018 Thermal Standards have been in "effect" since June 2015, only the interim limits in subsection 302.408(b) are currently "applicable" to ALU B waters. See R:08-09D, *Board Order on Motion to Clarify*, at 3 (Aug. 20, 2015).

[3] *See* Pre-Filed Testimony of Ray Henry, PCB R08-9C (Feb. 1, 2011), available at: http://www.ipcb.state.il.us/documents/dsweb/Get/Document-71291.

4. Estimated Retirement Date for Will County Station. (Section 106.1130(a)(6))

The estimated retirement date for the Station is 2034.

5. Plant Shutdowns (Section 106.1130(a)(7)-(9))

i. History of Plant Shutdowns for Past 5 Years (Planned and Emergency)

The planned and emergency shutdowns of WCGS Units 3 and 4 are listed in Exhibit 6. During the last 5 years, the two units have had a combined 604 outage days. This total does not include the days that Unit 3 has been deactivated from April 29, 2015, to the present.

ii. Planned and Projected of Plant Shutdowns for Next 5 Years

The planned and projected shutdowns of WCGS Unit 4 for the next 5 years are as follows:

- 1/26/2018 to 2/28/2018 (33 days) – Projected completion date of ongoing repairs.
- 4/27/2019 to 5/6/2019 (9 days) - Planned

Because MWGen does not currently have a plan for resuming operations at WCGS Unit 3, it does not have any planned or projected "shutdowns" during that time.

B. Description of Method for Heat Dissipation (Section 106.1130(b))

1. Type of Cooling System

WCGS has been operated with a once-through cooling water system since it began operations (Units 1 and 2 in 1955, Unit 3 in 1957, and Unit 4 in 1963). The CSSC is the single-surface water intake source for cooling water for WCGS. The Station utilizes a once-through circulating water system for condenser cooling.

Under its current single unit operation, cooling water is passed through the system at a design rate of approximately 570 MGD (395,842 gpm). Unit 3, when in operation, had a design flow rate of approximately 294 MGD (204,000 gpm). This water passes through the Station's heat exchangers and discharges directly back into the CSSC through a short discharge canal that is oriented downstream. The design temperature rise of the Unit 4 cooling-water discharge is 11.1°F and is similar for Unit 3. WCGS maintains its condenser tubes through dehumidification, which involves isolating and drying individual intake water boxes with residual heat. No chemicals are

used in this process. This practice is much more environmentally benign than the use of chlorination.

Circulating water used to cool and condense steam from the generating process is discharged to the CSSC. This discharge (shared by Units 3 and 4, and previously Units 1 and 2 as well) is located at the downstream end of the Station property and is oriented in a downstream position adjacent to the CSSC wall. Cooling water, once passed through the cooling condensers, exits the plant through this approximately 250-foot discharge canal which leads directly back to the CSSC. There are no flow controlling structures or gates associated with the WCGS discharge canal.

2. Summary Information on Temperature of Discharge to Receiving Waters in Narrative Form

To assess the actual effects of the WCGS thermal discharge, the Demonstration Report reviews thermal intake and discharge data covering the period from 2011-2016. From 2011 to April 2015, WCGS sometimes operated Units 3 and 4 simultaneously (approximately 40% of the time during the summer.) The mean summer discharge temperatures from 2011-2016 were all below 90°F, with the highest monthly mean occurring in July (88.2°F) (See Ex. 4, Appendix D, at Table D-1a). During July, the number of hours with discharge temperatures above 90°F exceeded 300 hours during 2011, 2012, and 2016 and exceeded 100 hours in 2013 (See id. at Table D-3a). During August, there were over 200 hours that discharge temperatures exceeded 90°F in 2011 and 2012. (Id. at Table D-1a) Similarly, the WCGS discharge temperature exceeded 93°F for over 100 hours in July during 2011, 2012, and 2013 and in August of 2012 and 2016. (Id.)

The Demonstration Report also closely reviews the winter (*i.e.*, December through March) intake and discharge temperatures for the 2011-2016 period of record. The highest temperatures during the winter 2011-2016 period were typically encountered in either December or March. (See id. at Table D-1b). The winter monthly means were all below 60°F, with the highest monthly means occurring in December (57.6°F) and March (58.2°F). (Id.) Intake temperatures during the month of March exceeded 60°F more than 5% of the time, while the upper 35th percentile discharge temperatures exceeded 60°F for both December and March. (Id. at Table D-1b.) Even during the consistently colder months of January and February, discharge temperatures exceeded 60°F up to 5% of the time, with maximums of 69.2°F and 68.6°F, respectively. (Id.)

C. Summary of compliance or non-compliance with thermal requirements at the WCGS facility in the last 5 years. (Section 106.1130(c).)

For thermal discharges, based on the existing thermal water quality standards and IEPA's approval of an allowed mixing zone for thermal discharges, the WCGS NPDES Permit provides that at the edge of the allowed 26-acre mixing zone, temperatures shall not exceed 93°F (34°C) more than 5% of the time, or 100°F (37.8°C) at any time. (Ex. 5 at p.8) For compliance monitoring purposes, MWGen uses an IEPA-approved Near-Field Thermal Model to determine the temperature of the CSSC at the boundary of WCGS's 26-acre mixing zone.[4] (Id.) The Near-Field Thermal Model utilizes real-time station operating data and 24-hour antecedent flow to calculate fully mixed temperatures in the main body of the waterway. (See Ex. 5, at Appendix D, Exhibit D) The results produced by the Near-Field Thermal Model have been demonstrated to be equivalent to the approximate edge of the allowed 26-acre mixing zone for WCGS.

Under Special Conditions 4.B and 4.C of the Station's NPDES Permit, the thermal discharge is also subject to alternate temperature limitations that are applicable in the main channel of the Lower Des Plaines River at the I-55 Bridge, where the General Use designation for these downstream waters begins. (Ex. 5, at p.8) These alternate thermal standards were requested by ComEd, the previous owner of the WCGS, pursuant to 35 Ill. Adm. Code 304.141(c) and CWA Section 316(a) and granted by the Board in 1996 pursuant to Section 28.1(c) of the Illinois Environmental Protection Act. *See* AS 96-10, dated Oct. 3, 1996 (amended Mar. 16, 2000). The Board granted the adjusted thermal standards after ComEd (which then owned WCGS) "presented adequate proof" that WCGS's impact on water temperatures past the I-55 Bridge were not sufficient to cause appreciable harm to the aquatic community. (*Id.* at 7.)

Originally, the AS 96-10 alternate thermal effluent limitations applied to the operations of four additional MWGen generating stations: Joliet #9, Joliet #29, Crawford, and Fisk. However, today the Joliet Stations and WCGS are the only stations still in operation. Also, Joliet #9 and #29 Generating Stations were converted from coal-fueled to natural gas in 2016 and are now operated as "peaking facilities" only during periods of peak system electrical demand. Demonstration studies to evaluate the new operating mode of the Joliet Generating Stations commenced in 2017

[4] The WCGS Near-Field Thermal Model was patterned after IEPA's Illinois Point Source Strategy for Waste Load Allocation document dated January 17, 1991. Special Condition 4.D.1 of the WCGS NPDES Permit requires the use of the model for the prediction of downstream river temperatures at the edge of the mixing zone and for monitoring of the use of excursion hours.

and are still in progress. It is necessary to study both the thermal discharges from the WCGS and the thermal discharges from the Joliet Stations in order to determine whether the I-55 Bridge alternate thermal standards will continue to be needed in the future. Accordingly, until the demonstration studies for the Joliet Stations are completed, MWGen does not have the information necessary to evaluate whether the WCGS thermal discharge will need some form of the I-55 Bridge alternate thermal standards going forward. MWGen intends to evaluate that issue as part of the 316(a) Demonstration Studies for the Joliet Stations. Therefore, no changes or modifications to the current I55-Bridge alternate thermal standards are being requested at this time.

The WCGS has complied with the existing thermal discharge limitations and conditions in its NPDES Permit for the last five years (2013-2017).

D. Detailed Plan of Study Submitted to the Agency under Section 106.1120(a) and the Agency's Written Response under Section 106.1120(f).

As stated above, a Detailed Study Plan in support of the WCGS 316(a) Demonstration was developed and submitted to both the IEPA and the IDNR on December 5, 2015. Agency approval of the detailed study plan was provided in written correspondence dated March 3, 2016. IDNR raised questions regarding the plan and MWGen addressed those questions to IDNR's satisfaction, resulting in IDNR approval, by email, on June 9, 2016. A copy of the IEPA and IDNR written approvals are attached as Exhibits 1 and 2.

Both the IEPA and U.S. EPA were also consulted in November 2016 regarding proposed modifications to the Detailed Study Plan which, if acceptable, would assist in expediting the completion of the 316(a) Demonstration Study while still providing the necessary supporting study data. Based on consultation with both agencies, the study plan was revised on December 5, 2016 on technical points related to the use of particular sources of habitat and fisheries data. The Illinois EPA provided written approval of the modified study plan on December 12, 2016, a copy of which is attached as Exhibit 3.

E. The Results of the Studies Conducted under the Detailed Plan of Study. (Section 106.1120(e).)

The WCGS § 316(a) Demonstration Report included with this Petition as Exhibit 4 is a voluminous report that presents the detailed information, data and findings supporting the requested thermal AEL. It is based on over 40 years of monitoring and analyses of the fauna and ecosystems associated with the CSSC in the vicinity of the WCGS. The Demonstration Report presents both prospective (Appendix B) and retrospective (Appendix C) analyses which show that the proposed thermal AELs will assure the protection and propagation of a BIC. It provides the required demonstration, meeting the requirements of the Subpart K regulations and the § 316(a) criteria, as outlined in the U.S. EPA's "Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements (DRAFT)" dated May 1, 1977 ("Draft 316(a) Guidance Manual"), that considering the impact of the WCGS thermal discharge, both individually and cumulatively with all other significant impacts on the species affected:

> (a) the generally applicable thermal water quality standard is more stringent than necessary to assure the protection and propagation of a balanced and indigenous community of shellfish, fish, and wildlife in and on the receiving water; and
>
> (b) the requested alternative thermal effluent limitation assures the protection and propagation of a balanced and indigenous population of shellfish, fish, and wildlife in the receiving water.

The Demonstration Report begins with a summary of all the information presented. Appendix A describes the CSSC in detail, while Appendices B and C respectively provide the above-described prospective and retrospective assessments. Appendix D details the operations at WCGS and recent hydrothermal analysis of the WCGS discharge, including thermal plume studies performed in 2016 and 2017. Appendix H presents the prior thermal plume study performed at WCGS in 2011. Appendix E reviews the various WCGS data collection programs that are referenced throughout the Demonstration Report. Appendices F and G present annual fisheries monitoring reports from 2015 and 2016.

As required by Section 106.1120(e)(1)-(4) of the Subpart K regulations, the results of the studies conducted under the WCGS Detailed Plan of Study are presented below. Additionally, a draft of the WCGS 316(a) Demonstration Report was provided to IEPA for review on

September 29, 2017. All comments received from the Agency were addressed and have been incorporated into the final document included with this Petition.

1. Background on Proposed Thermal Standards

The CSSC, which is the receiving stream for the WCGS thermal discharge, was formerly designated as a Secondary Contact and Indigenous Aquatic Life Water ("Secondary Contact Waters") under the Illinois use designation system in Part 303 of 35 Ill. Adm. Code. Due to the inherent limitations of the Chicago Area Waterway System ("CAWS"), of which the CSSC forms a part, these Secondary Contact waters were regulated by a set of water quality limitations that were less stringent than the General Use water quality standards that applied to most waters of the state. The waterway is heavily influenced by hydromodification, channelization, alterations in flow, wastewater discharges, and other factors that limit the kinds of aquatic life that can be maintained there. (Ex. 4, Appendix A.)

Since the adoption of the Secondary Contact Waters water quality standards in the 1970s, water quality improved over the years as the result of point source discharge controls, including wastewater control technology advances by publicly owned treatment works, which generated interest in revising the applicable designated uses and standards. In 2007, the Agency presented two use attainability analyses (UAAs) to the Board, and submitted that these studies indicated that the CSSC and other portions of the CAWS had attained, or had the potential to attain, higher designated recreational and aquatic life uses under the Clean Water Act than those provided by the Secondary Contact Waters designation.

The ensuing Board rulemaking, initiated on October 26, 2007, lasted several years. Ultimately, the Board redesignated the CSSC near WCGS from a Secondary Contact and Indigenous Aquatic Life water to a "Chicago Area Waterway System Aquatic Life Use B" or "ALU B" water. This designation is defined in the regulations as follows:

> Waters designated as Chicago Area Waterway System and Brandon Pool Aquatic Life Use B Waters are capable of maintaining, and shall have quality sufficient to protect, aquatic life populations predominated by individuals of tolerant types that are adaptive to unique physical conditions and modifications of long duration, including artificially constructed channels consisting of vertical sheet-pile, concrete and rip-rap walls designed to support commercial navigation, flood control, and drainage functions in deep-draft, steep-walled shipping channels. Such aquatic life may include, but is not limited to, fish species such as common carp, golden shiner, bluntnose minnow, yellow bullhead and green sunfish.

35 Ill. Adm. Code 303.240.

The CSSC is also the location of the U.S. Army Corps of Engineers Aquatic Nuisance Species Barrier Project, commonly referred to as the "Electric Barrier." Because the CSSC provides a two-way corridor for the passage of aquatic invasive species between the Illinois River and Lake Michigan, the Electric Barrier restricts the movement of fish between these waters and within the CSSC. It is located immediately upstream from WCGS. In the CAWS UAA proceeding, the Board determined that the electric barrier is a "temporary" use that is protected in the lower CSSC. *See in the Matter of: Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code 301, 302, 303, and 304*, PCB R08-9(C), slip op. at 8 (Feb. 6, 2014).[5]

In Subdocket D of the CAWS UAA Rulemaking, the Board subsequently concluded that General Use thermal water quality standards should apply in ALU B waters. The Board recognized that some thermal dischargers would need to seek additional relief from these thermal standards and noted that relief mechanisms such as the pursuit of alternate thermal effluent limitations were available. To allow dischargers like MWGen to pursue that relief, the Board delayed application of the thermal standards until three years after the 2015 effective date of the UAA rulemaking. *See in the Matter of: Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System and Lower Des Plaines River: Proposed Amendments to 35 Ill. Adm. Code 301, 302, 303, and 304,* PCB R08-9(D), slip op. at 77 (Mar. 19, 2015). Thus, the Board adopted the following temperature standards for the ALU B CSSC near WCGS that, upon becoming applicable on July 1, 2018, will reflect the most stringent thermal standards in the state:

Section 302.408 Temperature

b) The temperature standards in subsections (c) through (i) will become applicable beginning July 1, 2018. Starting July 1, 2015, the waters designated at 35 Ill. Adm. Code 303 as Chicago Area Waterway System Aquatic Life Use A, Chicago Area Waterway System and Brandon Pool Aquatic Life Use B, and Upper Dresden Island Pool Aquatic Life Use will not exceed temperature (STORET number (°F) 00011 and (°C) 00010) of 34°C (93°F) more than 5% of the time, or 37.8°C (100°F) at any time.

c) There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.

[5] The Board did not include the Electric Barrier as a protected use in the definition of ALU B waters because it is only in place in the CSSC and not in all of the ALU B waters covered by this use designation. *Id.* at 11.

d) The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.

e) The maximum temperature rise above natural temperatures shall not exceed 2.8°C (5°F).

f) Water temperature at representative locations in the main river shall not exceed the maximum limits in the applicable table in subsections (g), (h) and (i), during more than one percent of the hours in the 12-month period ending with any month. Moreover, at no time shall the water temperature exceed the maximum limits in the applicable table that follows by more than 1.7°C (3.0°F)

g) [*Subsection (g) contains the water temperature standards for "Aquatic Life Use A" waters (35 Ill. Adm. Code 303.235) which are not applicable to the CSSC or the WCGS discharge*]

h) Water temperature in the Chicago Area Waterway System and Brandon Pool Aquatic Life Use B waters listed in 35 Ill. Adm. Code 303.240, shall not exceed the limits in the following table in accordance with subsection (f):

Months	Daily Maximum (°F)
January	60
February	60
March	60
April	90
May	90
June	90
July	90
August	90
September	90
October	90
November	90
December	60

(Source: Amended at 39 Ill. Reg. 9388, effective July 1, 2015)

Because the WCGS NPDES Permit provides for an allowed mixing zone for the thermal discharge, the WCGS thermal discharge is also subject to the requirement in 35 Ill. Adm. Code 302.102(b)(6) that the allowed mixing zone must provide "for a zone of passage for aquatic life in which [thermal] water quality standards are met." Section 302.102(b)(8) mandates that the

area and volume in which mixing occurs "must not contain more than 25% of the cross-sectional area or volume of flow of a stream except for those streams for which the dilution ratio is less than 3:1." In other words, a zone of passage of 75% or more of the cross-sectional area of the waterway must be maintained. When the dilution ratio drops below 3:1, a smaller zone of passage of 50% or more of the cross-sectional area of the waterway is allowed.

WCGS remains in full compliance with the interim temperature standards imposed by Section 302.408(b). Further, based on the hydrothermal modeling results presented in the Demonstration Report, under typical winter weather and canal flow conditions, the WCGS also would nominally meet the new 2018 Thermal Standards, even though those standards apply a numeric temperature limit that is 33°F cooler than the previously applicable Secondary Contact Waters limit. (Ex. 4, Appendix D.) But, during unseasonably warm winter weather conditions (most often encountered in December and March) and/or during low-flow conditions, the WCGS thermal discharge would be unable to meet the 2018 Thermal Standards' numeric winter limit of 60°F, and would often exceed the maximum limit of 63°F. (Id.)

Modeling results also indicate that compliance with the 2018 Thermal Standards' summer limits would not be consistently assured. During typical summer conditions, and with favorable canal flows, the WCGS is not expected to exceed the 90°F thermal standard outside its 26-acre mixing zone. (Id.) But, under "worst case" summer conditions (historically high intake temperatures combined with chronically low waterway flows), WCGS would be unable to consistently meet an edge-of-mixing-zone limit of 90°F. (Id.) During these "worst case" summer conditions, there might not be enough flow available in the CSSC to dissipate discharge temperatures sufficiently to meet the applicable thermal standards at the edge of the allowed 26-acre mixing zone. During these periods, which are concurrent with hot, dry, conditions, WCGS will typically be operating at higher load factors in order to produce power to serve customer demand.

The 2018 Thermal Standards do allow for excursion hours (1% of the hours in any 12-month period, equivalent to approximately 87 hours per year), but this does not meaningfully increase WCGS's ability to comply with the limits. The small number of allowable excursion hours provided by the 2018 Thermal Standards would be entirely insufficient to support WCGS operations during both the summer and winter months, especially if unseasonal weather patterns and/or low flow conditions persisted during a given year.

With respect to the zone of passage requirements in 35 Ill. Adm. Code 302.102(b)(8), the WCGS thermal plume studies conducted in the waterway in 2011 and 2016/early 2017 all showed that a zone of passage of greater than 50% was maintained, despite the erratic flow conditions in the CSSC. However, the conservative thermal plume modeling conducted as part of the Demonstration Studies indicates that the WCGS thermal discharge will not be able to comply with the 75% zone-of-passage requirement at all times in every portion of its 26-acre mixing zone when high ambient temperatures coincide with relatively lower flow conditions in the CSSC. Because of the frequent and erratic changes in flow in the canal system, which occur on a year-round basis, the effective dilution ratio at any given time cannot be accurately assessed. For this reason, WCGS is requesting as part of its proposed AELs that the minimum zone-of-passage requirement under Section 302.102(b)(8) be modified to allow a 50% zone of passage or greater, at all times. As discussed further below and in the attached Demonstration Report, allowing a 50% zone-of-passage will assure the protection and propagation of a BIC in the CSSC.

The Demonstration Report shows that there is no evidence that operation of WCGS in accordance with the former Secondary Contact Waters thermal limits, nor the identical current interim thermal limits applicable until July 1, 2018, have caused appreciable harm to a BIC in the CSSC. The numeric thermal AELs proposed for WCGS in this petition are more stringent than the prior Secondary Contact and Indigenous Aquatic Life limits and logically should also not result in any such appreciable harm. The 316(a) Demonstration Report data and analysis demonstrates that the BIC will be protected under the proposed thermal AELs.

MWGen is also proposing that the Board adopt alternate thermal standards that provide for a more seasonally-based progression between the proposed summer and winter AELs, thereby further limiting the need for a specific delta-T provision to minimize abrupt changes in the receiving water temperature. The ALU B thermal standards provide for abrupt standards changes from March to April (60°F to 90°F) and from November to December (90°F to 60°F). As the chart below illustrates, the proposed thermal AELs for several of the transition months (April, May, and November) are *more* stringent than the corresponding limits under ALU B and closer to seasonal temperatures expected in the CSSC.

Month	Prior Secondary Contact Standards & Interim 35 IAC § 302.408(b) Standards (effective 1 July 2015-30 June 2018)	2018 ALU B Thermal Standards (Applicable July 1, 2018)**	Proposed WCGS Thermal AELs
	Daily Maximum	Daily Maximum	Daily Maximum
	(°F)	(°F)	(°F)
January	93	60	70
February	93	60	70
March	93	60	75
April	93	90	80
May	93	90	85
June	93	90	93
July	93	90	93
August	93	90	93
September	93	90	93
October	93	90	90
November	93	90	85
December	93	60	75
Excursion Hours	Shall not exceed 93°F more than 5% of the time, or 100°F at any time	Shall not exceed maximum limits during more than 1% of the hours in the 12-month period ending with any month; At no time shall water temperature exceed the maximum limits by more than 3.0°F[6]	Daily maximum not to be exceeded by more than 5% of the time in a calendar year; at no time shall water temperature exceed the maximum limits by more than 3°F

The requested numeric thermal AELs will protect the BIC in lieu of other narrative criteria found in Section 302.408(c)-(f). Further, as the Demonstration Report explains, the requested AELs would also replace Section 302.102(b)(8)'s requirements, and instead allow for a zone of passage

[6] 35 Ill. Adm. Code 302.408 expresses the maximum limit as "3.0°F". This phrasing is different from otherwise similar language in the General Use thermal standard in 302.211(e), which expresses the maximum excursion limit range as "3°F": "Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 1.7° C (3°F)." The AS 96-10 alternative thermal standard in the NPDES Permit, which replaced the otherwise applicable General Use thermal standards, also expresses the maximum excursion limit as "3°F". Because the 2018 ALU B thermal standards were intended to be consistent with the General Use thermal standards, the AEL maximum excursion temperature proposed in this petition is also "3°F".

of 50% or greater to be maintained at all times, as this would still assure adequate protection of the BIC in the CSSC.

2. Methods and Conclusions of Retrospective Studies

The Demonstration Report uses a retrospective analysis of aquatic community monitoring data collected during WCGS operations over the past 20 years. This extensive biological database was collected during a period when the less-stringent Secondary Contact and Indigenous Aquatic Life standard applied. The data analyzed includes data collected in the vicinity of the WCGS discharge during four-unit, two-unit and the current single-unit operation.

The retrospective evaluation was conducted in two parts. First, the condition of each biotic category as a whole was analyzed by comparing available information on its abundance and species composition to what would be expected based on existing habitat, flow, and chemical characteristics of the CSSC near WCGS. Second, the long-term trends in abundance for each of the biotic categories within the canal community were analyzed to determine whether a change in population abundance has occurred that can be attributed to the operation of WCGS. (See Ex. 4, Appendix C.) Taken together, the biotic category and long-term trend analyses provide a thorough and technically sound assessment of the status of the biological community in the CSSC near WCGS, consistent with § 316(a) guidance and practice.

The aquatic community protected by § 316(a) includes different biotic categories including phytoplankton, habitat formers, zooplankton, mussels and macroinvertebrates, fish, and other vertebrate wildlife. The WCGS Detailed Study Plan, like many § 316(a) studies before it, proposed focusing on the local fish community. The Illinois EPA provided input on and approved this approach. Focusing on fish is practical and is based on the reasonable assumption that significant disruption at lower trophic levels will be reflected in the fish community that relies on those biotic communities for food. Nonetheless, the Demonstration Report collects and summarizes available data on all of the biotic categories, providing individual summaries of each. (Id.)

Based on the years of studies, data and other information evaluated for the different biotic categories of the CSSC aquatic community, the Demonstration Report reaches several conclusions:

1. There have been no substantial increases in abundance or distribution of any nuisance species or heat-tolerant community;
2. There have been no substantial decreases of formerly abundant indigenous species other than nuisance species;
3. There had been no elimination of an established potential economic or recreational use of the waters;
4. There have been no reductions in the successful completion of life cycles of indigenous species, including those of migratory species;
5. There have been no substantial reductions of community heterogeneity or trophic structure;
6. There have been no adverse impacts on threatened or endangered species;
7. There has been no destruction of a unique or rare habitat; and
8. There have been no detrimental interactions with other pollutants, discharges, or water-use activities.

The retrospective studies also show that the proposed AELs would be protective of the aquatic community even if WCGS resumed two-unit operation. The lower Lockport Pool (Pool) of the CSSC, which is where WCGS is located, has undergone extensive biological monitoring by MWGen since 2005. During this time, WCGS has operated as a 4-unit (2005-2010), 2-unit (2010-2015) and 1-unit (2015-present) facility. Yet, sampling has shown few changes in the aquatic community in the Pool during that time. IWBmod, a score that scientifically quantifies fish community well-being, reflects very little impact: The Pool produced an average IWBmod score of 3.2 during 4-unit operations, 3.3 during 2-unit operations, and 3.0 during 2-unit operations. (Ex. 4, Appendix C, Tables C-8 and C-9.) Measurements of relative fish weights, also show that the aquatic community in the Pool remained in relatively good condition during that period of time, regardless of the number of units operating at WCGS in a given year. (Id. at Table C-12.) The Demonstration Report indicates that the BIC will be adequately protected by the proposed AEL even if WCGS returns to operating as a 2-unit facility.

3. Methods and Conclusions of Predictive Studies

The Demonstration Report also utilizes predictive studies to assess whether the proposed AELs will "assure the protection and propagation of a balanced, indigenous, community of shellfish, fish, and wildlife." This approach uses quantitative hydrothermal modeling to predict thermal conditions under various operating and ambient flow conditions, integrated with metrics of thermal requirements and tolerance limits identified in scientific literature for selected aquatic species representative of the BIC. This prospective analysis is used to predict the response of the aquatic community and receiving water body to the WCGS thermal discharge plume. For this Demonstration, a three-dimensional hydrodynamic mathematical model (MIKE 3) was developed, calibrated and validated using actual measured data from prior and current thermal plume studies performed at WCGS, which increases the reliability of the modeling results. (Ex. 4, Appendix D.) It was used to estimate ambient temperatures under various weather, canal flow, and WCGS thermal plume conditions (including six representative flow and temperature scenarios). (Id.) The hydrothermal modeling effort provided predictive information regarding "worst case," as well as more typical thermal compliance scenarios under the expected range of conditions under which WCGS operates during the summer and winter. As explained further below, the data from the modeling effort, along with historical station operating information, weather and canal flow records, provided the basis for development of the proposed thermal AELs for summer, winter and the transitional months.

Collectively, the hydrothermal model and predictive analysis were integrated with representative important species ("RIS") life history requirements to develop proposed WCGS summer and winter thermal AELs that are protective of the CSSC BIC. The RIS, selected under the criteria found in the U.S. EPA's 1977 Draft 316(a) Guidance Manual, were Gizzard Shad (*Dorosoma cepedianum*), Bluntnose Minnow (*Pimephales notatus*), Banded Killifish (*Fundulus diaphanous menona*), Common Carp (*Cyprinus carpio*), Channel Catfish (*Ictalurus punctatus*), Green Sunfish (*Lepomis cyanellus*), and Largemouth Bass (*Micropterus salmoides*).[7] (Ex. 4, Appendix B, at pp. B-7 to B-9.) The model was calibrated and validated for the seasonal conditions using a recent bathymetric survey and field surveys of water temperature under various canal flow

[7] This was identical to the RIS list contained in the Detailed Study Plan approved by the Agency. It also was presented to the U.S. EPA during the November 2016 consultation with the Agencies concerning the modifications to the Detailed Study Plan.

and weather conditions conducted during 2011, 2016 and early 2017. (Id. at Appendix D.) The calibrated model was used to estimate water temperature within each model cell under various ambient flow and station operating scenarios by simulating dilution and dispersion of elevated thermal plume temperatures. (Id.) Model-estimated cross-section and bottom water temperatures are compared to biothermal metrics to estimate the extent of otherwise available aquatic habitat that would be excluded or would be at less than optimum conditions for selected life history functions (*e.g.*, spawning, growth, and survival) of RIS due to water temperature, while still allowing for an adequate zone of passage.

The predictive analysis in the Demonstration Report found that the thermal limits outlined in the proposed AEL would produce acceptable temperature conditions for the RIS species and the broader aquatic community. The analysis further shows that during "worst case" conditions, local aquatic life will be able to avoid the heated waters by utilizing the available zone of passage maintained at lower temperatures for the relatively short period of time necessary for the heat to dissipate. (Id. at Appendix B.) The proposed AELs would provide sufficient limits on heated effluent such that the CSSC will maintain a zone of passage even under worst-case scenarios. During most of the year, under various discharge, flow and ambient temperatures, the zone of passage will include 75% or more of the cross-sectional area of the canal. (Id. at Appendix D.) Even under what may be termed "worst case scenarios," conservative modeling results support the conclusion that a 50% zone of passage would be maintained. (Id.) Finally, the Demonstration Report's modeling shows that the proposed AELs will also serve to maintain acceptable water temperatures for spawning (most of the species studied spawn earlier in the season than the typically warmer temperature months of July and August) and growth cycles.

4. Potential for Cold Shock Mortality

The Demonstration Report also assessed the potential for "cold shock" mortality. (Id. at Appendix B, p. B-34.) Cold shock occurs when fish become acclimated to an elevated waterway temperature during winter months, but a sudden termination of the heat source causes a rapid drop in temperatures that can, in extreme circumstances, result in fish kills. The magnitude of the change in temperature is important, but the driving factor in whether that change will harm the aquatic community is how cold the water becomes. At final temperatures exceeding 45°F, cold shock typically does not occur, regardless of the magnitude of the change. (Id.)

The CSSC is an unnatural waterway dominated by effluent from the Metropolitan Water Reclamation District of Greater Chicago's (MWRDGC) Stickney water reclamation plant. Winter ambient temperatures in the CSSC are normally near 50°F. Thus, even if the WCGS immediately stopped discharging heated effluent, this would not harm the aquatic community. Furthermore, the decay of the near-field thermal plume of the WCGS discharge is not extremely rapid after a shutdown in operations. There is residual heat in the system following a shutdown, such that temperatures of the discharge will remain elevated for a period of time as the Station's circulating water pumps generally continue to operate as the equipment is cooled. Therefore, the decline in temperature of the near-field plume is relatively gradual (hours versus minutes) in the event of a shutdown.

F. Overall Thermal Demonstration Conclusions

The retrospective assessment shows that there have been no substantial changes in abundance of nuisance species or in the physical and biological components of the ecology of the CSSC during the past 23 years of biological monitoring data collected near WCGS. During most of those 23 years, the CSSC was subject to thermal standards that were significantly less stringent than both the 2018 Thermal Standards and the standards contained in the proposed AEL. And during that time, the waterway was subject to significantly more thermal loading: For much of that period, WCGS had four generating units (it only has one today), and there was additional upstream thermal loading from the Crawford and Fisk generating stations, both of which have been inactive since 2012. Even with these reductions in thermal loading, the waterway continues to be dominated by tolerant and highly tolerant species.

The predictive assessment also provides reasonable assurance that the proposed AELs will allow for the protection and propagation of the BIC. The thermal standards in the proposed AEL are designed to maintain temperatures that are consistent with normal patterns of growth for aquatic life in the CSSC. The proposed AEL also considers the elevated temperatures that may be reached during "worst case" scenarios where elevated ambient air and water temperatures coincide with instances of low water flow in the CSSC. The proposed AEL allows for excursion hours so that WCGS can continue to remain in compliance during these periods of time—the Demonstration Report shows that, because the species inhabiting the CSSC are generally tolerant and have the ability to sense and avoid areas of water temperatures outside of their preferred range, these

temporary instances of increased thermal discharge temperatures will not fundamentally change the habitability of the CSSC.

The Demonstration Report documents that even during "worst case" conditions, the zone of passage for aquatic life under Section 302.102(b)(8) will be maintained. Based on review of historical operating and canal flow data, it is expected that a 75% or greater zone of passage under the proposed thermal AELs would be available in the CSSC near WCGS most of the time. (Ex. 4, Appendix D.) However, due to the frequency of erratic flow fluctuations, a zone-of-passage standard based on the dilution ratio occurring at any given time is difficult or impossible to determine for the volatile flow regime of the CSSC. The Demonstration Study shows that if the zone-of-passage standard is a 50% cross-sectional area or greater, regardless of the dilution ratio, this will not impair the ability of fish to move both upstream and downstream of the WCGS thermal plume area. (Demonstration Summary Document, Sec. 5.1) Accordingly, this zone-of-passage standard will assure the protection and propagation of a BIC in the CSSC.

G. Additional Information or Studies (Section 106.1130(f))

Each appendix of the Demonstration Report lists the other studies and guidance documents relied on by that section.

H. Statement of Requested Relief (Section 106.1130(g))

In lieu of the Chicago Area Waterway System Aquatic Life Use B thermal water quality standards provisions contained in 35 Ill. Adm. Code 302.408 (c)-(f), and (h) and the zone-of-passage requirement in 35 Ill. Adm. Code 302.102(b)(8) of the mixing zone regulations, MWGen respectfully requests that the Board find that the attached Demonstration Report adequately demonstrates that the following thermal effluent limits will allow for the protection and propagation of a balanced indigenous, community in the Chicago Sanitary and Ship Canal:

> (1) Water temperature at representative locations in the Chicago Sanitary and Ship Canal shall not exceed the maximum limits listed below for more than 5% of the time in a calendar year. Moreover, at no time shall water temperature exceed the daily maximum limit by more than 1.7°C (3°F).
>
> (2) A zone of passage for aquatic life in which the proposed thermal alternative effluent limits are met shall be maintained at 50% or greater at all times.
>
> (3) Proposed Numeric Thermal Alternative Effluent Limits for Will County Generating Station:

Month	Daily Maximum (°F)
January	70
February	70
March	75
April	80
May	85
June	93
July	93
August	93
September	93
October	90
November	85
December	75
Excursion Hours	Daily maximum not to be exceeded by more than 5% of the time in a calendar year; at no time shall water temperature exceed the maximum limits by more than 3°F

The above proposed thermal alternative effluent limits for Will County Generating Station are effective at the edge of the allowed 26-acre mixing zone (as determined for compliance monitoring purposes through the continued use of the WCGS Near-Field Model under the terms of its NPDES Permit). As discussed above, these proposed seasonally-based thermal AELs will effectively replace the function of provisions (c), (d), and (e) of the ALU B limits for the CSSC near WCGS which will not be applicable to the WCGS under the proposed AEL. They will also replace 35 Ill. Adm. Code 302.102(b)(8).

IV. CONCLUSION

The Board designated the CSSC as an ALU B water because that waterway has inherent limitations and is not fully capable of attaining the CWA's aquatic life goals. The CSSC is not a natural waterway. In the area near WCGS, it consists primarily of wastewater effluent from the MWRDGC Stickney water reclamation plant, and its flow and level are both artificially controlled by a series of locks and dams in order to effect flood control. Aquatic habitat is severely limited by the physical configuration of the CSSC, with its man-made vertical rock walls and lack of in-stream cover. Advances of aquatic nuisance species in the Upper Illinois Waterway system, unrelated to thermal influences, have required the construction of the Aquatic Nuisance Species Barrier Project to prevent these species from reaching Lake Michigan, which effectively prevents the migration of *all* motile aquatic life upstream in the CSSC. For these reasons, the findings of the extensive UAA rulemaking conducted for the CSSC only a few years ago concluded that the CSSC is properly designated under an ALU B standard that notes the generally poor quality of the habitat there.

Despite these limitations, the Board ruled that these waters should, as a baseline, face the same, stringent, thermal standards as any natural waterbody. MWGen noted at the time that the WCGS, even reduced to one-unit operation, cannot consistently meet those thermal standards. It also presented evidence that, because of those other limiting factors on the waterway, arbitrarily tightening the thermal effluent standards for the CSSC would not produce appreciable ecological benefits.

The Board's response to this was not to reject MWGen's interpretation of the scientific evidence. Instead, it suggested that affected generating stations avail themselves of existing regulatory relief procedures. MWGen has followed the Board's direction. In consultation with

the Agency and the U.S. EPA, MWGen (and its consultant, EA Engineering, Science, and Technology, Inc., PBC, a respected environmental consulting firm) developed a detailed plan for studying the effects of various levels of heat loading on the CSSC. It has now executed that plan.

The WCGS Demonstration is comprised of two studies: one a retrospective demonstration of the effects and non-effects of thermal loading on the waterbody and the other a predictive modeling exercise that studied the three-dimensional movement, accumulation, and dissipation of heat in the CSSC. Both studies found that the proposed AEL will allow for the protection and propagation of a BIC in the waterbody, when either or both Units 3 and 4 of the WCGS are operating. The WCGS Demonstration Report (Exhibit 4) demonstrates that:

> (a) The generally applicable thermal water quality standard is more stringent than necessary to assure the protection and propagation of a balanced and indigenous population of shellfish, fish, and wildlife in and on the receiving water; and
>
> (b) The requested alternative thermal effluent limitation assures the protection and propagation of a balanced and indigenous population of shellfish, fish, and wildlife in the receiving water.

Finally, MWGen also respectfully requests as part of granting the AELs proposed in this petition, because of the impending July 1, 2018 Thermal Standards, the Board should exercise its authority pursuant to 35 Ill. Adm. Code 106.1170(c) to order the IEPA to expeditiously modify WCGS's NPDES permit consistent with the new AELs. *See, e.g., Exelon Generation LLC (Dresden Nuclear Generating Station) v. IEPA*, PCB 15-204, slip op. at 102 (Mar. 3, 2016).

Respectfully submitted,

Midwest Generation, LLC

By: /s/Susan M. Franzetti

Susan M. Franzetti

Dated: January 26, 2018

Of Counsel:

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

TABLE OF EXHIBITS

EXHIBIT 1

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
BRUCE RAUNER, GOVERNOR LISA BONNETT, DIRECTOR

217/558-2012

MAR - 3 2016

NRG
Midwest Generation, LLC
Will County Generating Station
c/o Sharene Shealey, Environmental Manager
529 East 135th Street
Romeoville, Illinois 60446

RE: NPDES No. IL0002208
Midwest Generation – Will County Generating Station
316(a) Plan of Study Approval

Dear Ms. Shealey:

The Agency has reviewed the December 3, 2015 "Detailed Study Plan to Support Alternative Thermal Limits" for the Will County Generating Station. Based on the information provided, the Agency approves the "Detailed Plan of Study to Support Alternative Thermal Limits" thereby satisfying the requirements of 35 IAC 106.1120 (Detailed Plan of Study). The Agency reserves the option to provide further comments if new information becomes available.

If you have any questions or comments regarding this letter, please contact me at the above address and phone number. If you have questions regarding the permit, please call Permit Section at 217/782-0610.

Sincerely,

Scott Twait

Scott Twait
Water Quality Standards Unit
Bureau of Water

SAT:NRG-Will Co-316(a)planofstudy.docx

4302 N. Main St., Rockford, IL 61103 (815) 987-7760
595 S. State, Elgin, IL 60123 (847) 608-3131
2125 S. First St., Champaign, IL 61820 (217) 278-5800
2009 Mall St., Collinsville, IL 62234 (618) 346-5120
9511 Harrison St., Des Plaines, IL 60016 (847) 294-4000
412 SW Washington St., Suite D, Peoria, IL 61602 (309) 671-3022
2309 W. Main St., Suite 116, Marion, IL 62959 (618) 993-7200
100 W. Randolph, Suite 10-300, Chicago, IL 60601

EXHIBIT 2

From: Grider, Nathan
To: Rozic, Nathan J
Cc: Twait, Scott; LeCrone, Darin; Koch, Brian; Rabins, Jaime; Pescitelli, Steve; Wozniak, Julia; Vondruska, Joe; Shealey, Sharene; Grider, Nathan
Subject: RE: Detailed Study Plan for Alternative Thermal Limits - Will Co. Station - IL0002208
Date: Thursday, June 09, 2016 1:13:46 PM
Attachments: IDNR Response for Will County Station, 316(a),5-6-16 Combined,IDNR Response (2).pdf

Hi Nathan,

The Department's response concerning your response to our comments dated march 7, 2016 is attached. We have no further concerns and look forward to the study results and opportunity for further comment in the 316(a) process.

Thank you

Nathan Grider

Biologist

Impact Assessment Section

Illinois Department of Natural Resources

One Natural Resources Way

Springfield, IL 62702

(217) 524-0501

Fax: 217-524-4177

nathan.grider@illinois.gov

From: Rozic, Nathan J [mailto:Nathan.Rozic@nrg.com]
Sent: Friday, May 13, 2016 6:46 AM
To: Grider, Nathan; Shealey, Sharene
Cc: Twait, Scott; LeCrone, Darin; Koch, Brian; Rabins, Jaime; Pescitelli, Steve; Wozniak, Julia; Vondruska, Joe
Subject: RE: Detailed Study Plan for Alternative Thermal Limits - Will Co. Station - IL0002208

Good morning Nathan.

As requested during our April 19, 2016 follow-up conference call, please find attached Midwest Generation, LLC's response to the Department's March 7, 2016 comments regarding the Detailed Study Plan to Support Alternative Thermal Limits for the Will County Generating Station.

Please let us know if you'd also like a hardcopy mailed to you.

We look forward to your formal response to allow us to finalize our Detailed Study Plan over the

next couple of weeks.

Thank you.

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The power to change life.
The energy to make it happen

Nate Rozic
Environmental Manager
NRG Energy Southpointe Operations Center
121 Champion Way
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Canonsburg, PA 15317
Office: 724-597-8630
Mobile: 724-554-6208
Email: nathan.rozic@nrg.com

From: Grider, Nathan [mailto:Nathan.Grider@Illinois.gov]
Sent: Monday, March 07, 2016 3:11 PM
To: Shealey, Sharene
Cc: Twait, Scott; Rozic, Nathan J; Grider, Nathan; LeCrone, Darin; Koch, Brian; Rabins, Jaime; Pescitelli, Steve
Subject: RE: Detailed Study Plan for Alternative Thermal Limits - Will Co. Station - IL0002208

Hello Sharene,

The Department provides the following comments regarding the "Detailed Study Plan to Support Alternative Thermal Limits" for the Will County Generating Station.

1. Recent survey efforts by the Illinois Natural History Survey have identified state-endangered Blanding's turtle (*Emydoidea blandingii*) in the vicinity of the Will County generating Station. The Department recommends you contact Dr. Mike Dreslik (dreslik@illinois.edu) with the Illinois Natural History Survey to obtain the survey report and evaluate potential impacts to this species in your study plan. Field surveys should be conducted as necessary to support your findings. The principal investigator should obtain the proper permits to conduct survey efforts for state-listed species. Please contact the Department if you have further questions regarding this request.

2. While the Department agrees that no significant mussel populations are known to exist in the CSSC due to poor habitat quality, we also recognize that there has been little, if any, mussel survey efforts in the CSSC in recent history. Further, there is some evidence of freshwater mussel recovery in the Lower Des Plains River with the notable results of a 2014 mussel survey effort by EA Engineering. In that study, 24 species were found with one third being juvenile. Two state-threatened species, black sandshell (*Ligumia recta*) and purple wartyback (*Cyclonaias tuberculate*) were also collected. The number of mussels collected in all was 2,421! Given this information and a lack of recent data from the CSSC, the

Department requests a brailing survey for mussels in the study area to support the conclusion that mussel populations are not present. We do not think that a survey using divers is necessary in this location at this time unless the brailing results necessitate further effort. Please send a brailing survey proposal for review and concurrence on methods before initiating the field effort.

Thank you for the opportunity to comment. Please contact me if you have further questions. We look forward to further coordination.

Nathan Grider
Biologist
Impact Assessment Section
Illinois Department of Natural Resources
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(217) 524-0501
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nathan.grider@illinois.gov

From: Shealey, Sharene [mailto:Sharene.Shealey@nrg.com]
Sent: Monday, February 29, 2016 8:39 AM
To: LeCrone, Darin; Koch, Brian; Rabins, Jaime; Pescitelli, Steve; Grider, Nathan
Cc: Twait, Scott; Rozic, Nathan J
Subject: RE: Detailed Study Plan for Alternative Thermal Limits - Will Co. Station - IL0002208

Dear Darin, Brian, and Jaime:

Hard copies of the referenced detailed study plans for Will County Generating Station were delivered to the Agency on December 4, 2015. In accordance with 35 IAC Section 106.1120(f), we are looking forward to your approval or recommended revisions of our plan by Thursday, March 3, 2016.

If you would like to discuss anything or have any questions, please don't hesitate to contact me on my cell phone at 724-255-3220. If you would like to have a call prior to next Monday, please give me available times and I will set something up.

Thank you,
Sharene

Sharene Shealey
Environmental Manager
Will County Generating Station
529 E. 135th Street, Romeoville, IL 60466
(815) 372-4625 (office); (724) 255-3220 (cell)

From: Shealey, Sharene
Sent: Friday, December 04, 2015 4:10 PM
To: darin.lecrone@illinois.gov; brian.koch@illinois.gov; jaime.rabins@illinois.gov; steve.pescitelli@illinois.gov; nathan.grider@illinois.gov
Cc: scott.twait@illinois.gov; Rozic, Nathan J (Nathan.Rozic@nrg.com); jvondruska@eaest.com; sf@nijmanfranzetti.com
Subject: Detailed Study Plan for Alternative Thermal Limits - Will Co. Station - IL0002208

Dear Darin, Brian, Jaime, Steve and Nathan:

Please find attached the Detailed Study Plan to Support Alternative Thermal Limits for Will County Generating Station, NPDES Permit No. IL0002208. Two hard copies were mailed to Scott's attention for delivery today (12/4/15). Additionally, a hard copy was mailed to the attention of Mark Ackerman of USEPA for delivery Monday.

We look forward to your favorable review and will contact both IEPA and IDNR to follow-up in early 2016. If you have any questions in the meantime, please don't hesitate to contact me.

Thank you,

Sharene Shealey
Environmental Manager
Will County Generating Station
529 E. 135th Street, Romeoville, IL 60466
(815) 372-4625 (office); (724) 255-3220 (cell)

The following information is being submitted in response to the Illinois Department of Natural Resources (IDNR) comments on the Midwest Generation, LLC (MWGen) Will County Generating Station 316(a) Detailed Study Plan (DSP)—received via email on 7 March 2016 and discussed during a conference call held on 19 April 2016.

IDNR Comment:

The Department provides the following comments regarding the "Detailed Study Plan to Support Alternative Thermal Limits" for the Will County Generating Station.

1. Recent survey efforts by the Illinois Natural History Survey have identified state-endangered Blanding's turtle (*Emydoidea blandingii*) in the vicinity of the Will County generating Station. The Department recommends you contact Dr. Mike Dreslik (dreslik@illinois.edu) with the Illinois Natural History Survey to obtain the survey report and evaluate potential impacts to this species in your study plan. Field surveys should be conducted as necessary to support your findings. The principal investigator should obtain the proper permits to conduct survey efforts for state-listed species. Please contact the Department if you have further questions regarding this request.

MWGen Response:

- MWGen was involved with turtle habitat assessment efforts as part of the process to develop a multi-species Habitat Conservation Plan (HCP) for the Des Plaines River Valley from 2006-2012, with the primary objective of protecting Hine's emerald dragonfly and its designated Critical Habitat. Other species considered included the Blanding's turtle.

- The HCP team worked closely with the Illinois Nature Preserves Commission (INPC), the Forest Preserve District of Will County (FPDWC), and turtle researchers to obtain information regarding Blanding's turtle habitat in the vicinity of the Will County Generating Station (Will County Station). (See Attachment 1: 2008 MWGen Blanding's Turtle Habitat Ranking Map)

- No Blanding's turtles have ever been observed directly on Will County Station property, but there are both historical and current data that shows that the turtles do inhabit portions of the lower Des Plaines River Valley.

- Per IDNR's suggestion, the most recent turtle survey performed by the Illinois Natural History Survey (INHS) on Hanson Material Service (HMS) property to the south of the MWGen Will County Station was obtained and reviewed. The 2015 survey, which included both visual encounters and trapping, documented the presence of both Blanding's habitat and individuals on the HMS ComEd, River North and Middle Parcels (See Attachment 2: Figure from p. 22 of Feng and Dreslik 2015).

- **Based on the Blanding's habitat preference and life history, there is no evidence or reason to believe that the turtle would utilize the Chicago Sanitary and Ship Canal (CSSC) in any way.** In the vicinity of the station, the canal is lined with vertical limestone walls that extend anywhere from 6-12' (or more) above the water's surface, depending upon flow and flood control operations. There is little to no natural shoreline development or vegetation that would be considered even remotely marginal habitat for the Blanding's turtle.

- Given that the Blanding's is largely a wetlands species (using uplands for nesting and foraging), there should be no interaction between the turtle and the Will County Station thermal discharge, which is confined to the Chicago Sanitary and Ship Canal.

With consideration of the above information, Midwest Generation does not believe that Blanding's turtle surveys are necessary as part of the Will County 316(a) study plan.

OUTCOME:

Based on the information provided on 19 April 2016 conference call, we understand that IDNR has agreed that no additional turtle surveys are required for the Will County 316(a) Study Plan. As a state-listed, semi-aquatic species located near the 316(a) study area, the Blanding's turtle will be qualitatively covered in the final 316(a) demonstration document.

IDNR Comment

2. While the Department agrees that no significant mussel populations are known to exist in the CSSC due to poor habitat quality, we also recognize that there has been little, if any, mussel survey efforts in the CSSC in recent history. Further, there is some evidence of freshwater mussel recovery in the Lower Des Plaines River with the notable results of a 2014 mussel survey effort by EA Engineering. In that study, 24 species were found with one third being juvenile. Two state-threatened species, black sandshell (*Ligumia recta*) and purple wartyback (*Cyclonaias tuberculata*) were also collected. The number of mussels collected in all was 2,421! Given this information and a lack of recent data from the CSSC, the Department requests a brailing survey for mussels in the study area to support the conclusion that mussel populations are not present. We do not think that a survey using divers is necessary in this location at this time unless the brailing results necessitate further effort. Please send a brailing survey proposal for review and concurrence on methods before initiating the field effort.

MWGen Response:

- The intent of the 316(a) studies is to determine whether the Will County thermal discharge is currently having, or is expected to have, any significant adverse impacts on the aquatic community of the CSSC. Since prior studies have shown that the thermal plume is surficial in nature, and that a zone of passage is maintained for aquatic life [See Attachments 3a, 3b, and 3c: Excerpts from 2011 Will County Thermal Study—EA 2012b], there is no expectation that any benthic organisms would be negatively impacted, whether or not any mussel species may be present.

    - The draft DSP was developed in accordance with the 1977 USEPA 316(a) Interagency Guidance Document (p.26-27, regarding Information Requirements at USEPA 1977), which states:

"(T)he applicant should recognize that the level of effort is based on the area impacted and that sampling of the benthic component of the shellfish /

macroinvertebrate fauna would be minimal in the case of a site having sufficient depth that the plume does not reach the bottom." (Emphasis added)

- With current and expected future single-unit operation, the Will County Station thermal plume can be expected to have an even lesser impact on the waterway than when the original thermal plume studies were completed (under two-unit operation). Additional thermal monitoring and modeling to be performed as part of the current Detailed Study Plan will provide additional information in this regard.

- The referenced 2014 mussel survey results were from an area well downstream of the CSSC (23 River Miles), at the confluence of the Des Plaines and Kankakee Rivers, which form the headwaters of the Illinois River. The Kankakee River is a known source of mussel species, which is evidenced by the large assemblage found in the EA 2014 study where sampling locations were concentrated within the confluence area and downstream. There is no known source stream for mussels in the CSSC near Will County Station.

- Downstream evidence of mussel recovery must be looked at in conjunction with the availability of suitable habitat, which does exist near the Dresden Nuclear Station, but is extremely limited upstream, especially in the CSSC.

- The INHS (Price et al. 2012) performed a recent study (2009-2011) of the Lake Michigan and Des Plaines River tributaries to determine the presence of freshwater mussels. One of the locations (Site 10, IEPA Site G-11) was in the upper Des Plaines River, approximately two miles upstream of the confluence of the Des Plaines River and the CSSC, where potential mussel habitat is clearly superior to that present in the adjacent CSSC (See Attachment 4). However, at INHS Site 10, only dead and relic shells of three common mussel species were collected (Giant Floater: *Pyganodon grandis,* Paper Pondshell: *Utterbackia imbecillis and* Fat Mucket: *Lampsilis siliquoidea*). The MCI Community Index Score at this location was zero. Given that no live mussels were found in the upper Des Plaines River, they would not be expected to be present in the CSSC where habitat is comparatively poor.

- The Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) regularly performs biological, habitat, and sediment surveys throughout the waterways under its jurisdiction. The most recent published study from 2010 includes sampling at two locations in proximity to Will County Station (MWRDGC 2014 and EA 2012a—See excerpts in Attachments 5a and 5b, respectively):

  MWRDGC Location 48- Stephen St.: This location is on the CSSC (41° 41.127'N 87° 58.862'W). The exact sampling area is 1.1 miles upstream of Stephen St. (10' from the west bank and at mid-channel), which is approximately five miles upstream of Will County Station.

  MWRD Location 92- Lockport (16th St.): This location is on the CSSC (41° 34' 59.2"N 88° 04' 8.7"W). The sampling point is 75' upstream of the former Division St. Bridge location (20' from the west bank and at mid-channel), which is approximately 3.5 miles downstream of Will County Station.

Near-shore and mid-channel ponar samples were attempted at these stations during 2010. Ponar samples were not collected at the Stephen St. location on the CSSC because it lacked adequate sediment. Heavy barge traffic likely scoured the bottom of this constructed limestone channel. This location is similar to the remainder of the CSSC in this area, due to its vertical-walled configuration and continued heavy barge traffic. At Location 92, *Corbicula fluminea* was the only mussel species found in the both petite ponar and Hester Dendy samples). The only other mussel species found at the Stephen St. site (Location 48) in 2010, through Hester Dendy sampling, were *Corbicula fluminea*, *Dreissena bugensis,* and *Pisidium* sp.---all either non-indigenous/invasive or common species that would be expected to be found in this artificial waterway, given its sparse habitat, heavy barge traffic, and erratic flow regime. Thus, as discussed in the Detailed Study Plan (DSP) (EA 2015), as well as in the 19 April conference call, **there is little if any suitable habitat for native mussel colonization in the CSSC near or downstream of the Will County Station.**

- MWRDGC (2014) studied 11 benthic stations on the southern portion of the Chicago River System (including the Chicago River, South Branch of the Chicago River, Bubbly Creek, and the CSSC). **The few mussel species found in this entire portion of the waterway consisted primarily of non-native and/or invasive species.** The non-indigenous mottled fingernail clam (*Eupera cubensis*) was found in Hester-Dendy samples from the Cicero Avenue, Route 83, and Stephen St. locations on the CSSC, beginning in 2006. *E. cubensis* is native to the southern United States coastal plain and was also found at the Harlem Avenue, Route 83, and Lockport locations in the CSSC during 2006 (EA 2010).

- From a historical perspective, macroinvertebrate identifications performed by EA for the MWRDGC and Illinois EPA in 2000 (unpublished information—See Attachment 6), which covered a large portion of the Upper Illinois Waterway, encountered only three mussel species: *Corbicula fluminea, Musculium transversum,* and *Dreissena polymorpha.* Comparison of these data with the more recent 2010 data from MWRDGC (2014) (See Attachment 5a—Table 3) shows that there is a continued sparsity of mussel species in the system, even after 10 years, which supports the case that this altered system is not conducive to native mussel colonization, even given the documented water quality improvements and increased numbers and types of fish species that have occurred over this time period.

- These findings are also supported by the information obtained from other sources, as summarized in Section 5 of the Will County Station DSP (EA 2015; see Attachment 7).

- The most recent sediment sampling by the MWRDGC in 2011 also continues to show pervasive contamination of the upper reaches of the waterway, including the Lockport and Brandon Pools (MWRDGC 2012). Noticeably higher levels of cadmium, chromium, copper, lead, mercury, and zinc were found in the upper pools, compared to the lower Dresden Pool (See Attachment 8—Table 8 excerpt from MWRDGC [2012]). As such, **contaminated sediments also limit the potential for any significant native mussel populations in the waterway adjacent to Will County Station.**

- Adding to the extremely marginal habitat availability in the CSSC, the entire waterway from the Asian Carp Electric Barrier (just upstream of Will County Station), downstream to the Lockport Lock and Dam (a total distance of approximately 7 River Miles) was rotenoned in late 2009. While rotenone is considered a targeted piscicide, there have been documented impacts to

benthic gill-breathing organisms. **The more recent study findings from MWRDGC (2010) and INHS/Price et al. (2009-2011) provide supporting information to demonstrate that there has been no significant colonization of native mussels in the in the waterways or tributaries near or downstream of Will County Station.**

- From the Detailed Study Plan, Section 5. P. 13:

  "Given these conditions, the constraints on sampling methods and equipment related to Asian Carp control operations and activities, safety during sampling of this reach of the CSSC, and the relatively permanent and irreversible degradation of physical aquatic habitat, it was agreed at the 4 November 2015 meeting with Illinois EPA that the collection of fish data as part of the ongoing sampling program in the UIW would be adequate to characterize aquatic community conditions in the vicinity of the Will County Station. It was further agreed that additional sampling of fish or other biotic categories will be impractical and is not expected to yield representative information. For these reasons, such additional sampling will not be required to support the §316(a) Demonstration for the Will County Station. " **IEPA has subsequently provided approval of the DSP (letter dated 3 March 2016).**

All of the above information further supports MWGen's position that additional sampling for mussels is not warranted in the CSSC as part of the Will County Station 316(a) Study Plan. A discussion regarding expected impact on benthic organisms, including mussels, will be included as part of the overall 316(a) demonstration, in accordance with the USEPA 1977 Guidance Document requirements.

References:

EA Engineering, Science, and Technology, Inc. 2010. A Study of the Benthic Macroinvertebrate Community in Selected Chicago Metropolitan Area Waterways 2006-2008. Prepared for the Metropolitan Water Reclamation District of Greater Chicago Research and Development Department.

EA Engineering, Science, and Technology, Inc. 2011. A Study of the Benthic Macroinvertebrate Community in Selected Chicago Metropolitan Area Waterways 2009. Prepared for the Metropolitan Water Reclamation District of Greater Chicago Research and Development Department.

EA Engineering, Science, and Technology, Inc. 2012a. A Study of the Benthic Macroinvertebrate Community in Selected Chicago Metropolitan Area Waterways 2010. Prepared for the Metropolitan Water Reclamation District of Greater Chicago Research and Development Department.

EA Engineering, Science, and Technology, Inc. 2012b. Thermal Plume Surveys on the Chicago Sanitary and Ship Canal near Will County Station, July-September 2011.

EA Engineering, Science, and Technology, Inc., PBC. 2015. Detailed Study Plan for §316(a) Demonstration to Support Application for Alternative Thermal Limits at the Will County Generating Station. Prepared for Midwest Generation, LLC. Will County Station. Final Draft, 1 December 2015.

Feng, Christina Y. and Dreslik, Michael J. Preliminary Report on Surveys for Spotted and Blanding's Turtles in the Des Plaines River Valley. INHS Technical Report (16): p. 1-52, 15 July 2015. Fund Title—IDNR D6205 (Used with permission of Hanson Material Service-project funder).

Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). March 2014. Report No. 14-10 Ambient Water Quality Monitoring in the Chicago, Calumet and Des Plaines River Systems: A Summary of Biological, Habitat, and Sediment Quality During 2010.

Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). August 2012. Report No. 12-35 Water and Sediment Quality Along the Illinois Waterway from the Lockport Lock to the Peoria Lock During 2011.

Price, A.L., D.K. Shasteen, and S.A. Bales. 2012. *Freshwater mussels of the Des Plaines River and Lake Michigan tributaries in Illinois.* Illinois Natural History Survey Technical Report 2012 (10). Champaign, Illinois. 16 pp.

U.S. Environmental Protection Agency (USEPA) and Nuclear Regulatory Commission (NRC). 1977. *Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements, Draft.* Office of Water Enforcement, U.S. Environmental Protection Agency, Washington, D.C. 1 May 1977.

ATTACHMENT LIST:

Attachment 1:	2008 MWGen Blanding's Turtle Habitat Ranking Map
Attachment 2:	Figure from p. 22 of Feng and Dreslik 2015
Attachment 3a:	Will County 2011 Thermal Study Transect Map
Attachment 3b:	Will County 2011 Thermal Study--Vertical Temperature Measurements
Attachment 3c:	Will County 2011 Thermal Study--Zone of Passage Analysis
Attachment 4:	INHS Site 10 (IEPA G-11) Location Map
Attachment 5a:	Excerpts from MWRDGC 2010 Chicago Area Waterways Study (Benthic Macroinvertebrates)
Attachment 5b:	Excerpts from EA 2010 Benthic Macroinvertebrate Survey done for MWRDGC
Attachment 6:	IEPA Project Taxa List—Upper Illinois Waterway Benthos, 2000
Attachment 7:	Section 5 from Will County 316(a) Detailed Study Plan (December 2015)
Attachment 8:	Excerpts from MWRDGC 2011 Water and Sediment Quality Report

ATTACHMENT 1: From MWGen draft development materials for multi-species HCP (unpublished)

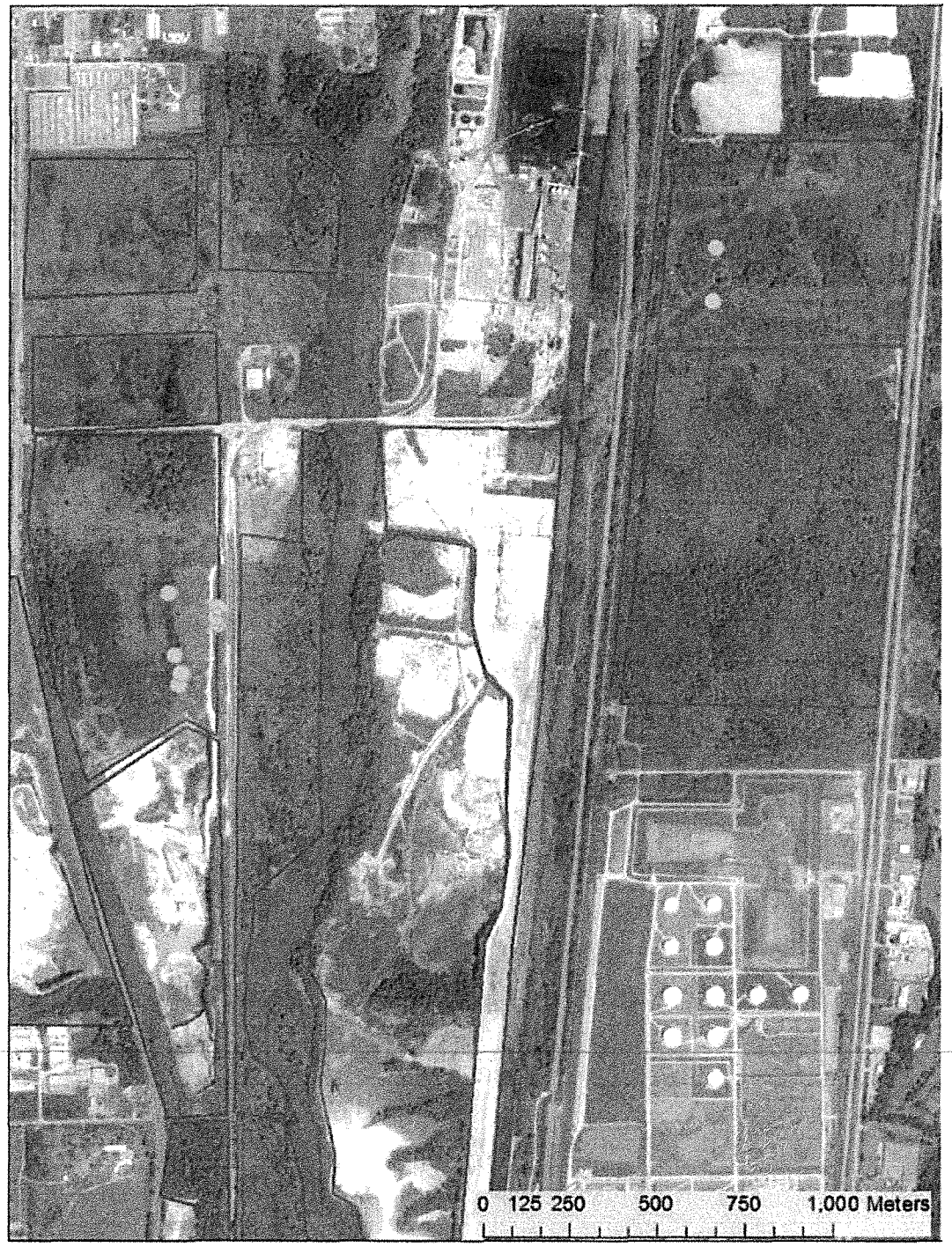


Plate 6: HMSC capture locations for *Emydoidea blandingii* (EMBL). Captures only occurred in Middle, ComEd, and River North Parcels.

ATTACHMENT 2: From INHS Technical Report (16), issued July 2015—obtained and used with permission of Hanson Material Service

ATTACHMENT 3a--Will County 2011 Thermal Study Transect Map

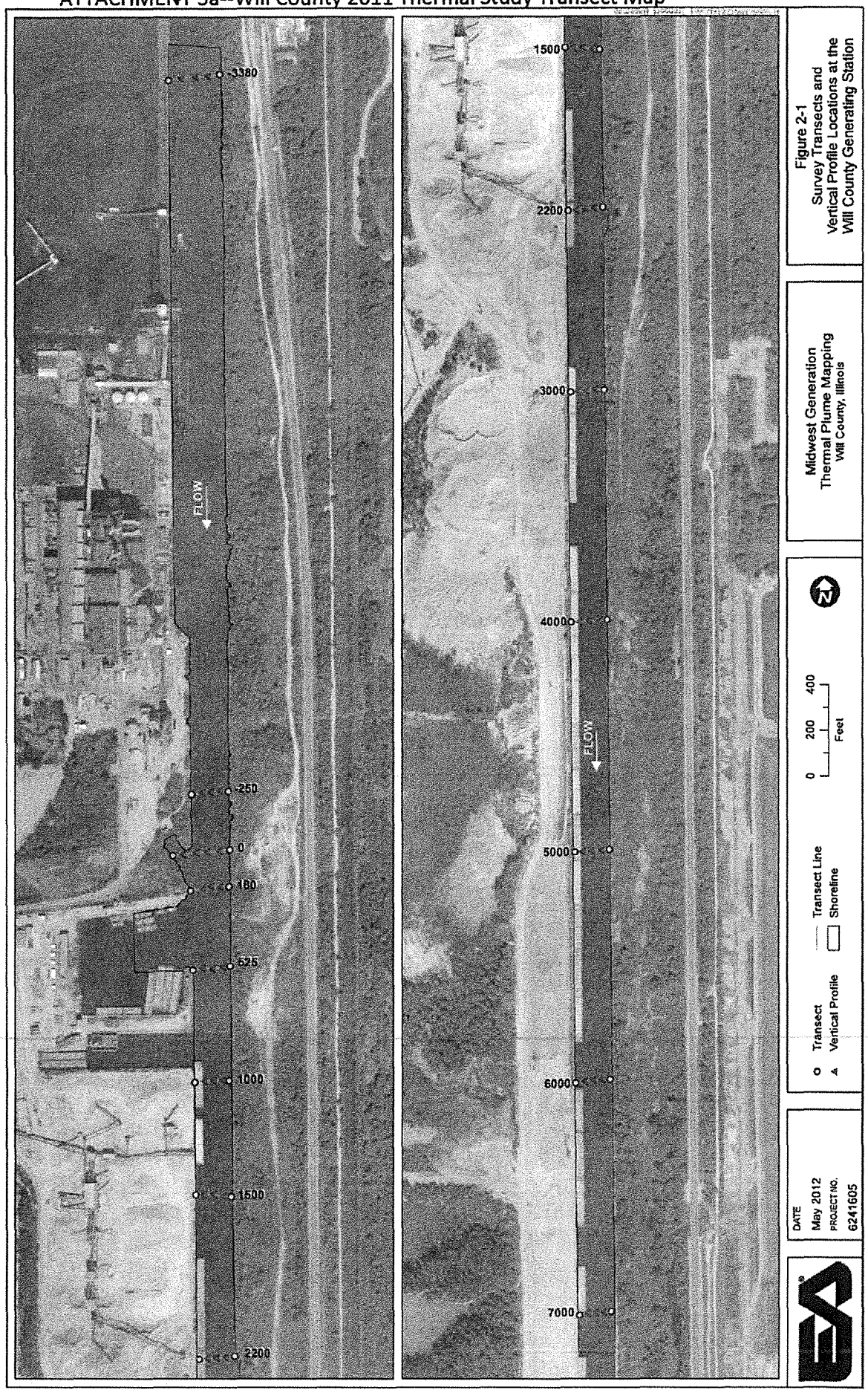


Table 3-1 Survey Times, Will County Generating Station Operating Parameters, and Site Conditions During the 2011 Plume Surveys

Survey	Surface Survey (hrs)	Vertical Survey (hrs)
13-Jul	1343 - 1456	1525 - 1910
26-Jul	1221 - 1340	1415 - 1730
10-Aug	1252 - 1414	1440 - 1806
1-Sep	1146 - 1310	1347 - 1654
8-Sep	1205 - 1340	1413 - 1726
21-Sep	1152 - 1318	1341 - 1636

Daily Average Station Operating Conditions

Survey	PowProd (MWe)	Temperature (°F)			Flow (mgd)
		Intake	Discharge	Delta	
13-Jul	650	81.5	93.9	12.4	864
26-Jul	535	77.2	85.7	8.5	864
10-Aug	667	79.0	90.5	11.5	864
1-Sep	680	78.7	91.6	12.9	864
8-Sep	562	74.5	84.9	10.4	864
21-Sep	636	73.1	85.7	12.6	864

Survey (3-hr) Station Operating Conditions

Survey	PowProd (MWe)	Temperature (°F)			Flow (mgd)
		Intake	Discharge	Delta	
13-Jul	788	81.6	96.5	14.9	864
26-Jul	625	77.1	86.9	9.8	864
10-Aug	780	79.0	92.3	13.3	864
1-Sep	757	79.1	93.8	14.7	864
8-Sep	691	74.7	87.7	13.0	864
21-Sep	741	75.7	90.1	14.4	864

River Flow and Meteorological Conditions

Survey	Canal Flow (cfs) (a)	Air Temp (°F) (b)	Wind Spd (mph) (a)	Wind Dir (deg)
13-Jul	2,971	69.0 (74)	10.9 (17)	NE
26-Jul	5,102	76.0 (82)	8.5 (14)	ESE
10-Aug	5,202	68.9 (77)	8.6 (15)	WNW
1-Sep	2,682	83.2 (92)	5.8 (16)	SSE
8-Sep	3,092	65.2 (72)	13.4 (26)	ESE
21-Sep	1,717	63.8 (70)	11 (20)	WSW

a) Daily average USGS flow

b) Daily average (hourly max)

Table D-1a
Vertical Temperature (°F) Profiles at Will County Generating Station, 13 July 2011

Depth (ft)	W-3380-1/4 1900	W-3380-1/2 1905	W-3380-3/4 1910	W-250-1/4 1835	W-250-1/2 1839	W-250-3/4 1843	W0-1/5 1824	W0-2/5 1820	W0-3/5 1816	W0-4/5 1813
1	81.8	81.6	81.6	89.4	90.2	90.3	91.2	91.6	94.0	96.0
2	81.8	81.6	81.6	88.5	89.4	89.9	91.0	90.8	93.9	96.0
3	81.8	81.6	81.6	87.9	89.0	89.8	91.0	89.4	93.5	96.0
4	81.8	81.6	81.6	87.6	89.0	89.8	90.8	88.6	92.9	96.0
5	81.8	81.6	81.6	87.5	89.2	89.1	90.7	87.3	91.9	96.0
6	81.8	81.6	81.6	87.6	89.1	88.4	90.6	86.5	91.1	96.0
7	81.8	81.6	81.6	87.6	89.0	86.5	90.7	86.9	92.1	96.0
8	81.8	81.7	81.6	87.7	88.2	85.0	90.7	87.9	90.4	96.0
9	81.9	81.7	81.6	87.6	86.0	84.5	90.7	88.5	89.2	96.0
10	81.8	81.7	81.6	87.7	85.4	84.4	90.6	89.8	87.7	96.0
11	81.8	81.6	81.6	87.4	84.6	84.2	90.3	89.2	86.3	96.0
12	81.8	81.6	81.6	87.1	83.5	83.5	88.6	85.2	85.3	96.0
13	81.9	81.6	81.7	85.6	85.8	82.7	86.3	83.3	83.7	96.0
14	81.9	81.6	81.7	83.4	87.9	82.3	85.3	82.9	83.0	
15	81.8	81.7	81.7	82.3	87.5	82.0	84.5	82.8	82.7	
16	81.8	81.7	81.7	82.1	87.6	82.0	84.0	82.7	82.5	
17	81.8	81.7	81.7	82.1	87.7	81.9	83.5	82.7	82.4	
18	81.8	81.7	81.7	82.0	87.7	81.9	82.8	82.6	82.2	
19	81.9	81.6	81.7	81.9	87.7	81.9	82.7	82.6	82.2	
20	81.9	81.6	81.7	81.9	86.2	81.9	82.6	82.5	82.2	
21	82.0	81.6	81.7	81.9	83.5	82.3	82.5	82.4	82.2	
22	82.0	81.7		81.9	82.3	83.3	82.5	82.4		
23	81.9	81.7		81.9	82.1	84.2	82.9	82.4		
24	81.8	81.7		81.8	82.0	85.7	84.2	82.3		
25	81.7	81.7		81.8	81.9	86.6	84.9	82.3		
26	81.8	81.7		82.4	82.6		86.1	82.3		
27					83.9					

Table D-1b
Vertical Temperature (°F) Profiles at Will County Generating Station, 13 July 2011

Depth (ft)	W180-1/4	W180-1/2 1803	W180-3/4 1807	W525-1/4 1744	W525-1/2 1748	W525-3/4 1753	W1000-1/4 1719	W1000-1/2 1723	W1000-3/4 1730
1	No Data	95.4	95.9	94.2	93.3	94.6	93.2	93.4	92.3
2		94.0	95.4	94.0	93.2	94.2	93.2	93.2	91.8
3		92.5	95.2	94.0	93.2	94.1	93.1	93.0	91.4
4		90.6	93.3	93.9	93.2	93.9	93.1	93.0	91.3
5		90.4	93.0	93.9	93.2	93.8	93.1	92.9	91.1
6		91.2	91.7	93.9	93.2	93.6	93.0	92.7	91.1
7		92.3	91.0	93.9	93.2	93.5	92.8	92.3	90.9
8		92.0	90.6	93.8	93.2	93.5	92.8	92.3	90.7
9		91.9	92.7	93.7	93.0	93.4	92.7	92.4	90.6
10		91.4	94.4	93.7	92.9	93.2	92.5	92.7	89.5
11		90.6	95.1	93.6	92.9	93.1	92.0	92.8	87.0
12		90.3	95.2	93.5	92.9	93.0	91.9	92.8	84.8
13		90.4	95.2	93.5	92.9	92.8	91.7	92.9	85.3
14		90.6	94.7	93.2	92.7	92.3	91.6	93.0	89.0
15		90.4	93.7	92.8	91.9	92.5	91.7	93.0	90.4
16		89.6	92.7	92.8	91.6	92.6	91.6	92.9	91.0
17		87.8	91.6	92.4	91.9	92.1	86.6	92.8	91.1
18		84.7	90.7	92.1	92.0	89.8	83.7	92.4	91.2
19		84.2	89.8	92.1	92.2	88.8	83.3	91.6	91.3
20		85.2	89.4	91.9	92.4	88.4	83.0	90.9	91.3
21		88.2	88.7	91.6	92.5	86.8	82.8	90.0	91.1
22		90.2	88.1	90.9	92.5	86.8	82.5	88.9	90.2
23		90.5	87.9	90.7	92.3	87.8	82.2	88.2	89.6
24		90.7	87.4	90.4	92.1	88.5	82.1	87.4	88.9
25		89.4	87.0	90.2	92.0	88.8	82.1	86.2	87.9
26		86.1	87.0	90.5	90.6	89.1	82.1	84.5	
27			86.9	90.6	89.3				

Table D-1c
Vertical Temperature (°F) Profiles at Will County Generating Station, 13 July 2011

Depth (ft)	W1500-1/4 1702	W1500-1/2 1707	W1500-3/4 1714	W2200-1/4 1642	W2200-1/2 1648	W2200-3/4 1653	W3000-1/4 1628	W3000-1/2 1632	W3000-3/4 1636	W4000-1/4 1611	W4000-1/2 1616	W4000-3/4 1620
1	94.0	93.9	93.4	94.6	94.1	94.1	93.6	93.4	92.7	93.0	93.0	92.8
2	93.7	93.7	93.4	94.3	94.1	94.1	93.6	93.3	92.6	92.9	93.0	92.7
3	93.7	93.5	93.4	93.9	94.2	94.2	93.6	93.1	92.5	92.9	93.0	92.5
4	93.7	93.2	93.4	93.8	94.2	94.2	93.4	92.7	92.5	92.9	93.0	92.5
5	93.6	92.9	93.4	93.7	94.1	94.1	93.4	92.4	92.4	92.9	93.0	92.4
6	93.5	92.8	93.3	93.6	93.9	94.1	93.3	92.2	92.3	92.8	93.0	92.4
7	93.4	92.5	93.3	93.6	93.7	94.1	93.3	91.8	92.3	92.7	93.0	92.3
8	93.4	92.5	93.2	93.5	93.2	94.1	93.2	91.2	92.4	92.4	93.0	92.3
9	93.3	93.1	93.1	93.4	93.2	94.1	93.2	90.8	92.5	92.0	92.9	92.3
10	93.3	93.3	93.1	93.3	93.6	94.1	93.2	90.6	92.6	91.8	92.5	92.3
11	93.2	93.4	93.0	93.2	94.0	94.1	93.1	91.6	92.7	92.1	91.4	92.4
12	93.2	93.3	92.9	93.1	94.0	94.1	92.9	92.1	92.7	92.2	90.8	92.5
13	93.0	91.9	93.0	92.9	94.0	94.1	92.8	92.6	92.6	92.0	91.3	92.5
14	92.9	90.5	92.9	92.8	94.0	94.0	92.7	92.7	89.8	89.9	92.5	92.5
15	92.8	88.7	92.7	92.6	94.0	94.0	92.5	92.3	85.8	85.8	92.7	92.6
16	92.6	88.6	92.6	92.3	93.4	93.9	92.5	86.5	84.7	86.0	92.5	92.6
17	92.4	85.5	92.4	92.1	88.4	93.8	92.5	84.9	83.5	89.1	90.6	92.6
18	92.3	83.2	92.1	92.0	86.0	93.8	92.4	90.1	82.8	91.6	89.0	92.6
19	92.1	82.8	91.7	91.9	87.0	91.0	92.3	92.6	82.5	91.4	84.3	92.5
20	92.0	82.5	91.3	88.4	90.9	84.6	92.2	92.7	82.3	91.2	82.6	92.5
21	91.8	82.4		83.0	91.5	82.9	88.5	92.0	82.3	90.8	82.2	92.3
22	91.6	82.2		82.3	91.9	82.4	83.2	90.8	83.9	90.2	82.1	91.8
23	90.9	82.1		82.2	91.6	82.2	82.4	89.9	83.9	89.0	82.0	91.5
24	89.4	82.1		82.1	85.1	82.1	82.2	88.8	82.5	87.5	82.0	91.1
25	89.1	82.1		82.3	82.5	82.1	82.1	88.0	82.1	86.1	82.0	83.9
26	89.4	82.0			82.4	82.7	82.8	86.4	82.1		84.0	
27	88.7	82.4										

Table D-1d

Vertical Temperature (°F) Profiles at Will County Generating Station, 13 July 2011

Depth (ft)	W5000-1/4 1557	W5000-1/2 1601	W5000-3/4 1605	W6000-1/4 1541	W6000-1/2 1545	W6000-3/4 1549	W7000-1/4 1525	W7000-1/2 1530	W7000-3/4 1535
1	92.5	92.5	92.5	92.4	92.3	92.2	92.3	92.3	92.2
2	92.5	92.5	92.3	92.4	92.2	92.2	92.4	92.3	92.2
3	92.5	92.4	92.3	92.4	92.1	92.2	92.3	92.3	92.1
4	92.4	92.4	92.1	92.2	92.1	92.1	92.3	92.2	92.1
5	92.4	92.4	91.9	92.1	92.0	92.1	92.2	92.2	92.1
6	92.3	92.3	91.3	92.1	92.0	92.1	92.0	92.1	91.9
7	92.3	92.3	90.8	92.1	92.0	92.0	92.0	92.0	91.4
8	92.2	92.3	89.4	92.1	91.8	91.8	92.0	91.4	90.2
9	92.2	92.2	87.4	92.0	90.8	91.0	91.9	90.5	89.2
10	92.2	92.2	86.3	91.5	89.6	89.5	91.3	89.0	87.8
11	92.0	92.1	84.9	90.3	87.9	88.2	91.1	87.9	86.9
12	92.0	92.0	83.7	87.9	86.5	87.9	91.0	87.5	87.0
13	91.9	91.9	83.7	86.5	85.8	88.3	90.9	90.0	89.4
14	91.7	91.5	85.2	85.5	85.4	89.0	91.0	91.1	90.1
15	91.6	91.4	85.7	84.8	86.1	90.4	90.3	91.0	90.5
16	91.5	91.1	83.9	83.8	87.0	90.8	86.3	91.1	91.1
17	91.3	88.3		83.2	85.8	90.7	83.8	91.1	91.5
18	89.2	85.4		82.8	83.5	86.6	83.4	91.0	91.5
19	87.2	83.7		82.6	82.7	83.8	83.1	90.9	90.7
20	83.9	83.2		82.6	82.6	83.1	82.9	90.4	85.1
21	82.8	82.8		82.5	82.5	83.1	82.9	85.9	83.4
22	83.0	82.5		82.4	82.4	83.1	82.8	84.0	82.8
23	82.6	82.3		82.4	82.4	82.8	82.7	84.5	82.6
24	82.5	82.5		82.4	82.4	82.7	82.7	83.3	82.5
25	82.4	85.6		82.4	82.3	82.6	82.7	82.7	82.9
26	83.0	86.7		82.4	82.4	82.5	82.9	82.7	
27	85.8	87.2		82.6	82.7	82.7			

Table D-2a
Vertical Temperature Profiles (°F) at Will County Generating Station, 26 July 2011

Depth (ft)	W-3380-1/4 1721	W-3380-1/2 1725	W-3380-3/4 1730	W-250-1/4 1704	W-250-1/2 1708	W-250-3/4 1714	W0-1/5 1646	W0-2/5 1650	W0-3/5 1655	W0-4/5 1659
1	77.9	77.7	77.7	77.9	77.6	77.6	77.9	79.6	85.8	89.2
2	77.8	77.7	77.7	77.8	77.6	77.6	77.7	84.0	84.8	89.2
3	77.8	77.7	77.7	77.9	77.6	77.6	77.6	82.2	84.3	89.2
4	77.8	77.7	77.7	78.0	77.6	77.6	77.6	80.6	83.2	89.2
5	77.8	77.7	77.7	78.0	77.6	77.6	77.7	81.2	82.2	89.2
6	77.8	77.7	77.7	78.0	77.6	77.6	77.9	81.1	83.9	89.2
7	77.8	77.7	77.7	77.9	77.6	77.6	78.0	80.2	84.1	89.2
8	77.8	77.7	77.7	77.7	77.6	77.6	78.2	79.6	83.2	89.2
9	77.8	77.7	77.7	77.7	77.6	77.7	78.3	79.6	82.3	89.2
10	77.8	77.7	77.7	77.6	77.6	77.7	78.4	79.7	81.7	89.0
11	78.0	77.7	77.7	77.6	77.6	77.7	78.5	79.7	82.0	87.1
12	78.1	77.7	77.7	77.6	77.6	77.7	78.5	79.7	83.0	83.6
13	78.2	77.7	77.7	77.6	77.7	77.7	78.4	79.3	83.6	84.5
14	78.3	77.7	77.7	77.6	77.7	77.7	77.9	78.1	84.1	
15	78.4	77.7	77.7	77.6	77.7	77.7	77.7	77.8	84.5	
16	78.5	77.7	77.7	77.7	77.7	77.7	77.6	77.7	84.5	
17	78.4	77.7	77.7	77.6	77.7	77.7	77.6	77.6	84.4	
18	78.4	77.7	77.7	77.6	77.7	77.7	77.6	77.6	84.2	
19	77.9	77.7	77.7	77.6	77.7	77.7	77.5	77.6	84.2	
20	77.8	77.7	77.7	77.6	77.7	77.6	77.5	77.6	84.0	
21	77.7	77.7	77.7	77.6	77.7	77.6	77.5	78.0	83.9	
22	77.7	77.7	77.7	77.6	77.6	77.6	77.5	78.3	83.9	
23	77.7	77.7	77.7	77.6	77.6	77.6	77.5	78.3	83.7	
24	77.7	77.7	77.7	77.6	77.6	77.6	77.5	78.3	83.3	
25	77.7	77.7		77.6	77.6	77.6	77.5	78.3		
26	77.7	77.7		77.6	77.6	77.6	77.5	78.5		

Table D-2b
Vertical Temperature Profiles (°F) at Will County Generating Station, 26 July 2011

Depth (ft)	W180-1/4 1629	W180-1/2 1634	W180-3/4 1638	W525-1/4 1610	W525-1/2 1614	W525-3/4 1618	W1000-1/4 1556	W1000-1/2 1600	W1000-3/4 1604
1	87.1	87.7	89.1	85.9	84.7	84.2	86.2	85.2	84.9
2	86.7	86.8	89.0	85.9	84.6	82.9	85.8	84.9	84.9
3	85.0	85.8	88.8	85.9	84.7	82.3	85.5	84.5	84.9
4	84.8	84.0	88.7	85.8	84.6	81.6	85.5	83.8	84.8
5	86.5	80.4	88.4	85.7	84.1	80.8	85.6	82.5	84.5
6	87.1	80.5	88.1	85.6	83.8	80.0	85.5	81.4	84.4
7	87.1	81.2	87.8	84.4	83.6	79.7	85.5	81.1	84.2
8	86.5	81.0	85.1	83.3	83.4	79.4	85.4	80.9	84.1
9	86.2	80.9	84.6	82.8	83.5	79.4	85.2	80.5	83.9
10	84.4	81.2	87.0	82.1	83.7	80.7	84.9	80.6	83.1
11	84.0	81.6	88.4	81.4	82.4	81.2	84.8	80.5	82.7
12	81.7	82.6	88.6	80.9	82.2	81.6	84.6	80.1	82.5
13	80.1	80.8	88.7	80.4	82.6	82.0	84.7	80.6	82.1
14	79.9	78.8	88.7	80.3	83.3	82.9	84.4	82.0	82.1
15	82.8	78.4	88.4	80.3	83.9	83.5	84.1	83.1	82.7
16	83.8	78.9	87.7	80.1	84.2	83.5	84.1	84.0	83.7
17	84.8	79.3	86.7	80.1	84.3	82.9	84.0	84.4	84.3
18	86.1	79.7	85.8	79.9	84.3	82.0	83.8	84.4	84.5
19	86.2	80.5	85.1	81.2	84.1	81.5	82.9	83.7	84.5
20	86.0	81.9	84.4	81.9	83.7	81.1	82.6	82.8	84.4
21	85.8	83.4	83.7	82.9	83.1	80.6	82.2	82.3	83.9
22	85.4	84.5	83.2	83.7	82.6	80.4	82.5	82.0	83.2
23	81.8	85.0	82.6	84.0	82.1	80.2	82.4	81.6	82.7
24	78.8	84.8	81.9	83.6	81.5	79.4	81.4	81.1	82.3
25	78.2	83.9	81.2	82.9	81.0		80.1	80.7	81.5
26	78.7	82.6	80.8	82.1	80.6		80.2		

Table D-2c
Vertical Temperature Profiles (°F) at Will County Generating Station, 26 July 2011

Depth (ft)	W1500-1/4 1543	W1500-1/2 1547	W1500-3/4 1551	W2200-1/4 1525	W2200-1/2 1530	W2200-3/4 1538	W3000-1/4 1511	W3000-1/2 1516	W3000-3/4 1520	W4000-1/4 1457	W4000-1/2 1501	W4000-3/4 1506
1	85.5	85.6	83.7	84.7	85.3	84.6	82.9	83.3	82.9	82.5	82.4	82.2
2	85.0	84.8	83.2	84.2	84.4	84.3	82.3	83.0	82.6	81.9	82.1	82.2
3	85.0	84.1	82.8	84.2	84.2	84.2	82.4	82.9	82.5	81.7	82.1	82.1
4	85.0	83.3	81.9	84.2	83.9	84.4	82.5	82.9	82.5	81.7	81.8	81.6
5	85.1	82.7	81.0	84.3	83.5	84.0	82.5	83.0	82.5	81.8	81.5	81.4
6	85.0	81.8	80.9	84.3	83.2	82.8	82.6	83.0	82.5	81.5	81.3	81.3
7	85.0	81.6	82.4	84.2	82.7	81.1	82.5	82.5	82.5	81.5	81.0	81.3
8	84.9	81.6	83.3	84.1	82.0	80.7	82.4	82.2	82.5	81.5	81.0	81.5
9	84.8	81.6	83.8	84.1	81.0	80.6	82.1	81.8	82.7	81.6	80.6	81.6
10	84.7	81.1	83.8	84.2	80.7	81.2	82.2	82.0	82.8	81.8	80.5	81.8
11	84.4	79.7	83.5	84.1	80.2	82.2	82.2	82.6	82.8	81.9	80.2	82.0
12	84.0	78.9	82.6	84.2	79.8	83.2	82.1	82.4	82.8	81.7	79.8	81.5
13	84.4	80.1	81.7	84.3	79.6	83.9	82.1	80.8	82.8	81.4	79.7	81.0
14	84.5	81.5	80.8	84.4	80.2	84.0	82.0	80.1	82.7	81.4	79.5	80.8
15	84.7	82.0	80.4	84.4	81.8	84.0	82.2	80.3	82.6	81.4	79.5	80.3
16	84.8	81.5	80.2	84.4	83.3	84.0	82.1	80.0	82.4	81.7	79.6	79.8
17	84.8	79.5	79.4	84.4	83.9	83.1	82.6	80.3	82.3	81.8	79.7	79.5
18	84.9	79.7		84.3	84.0	79.8	82.5	80.5	82.1	81.9	79.7	79.4
19	84.8	79.0		84.3	83.6	78.9	82.9	79.6	82.0	81.9	79.7	79.4
20	84.8	78.2		84.2	83.0	78.7	82.6	79.2	81.8	82.0	79.6	79.0
21	84.7	77.9		83.4	82.1	78.5	82.4	79.0	81.6	82.1	79.6	78.7
22	84.6	77.8		82.4	81.2	78.3	82.0	78.6	81.5	82.2	79.4	78.7
23	84.5	77.8		82.5	81.1	78.3	81.9	78.7	81.4	81.9	79.1	78.7
24	84.4	78.3		81.7	80.9	78.2	81.8	79.6	81.3	80.9	79.0	78.7
25	84.2			81.5	80.4		80.0	80.3	81.1	81.0	79.0	
26	84.0										79.0	

Table D-2d
Vertical Temperature Profiles (°F) at Will County Generating Station, 26 July 2011

Depth (ft)	W5000-1/4 1443	W5000-1/2 1448	W5000-3/4 1453	W6000-1/4 1429	W6000-1/2 1434	W6000-3/4 1439	W7000-1/4 1415	W7000-1/2 1420	W7000-3/4 1424
1	83.5	84.1	84.0	83.2	83.3	83.1	83.0	83.3	82.4
2	82.9	83.2	83.4	82.8	82.8	82.7	82.5	82.9	81.9
3	82.4	83.4	83.2	82.6	82.3	82.5	82.3	83.0	82.1
4	82.2	83.4	82.8	82.7	81.9	82.6	82.2	83.1	82.3
5	81.8	83.4	82.6	83.0	81.4	82.8	82.0	83.1	82.1
6	81.6	83.4	81.8	83.1	81.8	81.9	81.8	83.2	81.4
7	81.4	83.6	81.2	83.1	82.5	80.9	81.6	83.2	81.5
8	81.6	83.6	81.2	83.1	82.6	81.0	81.6	82.1	81.3
9	81.9	83.5	81.0	82.4	81.9	80.3	81.4	81.1	80.8
10	82.3	82.4	79.9	81.5	80.7	80.0	81.5	82.4	80.7
11	82.5	82.3	79.3	81.1	80.4	80.0	82.1	82.7	80.6
12	83.1	82.9	80.3	80.9	80.2	79.9	82.3	82.5	80.6
13	83.2	82.5	81.6	80.6	80.0	79.8	82.1	81.7	80.4
14	82.8	81.5	82.9	80.4	79.9	79.8	81.9	80.9	80.3
15	82.2	79.5		80.0	79.8	80.0	81.8	80.4	80.3
16	81.8	79.1		79.8	79.7	80.5	81.4	80.2	80.2
17	81.5	79.0		79.7	79.6	80.7	80.6	80.1	80.5
18	81.3	79.0		79.6	79.5	80.8	80.1	80.1	80.7
19	81.1	78.9		79.6	79.7	80.3	80.0	80.0	80.9
20	80.9	78.9		79.6	80.0	79.9	79.9	80.0	81.0
21	80.7	78.9		80.0	79.7	79.7	79.9	80.0	81.0
22	80.7	79.8		80.3	79.5	79.7	79.9	79.9	80.7
23	80.5	80.2		80.7	79.7	79.7	79.8	79.9	80.3
24	80.3	81.2		81.2	79.5		79.8	79.9	80.2
25	79.4	82.2		81.4	79.3		79.8	80.1	
26	78.9	82.4		81.6	79.3		80.1		

Table D-3a
Vertical Temperature Profiles (°F) at Will County Generating Station, 10 August 2011

Depth (ft)	W-3380-1/4 1757	W-3380-1/2 1801	W-3380-3/4 1806	W-250-1/4 1739	W-250-1/2 1743	W-250-3/4 1748	W0-1/5 1721	W0-2/5 1725	W0-3/5 1730	W0-4/5 1734
1	79.1	79.0	79.0	79.1	79.0	79.0	79.2	79.1	87.3	92.3
2	79.1	79.0	79.0	79.1	79.0	79.0	79.2	79.2	86.8	92.3
3	79.1	79.0	79.0	79.1	79.1	79.0	79.1	79.1	86.9	92.3
4	79.1	79.0	79.0	79.1	79.1	79.0	79.1	79.1	86.2	92.3
5	79.1	79.0	79.0	79.1	79.1	79.1	79.1	79.1	84.8	92.3
6	79.1	79.0	79.0	79.1	79.1	79.1	79.1	79.1	84.1	92.4
7	79.1	79.0	79.0	79.1	79.1	79.1	79.1	79.1	82.5	92.3
8	79.1	79.0	79.0	79.1	79.1	79.1	79.1	79.3	81.7	92.3
9	79.2	79.0	79.0	79.1	79.1	79.1	79.1	79.5	80.9	91.9
10	79.2	79.0	79.0	79.1	79.1	79.1	79.1	79.6	79.6	91.8
11	79.2	79.0	79.0	79.1	79.1	79.1	79.1	79.8	79.4	92.2
12	79.2	79.0	79.0	79.1	79.1	79.1	79.1	80.0	79.3	91.9
13	79.2	79.0	79.0	79.1	79.1	79.1	79.1	80.2	79.3	90.3
14	79.2	79.0	79.0	79.1	79.1	79.1	79.1	80.1	79.3	
15	79.2	79.0	79.0	79.1	79.1	79.1	79.1	79.9	79.2	
16	79.2	79.0	79.0	79.1	79.1	79.1	79.1	79.7	79.2	
17	79.2	79.0	79.0	79.1	79.1	79.0	79.2	79.5	79.2	
18	79.2	79.0	79.0	79.1	79.1	79.0	79.2	79.4	79.2	
19	79.2	79.0	79.0	79.1	79.1	79.0	79.2	79.4	79.2	
20	79.2	79.0	79.0	79.1	79.1	79.0	79.3	79.3	79.3	
21	79.2	79.0	79.0	79.1	79.1	79.0	79.3	79.3	80.1	
22	79.2	79.0	79.0	79.1	79.1	79.1	79.3	79.2	80.3	
23	79.2	79.0	79.0	79.1	79.1	79.1	79.3	79.2		
24	79.2	79.0		79.2	79.1	79.1	79.2	79.2		
25	79.2	79.0		79.2	79.1	79.1	79.1	79.2		
26								79.2		

Table D-3b
Vertical Temperature Profiles (°F) at Will County Generating Station, 10 August 2011

Depth (ft)	W180-1/4 1706	W180-1/2 1711	W180-3/4 1715	W525-1/4 1648	W525-1/2 1653	W525-3/4 1657	W1000-1/4 1631	W1000-1/2 1636	W1000-3/4 1640
1	89.3	91.7	92.1	86.9	87.2	86.1	88.0	87.1	87.5
2	88.9	91.4	91.1	85.3	86.6	85.7	87.4	86.9	87.7
3	88.9	91.3	90.9	84.7	86.8	85.7	87.0	86.5	87.6
4	88.8	91.1	90.9	85.0	86.9	85.7	86.7	86.6	87.3
5	88.8	91.0	91.3	85.3	86.9	85.6	86.6	86.7	87.3
6	88.7	90.5	91.3	85.4	86.9	85.7	86.7	86.7	87.1
7	88.4	89.9	89.6	85.5	86.9	85.5	86.5	86.6	86.4
8	88.0	86.5	87.4	85.6	86.7	85.5	86.2	86.6	86.5
9	88.3	85.5	86.8	85.6	86.7	85.5	85.9	86.3	85.9
10	88.5	86.6	84.5	85.3	86.5	85.2	85.6	86.1	85.6
11	88.5	85.9	85.1	85.3	86.3	85.1	85.7	85.9	84.5
12	88.5	87.8	84.8	85.3	86.2	85.0	86.0	86.4	83.8
13	88.5	89.4	84.2	85.3	86.0	85.1	85.8	86.3	83.3
14	88.5	89.9	85.2	85.1	85.9	85.1	85.7	84.8	82.1
15	88.5	89.9	84.5	85.1	85.7	84.9	85.8	82.4	81.9
16	88.3	89.3	84.2	85.5	85.5	84.6	85.7	81.1	81.7
17	88.1	89.1	86.9	85.1	85.2	83.8	85.6	80.6	81.1
18	87.4	88.2	89.3	84.9	84.5	83.2	85.5	80.7	80.3
19	86.3	86.4	90.3	84.7	84.4	80.5	85.0	79.9	80.1
20	85.2	85.0	89.3	85.6	82.1	79.6	85.1	79.7	80.6
21	84.1	83.5	87.6	85.6	80.4	79.4	84.4	79.6	80.4
22	82.9	82.4	86.2	84.1	80.8	79.3	83.6	79.6	80.2
23	82.0	82.0	83.6	81.0	81.5	79.3	81.8	79.6	79.9
24	81.6	81.7	82.7	79.8	80.6	79.2	80.0	79.5	79.8
25	81.3	80.6	82.2	79.6	79.6	80.3	79.7	79.5	
26			81.8		79.4				

Table D-3c
Vertical Temperature Profiles (°F) at Will County Generating Station, 10 August 2011

Depth (ft)	W1500-1/4 1619	W1500-1/2 1623	W1500-3/4 1627	W2200-1/4 1606	W2200-1/2 1611	W2200-3/4 1615	W3000-1/4 1549	W3000-1/2 1554	W3000-3/4 1558	W4000-1/4 1527	W4000-1/2 1531	W4000-3/4 1535
1	88.3	86.1	84.8	86.9	86.9	87.1	84.6	85.0	83.8	84.2	84.4	83.7
2	87.2	84.9	84.4	85.9	86.8	87.0	84.1	84.8	83.7	83.9	83.6	83.5
3	86.5	84.6	84.3	85.7	86.7	87.0	84.1	84.8	83.4	83.9	83.6	83.6
4	86.7	84.8	84.2	85.7	86.5	87.0	84.2	84.8	83.3	83.8	83.7	83.6
5	86.8	85.5	84.2	85.6	86.4	87.0	84.2	84.8	83.0	83.6	83.8	83.3
6	86.7	83.9	83.7	85.7	86.2	87.0	83.6	84.8	82.5	83.5	83.9	83.6
7	86.7	83.1	83.1	85.7	86.2	86.9	83.1	84.4	82.2	83.6	84.0	83.7
8	86.6	83.5	82.5	85.8	86.3	86.9	83.1	84.0	82.4	83.9	84.0	83.7
9	86.5	84.0	81.8	85.8	86.3	86.9	83.0	83.4	82.6	83.9	83.6	83.7
10	86.2	82.9	81.7	85.6	86.3	86.9	82.2	82.9	82.7	84.0	83.8	83.0
11	86.2	81.6	82.1	85.6	86.3	86.8	81.9	82.7	82.7	84.0	84.0	82.4
12	86.0	81.0	82.8	85.6	86.2	86.6	82.1	83.0	82.6	84.0	84.1	83.0
13	86.0	80.8	81.2	85.5	86.3	86.4	82.5	83.7	81.7	84.0	83.7	83.4
14	85.9	80.6	80.3	85.4	86.1	85.8	82.3	83.8	80.6	83.2	81.7	83.6
15	85.9	80.6	80.0	85.2	86.1	83.9	81.6	83.8	80.4	82.2	81.4	83.6
16	85.6	80.5	79.9	85.2	86.0	83.0	80.8	83.1	80.5	81.7	82.0	83.6
17	83.6	80.1	79.9	85.0	85.9	82.6	80.6	81.3	80.4	81.4	82.4	83.6
18	84.0	80.0		84.5	85.7	82.6	80.7	80.4	80.3	81.2	81.9	82.9
19	84.4	80.0		83.6	85.5	82.6	80.5	80.3	80.2	81.0	81.1	82.0
20	83.5	79.8		83.6	83.6	82.0	80.3	80.4	80.1	80.9	80.8	81.0
21	82.2	79.7		81.4	81.3	80.8	80.2	81.6	80.2	80.8	80.6	80.7
22	81.3	79.7		80.8	80.6	80.5	80.2	83.2	80.2	81.7	80.6	80.7
23	81.6	79.7		80.6	80.4	80.3	80.2	84.1	80.2	82.4	80.6	80.6
24	81.2	80.0		80.5	80.8		80.2	84.2	80.1	82.8	80.6	80.6
25	85.0				80.4		81.3	84.0	80.1	82.7	80.6	
26												

Table D-3d
Vertical Temperature Profiles (°F) at Will County Generating Station, 10 August 2011

Depth (ft)	W5000-1/4 1513	W5000-1/2 1517	W5000-3/4 1522	W6000-1/4 1459	W6000-1/2 1503	W6000-3/4 1508	W7000-1/4 1440	W7000-1/2 1448	W7000-3/4 1452
1	83.9	84.5	84.1	82.4	81.9	82.0	83.9	82.0	82.8
2	83.7	84.4	83.9	82.5	81.9	81.9	83.9	82.2	82.8
3	83.4	84.4	83.9	82.5	81.9	81.9	83.9	82.2	82.8
4	83.3	84.5	83.8	82.4	81.9	81.9	83.8	82.1	82.8
5	83.3	84.5	83.8	82.4	81.9	81.9	83.7	82.2	82.7
6	83.3	84.5	83.7	82.3	81.9	81.9	83.8	82.2	82.6
7	83.3	84.5	83.3	82.2	81.9	81.9	83.8	82.1	82.3
8	83.2	84.5	82.7	82.2	81.8	81.9	83.6	82.2	82.5
9	83.2	84.5	82.6	82.1	81.8	81.9	83.6	82.2	82.3
10	83.3	84.4	83.2	82.0	81.8	81.9	83.8	82.2	82.2
11	82.9	83.2	83.5	82.0	81.8	81.9	83.1	82.2	82.6
12	82.6	82.5	83.0	81.8	81.8	81.9	82.6	82.2	82.7
13	82.9	83.4	82.1	81.8	81.8	81.9	82.7	82.2	82.6
14	82.9	83.1	81.7	81.8	81.8	81.9	82.4	82.1	82.6
15	82.5	83.6		81.7	81.7	81.9	82.3	82.0	82.6
16	82.2	83.9		81.7	81.7	81.9	82.1	81.9	82.6
17	81.8	83.5		81.6	81.7	81.9	82.0	81.9	82.6
18	81.7	83.3		81.6	81.7	81.9	82.1	82.0	82.4
19	81.7	83.5		81.5	81.6	81.9	82.0	82.1	82.3
20	81.7	83.7		81.5	81.6	81.9	82.3	82.1	82.3
21	81.6	83.6		81.4	81.5	81.9	82.7	82.1	82.4
22	81.6	82.9		81.5	81.5	81.9	83.0	82.1	82.1
23	81.6	82.4		81.5	81.5	81.9	83.1	82.0	82.0
24	82.0	81.8		81.4	81.5		82.6	82.0	
25	82.8	81.6		81.4	81.5		82.0		
26		81.6							

Table D-4a
Vertical Temperature Profiles (°F) at Will County Generating Station, 1 September 2011

Depth (ft)	W-3380-1/4 1646	W-3380-1/2 1650	W-3380-3/4 1654	W-250-1/4 1630	W-250-1/2 1634	W-250-3/4 1639	W0-1/5 1612	W0-2/5 1618	W0-3/5 1622	W0-4/5 1625
1	79.6	79.4	79.3	88.7	88.9	88.4	89.3	89.3	90.4	93.7
2	79.4	79.2	79.3	88.7	88.7	88.2	89.3	88.5	89.7	93.7
3	79.3	79.2	79.2	88.3	87.6	88.0	89.3	87.7	89.2	93.7
4	79.3	79.2	79.2	87.9	86.8	86.9	89.0	87.2	89.3	93.7
5	79.3	79.3	79.1	85.0	85.8	86.4	87.5	87.4	89.0	93.7
6	79.2	79.3	79.1	83.6	84.6	86.1	87.2	86.7	86.1	93.7
7	79.2	79.2	79.1	83.4	83.8	84.9	85.1	85.1	84.2	93.7
8	79.2	79.2	79.1	82.9	83.0	83.8	83.6	84.0	83.9	93.7
9	79.2	79.1	79.1	82.2	82.4	82.9	82.9	83.3	83.1	93.7
10	79.2	79.1	79.1	81.3	81.1	82.1	82.2	82.7	81.8	93.7
11	79.2	79.1	79.1	80.7	80.1	80.7	82.1	82.3	80.2	93.7
12	79.2	79.1	79.1	80.3	79.7	79.7	81.5	81.2	79.5	93.7
13	79.2	79.1	79.1	80.2	79.7	79.5	81.0	79.8	79.3	93.7
14	79.2	79.1	79.1	80.1	79.6	79.4	79.6	79.5	79.2	
15	79.2	79.1	79.1	79.5	79.3	79.4	79.5	79.3	79.1	
16	79.2	79.1	79.1	79.2	79.2	79.4	79.3	79.2	79.1	
17	79.2	79.1	79.1	79.1	79.1	79.3	79.1	79.0	79.1	
18	79.2	79.1	79.1	79.1	79.0	79.2	79.0	79.0	79.1	
19	79.2	79.1	79.1	79.0	79.0	79.2	79.0	79.0	79.1	
20	79.1	79.1	79.1	79.0	79.0	79.1	78.9	79.0		
21	79.1	79.1		79.0	79.0	79.1	78.9	79.0		
22	79.1	79.1		79.0	79.0	79.1	78.9	79.0		
23	79.1	79.1		79.0	79.0	79.1	78.9	79.0		
24	79.1	79.1		79.0	79.0	79.1	78.9	79.0		
25	79.1	79.1		79.0	79.0	79.1	78.9	79.0		
26	79.1	79.1		79.0	79.0	79.1	78.9	79.0		

Table D-4b
Vertical Temperature Profiles (°F) at Will County Generating Station, 1 September 2011

Depth (ft)	W180-1/4 1558	W180-1/2 1602	W180-3/4 1607	W525-1/4 1533	W525-1/2 1537	W525-3/4 1541	W1000-1/4 1520	W1000-1/2 1523	W1000-3/4 1527
1	91.1	92.6	92.7	90.5	89.8	89.1	90.8	90.2	90.7
2	90.3	91.5	91.0	90.2	89.8	89.0	90.5	89.8	89.6
3	89.4	91.8	90.2	90.1	89.7	88.8	89.5	89.5	89.7
4	89.0	90.7	89.9	89.7	89.6	88.4	88.7	88.9	89.6
5	88.8	88.8	89.8	89.6	88.9	88.4	88.2	88.4	89.5
6	89.0	88.9	89.3	89.0	88.1	88.0	87.9	88.3	89.1
7	89.0	89.0	87.0	87.3	87.8	87.2	87.8	88.1	88.4
8	88.9	88.5	85.7	83.3	87.1	86.3	87.3	88.0	87.6
9	88.8	87.7	85.3	81.3	86.1	85.7	86.3	87.8	87.0
10	88.9	87.1	85.5	80.7	84.9	85.0	86.0	86.2	86.4
11	88.9	87.2	85.1	80.6	82.7	85.2	85.5	84.5	86.1
12	88.8	86.7	85.1	80.6	81.4	85.2	84.9	83.5	83.4
13	88.8	86.7	83.3	80.3	80.6	83.5	83.3	82.3	81.8
14	88.5	86.6	80.3	79.9	80.3	80.9	82.3	81.1	80.4
15	88.4	84.9	79.2	79.7	80.1	79.7	81.9	80.4	80.4
16	86.7	82.2	79.2	79.5	79.9	79.3	81.7	80.1	79.9
17	83.1	82.0	79.1	79.2	79.7	79.3	81.2	79.6	79.7
18	81.7	79.9	79.0	79.1	79.4	79.3	80.8	79.5	79.6
19	79.9	79.2	79.0	79.0	79.4	79.3	80.1	79.3	79.3
20	79.3	79.1	79.0	79.0	79.2	79.3	79.6	79.3	79.3
21	79.1	79.0	79.0	79.0	79.1	79.2	79.5	79.3	79.3
22	79.0	79.0	79.0	79.0	79.1	79.2	79.4	79.2	79.3
23	79.0	78.9	78.9	79.0	79.1	79.2	79.4	79.2	79.3
24	79.0	78.9	78.9	79.0	79.1		79.3	79.2	79.3
25	79.0	78.9	78.9	79.0	79.1		79.3	79.2	79.3
26	79.0	78.9	78.9	79.0			79.3	79.2	
27				79.0					

Table D-4c
Vertical Temperature Profiles (°F) at Will County Generating Station, 1 September 2011

Depth (ft)	W1500-1/4 1507	W1500-1/2 1511	W1500-3/4 1515	W2200-1/4 1453	W2200-1/2 1458	W2200-3/4 1502	W3000-1/4 1440	W3000-1/2 1444	W3000-3/4 1448	W4000-1/4 1426	W4000-1/2 1430	W4000-3/4 1434
1	90.2	90.1	89.8	90.9	90.8	90.7	90.7	90.8	90.6	91.8	91.5	91.5
2	90.2	89.8	89.5	90.1	90.4	90.4	90.6	90.6	90.5	91.4	91.2	91.2
3	89.9	89.5	88.9	90.0	90.3	90.4	90.5	90.6	90.2	91.2	91.0	91.3
4	89.1	89.1	88.8	89.8	90.0	90.3	90.3	90.4	89.9	90.7	90.7	90.8
5	88.4	88.7	88.8	89.5	89.9	90.0	89.8	90.1	89.5	90.3	90.5	90.1
6	87.9	88.1	88.5	89.3	89.7	89.6	89.5	89.8	89.3	90.1	90.0	90.1
7	87.8	86.6	87.9	88.9	89.4	89.2	89.3	89.5	89.1	89.8	89.6	90.0
8	86.8	85.1	87.5	88.2	89.0	88.9	88.9	89.3	88.9	89.6	89.1	90.0
9	86.4	84.6	87.1	86.9	88.6	88.5	88.7	89.1	88.3	89.1	88.7	89.9
10	86.3	83.5	86.6	85.5	87.8	88.1	88.2	88.8	88.1	88.9	88.0	89.7
11	86.2	82.5	84.3	84.2	86.7	87.6	87.6	88.6	88.0	88.3	87.5	89.6
12	85.1	79.9	82.6	83.2	85.2	86.0	87.0	87.9	87.1	87.4	87.0	88.3
13	83.9	79.7	81.6	82.7	83.6	83.4	86.6	87.3	85.3	87.0	86.4	86.2
14	80.8	79.6	81.3	81.3	81.7	81.8	86.2	86.3	84.7	86.7	85.9	84.7
15	79.6	79.6	80.0	80.4	80.7	80.9	85.4	85.3	83.9	85.7	84.8	83.7
16	79.4	79.5	79.6	79.7	80.2	80.6	83.1	83.8	83.1	84.5	83.3	82.7
17	79.3	79.5	79.5	79.4	79.9	80.4	81.1	82.1	82.4	83.3	82.2	81.5
18	79.3	79.5	79.5	79.3	79.6	80.1	80.3	80.7	81.9	82.9	81.1	81.0
19	79.2	79.3		79.3	79.5	79.6	79.9	80.3	80.6	81.9	80.7	80.5
20	79.1	79.2		79.2	79.4	79.3	79.5	80.1	80.0	81.0	80.6	80.3
21	79.1	79.1		79.2	79.3	79.2	79.5	79.9	79.6	80.8	80.5	80.0
22	79.1	79.1		79.2	79.2	79.2	79.4	79.7	79.5	80.5	80.3	80.0
23	79.1	79.1		79.1	79.2	79.2	79.4	79.5	79.4	80.4	80.0	79.9
24	79.1	79.1		79.2	79.2		79.4	79.4	79.4	80.2	79.9	79.9
25	79.1	79.1		79.2	79.1		79.4	79.4		79.9	79.8	
26	79.0				79.2		79.4	79.4		79.8	79.8	

Table D-4d
Vertical Temperature Profiles (°F) at Will County Generating Station, 1 September 2011

Depth (ft)	W5000-1/4 1414	W5000-1/2 1418	W5000-3/4 1422	W6000-1/4 1400	W6000-1/2 1404	W6000-3/4 1408	W7000-1/4 1347	W7000-1/2 1351	W7000-3/4 1354
1	90.6	90.2	90.6	90.6	90.7	90.4	89.7	89.7	89.7
2	90.2	90.2	90.5	90.4	90.2	90.1	89.6	89.6	89.3
3	90.1	90.2	90.3	90.2	89.9	89.9	89.5	89.3	89.1
4	89.9	90.1	90.1	89.6	89.6	89.6	89.4	89.0	88.8
5	89.8	89.9	89.9	89.4	88.9	89.4	89.2	88.9	88.6
6	89.7	89.8	89.7	89.2	88.6	89.2	88.8	88.7	88.5
7	89.3	89.8	89.1	88.8	88.4	89.2	88.5	88.5	88.1
8	89.2	89.8	89.0	88.5	88.2	89.1	88.4	88.2	87.9
9	89.0	89.7	88.5	88.1	87.7	88.7	88.1	87.8	87.6
10	88.6	89.4	88.1	87.8	86.7	87.2	87.7	87.5	87.2
11	88.4	89.0	87.8	87.4	86.2	86.1	87.3	87.1	87.1
12	88.0	88.5	87.4	86.7	85.9	85.7	87.1	86.8	87.0
13	86.9	87.5	87.2	85.4	85.8	85.4	86.8	86.6	86.9
14	86.4	85.8	86.5	84.8	85.5	85.1	86.4	86.5	86.8
15	85.9	83.7	85.4	84.4	85.3	85.0	85.9	86.4	86.5
16	85.2	82.9	84.7	84.3	85.0	84.9	85.5	86.0	85.6
17	83.0	82.4	83.6	84.3	84.9	84.8	85.3	85.5	85.2
18	82.5	82.2		84.2	84.7	84.8	85.1	85.3	84.8
19	82.1	82.2		84.1	84.4	84.6	84.9	85.0	84.6
20	81.8	82.2		84.0	84.1	84.4	84.8	84.8	84.6
21	81.6	82.0		83.9	83.9	84.0	84.7	84.7	84.5
22	81.4	81.5		83.8	83.8	83.7	84.7	84.7	84.5
23	81.3	81.2		83.8	83.8	83.7	84.6	84.6	84.5
24	81.2	80.9		83.6	83.7		84.5	84.6	84.5
25	81.2	80.9		83.6	83.7		84.5	84.5	
26	81.2	80.9		83.5	83.7		84.5	84.5	
27		80.9							

Table D-5a
Vertical Temperature Profiles (°F) at Will County Generating Station, 8 September 2011

Depth (ft)	W-3380-1/4 1711	W-3380-1/2 1726	W-3380-3/4 1720	W-250-1/4 1652	W-250-1/2 1703	W-250-3/4 1656	W0-1/5 1636	W0-2/5 1641	W0-3/5 1644	W0-4/5 1648
1	73.8	73.8	73.7	74.1	74.1	74.1	74.1	74.1	81.4	86.2
2	73.8	73.8	73.7	74.1	74.1	74.1	74.1	74.1	78.4	86.3
3	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	77.2	86.3
4	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	77.6	86.3
5	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	78.0	86.3
6	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	78.6	86.2
7	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	79.6	86.3
8	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	78.6	86.3
9	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	76.6	86.3
10	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.3	86.2
11	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	86.2
12	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	86.2
13	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	86.2
14	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
15	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
16	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
17	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
18	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
19	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
20	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
21	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
22	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
23	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
24	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
25	73.8	73.8	73.8	74.1	74.1	74.1	74.1	74.1	74.1	
26	73.8	73.8		74.1	74.1	74.1	74.1	74.1		

Table D-5b
Vertical Temperature Profiles (°F) at Will County Generating Station, 8 September 2011

Depth (ft)	W180-1/4 1624	W180-1/2 1628	W180-3/4 1632	W525-1/4 1606	W525-1/2 1610	W525-3/4 1613	W1000-1/4 1553	W1000-1/2 1557	W1000-3/4 1601
1	80.3	84.1	85.2	81.5	80.8	78.9	82.2	81.4	80.9
2	80.7	83.4	84.7	80.8	80.3	77.6	82.0	81.0	80.2
3	81.3	84.1	84.7	79.8	79.6	77.0	81.9	80.4	79.7
4	80.8	81.6	83.4	79.3	78.7	76.8	81.3	78.3	79.4
5	80.8	80.2	81.1	78.9	78.2	77.0	81.0	77.3	79.3
6	79.6	81.4	81.9	80.5	77.8	76.9	80.4	77.1	78.8
7	76.7	82.0	82.0	81.3	77.3	77.1	79.0	76.8	78.4
8	77.1	79.7	82.7	81.0	78.0	76.4	77.3	75.9	77.9
9	78.0	78.9	79.8	80.1	78.9	75.7	76.4	75.8	77.8
10	75.9	79.0	78.2	79.7	78.9	75.5	75.6	76.1	77.8
11	74.6	77.8	78.1	80.3	79.0	75.6	75.2	75.5	77.7
12	74.2	75.5	78.6	80.0	77.8	75.7	75.2	75.3	77.3
13	74.2	74.2	76.1	79.2	77.3	75.3	75.1	74.7	77.4
14	74.2	74.2	74.3	78.6	77.2	75.2	75.0	74.6	77.2
15	74.2	74.2	74.2	78.6	77.3	74.6	74.9	74.7	77.4
16	74.2	74.2	74.2	78.5	77.2	74.3	74.9	74.6	77.4
17	74.2	74.2	74.2	78.7	76.5	74.3	74.9	74.9	77.4
18	74.2	74.2	74.2	78.4	75.2	74.3	74.9	74.8	77.2
19	74.2	74.2	74.2	77.5	75.5	74.3	74.9	74.7	76.3
20	74.2	74.2	74.1	77.4	75.4	74.2	74.8	74.5	75.9
21	74.1	74.2	74.1	76.8	74.9	74.2	74.8	74.5	75.9
22	74.1	74.1	74.1	77.0	74.3	74.2	74.8	74.5	75.8
23	74.2	74.1	74.1	75.2	74.3	74.2	74.8	74.5	75.5
24	74.2	74.1	74.1	75.0	74.3	74.2	74.8	74.5	75.4
25	74.1	74.1	74.1	74.5	74.2	74.2	74.8	74.4	75.2
26	74.1	74.2	74.1	74.3	74.2		74.8		

Table D-5c
Vertical Temperature Profiles (°F) at Will County Generating Station, 8 September 2011

Depth (ft)	W1500-1/4 1539	W1500-1/2 1544	W1500-3/4 1548	W2200-1/4 1524	W2200-1/2 1528	W2200-3/4 1533	W3000-1/4 1509	W3000-1/2 1518	W3000-3/4 1514	W4000-1/4 1455	W4000-1/2 1459	W4000-3/4 1503
1	82.4	82.4	81.2	80.9	81.6	81.5	83.2	81.6	82.6	83.9	83.4	83.7
2	81.9	82.2	81.2	81.0	81.5	81.0	83.0	82.0	82.6	84.0	83.3	83.4
3	81.1	81.9	81.1	81.3	81.4	80.6	82.8	81.9	82.6	83.7	83.2	83.0
4	80.8	81.6	81.0	81.5	81.3	80.3	82.5	81.6	82.6	83.5	83.1	82.6
5	80.5	81.2	80.1	81.3	81.3	80.0	82.4	81.5	82.4	83.3	83.0	82.0
6	80.4	80.9	79.6	81.3	81.2	79.9	82.0	81.5	82.3	83.1	83.0	80.5
7	80.0	80.4	78.7	80.9	81.1	79.7	81.9	81.6	82.4	82.8	82.8	80.4
8	79.5	79.9	77.3	80.9	80.9	79.2	81.2	81.6	82.4	82.7	82.7	79.0
9	79.0	79.6	76.4	80.8	80.5	78.0	80.2	81.4	82.3	82.4	82.6	79.9
10	78.7	79.3	75.6	80.4	80.5	77.0	78.7	81.4	82.3	82.3	82.3	78.7
11	77.8	78.6	75.5	80.1	80.1	76.1	77.6	80.6	82.2	82.0	81.3	77.9
12	77.7	78.0	75.4	80.2	79.8	75.8	77.5	80.6	82.2	81.8	80.6	77.5
13	77.5	77.0	75.1	80.0	79.4	75.6	77.3	81.2	81.9	81.7	79.8	76.7
14	77.3	76.4	75.0	79.7	78.5	75.4	77.2	80.1	81.5	81.6	78.8	76.3
15	77.1	75.9	74.9	77.2	77.5	75.2	76.5	80.2	80.7	81.2	77.6	76.1
16	77.0	75.6	74.9	76.6	77.0	75.1	75.8	80.6	79.0	80.2	76.9	76.0
17	76.9	75.3	74.9	76.3	76.7	75.1	75.8	78.3	77.9	79.8	76.8	75.9
18	76.8	75.2	74.9	76.6	76.3	75.1	75.6	76.2	77.8	79.4	76.6	75.9
19	76.5	75.0		75.7	75.5	75.0	75.6	75.8	77.4	78.4	76.5	75.9
20	76.6	74.9		76.3	75.1	75.0	75.6	75.7	76.3	77.9	76.3	75.9
21	75.8	74.7		75.5	75.1	75.0	75.7	75.6	75.9	77.7	76.2	75.9
22	75.3	74.6		75.3	75.2	74.9	75.5	75.5	75.8	77.2	76.2	75.9
23	75.0	74.6		75.2	75.0	74.9	75.4	75.6	75.7	77.1	76.2	75.9
24	74.8	74.6		75.0	74.9	74.9	75.4	75.5	75.6	77.0	76.1	75.9
25	74.7			75.0	74.9		75.4	75.5	75.6	76.6	76.1	75.9
26	74.7				74.9		75.4	75.5		76.2	76.1	

Table D-5d
Vertical Temperature Profiles (°F) at Will County Generating Station, 8 September 2011

Depth (ft)	W5000-1/4 1442	W5000-1/2 1446	W5000-3/4 1450	W6000-1/4 1427	W6000-1/2 1431	W6000-3/4 1436	W7000-1/4 1413	W7000-1/2 1417	W7000-3/4 1421
1	83.8	83.6	83.4	84.0	84.1	83.8	82.6	82.6	82.8
2	83.9	83.7	83.3	84.1	84.1	83.9	82.7	82.7	82.8
3	84.0	83.6	83.2	83.9	84.0	83.8	82.7	82.6	82.6
4	83.9	83.4	83.1	83.8	84.1	83.8	82.6	82.4	82.5
5	83.8	83.2	83.0	83.7	83.9	83.7	82.6	82.4	82.4
6	83.7	83.0	82.7	83.6	83.7	83.5	82.6	82.1	82.3
7	83.6	82.7	81.8	83.5	83.6	83.2	82.4	81.9	82.2
8	83.6	82.2	80.5	83.5	83.3	83.3	81.9	81.8	82.1
9	83.4	81.5	80.1	83.5	83.0	83.3	81.7	81.7	82.0
10	83.1	81.3	79.8	83.3	82.8	83.0	81.3	81.6	81.9
11	83.0	80.9	79.6	83.0	82.6	82.7	81.1	81.5	81.9
12	82.3	80.6	79.0	82.6	82.3	82.2	81.0	81.3	81.9
13	82.4	80.4	78.9	82.1	82.0	81.5	81.0	81.1	81.7
14	81.7	79.4	78.8	81.6	82.0	80.9	80.8	80.9	81.2
15	81.4	78.9	78.8	81.3	81.8	80.5	80.7	80.7	80.8
16	81.1	78.8	78.8	81.1	81.3	80.3	80.6	80.5	80.6
17	80.8	78.7		81.0	80.6	80.3	80.5	80.5	80.6
18	80.5	78.5		80.8	80.3	80.7	80.5	80.4	80.4
19	79.7	78.4		80.7	80.2	80.7	80.3	80.4	80.4
20	78.9	78.3		80.5	80.0	80.5	80.2	80.2	80.4
21	78.8	78.3		80.3	79.7	80.1	80.2	80.2	80.2
22	78.8	78.2		80.2	79.6	80.0	80.2	80.1	80.2
23	78.7	78.3		80.1	79.7	80.0	80.1	80.1	80.1
24	78.8	78.2		80.1	79.7	79.9	80.1	80.1	80.1
25	78.8	78.2		80.1	79.6		80.1	80.1	
26	78.7	78.1		80.1	79.5		80.1	80.1	
27		78.1							

Table D-6a
Vertical Temperature Profiles (°F) at Will County Generating Station, 21 September2011

Depth (ft)	W-3380-1/4 1636	W-3380-1/2 1632	W-3380-3/4 1626	W-250-1/4 1613	W-250-1/2 1617	W-250-3/4 0	W0-1/5 1558	W0-2/5 1601	W0-3/5 1605	W0-4/5 1609
1	70.8	70.8	70.9	81.3	81.2		81.9	82.7	82.3	86.4
2	70.8	70.8	70.9	80.9	80.7	No	81.8	82.4	81.7	86.4
3	70.8	70.8	70.8	80.3	79.7	Data	81.8	81.7	81.1	86.4
4	70.8	70.8	70.8	79.9	78.8		81.6	80.7	80.1	86.4
5	70.8	70.8	70.8	79.3	78.8		81.3	79.0	77.4	86.4
6	70.8	70.8	70.9	78.2	78.0		80.2	76.8	77.3	86.4
7	70.8	70.8	70.9	77.2	76.9		79.4	76.4	77.1	86.4
8	70.8	70.8	70.9	75.9	75.2		78.0	76.3	76.7	86.4
9	70.8	70.8	70.9	74.1	73.9		77.6	75.8	75.8	86.4
10	70.8	70.8	70.8	73.2	72.6		76.7	74.4	74.4	86.4
11	70.8	70.8	70.9	72.7	72.2		74.8	73.4	72.4	86.4
12	70.8	70.8	70.9	72.4	71.8		74.4	72.6	72.2	86.4
13	70.8	70.8	70.9	72.1	71.7		74.3	72.4	72.1	86.4
14	70.8	70.8	70.9	72.0	71.6		72.7	72.3	72.0	
15	70.8	70.8	70.8	71.9	71.4		72.5	72.1	71.9	
16	70.8	70.8	70.9	71.7	71.3		72.3	72.1	71.9	
17	70.8	70.8	70.9	71.5	71.3		72.1	71.8	71.9	
18	70.8	70.8	70.9	71.4	71.3		71.9	71.8	71.8	
19	70.8	70.8	70.9	71.4	71.3		71.9	71.8	71.8	
20	70.8	70.8	70.8	71.3	71.2		71.9	71.8	71.7	
21	70.8	70.8	70.8	71.2	71.2		71.8	71.8	71.7	
22	70.8	70.8	70.8	71.2	71.2		71.8	71.8	71.8	
23	70.8	70.8	70.8	71.2	71.2		71.8	71.8	71.8	
24	70.8	70.8	70.8	71.2	71.2		71.8	71.8	71.8	
25	70.8	70.8	70.8	71.2	71.2		71.8	71.8		
26	70.8				71.2		71.8	71.8		

Table D-6b
Vertical Temperature Profiles (°F) at Will County Generating Station, 21 September2011

Depth (ft)	W180-1/4 1545	W180-1/2 1549	W180-3/4 1552	W525-1/4 1528	W525-1/2 1532	W525-3/4 1536	W1000-1/4 1516	W1000-1/2 1519	W1000-3/4 1523
1	83.9	84.5	83.8	85.0	84.6	83.8	84.8	84.4	84.2
2	83.2	83.7	83.9	85.0	84.6	83.9	84.9	84.5	84.2
3	82.5	83.6	83.9	84.8	84.6	83.8	84.7	84.5	84.2
4	82.7	82.9	82.4	84.4	84.6	83.8	84.5	84.5	84.2
5	82.6	82.2	82.2	83.9	84.6	83.5	84.4	84.5	84.2
6	82.5	81.9	80.4	83.1	84.6	83.0	84.0	84.4	83.9
7	82.4	81.0	80.6	82.4	84.4	82.6	83.7	84.3	83.3
8	82.4	81.5	81.3	79.0	83.1	81.8	83.1	84.1	82.8
9	82.4	81.2	81.5	77.2	82.1	81.3	82.2	83.4	82.0
10	82.6	81.0	81.9	76.7	81.7	79.8	81.2	82.9	81.0
11	82.6	80.8	80.2	76.0	80.6	78.8	80.7	81.8	80.4
12	82.6	80.9	80.0	75.8	77.8	76.7	80.4	79.8	79.5
13	82.2	80.9	79.3	74.2	75.5	76.1	78.8	78.1	79.0
14	79.9	80.9	77.3	73.2	74.8	76.0	75.0	75.0	77.7
15	77.2	80.7	74.9	72.7	73.6	75.8	73.5	73.5	76.1
16	75.4	77.2	74.2	72.5	72.7	73.4	73.2	73.0	75.3
17	74.3	74.6	73.1	72.3	72.5	72.7	73.1	72.8	74.7
18	73.4	73.7	72.1	72.3	72.5	72.7	73.0	72.7	73.8
19	72.8	73.3	72.0	72.2	72.3	72.7	73.0	72.7	73.3
20	72.5	72.5	71.9	72.2	72.3	72.7	72.9	72.7	73.1
21	72.3	72.3	71.9	72.2	72.3	72.4	72.9	72.7	73.0
22	72.1	72.2	71.9	72.2	72.2	72.2	72.9	72.7	73.0
23	72.0	72.1	71.9	72.2	72.2	72.1	72.9	72.7	72.8
24	71.9	72.0	71.9	72.2	72.2	72.1	72.9	72.7	72.8
25	71.9	72.0	71.9	72.1	72.2	72.1	72.9	72.6	72.8
26	71.9	71.9	71.9	72.1	72.2		72.9	72.7	
27			71.8	72.1					

Table D-6c
Vertical Temperature Profiles (°F) at Will County Generating Station, 21 September2011

Depth (ft)	W1500-1/4 1503	W1500-1/2 1508	W1500-3/4 1511	W2200-1/4 1450	W2200-1/2 1454	W2200-3/4 1458	W3000-1/4 1437	W3000-1/2 1441	W3000-3/4 1445	W4000-1/4 1424	W4000-1/2 1428	W4000-3/4 1432
1	85.1	84.6	84.4	85.5	85.4	85.2	85.5	85.5	85.5	85.4	85.3	85.3
2	84.8	84.6	84.4	85.5	85.3	85.2	85.5	85.5	85.4	85.4	85.3	85.1
3	84.7	84.6	84.4	85.3	85.3	85.3	85.5	85.5	85.5	85.3	85.3	84.1
4	84.6	84.5	84.4	85.2	85.2	85.3	85.5	85.5	85.4	85.2	85.3	83.9
5	84.5	84.4	84.3	85.1	85.2	85.3	85.5	85.4	85.2	85.2	85.3	84.1
6	84.4	84.4	84.3	85.1	85.2	85.3	85.4	85.2	85.1	85.1	85.3	84.1
7	84.1	84.3	84.3	85.1	85.1	85.2	85.4	84.9	84.9	84.9	85.2	84.1
8	83.7	84.1	84.2	85.1	85.1	85.2	85.3	84.8	84.7	84.4	85.1	84.1
9	83.5	83.7	84.2	84.9	84.8	84.6	85.1	84.4	84.7	83.9	84.7	83.6
10	83.3	83.3	84.0	84.7	84.2	83.5	83.7	83.6	84.4	82.8	84.3	83.5
11	82.8	83.1	83.5	84.3	83.9	82.7	82.8	83.5	83.8	82.0	84.1	83.6
12	82.5	82.9	82.3	83.9	83.3	82.2	82.4	83.3	83.0	80.9	83.6	83.8
13	82.1	81.8	80.8	81.7	82.5	81.2	82.3	82.9	82.3	79.9	83.3	83.3
14	81.2	80.2	79.5	78.8	80.1	80.0	82.2	81.9	79.6	78.6	83.0	82.6
15	77.5	77.5	77.6	77.4	77.8	78.9	81.8	79.4	78.3	78.5	81.6	80.7
16	74.7	75.4	76.1	75.9	75.3	77.9	80.6	78.3	78.2	78.6	80.3	78.8
17	74.0	74.5	75.3	75.4	74.7	75.1	80.1	77.8	77.4	78.7	79.1	79.9
18	73.8	74.3	73.7	74.6	74.4	74.1	79.8	76.8	76.2	78.5	78.0	80.9
19	73.5	74.1	73.4	74.4	74.1	73.9	78.9	76.2	76.0	78.1	77.2	78.7
20	73.4	73.9	73.3	74.2	74.1	73.9	77.6	75.5	75.9	77.3	77.1	77.0
21	73.3	73.6		74.1	73.9	73.8	75.2	75.2	75.4	76.8	76.9	76.7
22	73.3	73.4		74.1	73.9	73.8	75.0	75.0	75.0	76.7	76.7	76.6
23	73.3	73.4		74.1	73.9	73.8	74.8	74.8	74.9	76.7	76.6	76.6
24	73.3	73.3		74.1	73.9	73.8	74.7	74.7	74.7	76.7	76.6	76.6
25	73.3	73.3			73.9		74.6	74.6	74.7	76.7	76.6	
26	73.3				73.9		74.6	74.6	74.7	76.7	76.6	

Table D-6d
Vertical Temperature Profiles (°F) at Will County Generating Station, 21 September2011

Depth (ft)	W5000-1/4 1410	W5000-1/2 1414	W5000-3/4 1418	W6000-1/4 1356	W6000-1/2 1401	W6000-3/4 1405	W7000-1/4 1341	W7000-1/2 1346	W7000-3/4 1350
1	85.6	85.5	85.4	85.6	85.5	85.6	85.1	84.8	84.7
2	85.6	85.5	85.4	85.6	85.5	85.6	85.0	84.8	84.7
3	85.6	85.4	85.3	85.6	85.3	85.5	84.9	84.7	84.7
4	85.6	85.4	85.3	85.5	85.1	85.4	84.8	84.5	84.7
5	85.6	85.3	85.2	85.3	85.0	85.4	84.5	84.3	84.5
6	85.4	85.2	85.1	85.2	84.8	85.4	84.1	84.2	84.4
7	85.0	85.0	85.0	84.8	84.4	85.2	83.7	84.0	84.3
8	84.8	84.9	85.0	84.6	84.1	84.7	83.4	83.8	84.1
9	84.7	84.8	84.8	84.4	84.0	84.2	83.3	83.5	84.0
10	84.5	84.3	84.0	84.1	83.7	84.0	82.7	83.2	83.1
11	83.7	83.3	83.5	83.7	83.2	83.6	82.1	82.9	82.3
12	82.7	82.5	83.2	83.1	82.3	83.5	81.5	82.5	81.9
13	82.3	82.1	82.5	82.6	81.9	83.5	81.2	82.1	81.7
14	81.9	81.7	81.1	82.0	81.3	83.3	81.0	81.7	81.4
15	80.8	81.3	80.2	81.5	80.8	82.3	80.9	81.0	81.2
16	80.2	80.0	79.8	81.2	80.5	81.4	80.7	80.2	80.8
17	79.9	79.4	79.0	80.9	80.2	80.5	80.6	80.0	80.4
18	79.8	79.3		80.8	79.9	80.3	80.4	80.0	80.3
19	79.1	79.3		80.7	79.7	80.2	80.3	79.7	79.9
20	78.8	79.1		80.1	79.5	79.9	79.9	79.5	79.7
21	78.7	78.9		79.4	79.4	79.7	79.4	79.5	79.3
22	78.7	78.7		79.1	79.4	79.5	79.3	79.3	79.1
23	78.6	78.7		79.1	79.3	79.4	79.0	78.9	79.0
24	78.6	78.7		79.1	79.3	79.3	78.6	78.0	78.8
25	78.5	78.6		79.0	79.2	79.3	77.6	76.9	
26	78.5	78.5		78.9	79.0		76.8	76.3	
27		78.5							

ATTACHMENT 3c: Excerpt from Will County 2011 Thermal Study Report—(EA 2012a)

4.2 ZONE OF PASSAGE AND CROSS-SECTIONAL AREA

When mixing zones are allowed a zone of passage for aquatic life is a regulatory requirement. Under Title 35 Illinois Administrative Code Section 302.102, the mixing zone must allow for a zone of passage in which water quality standards are met. Under these regulations, the following mixing zone requirement applies: "The area and volume in which mixing occurs, alone or in combination with other areas and volumes of mixing must not contain more than 25% of the cross-sectional area or volume of flow of a stream except for those streams where the dilution ratio is less than 3:1". In other words, the zone of passage must occupy at least 75% of the cross-sectional area or flow volume.

The thermal water quality standards that apply to Will County Station's mixing zone are Illinois' Secondary Contact and Indigenous Life Standards. These standards require that temperatures shall not exceed 100°F at any time at the edge of the mixing zone (35 Illinois Administrative Code Section 302.408).

Cross-sectional areas enclosed by temperature contours over the range of observed survey temperatures were calculated for the six Will County Station thermal plume surveys. The resulting cross-sectional areas, reported as a percentage of the total cross-sectional area that was at temperatures less than or equal the specified temperature, are provided in Tables 4-3 to 4-8. These tables also include the minimum, maximum, and average temperature observed during the vertical surveys at each of the 13 transects. Temperatures corresponding to less than 75 percent of the cross-sectional area for the six 2011 surveys are provided below.

Temperature (°F) at 75% Cross-Sectional Area

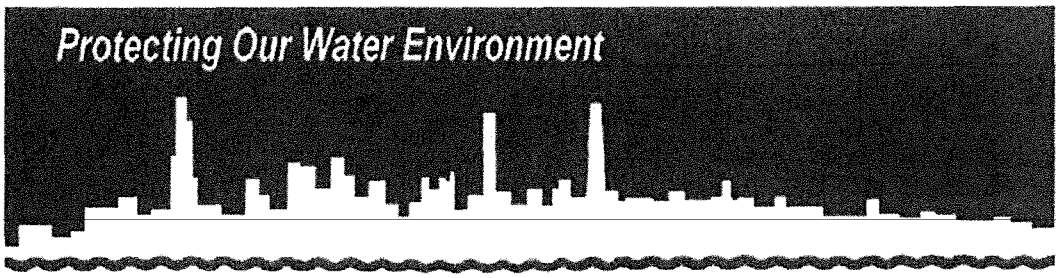
Survey	W0	W180	W525	W1000	W1500
13 July	91.5	92.5	93.5	92.5	93.5
26 July	84.0	87.0	83.5	84.5	84.5
10 August	84.5	89.0	85.5	86.5	85.5
1 Sept	89.0	88.5	87.5	88.0	88.0
8 Sept	78.5	80.0	78.5	78.0	80.0
21 Sept	81.5	82.0	82.5	83.5	84.5

The above table indicates that temperatures at the edge of the mixing zone never exceeded the 100°F criteria.

ATTACHMENT 4. INHS Site 10 in the upper Des Plaines River in relation to the Chicago Sanitary and Ship Canal.

EXCERPTS

ATTACHMENT 5a--Excerpts from MWRDGC 2010 Chicago Area Waterways Study



Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 14-10

AMBIENT WATER QUALITY MONITORING IN THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS: A SUMMARY OF BIOLOGICAL, HABITAT, AND SEDIMENT QUALITY DURING 2010

March 2014

TABLE 6: BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2010

Taxa	Hester Dendy	Petite Ponar
COELENTERATA (Hydroids)		
Hydra	X	X
PLATYHELMINTHES (Flat worms)		
Turbellaria	X	X
ANNELLIDA		
Oligochaeta (Aquatic Worms)	X	X
Hirudinea (Leeches)		
Desserobdella phalera	X	
Helobdella[1]	X[1]	X[1]
Helobdella stagnalis	X	X
Placobdella nuchalis	X	
Haemopis	X	X
Erpobdella punctata punctata	X	X
Erpobdella microstoma	X	X
CRUSTACEA		
Isopoda (Sow Bugs)		
Caecidotea	X	X
Amphipoda (Side Swimmers)		
Hyalella azteca	X	X
Gammarus	X	X
Echinogammarus ischusa	X	X
DECAPODA (Crayfish)		
Orconectes	X	
Procambarus	X	

TABLE 6 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2010

Taxa	Hester Dendy	Petite Ponar
ARACHNOIDEA		
Hydracarina (Water Mites)	X	
INSECTA		
Ephemeroptera (Mayflies)		
Baetis intercalaris	X	X
Maccaffertium integrum	X	
Maccaffertium terminatum	X	X
Stenacron	X	
Tricorythodes	X	X
Anthopotamus myops grp.		X
Ephoron album		X
Odonata (Damselflies and Dragonflies)		
Argia	X	
Enallagma	X	X
Aeshna	X	
Trichoptera (Caddisflies)		
Cyrnellus fraternus	X	
Ceratopsyche morosa	X	
Cheumatopsyche	X	X
Hydropsyche bidens	X	
Hydropsyche simulans	X	
Potamyia flava		X
Nectopsyche	X	X
Oecetis		X

TABLE 6 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2010

Taxa	Hester Dendy	Petite Ponar
Coleoptera (Beetles)		
Peltodytes	X	
Dubiraphia		X
Macronychus glabratus	X	X
Stenelmis	X	X
Diptera (True Flies)		
Ceratopogonidae	X	X
Pericoma	X	X
Simulium	X	
Tipula		X
Chironimidae (Midges)		
Clinotanypus		X
Procladius	X	X
Tanypus		X
Ablabesmyia janta	X	
Ablabesmyia mallochi	X	X
Labrundinia	X	
Thienemannimyia grp	X	X
Corynoneura lobata	X	
Cricotopus bicinctus grp.	X	X
Cricotopus sylvestris grp.	X	X
Cricotopus tremulus grp.	X	
Mesosmittia	X	X
Nanocladius crassicornus/rectinervis	X	
Nanocladius distinctus	X	X
Parakiefferiella		X
Rheocricotopus robacki	X	
Thienemanniella similis	X	X
Thienemanniella xena	X	X
Chironomus	X	X
Cladopelma	X	X
Cryptotendipes		X
Cryptochironomus	X	X

TABLE 6 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2010

Taxa	Hester Dendy	Petite Ponar
Chironimidae (Midges) (Continued)		
Dicrotendipes fumidus	X	X
Dicrotendipes lucifer	X	X
Dicrotendipes neomodestus	X	X
Dicrotendipes simpsoni	X	X
Endochironomus nigricans	X	
Glyptotendipes	X	X
Microtendipes		X
Parachironomus	X	X
Paracladopelma	X	X
Paralauterborniella nigrohalteralis		X
Paratendipes	X	X
Phaenopsectra obediens	X	X
Polypedilum fallax grp.	X	
Polypedilum flavum	X	X
Polypedilum halterale grp.	X	X
Polypedilum illinoense	X	X
Polypedilum scalaenum grp.	X	X
Stenochironomus	X	
Stictochironomus		X
Xenochironomus xenolabis	X	
Cladotanytarsus mancus grp	X	X
Cladotanytarsus vanderwulpi grp.	X	X
Paratanytarsus	X	X
Rheotanytarsus	X	X
Tanytarsus	X	X
Tanytarsus glabrescens grp.	X	

TABLE 6 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2010

Taxa		Hester Dendy	Petite Ponar
GASTROPODA (Snails)			
	Ferrissia	X	X
	Amnicola	X	X
	Physa	X	X
	Menetus	X	
	Pleurocera		X
PELECYPODA (Mussels and Clams)			
	Corbicula fluminea	X	X
	Dreissena bugensis	X	X
	Dreissena polymorpha	X	X
	Eupera cubensis	X	
	Sphaerium		X
	Musculium		X
	Pisidium		X
	Leptodea fragilis		X
TOTAL SPECIES RICHNESS BY SAMPLE TYPE		85	75
EPT[2] SPECIES RICHNESS BY SAMPLE TYPE		11	9
TOTAL SPECIES RICHNESS FOR 2010		103	
EPT[2] SPECIES RICHNESS FOR 2010		15	

[1]Not counted as a discreet taxon.
[2]Ephemeroptera, Plecoptera, and Tricoptera are considered relatively sensitive taxa.

EXCERPTS

ATTACHMENT 5b--Excerpts from EA 2010 Macroinvertebrate Survey done for MWRDGC

FINAL

A STUDY OF THE BENTHIC MACROINVERTEBRATE COMMUNITY IN SELECTED CHICAGO METROPOLITAN AREA WATERWAYS DURING 2010

Prepared for:

Metropolitan Water Reclamation District of Greater Chicago
Monitoring and Research Department

Prepared by:

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

April 2012

EA Project 61755.03

Table 2-1 - Continued

Watershed	Sampling Station	Waterway	Lat./Lon.	Location Description
SBCR and CSSC [1]	40- Damen Ave.	Chicago Sanitary and Ship Canal	41° 50' 31.9"N 87°40' 31.1"W	40' upstream of Damen Ave. (40' from north bank and at center channel)
	75- Cicero Ave.	Chicago Sanitary and Ship Canal	41° 49' 11.4"N 87° 44' 35.7"W	20' upstream of Cicero Ave. (70' from north bank and at center channel)
	41- Harlem Ave.	Chicago Sanitary and Ship Canal	41° 48' 4.01"N 87° 48' 5.64"W	50' upstream of Harlem Ave. (50' from south bank and at center channel)
	42- Rt. 83	Chicago Sanitary and Ship Canal	41° 42' 29.5"N 87° 55' 38.6"W	4000' upstream of Rt. 83 (5' from south bank and at center channel)
	48- Stephen St.	Chicago Sanitary and Ship Canal	41° 41.127'N 87° 58.862'W	1.1 miles upstream of Stephen St. (10' from west bank and at center channel)
	92- Lockport (16th St.)	Chicago Sanitary and Ship Canal	41° 34' 59.2"N 88° 04' 8.7"W	75' upstream of former Division St. bridge location (20' from west bank and at center
Des Plaines River	64- Lake St.	W Branch Du Page R.	41° 58'43.1"N 88° 07' 59.4"W	125' upstream of Lake St. (5' from west bank and at center channel)
	18- Devon Ave.	Salt Cr.	41° 59'34.6"N 87° 59' 42.9"W	200' feet upstream of Devon Ave. (10' from west bank and at center channel)
	78- Wille Road	Higgins Cr.	42° 01' 7.24"N 87° 56' 12.03"W	200' downstream of Wille Rd., inside entrance to culvert (5' from west bank and at center
	13- Lake-Cook Rd.	Des Plaines R.	42° 09' 9.8"N 87° 54' 36.2"W	20' downstream of Lake-Cook Rd. (20' from west bank and at center channel)
	22- Ogden Ave.	Des Plaines R.	41° 49'14.4"N 87° 48' 38.2"W	200' upstream of Ogden Ave. (15' from east bank and at center channel)
	91- Material Service Rd.	Des Plaines R.	41° 35' 29.3"N 88° 4' 8.30"W	20-30' downstream of Material Service Rd. (20' from east bank and at center channel)

(1) SBCR=South Branch of the Chicago River, CSSC= Chicago Sanitary and Ship Canal

Figure 2-1: Sampling stations for the MWRDGC benthic macroinvertebrate program.

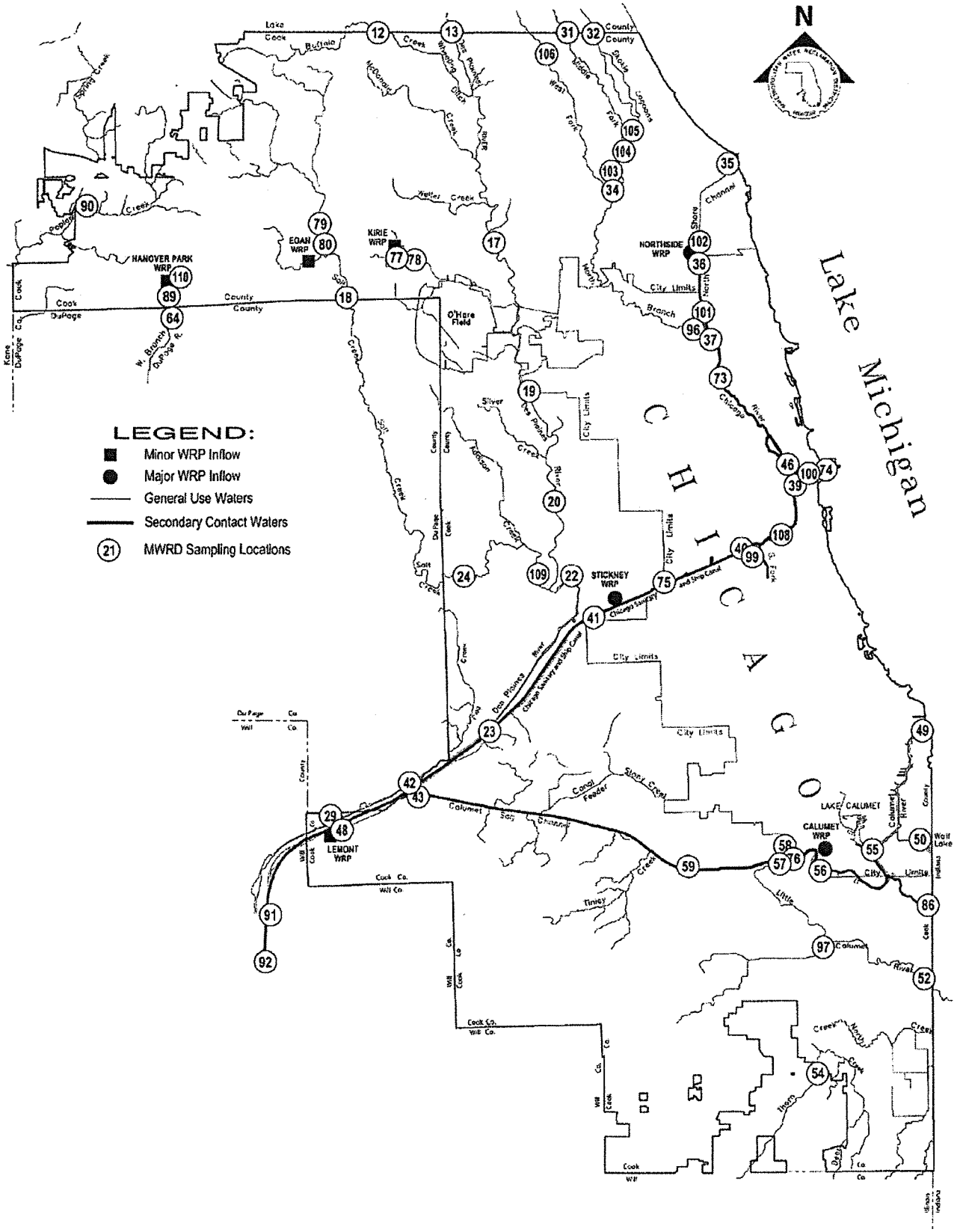


Table 3-1. List of benthic macroinvertebrate taxa collected in Hester-Dendy and Ponar samples from several Chicago Metropolitan Area waterways during the similar program years 2002, 2006, and 2010 (EA 2004 and 2010). Underlined taxa are those considered to be highly tolerant based on literature sources.

Taxa	HD 2002	Ponar 2002	HD 2006	Ponar 2006	HD 2010	Ponar 2010
COELENTERATA (Hydroids)						
Hydra	X	X	X	X	X	X
PLATYHELMINTHES (Flat worms)						
Turbellaria	X	X	X	X	X	X
NEMERTEA (Proboscis Worms)			X			
ECTOPROCTA (Bryozoans)						
Plumatellä	X	X	X			
ANNELLIDA						
Oligochaeta (Aquatic Worms)	X	X	X	X	X	X
Hirudinea (Leeches)						
Glossiphoniidae[1]	X[1]	X[1]				
Desserobdella phalera			X		X	
Helobdella[1]			X[1]	X[1]	X	X
Helobdella stagnalis	X	X	X	X	X	X
Helobdella triserialis	X		X	X		
Placobdella[1]	X					
Placobdella nuchalis					X	
Haemopis					X	X
Erpobdella punctata punctata		X			X	X
Erpobdella microstoma	X	X	X	X	X	X
CRUSTACEA						
Ostracoda (Seed Shrimp)			X	X		
Isopoda (Sow Bugs)						
Caecidotea	X	X	X	X	X	X
Amphipoda (Side Swimmers)						
Hyalella azteca			X		X	X
Gammarus[1]		X[1]	X	X	X	X
Gammarus fasciatus	X	X				
Echinogammarus ischusa			X	X	X	X
Decapoda (Crayfish)						
Orconectes[1]			X[1]	X	X	
Orconectes immunis			X			
Orconectes virilis		X				
Procambarus					X	
ARACHNOIDEA						
Hydracarina (Water Mites)			X		X	
INSECTA						
Ephemeroptera (Mayflies)						
Isonychia	X					
Baetis intercalaris	X	X	X	X	X	X
Heptagenia	X					

Table 3-1 (cont.)

Taxa	HD 2002	Ponar 2002	HD 2006	Ponar 2006	HD 2010	Ponar 2010
Ephemeroptera (cont.)						
Leucrocuta	X		X			
Maccaffertium integrum	X		X		X	
Maccaffertium terminatum	X				X	X
Stenacron	X		X	X	X	
Tricorythodes	X	X	X	X	X	X
Caenis			X	X		
Anthopotamus myops grp.						X
Hexagenia bilineata		X				
Ephoron [1]				X		
Ephoron album						X
Odonata (Damselflies and Dragonflies)						
Argia	X		X	X	X	
Enallagma	X		X	X	X	X
Aeshna					X	
Boyeria vinosa			X			
Stylurus				X		
Somatochlora	X					
Hemiptera (True Bugs)						
Trepobates	X					
Corixidae	X	X				
Trichoptera (Caddisflies)						
Cyrnellus fraternus	X		X		X	
Hydropsychidae[1]		X[1]				
Ceratopsyche morosa	X		X		X	
Cheumatopsyche	X	X	X	X	X	X
Hydropsyche	X		X			
Hydropsyche betteni	X		X			
Hydropsyche bidens	X		X		X	
Hydropsyche orris	X		X			
Hydropsyche simulans	X		X	X	X	
Potamyia flava	X	X				X
Hydroptila	X		X	X		
Nectopsyche			X		X	X
Oecetis						X
Lepidoptera (Aquatic Moths)						
Petrophila	X					
Coleoptera (Beetles)						
Copelatus	X					
Laccophilus maculosus	X					
Peltodytes					X	
Dubiraphia		X	X	X		X
Macronychus glabratus	X		X	X	X	X
Stenelmis	X	X	X	X	X	X

Table 3-1 (cont.)

Taxa	HD 2002	Ponar 2002	HD 2006	Ponar 2006	HD 2010	Ponar 2010
Coleoptera (cont.)						
Tropisternus	X					
Diptera (True Flies)						
Ceratopogonidae			X	X	X	X
Hemerodromia			X			
Pericoma					X	X
Simulium			X	X	X	
Tipula	X					X
Chironomidae (Midges)[1]	X[1]	X[1]				
Alotanypus			X			
Clinotanypus						X
Coelotanypus		X		X		
Procladius	X	X	X	X	X	X
Tanypus						X
Ablabesmyia annulata				X		
Ablabesmyia janta	X	X	X	X	X	
Ablabesmyia mallochi	X	X	X	X	X	X
Labrundinia					X	
Nilotanypus fimbriatus	X					
Thienemannimyia grp.	X	X	X	X	X	X
Corynoneura[1]			X			
Corynoneura lobata					X	
Cricotopus bicinctus grp.	X	X	X	X	X	X
Cricotopus sylvestris grp.	X	X	X	X	X	X
Cricotopus tremulus grp.	X	X	X	X	X	
Cricotopus trifascia grp.	X	X		X		
Heterotrissocladius	X		X			
Mesosmittia					X	X
Nanocladius[1]			X[1]			
Nanocladius crassicornus/rectinervis	X		X	X	X	
Nanocladius distinctus	X	X	X	X	X	X
Parakiefferiella						X
Rheocricotopus robacki	X		X	X	X	
Thienemanniella lobapodema			X	X		
Thienemanniella similis			X	X	X	X
Thienemanniella xena	X		X	X	X	X
Chironomus	X	X	X	X	X	X
Cladopelma	X		X	X	X	X
Cryptochironomus	X	X	X	X	X	X
Cryptotendipes			X			X
Dicrotendipes fumidus			X	X	X	X
Dicrotendipes lucifer			X	X	X	X
Dicrotendipes modestus			X	X		
Dicrotendipes neomodestus	X	X	X	X	X	X

Table 3-1 (cont.)

Taxa	HD 2002	Ponar 2002	HD 2006	Ponar 2006	HD 2010	Ponar 2010
Chironomidae (cont.)						
Dicrotendipes simpsoni	X	X	X	X	X	X
Endochironomus nigricans			X	X	X	
Glyptotendipes	X	X	X	X	X	X
Harnischia			X	X		
Microchironomus	X		X			
Microtendipes		X	X	X		X
Parachironomus	X	X	X	X	X	X
Paracladopelma		X			X	X
Paralauterborniella nigrohalteralis						X
Paratendipes			X	X	X	X
Phaenopsectra obediens			X	X	X	X
Phaenopsectra punctipes			X			
Polypedilum fallax grp.	X		X		X	
Polypedilum flavum	X	X	X	X	X	X
Polypedilum halterale grp.	X	X	X	X	X	X
Polypedilum illinoense	X	X	X	X	X	X
Polypedilum scalaenum grp.	X	X	X	X	X	X
Pseudochironomus			X	X		
Stenochironomus	X		X		X	
Stictochironomus			X	X		X
Tribelos jucundum			X			
Xenochironomus xenolabis	X		X		X	
Cladotanytarsus mancus grp.	X	X	X	X	X	X
Cladotanytarsus vanderwulpi grp.			X	X	X	X
Micropsectra	X					
Paratanytarsus	X	X	X	X	X	X
Rheotanytarsus	X		X	X	X	X
Tanytarsus	X	X	X	X	X	X
Tanytarsus glabrescens grp.		X	X		X	
Tanytarsus sepp	X		X			
GASTROPODA (Snails)						
Ferrissia	X	X	X	X	X	X
Amnicola		X		X	X	X
Physa	X		X	X	X	X
Helisoma			X	X		
Menetus	X			X	X	
Pleurocera			X	X		X
PELECYPODA (Mussels and Clams)						
Corbicula fluminea	X	X	X	X	X	X
Dreissena bugensis			X	X	X	X
Dreissena polymorpha	X	X	X	X	X	X
Eupera cubensis			X		X	
Sphaerium						X
Musculium	X	X	X	X		X

Table 3-1 (cont.)

Taxa	HD 2002	Ponar 2002	HD 2006	Ponar 2006	HD 2010	Ponar 2010
PELECYPODA (cont.)						
Pisidium			X	X		X
Pisidium nitidum		X				
Leptodea fragilis						X
TOTAL RICHNESS	81	50	103	80	86	76
EPT RICHNESS	18	5	16	8	11	9
TOTAL RICHNESS BY YEAR	90		110		104	
EPT RICHNESS BY YEAR	19		17		15	

[1]Taxon unidentifiable beyond level indicated. Not counted as a discreet taxon for all samples and years combined. May be counted as a discreet taxon for individual samples, sample types, stations, or locations if it is the only representative of that taxonomic order, family, or genus.

TABLE 3-20. HESTER-DENDY DENSITIES AT EACH SAMPLING STATION WITHIN THE CHICAGO SANITARY AND SHIP CANAL, JULY-SEPTEMBER 2010.

TAXA	40 DAMEN AVE.		75 CICERO AVE.		41 HARLEM AVE.		42 ROUTE 83		48 STEPHEN ST.		92 LOCKPORT	
	#/m2	%	#/m2	%	#/m2	%	#/m2	%	#/m2	%	#/m2	%
Hydra	622.5	4.76	53.8	0.30	132.8	0.86	412.6	11.40	154.3	3.01	986.7	18.89
Turbellaria	235.0	1.80	1,255.8	7.01	4,217.8	27.22	1,420.9	39.27	50.2	0.98	152.5	2.92
Oligochaeta	11,481.9	87.78	14,729.1	82.18	9,775.7	63.09	364.2	10.06	1,063.9	20.73	321.1	6.15
Desserobdella phalera	--	--	--	--	1.8	0.01	--	--	--	--	--	--
Helobdella	--	--	--	--	--	--	5.4	0.15	1.8	0.03	--	--
Helobdella stagnalis	37.7	0.29	161.5	0.90	14.4	0.09	32.3	0.89	--	--	--	--
Erpobdella punctata punctata	21.5	0.16	--	--	--	--	1.8	0.05	--	--	--	--
Erpobdella microstoma	--	--	--	--	9.0	0.06	--	--	--	--	--	--
Caecidotea	5.4	0.04	--	--	12.6	0.08	12.6	0.35	25.1	0.49	--	--
Hyalella azteca	125.6	0.96	--	--	479.0	3.09	735.6	20.33	25.1	0.49	362.4	6.94
Gammarus	--	--	35.9	0.20	--	--	129.2	3.57	--	--	678.1	12.99
Echinogammarus ischusa	--	--	--	--	--	--	--	--	104.1	2.03	100.5	1.92
Cyrnellus fraternus	--	--	--	--	--	--	10.8	0.30	2,452.5	47.80	23.3	0.45
Ceratopsyche morosa	--	--	--	--	--	--	--	--	--	--	1.8	0.03
Cheumatopsyche	--	--	--	--	--	--	--	--	--	--	21.5	0.41
Hydropsyche simulans	--	--	--	--	--	--	--	--	--	--	3.6	0.07
Procladius	7.2	0.05	--	--	--	--	--	--	--	--	--	--
Ablabesmyia janta	--	--	--	--	--	--	17.9	0.50	199.1	3.88	12.6	0.24
Thienemannimyia grp.	--	--	--	--	--	--	--	--	43.1	0.84	--	--
Cricotopus bicinctus grp.	--	--	17.9	0.10	--	--	--	--	--	--	--	--
Nanocladius distinctus	--	--	179.4	1.00	64.6	0.42	1.8	0.05	48.4	0.94	358.8	6.87
Chironomus	3.6	0.03	--	--	--	--	--	--	--	--	--	--
Dicrotendipes neomodestus	--	--	17.9	0.10	--	--	--	--	--	--	--	--
Dicrotendipes lucifer	229.6	1.76	645.9	3.60	462.9	2.99	111.2	3.07	249.4	4.86	1,237.9	23.70
Dicrotendipes simpsoni	192.0	1.47	699.7	3.90	315.8	2.04	93.3	2.58	57.4	1.12	353.4	6.77
Glyptotendipes	71.8	0.55	--	--	--	--	--	--	12.6	0.24	12.6	0.24
Parachironomus	3.6	0.03	17.9	0.10	--	--	1.8	0.05	--	--	--	--
Polypedilum halterale grp.	--	--	--	--	--	--	1.8	0.05	--	--	--	--
Polypedilum illinoense	--	--	--	--	--	--	--	--	7.2	0.14	--	--
Stenochironomus	--	--	--	--	--	--	--	--	84.3	1.64	--	--
Physa	3.6	0.03	17.9	0.10	--	--	1.8	0.05	--	--	--	--
Menetus	39.5	0.30	--	--	--	--	--	--	--	--	--	--
Ferrissia	--	--	17.9	0.10	--	--	16.1	0.45	222.5	4.34	583.1	11.16
Corbicula fluminea	--	--	--	--	--	--	--	--	159.7	3.11	12.6	0.24
Eupera cubensis	--	--	71.8	0.40	--	--	247.6	6.84	1.8	0.03	--	--
Dreissena bugensis	--	--	--	--	9.0	0.06	--	--	168.6	3.29	--	--
TOTAL BENTHOS	13,080.4	100.00	17,922.5	100.00	15,495.2	100.00	3,618.6	100.00	5,131.0	100.00	5,222.5	100.00
TOTAL TAXA RICHNESS	15		14		12		19		20		17	
EPT TAXA RICHNESS	0		0		0		1		1		4	

TABLE 3-21. PETITE PONAR DENSITIES AT EACH SAMPLING STATION WITHIN THE CHICAGO SANITARY AND SHIP CANAL, JULY-SEPTEMBER 2010.

TAXA	40 DAMEN AVE.		75 CICERO AVE.		41 HARLEM AVE.		42 ROUTE 83		92 LOCKPORT	
	#/m2	%	#/m2	%	#/m2	%	#/m2	%	#/m2	%
Hydra	--	--	35.9	0.11	--	--	--	--	--	--
Turbellaria	--	--	--	--	107.6	0.29	71.8	0.52	28.7	0.07
Oligochaeta	165,364.0	99.22	31,268.6	98.02	36,995.6	99.21	13,104.5	95.80	37,806.5	97.45
Helobdella	--	--	--	--	--	--	--	--	7.2	0.02
Helobdella stagnalis	--	--	--	--	43.1	0.12	430.6	3.15	--	--
Erpobdella microstoma	--	--	--	--	--	--	--	--	43.1	0.11
Caecidotea	7.2	0.00	--	--	--	--	--	--	--	--
Hyalella azteca	64.6	0.04	--	--	--	--	14.4	0.10	14.4	0.04
Echinogammarus ischusa	--	--	--	--	--	--	--	--	14.4	0.04
Ceratopogonidae	358.8	0.22	--	--	--	--	--	--	--	--
Procladius	760.7	0.46	157.9	0.49	64.6	0.17	--	--	681.8	1.76
Thienemannimyia grp.	--	--	--	--	--	--	--	--	14.4	0.04
Nanocladius distinctus	--	--	--	--	--	--	--	--	21.5	0.06
Chironomus	50.2	0.03	--	--	43.1	0.12	--	--	--	--
Cryptotendipes	--	--	--	--	35.9	0.10	--	--	--	--
Dicrotendipes lucifer	--	--	71.8	0.22	--	--	28.7	0.21	14.4	0.04
Dicrotendipes simpsoni	21.5	0.01	--	--	--	--	14.4	0.10	14.4	0.04
Paralauterborniella nigrohalteralis	--	--	7.2	0.02	--	--	--	--	--	--
Polypedilum halterale grp.	--	--	--	--	--	--	--	--	7.2	0.02
Polypedilum illinoense	--	--	--	--	--	--	--	--	7.2	0.02
Corbicula fluminea	35.9	0.02	358.8	1.12	--	--	14.4	0.10	122.0	0.31
TOTAL BENTHOS	166,663.0	100.00	31,900.1	100.00	37,289.8	100.00	13,678.7	100.00	38,796.9	100.00
TOTAL TAXA RICHNESS	8		6		6		7		14	
EPT TAXA RICHNESS	0		0		0		0		0	

no sample possible for Stephen St - Loc. 48 due to lack of sediment

APPENDIX A - 2010 MACROINVERTEBRATE SAMPLES - RAW DATA SUMMARY - HESTER-DENDY DATA

WATERWAY= C.S.S.C.,
LOCATION= HARLEM AVE.,
STATION= 41,
and DATE= 16AUG10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Hydra	14	50.2	0.62	60	215.3	0.94
Turbellaria	511	1,833.5	22.49	1,840	6,602.1	28.91
Oligochaeta	1,674	6,006.5	73.68	3,775	13,545.0	59.31
Desserobdella phalera	1	3.6	0.04	0	0.0	0.00
Helobdella stagnalis	8	28.7	0.35	0	0.0	0.00
Erpobdella microstoma	5	17.9	0.22	0	0.0	0.00
Caecidotea	7	25.1	0.31	0	0.0	0.00
Hyalella azteca	22	78.9	0.97	245	879.1	3.85
Nanocladius distinctus	1	3.6	0.04	35	125.6	0.55
Dicrotendipes lucifer	13	46.6	0.57	245	879.1	3.85
Dicrotendipes simpsoni	16	57.4	0.70	160	574.1	2.51
Dreissena bugensis	0	0.0	0.00	5	17.9	0.08
TOTAL BENTHOS	2,272	8,152.1	100.00	6,365	22,838.2	100.00

WATERWAY= C.S.S.C.,
LOCATION= LOCKPORT,
STATION= 92,
and DATE= 23JUL10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Hydra	547	1,962.7	30.36	3	10.8	0.27
Turbellaria	72	258.3	4.00	13	46.6	1.17
Oligochaeta	14	50.2	0.78	165	592.0	14.88
Hyalella azteca	137	491.6	7.60	65	233.2	5.86
Gammarus	331	1,187.7	18.37	47	168.6	4.24
Echinogammarus ischusa	43	154.3	2.39	13	46.6	1.17
Cyrnellus fraternus	8	28.7	0.44	5	17.9	0.45
Cheumatopsyche	0	0.0	0.00	12	43.1	1.08
Hydropsyche simulans	0	0.0	0.00	2	7.2	0.18
Ceratopsyche morosa	1	3.6	0.06	0	0.0	0.00
Ablabesmyia janta	0	0.0	0.00	7	25.1	0.63
Nanocladius distinctus	22	78.9	1.22	178	638.7	16.05
Dicrotendipes lucifer	407	1,460.4	22.59	283	1,015.4	25.52
Dicrotendipes simpsoni	105	376.7	5.83	92	330.1	8.30
Glyptotendipes	0	0.0	0.00	7	25.1	0.63
Ferrissia	108	387.5	5.99	217	778.6	19.57
Corbicula fluminea	7	25.1	0.39	0	0.0	0.00
TOTAL BENTHOS	1,802	6,465.7	100.00	1,109	3,979.2	100.00

WATERWAY= C.S.S.C.,
LOCATION= ROUTE 83,
STATION= 42,
and DATE= 07SEP10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Hydra	158	566.9	15.27	72	258.3	7.33
Turbellaria	353	1,266.6	34.11	439	1,575.2	44.70
Oligochaeta	75	269.1	7.25	128	459.3	13.03
Helobdella	2	7.2	0.19	1	3.6	0.10
Helobdella stagnalis	10	35.9	0.97	8	28.7	0.81
Erpobdella punctata punctata	1	3.6	0.10	0	0.0	0.00
Caecidotea	6	21.5	0.58	1	3.6	0.10
Hyalella azteca	259	929.3	25.02	151	541.8	15.38
Gammarus	72	258.3	6.96	0	0.0	0.00
Cyrnellus fraternus	0	0.0	0.00	6	21.5	0.61
Ablabesmyia janta	10	35.9	0.97	0	0.0	0.00
Nanocladius distinctus	0	0.0	0.00	1	3.6	0.10
Dicrotendipes lucifer	17	61.0	1.64	45	161.5	4.58
Dicrotendipes simpsoni	19	68.2	1.84	33	118.4	3.36
Parachironomus	0	0.0	0.00	1	3.6	0.10
Polypedilum halterale grp.	0	0.0	0.00	1	3.6	0.10
Physa	0	0.0	0.00	1	3.6	0.10
Ferrissia	1	3.6	0.10	8	28.7	0.81
Eupera cubensis	52	186.6	5.02	86	308.6	8.76
TOTAL BENTHOS	1,035	3,713.7	100.00	982	3,523.5	100.00

APPENDIX A - 2010 MACROINVERTEBRATE SAMPLES - RAW DATA SUMMARY - HESTER-DENDY DATA

WATERWAY= C.S.S.C.,
LOCATION= STEPHEN ST.,
STATION= 48,
and DATE= 07SEP10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Hydra	58	208.1	3.01	28	100.5	3.01
Turbellaria	28	100.5	1.45	0	0.0	0.00
Oligochaeta	542	1,944.7	28.08	51	183.0	5.48
Helobdella	0	0.0	0.00	1	3.6	0.11
Caecidotea	14	50.2	0.73	0	0.0	0.00
Hyalella azteca	14	50.2	0.73	0	0.0	0.00
Echinogammarus ischusa	44	157.9	2.28	14	50.2	1.51
Cyrnellus fraternus	640	2,296.4	33.16	727	2,608.5	78.17
Ablabesmyia janta	92	330.1	4.77	19	68.2	2.04
Thienemannimyia grp.	24	86.1	1.24	0	0.0	0.00
Nanocladius distinctus	20	71.8	1.04	7	25.1	0.75
Dicrotendipes lucifer	96	344.5	4.97	43	154.3	4.62
Dicrotendipes simpsoni	16	57.4	0.83	16	57.4	1.72
Glyptotendipes	4	14.4	0.21	3	10.8	0.32
Polypedilum illinoense	4	14.4	0.21	0	0.0	0.00
Stenochironomus	38	136.3	1.97	9	32.3	0.97
Ferrissia	124	444.9	6.42	0	0.0	0.00
Corbicula fluminea	86	308.6	4.46	3	10.8	0.32
Eupera cubensis	0	0.0	0.00	1	3.6	0.11
Dreissena bugensis	86	308.6	4.46	8	28.7	0.86
TOTAL BENTHOS	1,930	6,925.0	100.00	930	3,336.9	100.00

WATERWAY= CALUMET R.,
LOCATION= 130TH ST.,
STATION= 55,
and DATE= 11AUG10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Oligochaeta	200	717.6	0.29	300	1,076.4	0.41
Gammarus	400	1,435.2	0.57	500	1,794.0	0.69
Ablabesmyia mallochi	0	0.0	0.00	100	358.8	0.14
Nanocladius distinctus	200	717.6	0.29	0	0.0	0.00
Dicrotendipes neomodestus	100	358.8	0.14	0	0.0	0.00
Dicrotendipes lucifer	0	0.0	0.00	100	358.8	0.14
Dicrotendipes simpsoni	100	358.8	0.14	100	358.8	0.14
Dreissena polymorpha	2,900	10,405.5	4.14	7,400	26,551.8	10.21
Dreissena bugensis	66,100	237,172.6	94.43	64,000	229,637.6	88.28
TOTAL BENTHOS	70,000	251,166.1	100.00	72,500	260,136.3	100.00

WATERWAY= CHICAGO R.,
LOCATION= LAKE SHORE DR.,
STATION= 74,
and DATE= 09AUG10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Turbellaria	145	520.3	2.39	10	35.9	0.08
Oligochaeta	1,535	5,507.7	25.27	1,020	3,659.8	8.62
Helobdella stagnalis	10	35.9	0.16	0	0.0	0.00
Caecidotea	290	1,040.5	4.77	0	0.0	0.00
Hyalella azteca	685	2,457.8	11.28	10	35.9	0.08
Gammarus	325	1,166.1	5.35	40	143.5	0.34
Procladius	15	53.8	0.25	10	35.9	0.08
Cricotopus bicinctus grp.	5	17.9	0.08	10	35.9	0.08
Nanocladius distinctus	5	17.9	0.08	20	71.8	0.17
Chironomus	10	35.9	0.16	0	0.0	0.00
Cladopelma	10	35.9	0.16	10	35.9	0.08
Dicrotendipes neomodestus	10	35.9	0.16	0	0.0	0.00
Dicrotendipes fumidus	20	71.8	0.33	0	0.0	0.00
Dicrotendipes lucifer	45	161.5	0.74	20	71.8	0.17
Dicrotendipes simpsoni	20	71.8	0.33	20	71.8	0.17
Polypedilum halterale grp.	5	17.9	0.08	0	0.0	0.00
Tanytarsus glabrescens grp.	5	17.9	0.08	0	0.0	0.00
Physa	10	35.9	0.16	0	0.0	0.00
Menetus	10	35.9	0.16	0	0.0	0.00
Dreissena bugensis	2,915	10,459.3	47.98	10,660	38,249.0	90.11
TOTAL BENTHOS	6,075	21,797.6	100.00	11,830	42,447.1	100.00

APPENDIX A - 2010 MACROINVERTEBRATE SAMPLES - RAW DATA SUMMARY - PETITE PONAR DATA

WATERWAY= C.S.C., LOCATION= CICERO AVE.,
STATION= 59, and DATE= 13AUG10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Oligochaeta	6,990	100,329.4	94.72	9,290	133,341.9	94.70
Procladius	220	3,157.7	2.98	300	4,306.0	3.06
Chironomus	70	1,004.7	0.95	110	1,578.9	1.12
Cryptochironomus	10	143.5	0.14	0	0.0	0.00
Polypedilum scalaenum grp.	0	0.0	0.00	10	143.5	0.10
Corbicula fluminea	90	1,291.8	1.22	90	1,291.8	0.92
Musculium	0	0.0	0.00	10	143.5	0.10
TOTAL BENTHOS	7,380	105,927.1	100.00	9,810	140,805.6	100.00

WATERWAY= C.S.S.C., LOCATION= CICERO AVE.,
STATION= 75, and DATE= 20AUG10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Hydra	0	0.0	0.00	5	71.8	0.75
Oligochaeta	3,710	53,250.6	98.15	647	9,286.6	97.29
Procladius	10	143.5	0.26	12	172.2	1.80
Dicrotendipes lucifer	10	143.5	0.26	0	0.0	0.00
Paralauterborniella nigrohalteralis	0	0.0	0.00	1	14.4	0.15
Corbicula fluminea	50	717.7	1.32	0	0.0	0.00
TOTAL BENTHOS	3,780	54,255.4	100.00	665	9,544.9	100.00

WATERWAY= C.S.S.C., LOCATION= DAMEN AVE.,
STATION= 40, and DATE= 26JUL10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Oligochaeta	15,800	226,781.6	99.06	7,242	103,946.4	99.57
Caecidotea	0	0.0	0.00	1	14.4	0.01
Hyalella azteca	0	0.0	0.00	9	129.2	0.12
Ceratopogonidae	50	717.7	0.31	0	0.0	0.00
Procladius	100	1,435.3	0.63	6	86.1	0.08
Chironomus	0	0.0	0.00	7	100.5	0.10
Dicrotendipes simpsoni	0	0.0	0.00	3	43.1	0.04
Corbicula fluminea	0	0.0	0.00	5	71.8	0.07
TOTAL BENTHOS	15,950	228,934.6	100.00	7,273	104,391.3	100.00

WATERWAY= C.S.S.C., LOCATION= HARLEM AVE.,
STATION= 41, and DATE= 16AUG10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Turbellaria	15	215.3	0.61	0	0.0	0.00
Oligochaeta	2,425	34,806.7	98.94	2,730	39,184.4	99.45
Helobdella stagnalis	1	14.4	0.04	5	71.8	0.18
Procladius	9	129.2	0.37	0	0.0	0.00
Chironomus	1	14.4	0.04	5	71.8	0.18
Cryptotendipes	0	0.0	0.00	5	71.8	0.18
TOTAL BENTHOS	2,451	35,179.9	100.00	2,745	39,399.7	100.00

WATERWAY= C.S.S.C., LOCATION= LOCKPORT,
STATION= 92, and DATE= 23JUL10

TAXA	CENTER			SIDE		
	#	#/m2	%	#	#/m2	%
Turbellaria	4	57.4	0.27	0	0.0	0.00
Oligochaeta	1,446	20,754.8	97.77	3,822	54,858.2	97.33
Helobdella	1	14.4	0.07	0	0.0	0.00
Erpobdella microstoma	5	71.8	0.34	1	14.4	0.03
Hyalella azteca	0	0.0	0.00	2	28.7	0.05
Echinogammarus ischusa	2	28.7	0.14	0	0.0	0.00
Procladius	3	43.1	0.20	92	1,320.5	2.34
Thienemannimyia grp.	0	0.0	0.00	2	28.7	0.05
Nanocladius distinctus	3	43.1	0.20	0	0.0	0.00
Dicrotendipes lucifer	2	28.7	0.14	0	0.0	0.00
Dicrotendipes simpsoni	0	0.0	0.00	2	28.7	0.05
Polypedilum halterale grp.	1	14.4	0.07	0	0.0	0.00
Polypedilum illinoense	0	0.0	0.00	1	14.4	0.03
Corbicula fluminea	12	172.2	0.81	5	71.8	0.13
TOTAL BENTHOS	1,479	21,228.5	100.00	3,927	56,365.3	100.00

ATTACHMENT 6: **IEPA Project Taxa List - Upper Illinois Waterway Benthos, 2000**

Annelida
Oligochaeta
Platyhelmithes
Turbellaria
Isopoda
Caecidotea
Amphipoda
Gammarus fasciatus
Ephemeroptera
Isonychia
Baetis intercalaris
Callibaetis
Plauditus
Pseudocloeon longipalpus
Stenacron
Stenonema exiguum
Stenonema femoratum
Stenonema terminatum
Caenis hilaris
Tricorythodes
Ephemeridae
Hexagenia
Odonata
Argia apicalis
Argia moesta
Enallagma
Hetaerina americana
Megaloptera
Corydalus cornutus
Sialis
Hemiptera
Trichocorixa
Coleoptera
Dubiraphia
Macronychus glabratus
Stenelmis
Stenelmis crenata grp.
Stenelmis humerosa/sinuata grp.
Lepidoptera
Petrophila
Trichoptera
Cyrnellus fraternus
Polycentropus
Hydropsychidae
Cheumatopsyche
Ceratopsyche morosa
Hydropsyche orris
Hydropsyche phalerata

Diptera (cont.)
Simulium
Coelotanypus
Procladius (Holotanypus)
Tanypus
Ablabesmyia
Ablabesmyia monilis
Thienemannimyia grp.
Corynoneura celeripes
Thienemanniella similis
Thienemanniella xena
Cricotopus bicinctus grp.
Cricotopus sylvestris grp.
Eukiefferiella
Hydrobaenus
Nanocladius
Nanocladius crassicornus/rectinervis
Nanocladius distinctus
Orthocladius
Tvetenia discoloripes grp.
Dicrotendipes
Dicrotendipes neomodestus
Dicrotendipes simpsoni
Glyptotendipes
Chironomus plumosus grp.
Cryptochironomus
Microchironomus
Microtendipes
Paralauterborniella
Phaenopsectra punctipes
Polypedilum fallax grp.
Polypedilum flavum
Polypedilum halterale grp.
Polypedilum illinoense
Polypedilum scalaenum grp.
Pseudochironomus
Stenochironomus
Tribelos fuscicorne
Xenochironomus xenolabis
Cladotanytarsus mancus grp.
Cladotanytarsus vanderwulpi grp.
Rheotanytarsus
Tanytarsus glabrescens grp.
Gastropoda
Ferrissia
Amnicola
Physella
Pleurocera

Hydropsyche placoda
Hydropsyche simulans
Potamyia flava
Hydroptila

Diptera

Ceratopogonidae
Hemerodromia

Pelecypoda

Corbicula fluminea
Musculium transversum
Dreissena polymorpha

5. HABITAT AND SAMPLING CONSTRAINTS IN THE CSSC

The Will County Station is located at River Mile ("RM") 295.5, approximately 4.5 miles upstream of the Lockport Lock and Dam. The CSSC is a man-made watercourse completed in 1900 to help convey treated sewage and storm water flow away from Chicago and the city's drinking water source, Lake Michigan, to the Illinois River and eventually the Mississippi River and the Gulf of Mexico. Flow in the CSSC is completely regulated by a system of locks and dams. In much of the reach in the vicinity of the Will County Station, the CSSC was excavated into limestone with vertical side walls and a relatively deep, flat bottom to facilitate commercial navigation. As a consequence, the CSSC is an extensively modified, manipulated, and impacted waterway that has significant habitat limitations for many aquatic species. Certain of these conditions also present severe challenges for the collection of representative samples of the aquatic community. Examples of these conditions include:

1. Commercial navigation—With material barges tied up along the canal walls and frequent tugboat/barge traffic, much of the width of the canal (Figure 1) can be unsafe for sampling, and fixed, moored monitoring sensors and samplers are frequently damaged or destroyed by this traffic.
2. Substrate disturbance—Frequent movement of tugboat/barges continually disturb the bottom substrate and re-suspend fine sediments, which has an adverse effect on the benthic macroinvertebrate community.
3. Flood control management—In anticipation of significant storm events, the United States Army Corp of Engineers ("USACE") will drawdown the water level in the CSSC (Figure 2) to increase capacity to carry anticipated stormwater runoff and to control flooding. Depending on the quantity of precipitation actually received during a predicted storm event, low water levels can persist for extended periods of time. These conditions affect fish distribution, potentially strand fish in isolated pools, disrupt spawning activity, and result in desiccation of aquatic species, particularly early life stages of fish, benthic macroinvertebrates, and aquatic vegetation.
4. Combined sewer overflow ("CSO") events—CSO events associated with precipitation runoff reduce dissolved oxygen in portions of the CSSC, which can result in periodic fish kills (Figure 3).
5. USACE electric fish barrier—To impede the dispersion of exotic Asian carp from the Mississippi drainage into the Great Lakes, the USACE operates an electric fish barrier approximately 0.75 miles upstream of the Will County Station (Figure 4). While this barrier may prevent the movement of Asian carp, it also prevents the normal upstream and downstream movement of native fish. The barrier also limits the area available to sample biota upstream of the Station and can result in an accumulation of upstream migrating fish immediately downstream of the barrier.
6. Chemical management measure to control invasive fish species— In early December 2009, rotenone was applied into the water column of the CSSC from RM 296.7 to RM 291 and then detoxified with potassium permanganate. The Will County Station is within this area at RM 295.5. It was estimated that approximately 55,000 pounds of fish were removed (Wisconsin Sea Grant 2010, ANS Barrier Panel notes). At least one Bighead Carp and thousands of other fish, mainly Common Carp, were recovered in the three days

following the rotenone application (Asian Carp News Archive.htm). If such chemical management were to recur during the study period, it may affect the ability to collect representative samples of the fish community for a period of time thereafter until the fish community recovers.

7. Littoral habitat—Shallow littoral habitat, important to many aquatic species, is virtually non-existent in the vicinity of the Will County Station (Figure 5). The closest littoral habitat is more than two miles downstream of the Will County Station's discharge, near the Lockport Controlling Works.
8. Sediment quality—Persistent sediment contamination has resulted in longstanding advisories against consumption of fish.

In order for the December 2009 rotenone application to occur, the USACE prepared an Environmental Assessment. The assessment stated that "*The fish assemblage identified in the proposed eradication reach are for the most part nonnative, tolerant species that are able to withstand very poor water quality and inadequate habitat and fluvial function that is necessary to support a healthy riverine ecosystem. The portion of the Chicago Sanitary and Ship Canal to be treated is completely a man-made system and never was intended to support riverine fishes or riverine macroinvertebrates. The native fishes and macroinvertebrates that will be eradicated in consequence to removing Asian carps would quickly recolonize from both down and upstream reaches.*" (USACE 2009, p. 36).

The USACE also prepared an Environmental Assessment for a proposed upgrade of the Aquatic Nuisance Species Dispersal Barriers Project in the CSSC. This assessment stated that "*The CSSC is a created structure built to transport sewage through a heavily industrialized and urbanized area with poor water quality generally limiting the aquatic resources of the canal. For this reason, fisheries populations in the CSSC and the upper Illinois River declined over many years to a point where they were virtually nonexistent except for the most pollutant-tolerant of species. As a completely channelized structure, the CSSC only provides main channel and main channel order habitat with virtually no spawning habitat, and it significantly reduces the quality and quantity of habitat available for fish and wildlife resources.*" It also stated that "*The present day Lockport Pool of the CSSC supported no aquatic life prior to its construction. Fish species that colonized the new canal came from nearby waters including the Des Plaines River, Lake Michigan and several small streams that flowed into the CSSC.*" (USACE 2013, pp. EA 9-10).

A description of the CSSC is provided in the Great Lakes and Mississippi River Interbasin Study ("GLMRIS") Report prepared by the USACE. The GLMRIS Report presents the results of a multi-year study regarding the range of options and technologies available to prevent aquatic nuisance species movement between the Great Lakes and Mississippi River basins through aquatic connections. Concerning the CSSC, the GLMRIS Report states: "*The CSSC is a man-made channel that was constructed in 1900 to supplement and ultimately replace the Illinois and Michigan Canal as a conduit to the Mississippi River system. Its construction facilitated the reversal of the Chicago River. Industrial and commercial land use dominates the riparian zone along most of the CSSC. There is little to no canopy cover and instream habitat for aquatic life is limited. Areas of scouring, as well as pockets of deep silty sediments also occur near*

Lockport, although habitat improves slightly near the sunken barges on the west bank. Aquatic vegetation and snags are present in this shallow area with deep sand and silt deposits (MWRDGC 2008). Water and sediment quality is impaired throughout. Sediment samples collected near Lockport in 2006 contained elevated levels of cyanide and phenols. Ten-day Chironomus tentans toxicity testing on sediments collected at Lockport indicated poor habitat quality for benthic organisms (MWRDGC 2006)." (USACE 2014, Appendix B, p. B-12).

The waterway will continue to be subjected to these types of Asian carp monitoring and control activities in the future. Along with the minimal habitat provided by the CSSC environment, these activities will serve to limit any potential improvements in the aquatic community in the vicinity of Will County Station.

Given these conditions, the constraints on sampling methods and equipment, safety during sampling of this reach of the CSSC, and the relatively permanent and irreversible degradation of physical aquatic habitat, it was agreed at the 4 November 2015 meeting with IEPA that the collection of fish data as part of the ongoing sampling program in the UIW will be adequate to characterize aquatic community conditions in the vicinity of the Will County Station. It was further agreed that additional sampling of fish or other biotic categories will be impractical and is not expected to yield representative information. For these reasons, such additional sampling will not be required to support the §316(a) Demonstration for the Will County Station.

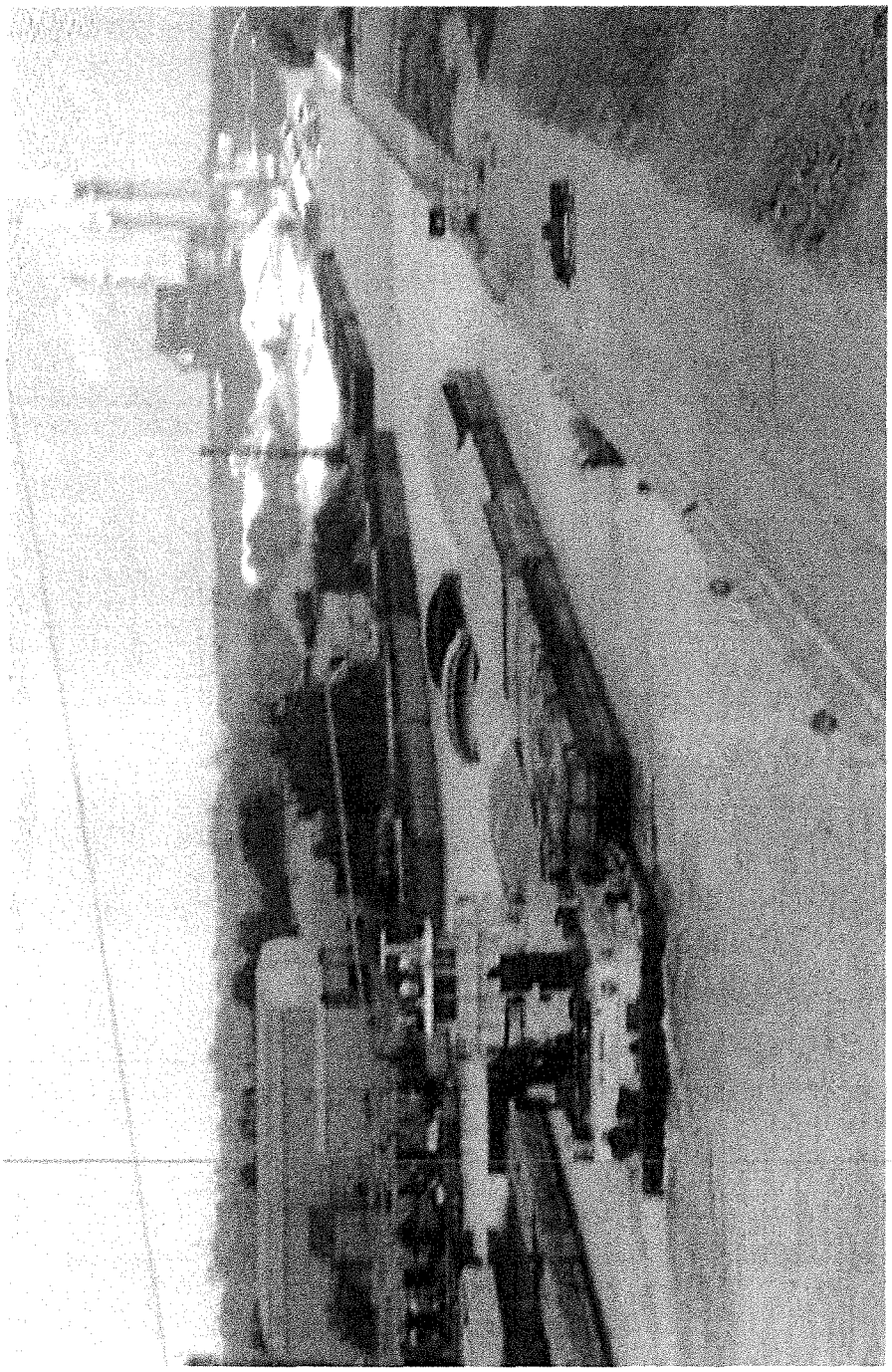
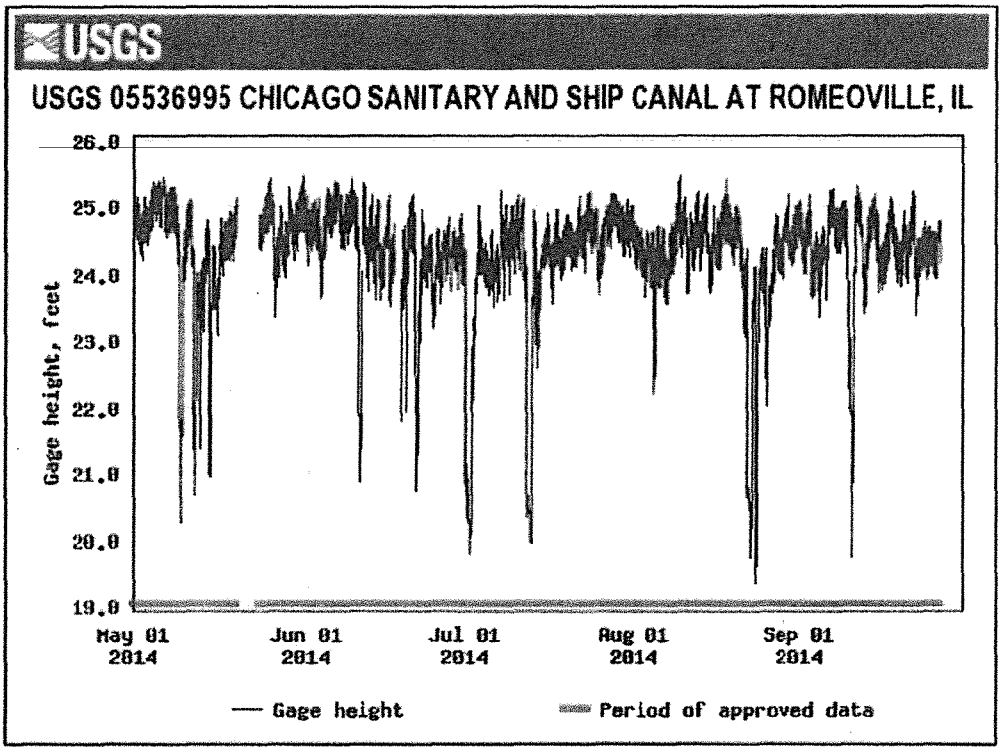


Figure 1. Commercial barge traffic and material barges tied up along the CSSC downstream of Will County Generating Station.



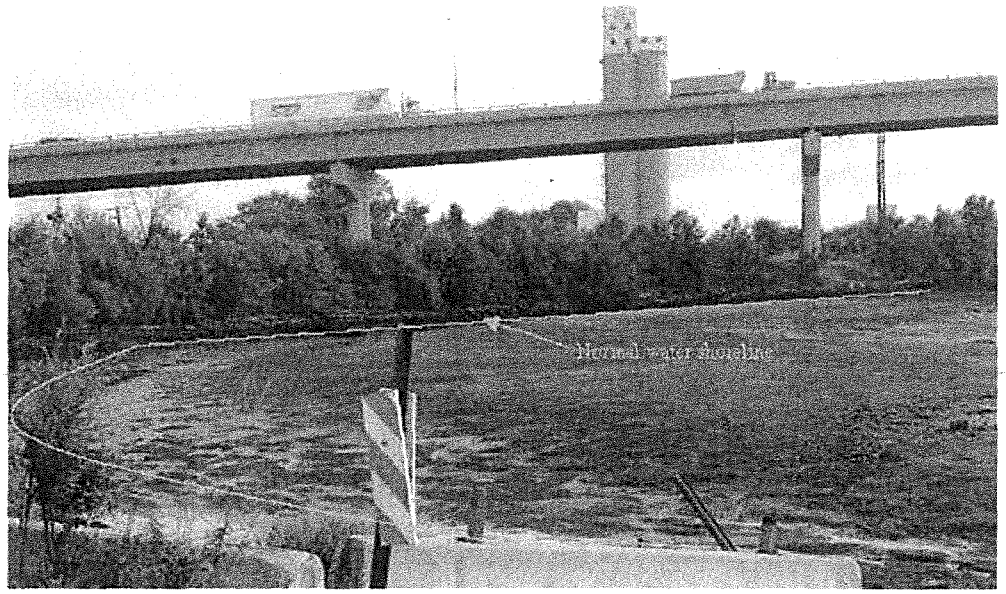


Figure 2. USGS data showing manipulations of water level in the CSSC near Will County Station and exposed littoral habitat above Lockport Lock and Dam during drawdown event, July 1, 2014.

Figure 3. Stressed and dead fish in the CSSC near Will County Station following a CSO event, 2014.

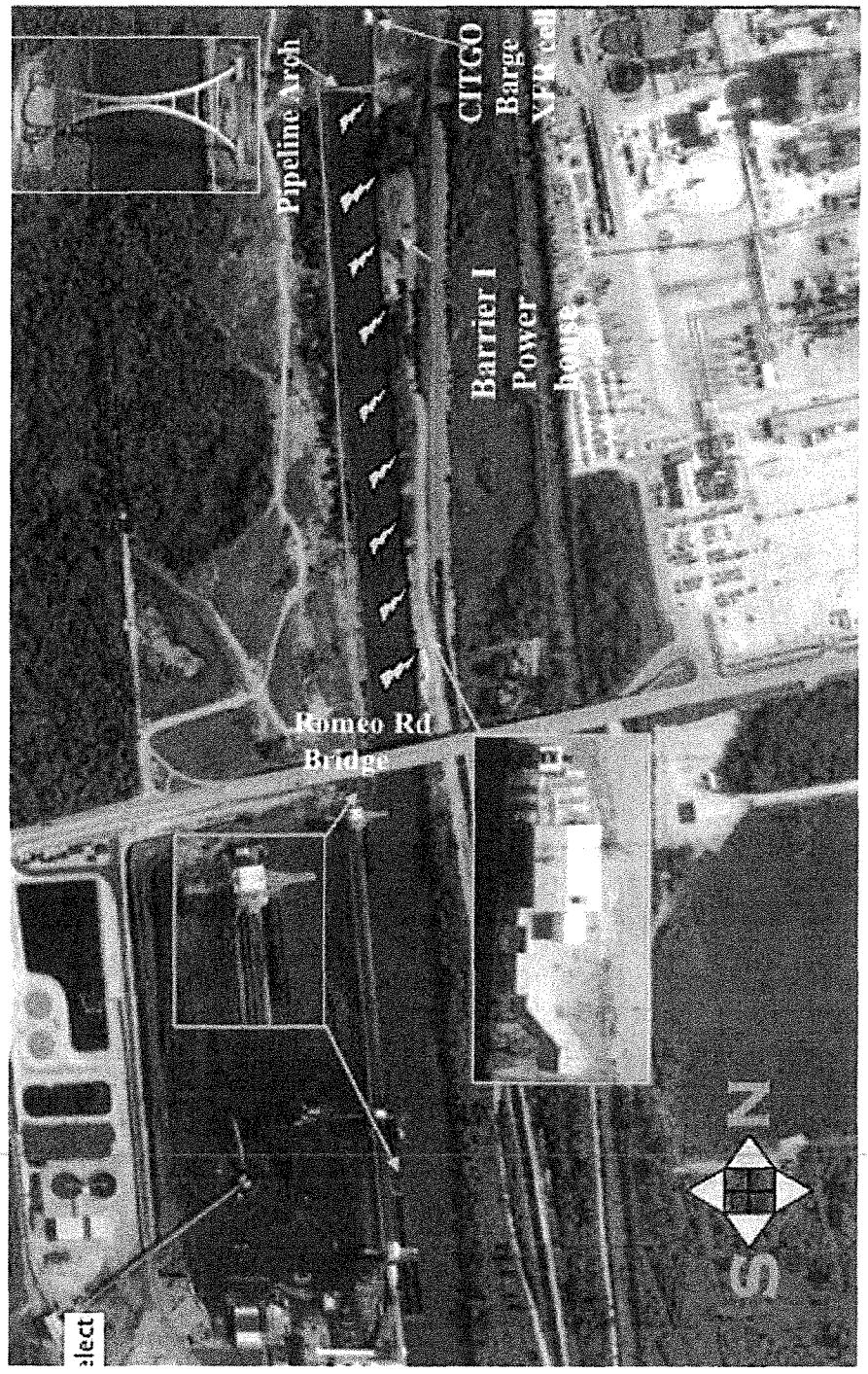


Figure 4. Location of USACE electric fish barrier in the CSSC immediately upstream of the Will County Station.

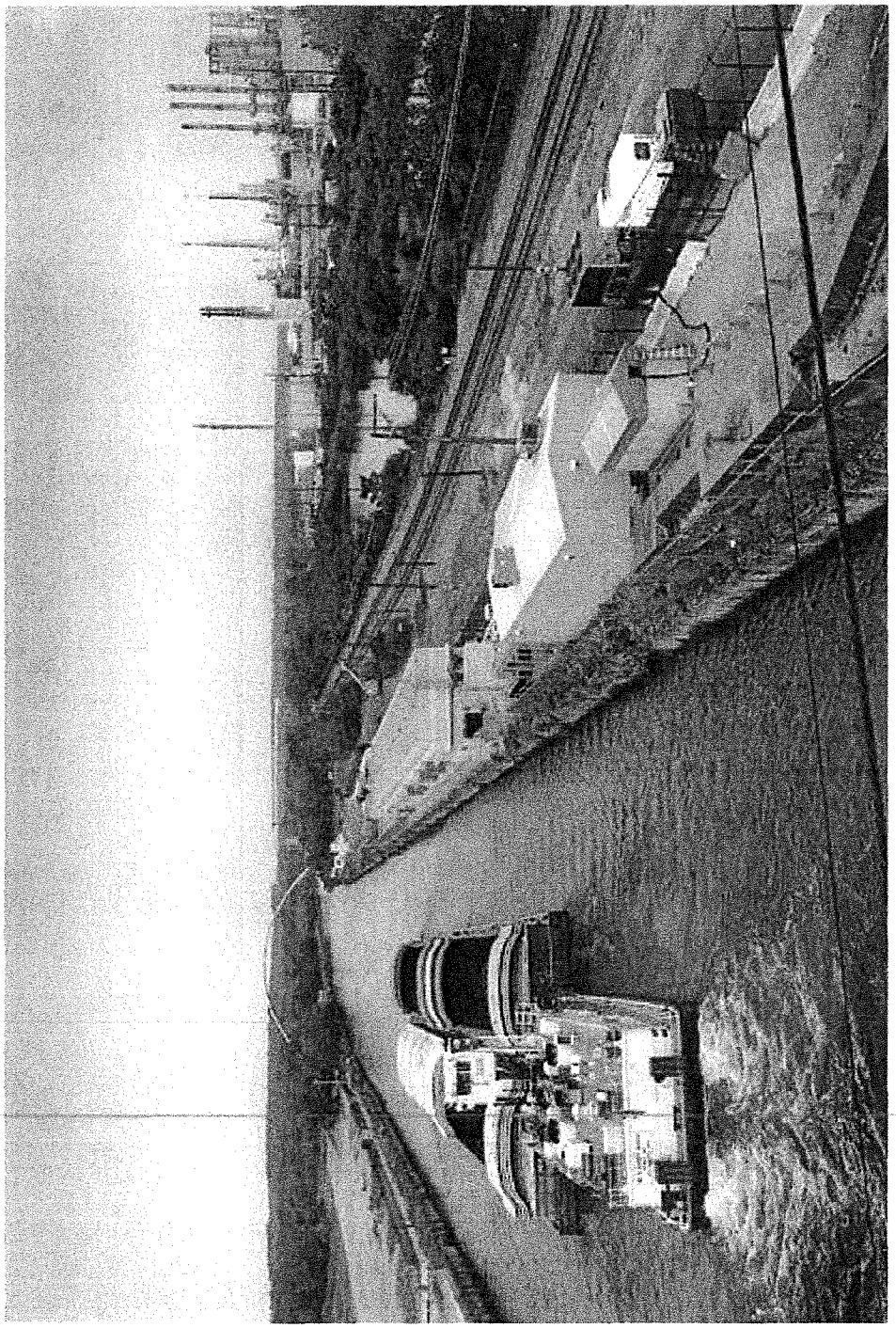
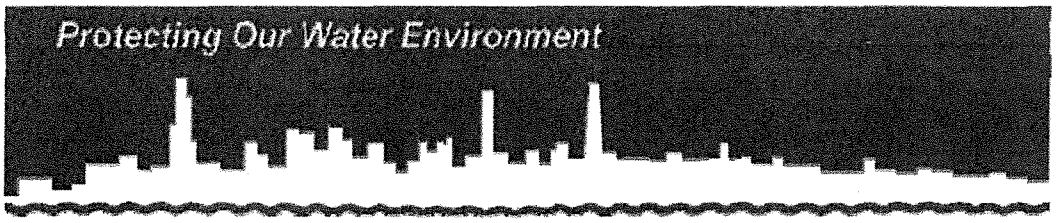


Figure 5. Reach of the CSSC in the vicinity of the electric fish barrier and the Will County Station with vertical walls and no littoral habitat.

ATTACHMENT 8: Excerpts from MWRDGC 2011 Water and Sediment Quality Report



Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 12-35

WATER AND SEDIMENT QUALITY ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING 2011

August 2012

DESCRIPTION OF THE STUDY AREA

Illinois Waterway

The Illinois Waterway extends from Grafton, Illinois, located on the Mississippi River upstream of St. Louis, Missouri, to Lake Michigan in Chicago, Illinois. The 327-mile waterway is composed of a series of eight navigational pools (Lockport, Brandon Road, Dresden Island, Marseilles, Starved Rock, Peoria, LaGrange, and Alton) whose lengths and United States Army Corps of Engineers waterway mile-point designations are presented in Table 1.

The pools were created in the 1930s by lock and dam structures to maintain the water depths required for commercial navigation. The present study area is a 133-mile reach of the Illinois Waterway extending from the Lockport Lock to the Peoria Lock (Figures 1 and 2).

TABLE 1: ILLINOIS WATERWAY NAVIGATIONAL POOLS

Navigational Pool	Inclusive Waterway Mile-Points	Length (Miles)
Lockport	327.2 - 291.0	36.2
Brandon Road	291.0 - 286.0	5.0
Dresden Island	286.0 - 271.5	14.5
Marseilles	271.5 – 244.5	27.0
Starved Rock	244.5 - 231.0	13.5
Peoria	231.0 - 157.6	73.4
LaGrange	157.6 - 80.2	77.4
Alton	80.2 - 0.0	80.2

Monitoring Stations

Forty-nine monitoring stations were selected for the study (Figures 1 and 2). Two stations were located on the Chicago Sanitary and Ship Canal (CSSC), eight on the Des Plaines River, and 39 stations on the Illinois River. Table 2 lists the locations of the 49 monitoring stations.

FIGURE 1: MAP OF THE ILLINOIS WATERWAY FROM LOCKPORT TO MARSEILLES SHOWING SAMPLING STATIONS 1 TO 21

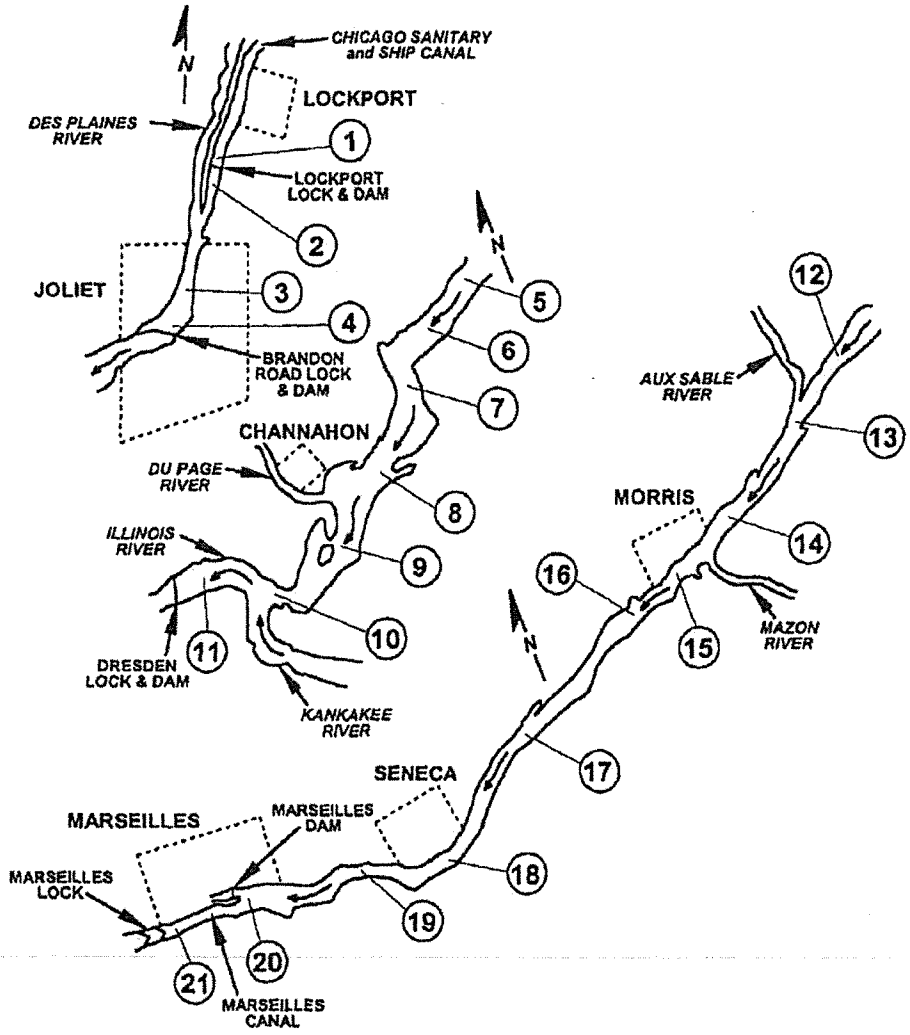


FIGURE 2: MAP OF ILLINOIS WATERWAY FROM OTTAWA TO PEORIA SHOWING SAMPLING STATIONS 22 TO 49

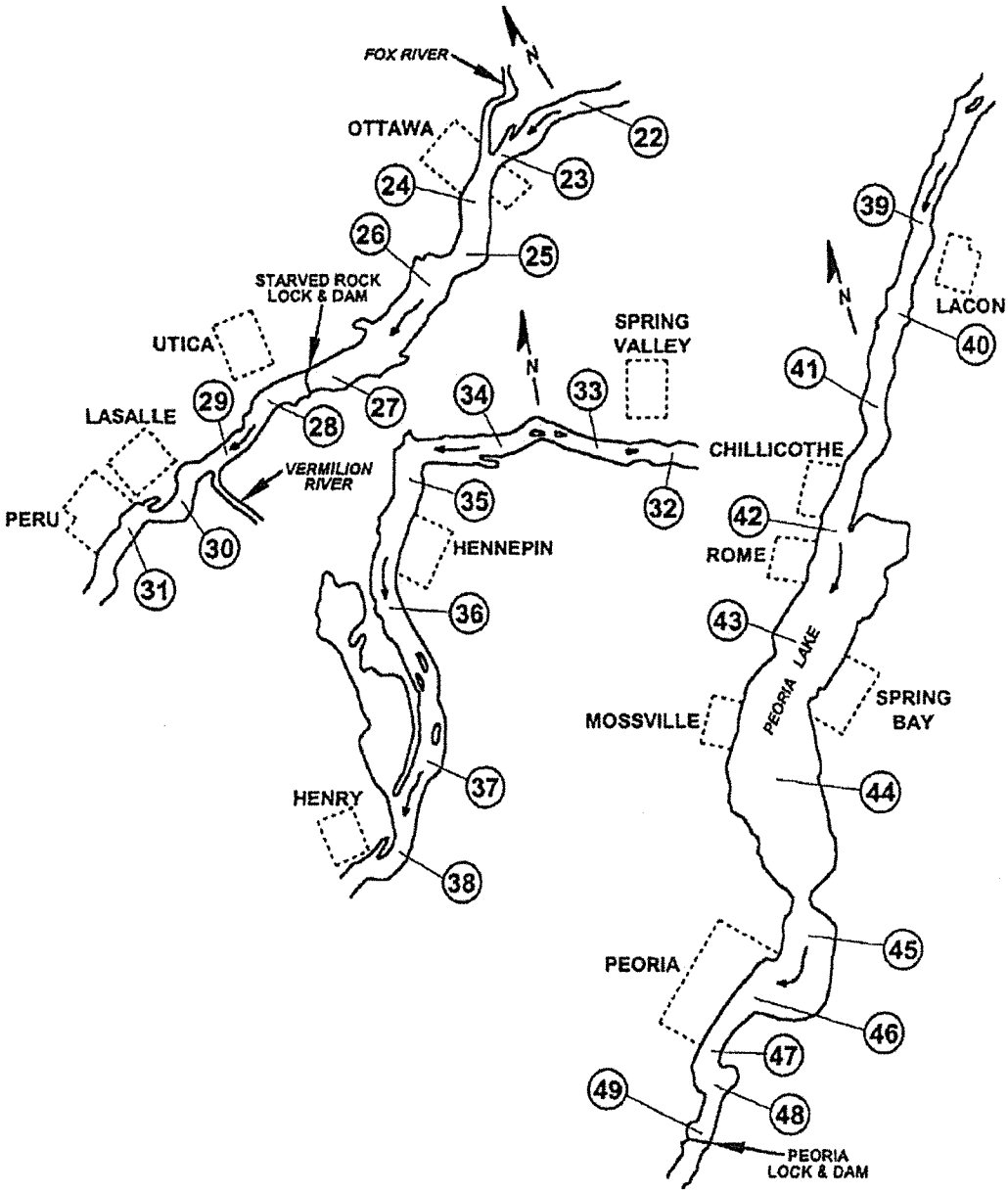


TABLE 2: MONITORING STATIONS ALONG THE ILLINOIS WATERWAY FROM LOCKPORT LOCK TO PEORIA LOCK

Station Number	Waterway	Waterway Mile-Point Location	Navigational Pool
1	Chicago Sanitary and Ship Canal	291.5	Lockport
2	Chicago Sanitary and Ship Canal	290.5	Brandon Road
3	Des Plaines River	287.3	Brandon Road
4	Des Plaines River	286.5	Brandon Road
5	Des Plaines River	285.0	Dresden Island
6	Des Plaines River	282.8	Dresden Island
7	Des Plaines River	280.5	Dresden Island
8	Des Plaines River	278.0	Dresden Island
9	Des Plaines River	276.1	Dresden Island
10	Des Plaines River	274.0	Dresden Island
11	Illinois River	272.4	Dresden Island
12	Illinois River	270.0	Marseilles
13	Illinois River	267.2	Marseilles
14	Illinois River	265.0	Marseilles
15	Illinois River	263.0	Marseilles
16	Illinois River	261.6	Marseilles
17	Illinois River	256.0	Marseilles
18	Illinois River	253.0	Marseilles
19	Illinois River	250.0	Marseilles
20	Illinois River	247.5	Marseilles
21	Illinois River	246.0	Marseilles
22	Illinois River	243.7	Starved Rock
23	Illinois River	240.6	Starved Rock
24	Illinois River	238.5	Starved Rock
25	Illinois River	236.8	Starved Rock
26	Illinois River	234.5	Starved Rock
27	Illinois River	231.7	Starved Rock

TABLE 2 (Continued): MONITORING STATIONS ALONG THE ILLINOIS WATERWAY FROM LOCKPORT LOCK TO PEORIA LOCK

Station Number	Waterway	Waterway Mile-Point Location	Navigational Pool
28	Illinois River	229.6	Peoria
29	Illinois River	226.9	Peoria
30	Illinois River	224.7	Peoria
31	Illinois River	222.6	Peoria
32	Illinois River	219.8	Peoria
33	Illinois River	217.1	Peoria
34	Illinois River	213.4	Peoria
35	Illinois River	209.4	Peoria
36	Illinois River	205.0	Peoria
37	Illinois River	200.4	Peoria
38	Illinois River	196.9	Peoria
39	Illinois River	190.0	Peoria
40	Illinois River	186.4	Peoria
41	Illinois River	183.2	Peoria
42	Illinois River	179.0	Peoria
43	Illinois River	174.9	Peoria
44	Illinois River	170.9	Peoria
45	Illinois River	165.3	Peoria
46	Illinois River	162.8	Peoria
47	Illinois River	160.6	Peoria
48	Illinois River	159.4	Peoria
49	Illinois River	158.2	Peoria

TABLE 7: CHEMICAL CHARACTERISTICS OF SEDIMENT COLLECTED FROM MONITORING STATIONS IN THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, OCTOBER 2011

Station No.	Navigational Pool	Constituents (Expressed on a dry weight basis)						
		Total Solids (%)	Total Volatile Solids (% of Total)	Ammonia Nitrogen (mg/kg)	Total Kjeldahl Nitrogen (mg/kg)	Nitrite + Nitrate Nitrogen (mg/kg)	Total Phos-phorus (mg/kg)	Phenols (mg/kg)
1	Lockport	38	13	43	3,374	45	5,300	0.259
2	Brandon Road	47	16	59	2,268	25	8,058	0.346
5*	Dresden Island	NA	NA	NA	NA	NA	NA	NA
8	Dresden Island	53	11	29	2,339	23	2,430	0.158
12	Marseilles	77	1	3	255	7	1,170	0.232
18	Marseilles	64	4	12	1,079	17	1,122	0.235
23	Starved Rock	74	1	7	351	9	482	0.132
28	Peoria	76	3	3	242	5	279	0.372
32	Peoria	80	3	2	82	5	118	0.200
35	Peoria	73	2	4	331	8	337	0.116
38	Peoria	71	3	7	394	7	608	0.189
41	Peoria	48	10	29	1,926	16	1,309	0.240
44	Peoria	37	9	41	2,532	43	1,458	0.258
48	Peoria	59	5	48	1,006	19	672	0.221

NA = Not Available
*Station 5 sample bottle broken in transit.

TABLE 8: TRACE METALS IN SEDIMENT COLLECTED FROM MONITORING STATIONS IN THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, OCTOBER 2011

Station No.	Navigational Pool	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
		(mg/kg dry weight)										
1	Lockport	<10	22.3	202	204	25,312	215	334	1.01	53	9.8	905
2	Brandon Road	<10	5.2	62	111	32,302	124	845	0.48	29	2.5	491
5*	Dresden Island	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8	Dresden Island	<10	3.0	33	61	20,157	57	441	0.62	22	1.5	225
12	Marseilles	<10	0.5	10	7	7,830	14	266	<0.25	6	<0.7	50
18	Marseilles	<10	1.0	16	20	10,887	21	332	<0.25	10	1.0	88
23	Starved Rock	<10	0.3	8	8	9,316	11	192	<0.25	8	<0.7	54
28	Peoria	<10	<0.2	5	4	5,679	14	140	<0.25	4	<0.7	34
32	Peoria	<10	<0.2	4	<3	7,614	11	181	<0.25	6	<0.7	53
35	Peoria	<10	0.2	8	6	9,430	8	226	<0.25	8	<0.7	36
38	Peoria	<10	0.4	7	5	8,932	10	248	<0.25	7	<0.7	63
41	Peoria	<10	1.3	18	22	15,429	22	472	<0.25	14	0.9	117
44	Peoria	<10	1.6	26	32	19,621	27	559	0.26	19	0.8	142
48	Peoria	<10	0.7	13	16	12,592	20	418	<0.25	14	<0.7	73

ND = No Data
*Station 5 sample bottle broken in transit.

EXHIBIT 3

DETAILED STUDY PLAN FOR §316(a) DEMONSTRATION TO SUPPORT APPLICATION FOR ALTERNATIVE THERMAL LIMITS AT THE WILL COUNTY GENERATING STATION

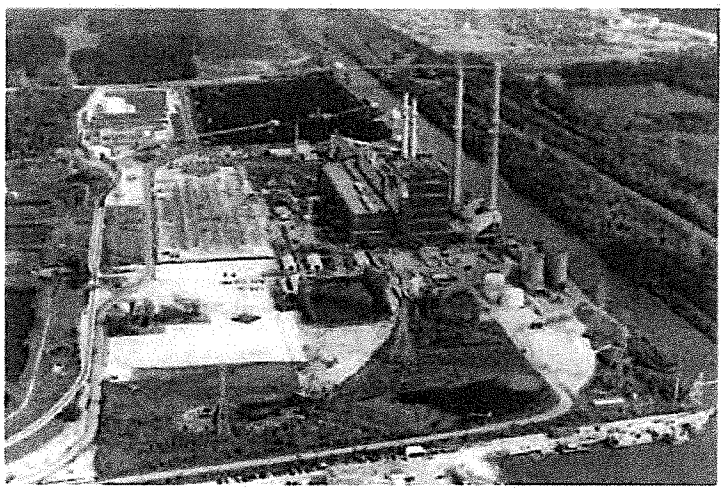


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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
ALU	Aquatic Life Use
ANOVA	Analysis of Variance
ANS	Aquatic Nuisance Species
AS	Adjusted Standard, thermal
ATL	Alternative Thermal Limit
BIC	Balanced, Indigenous Community
C	Celsius
CAWS	Chicago Area Waterway System
CPE	Catch-per-unit-effort
CSO	Combined Sewer Overflow
CSSC	Chicago Sanitary and Ship Canal
CTD	Conductivity, Temperature, and Depth
DELT	Deformities+Erosion+Lesions+Tumors
DGPS	Differential Global Positioning System
EA	EA Engineering, Science, and Technology, Inc., PBC
F	Fahrenheit
ft	foot (feet)
g	gram (grams)
GIS	Geographic Information System
GLMRIS	Great Lakes and Mississippi River Interbasin Study
GPS	Global Positioning System
IEPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
IWB	Index of Well-Being
IWBmod	modified Index of Well-Being
LDIP	Lower Dresden Island Pool
LLC	Limited Liability Company
m	meter (meters)
Midwest Generation	Midwest Generation, LLC
mm	millimeter (millimeters)
MRWG	Monitoring and Response Work Group
MWRDGC	Metropolitan Water Reclamation District of Greater Chicago

NAD83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NPDES	National Pollutant Discharge Elimination System
p.	page
pp.	pages
PAH	Polycyclic Aromatic Hydrocarbons
PBC	Public Benefit Corporation
Plan	Detailed Study Plan
QHEI	Qualitative Habitat Evaluation Index
RAS	Representative Aquatic Species
RIS	Representative Important Species
RM	River Mile
RTK	Real Time Kinematic
Station	Will County Generating Station
UIW	Upper Illinois Waterway
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
Will County Station	Will County Generating Station

1. INTRODUCTION

Pursuant to Section 106.1120 of the Illinois Subpart K thermal variance regulations, 35 Illinois Administrative Code §106.1100 et seq. (the "Subpart K Regulations"), this document presents the Detailed Study Plan (the "Plan") for the Will County Generating Station ("Will County Station" or "the Station"). The Will County Station is located on the lower Lockport Pool of the Chicago Sanitary and Ship Canal ("CSSC"). The water quality standards, including water temperature limits for portions of the Upper Illinois Waterway ("UIW"), have recently been reviewed and modified by the Illinois Pollution Control Board ("IPCB") (IPCB Docket No. 2008-09, Subdocket D). The new thermal standards, which were adopted by the IPCB on 16 June 2015 and codified on 10 July 2015, will be applicable on 1 July 2018.

Midwest Generation, LLC ("Midwest Generation") intends to petition the IPCB for Alternative Thermal Limits ("ATLs") for the Station. This Plan is designed to provide necessary data for the preparation of a Clean Water Act §316(a) Demonstration under the Subpart K Regulations to support an application for ATLs in National Pollutant Discharge Elimination System ("NPDES") Permit No. IL0002208. Because of the timing of the modification to the Station operations and the duration of studies to be conducted to support the application for ATLs, Midwest Generation will require additional time beyond the 1 July 2018 applicability date of the new thermal standards to complete the process of obtaining ATLs. Therefore, on 21 July 2015, Midwest Generation filed a variance petition with the IPCB, Docket No. 16-19, seeking a 2-year variance from the new thermal standards for the period from the 1 July 2018 applicability date through 30 June 2020 for its Will County, Joliet #9, and Joliet #29 Generating Stations.

As specified in §106.1115(b) of the Subpart K Regulations, Midwest Generation met with the Illinois Environmental Protection Agency ("IEPA") on 4 November 2015 to discuss the elements of the Conceptual Study Plan that had been submitted to IEPA on 7 October 2015. Input from those discussions with IEPA is incorporated into this Plan. This Plan provides specific sampling locations, methods, frequency, and schedule, as well as data management and quality assurance/quality control procedures. Consistent with the discussion with IEPA during the 4 November 2015 meeting regarding habitat, sampling constraints, and safety issues in the CSSC, the ongoing fish sampling program in Lower Lockport Pool will be used to support the Will County Station §316(a) Demonstration, but no additional biota sampling will be required. The additional hydrothermal field surveys will be conducted during the summer of 2016 and winter of 2016-early 2017.

The receiving waterbody for the thermal discharge from the Will County Station is part of the UIW, which has been extensively studied by various dischargers, agencies, and other stakeholders over the last four decades. Site-specific studies have been conducted for the Will County Station by the power plant owners and/or operators over this time. More recently, state and federal partners have conducted a variety of studies to support efforts to limit the range expansion of non-native nuisance species, including several species of Asian carp, between the Mississippi River and Great Lakes drainage basins. Midwest Generation will coordinate the sampling program with the ongoing sampling efforts by these other entities.

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2. COMPONENTS FOR A COMPLETE DEMONSTRATION TO SUPPORT APPLICATION FOR ALTERNATIVE THERMAL LIMITS

In cooperation with the Atomic Energy Commission (predecessor to the Nuclear Regulatory Commission), the United States Environmental Protection Agency ("USEPA") developed the *Draft Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements* (1977) ("Technical Guidance Manual"). Although the Technical Guidance Manual has not been finalized, it remains the primary guidance for preparation of §316(a) Demonstrations to support a request for a variance from thermal standards in NPDES permits for electric generating stations. The Technical Guidance Manual presents several approaches for developing a complete §316(a) Demonstration: Retrospective, Predictive, and a "combined" approach.

2.1 RETROSPECTIVE APPROACH

For power plants similar to the Will County Station that have been in operation for a long period and have assembled an extensive database related to the aquatic community, the retrospective analysis uses these historical data to demonstrate that the thermal discharge has not resulted in *prior appreciable harm to the balanced, indigenous population* (community). In the case of the Will County Station, historical operation in compliance with Secondary Contact and AS 96-10 thermal standards has not caused appreciable harm to the aquatic community in the CSSC. A retrospective analysis looks at the historical effects of the thermal discharge on several community biotic categories that may, depending on site-specific conditions, include phytoplankton, zooplankton, benthic macroinvertebrates, habitat formers, and fish. This analysis may look at the abundance, distribution, diversity, long-term trends, and other indicators of the health of these biotic categories relative to areas affected by the thermal discharge and areas beyond the influence of the discharge. Based on the rationale presented in the Conceptual Study Plan and input from IEPA, the §316(b) Demonstration for the Will County Station will focus on the available aquatic habitat and the fish community in the vicinity of the Station.

2.2 PREDICTIVE APPROACH

The predictive analysis uses various metrics for measuring the physiological and behavioral responses of resident aquatic organisms to water temperature derived from laboratory studies and, in some cases, field observations. Such measures may include: mortality under acute and chronic exposure to high or low temperatures, temperature avoidance and preference, and temperature effects on spawning, development, and growth. A hydrothermal model of the receiving water will be developed to predict the rate of heat dissipation, dilution, and configuration of the thermal plume under various ambient canal flows and temperatures, meteorological conditions, and Station operating conditions. The laboratory predicted range of response temperatures of organisms can then be compared to the model predicted distribution of temperatures within the thermal discharge plume to assess the potential for mortality, blockage of migration, avoidance/exclusion from critical habitat or excessively large areas, and potential effects on spawning success, development, and growth.

2.3 APPROACH FOR THE §316(a) DEMONSTRATION FOR THE WILL COUNTY GENERATING STATION

Several recent §316(a) Demonstrations in support of ATLs that follow the USEPA's (1977) Technical Guidance Manual have been filed with IEPA, including one for the Dresden Generating Station located on the Lower Dresden Island Pool ("LDIP") of the Illinois River at the confluence of the lower Des Plaines River and the Kankakee River. These recent Demonstrations have integrated the retrospective and predictive approaches. Given the long operating history and extensive historical fish community data available for the Will County Station, EA Engineering, Science, and Technology, Inc., PBC ("EA") will use a similar approach, integrating retrospective and predictive methods to prepare the §316(a) Demonstration for the Station.

Specifically, the extensive historical database (Section 3) and ongoing fish studies will be used to develop a rationale demonstrating that the thermal discharge from the Station under the Secondary Contact and AS 96-10 standards has resulted in no "prior appreciable harm" to the balanced, indigenous community ("BIC") in the CSSC. Statistical evaluation of the data will be used to compare conditions upstream, within, and downstream of the thermal discharge and to evaluate long-term trends in community metrics. Laboratory-generated biothermal response data for Representative Important Species ("RIS") (Section 2.4) will be used in conjunction with predictive hydrothermal modeling in the vicinity of the Station to estimate the potential effects of the reduced thermal discharge (Section 4) on the BIC under selected operating and environmental conditions.

2.4 LIST OF REPRESENTATIVE IMPORTANT SPECIES

Acknowledging that it is not possible, feasible, or necessary to evaluate every species in a receiving water body, USEPA (1977) provides guidance for selection of RIS to be used for evaluating the effects of thermal discharges on the BIC. The selected species are representative of specific components of the aquatic community including:

- Target species of commercial or recreational fisheries
- Nuisance species
- State or federally listed threatened or endangered species
- Species important to the trophic structure/food chain
- Forage species
- Top level predatory species
- Thermally sensitive species.

In a report prepared for USEPA Region 5 and IEPA, Midwest Biodiversity Institute (Yoder and Rankin 2005) identified a master list of potential Representative Aquatic Species ("RAS") for evaluation of use categories and thermal standards; use of RAS in the evaluation of ATLs is equivalent to USEPA's (1977) RIS rationale process. The RIS list for the Will County Station has been drawn from these RAS lists for the Chicago Area Waterway System ("CAWS")

Aquatic Life Use ("ALU") B classification, which applies to the receiving water for the Will County Station discharge.

In its June 16, 2015 Final Opinion and Order (Docket No. 2008-09, Subdocket D), the IPCB decided that General Use Temperature Standards would apply to the CAWS ALU B classification. Selection of the RIS is based on review of 15 years of fish sampling data collected between 1994 and 2014 from the CSSC (between Romeo Road and the Lockport Lock and Dam); these data are summarized by EA (2015) in the 2014 annual fisheries report[1] (Table 1). These data were used to identify species representative of the fish community in this reach of the CSSC, e.g., numerically dominant species, various trophic levels, targets for recreational or commercial fisheries, potential nuisance species, thermally sensitive species, and state-listed threatened and endangered species; no federally-listed species occur in the CSSC. During the 15 sampling years, a total of 50 fish species has been collected (Table 1). The number of species collected per year ranged from 12 in 1994 to 28 in 2002. Five species were collected in all 15 sampling years and another nine in at least 10 of the study years. The 15 most abundant species accounted for 98 percent of the fish collected in this reach over the past 15 study years and include forage species, top predators, and commercial and recreational species. Six of these most abundant species have been selected as RIS: Bluntnose Minnow, Gizzard Shad, Green Sunfish, Largemouth Bass, Common Carp, and Channel Catfish. Other species among the 15 most abundant are forage and/or recreational species that are adequately represented by the selected species. Banded Killifish, a state-listed RIS species, has only been collected during the three most recent sampling years reported (2012-2014) (Table 1), was collected in greatest abundance in 2014. Thermally sensitive species such as White Sucker and redhorse species prefer riffle and run habitat with clean coarse substrate, particularly for spawning, and therefore, would not be expected to occur in this reach of the CSSC given the significant habitat constraints (Section 5); these species are not included as RIS, which is consistent with the Secondary Contact list developed by Yoder and Rankin (2005).

The retrospective portion of the §316(a) Demonstration will assess the distribution and condition of the BIC as a whole, as well as the distribution of the RIS, comparing the aquatic community within and outside of the influence of the Will County Station's thermal plume. For the predictive portion of the §316(a) Demonstration, thermal effects data are limited for some RIS, in which case data for closely related congeneric species will be evaluated. For example, thermal effects data would be pooled for various species of *Fundulus* spp. as a surrogate for Banded Killifish; this species was not collected in the CSSC prior to 2012.

[1] The 2014 annual fisheries report was submitted to IEPA in September 2015.

The following species are the selected RIS for evaluation of ATLs for the Will County Station in this reach of the CSSC:

Species	Abundant	Commercial[a]	Recreational[b]	Nuisance	Threated and Endangered	Forage	Predator
Gizzard Shad	X					X	
Bluntnose Minnow	X					X	
Banded Killifish					X		
Common Carp	X			X			
Channel Catfish			X				
Green Sunfish	X		X				X
Largemouth Bass	X		X				X

a. No commercial fishing currently takes place in this waterway.
b. Recreational fishing is minimal due to limited access, heavy commercial barge traffic, the presence of legacy contaminants, and long-standing consumption advisories.

3. DATA GAP ANALYSIS – REVIEW OF EXISTING DATA SOURCES

Commonwealth Edison and Midwest Generation have conducted a variety of studies since 1984 to monitor and document the condition and composition of the aquatic community, and the physicochemical conditions in the vicinity of the Will County Station. The longest running sampling programs have targeted the fish community. In addition to the work by Commonwealth Edison and Midwest Generation, the Asian Carp Regional Coordinating Committee's Monitoring and Response Work Group (MRWG) has conducted annual monitoring of various aquatic trophic groups in the CAWS since 2010, including some portions of the UIW near the Will County Station. The table below briefly summarizes the years of studies conducted or ongoing:

Data Category	Midwest Generation	MRWG
Fish	1984-1995, 2000-2002, and 2005-2015	2010-2015
Aquatic Macrophytes	1992-1995	
Phytoplankton	1991 and 1993 (MWRDGC)	2010-2015[a]
Zooplankton	(MWRDGC)	2010-2015[a]
Macroinvertebrates	1993 and 1994 (MWRDGC)	
Ichthyoplankton	2005 and 2016[b] (entrainment)	2010-2015[a]
Sediment	1994-1995	
Habitat Characterization	1993-1995	
Thermal Plume Studies	2002 and 2011	
Mixing Zone	2002 and 2011	
Intake Temperature Monitoring	Continuously for most recent 5-year period (Station collected data)	
Discharge Temperature Monitoring	Continuously for most recent 5-year period (Station collected data)	
Thermal Modeling	2011	

a. Just downstream of Lockport Lock and Dam in Brandon Pool.
b. Midwest Generation is currently planning to conduct this §316(b)-related study in 2016 at Will County Station.
Note: MWRDGC = Metropolitan Water Reclamation District of Greater Chicago.

The information presented in the table has been used to identify existing data gaps that would need to be addressed in order to meet the criteria (USEPA 1977) for a §316(a) Demonstration in support of the application for an appropriate ATL for the Station.

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4. CURRENT STATION OPERATING SCENARIO

In April 2015, Midwest Generation mothballed Unit 3 at the Will County Station, resulting in a significant reduction in the volume of cooling water discharged to the CSSC. Will County will continue to operate a single unit (Unit 4) for the foreseeable future. Although existing Station operation data may be adequate for analysis of alternative temperature limits, 2 years (~~2016~~2015-~~2017~~2016) of studies will be conducted to document the response of the aquatic community to changes in the temporal and geographical extent of the thermal plume under one-unit operation.

Similarly, approximately 2 years (~~2016~~2015-~~2017~~2016) of flow and temperature monitoring data from the Station's cooling water intake and discharge will be collected to reasonably document and characterize the thermal loading patterns and capacity factors associated with one-unit operation. Barring unusual meteorological conditions and/or atypical Station operation during the ~~2016~~2015-~~2017~~ 2016 study period, this two-year study period will provide adequate data for the development of the Danish Hydraulic Institute's MIKE 3 model (Section 6.8) that will be used for the predictive assessment of potential thermal effects to RIS under the new current operating scenario for the Will County Station. In the event meteorological or station operating conditions during the ~~2016~~2015-~~2017~~ 2016 study period do not provide adequate data for the model's predictive assessment, the study period will be extended as necessary to collect the additional data required.

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5. HABITAT AND SAMPLING CONSTRAINTS IN THE CSSC

The Will County Station is located at River Mile ("RM") 295.5, approximately 4.5 miles upstream of the Lockport Lock and Dam. The CSSC is a man-made watercourse completed in 1900 to help convey treated sewage and storm water flow away from Chicago and the city's drinking water source, Lake Michigan, to the Illinois River and eventually the Mississippi River and the Gulf of Mexico. Flow in the CSSC is completely regulated by a system of locks and dams. In much of the reach in the vicinity of the Will County Station, the CSSC was excavated into limestone with vertical side walls and a relatively deep, flat bottom to facilitate commercial navigation. As a consequence, the CSSC is an extensively modified, manipulated, and impacted waterway that has significant habitat limitations for many aquatic species. Certain of these conditions also present severe challenges for the collection of representative samples of the aquatic community. Examples of these conditions include:

1. Commercial navigation—With material barges tied up along the canal walls and frequent tugboat/barge traffic, much of the width of the canal (Figure 1) can be unsafe for sampling, and fixed, moored monitoring sensors and samplers are frequently damaged or destroyed by this traffic.
2. Substrate disturbance—Frequent movement of tugboat/barges continually disturb the bottom substrate and re-suspend fine sediments, which has an adverse effect on the benthic macroinvertebrate community.
3. Flood control management—In anticipation of significant storm events, the United States Army Corp of Engineers ("USACE") will drawdown the water level in the CSSC (Figure 2) to increase capacity to carry anticipated stormwater runoff and to control flooding. Depending on the quantity of precipitation actually received during a predicted storm event, low water levels can persist for extended periods of time. These conditions affect fish distribution, potentially strand fish in isolated pools, disrupt spawning activity, and result in desiccation of aquatic species, particularly early life stages of fish, benthic macroinvertebrates, and aquatic vegetation.
4. Combined sewer overflow ("CSO") events—CSO events associated with precipitation runoff reduce dissolved oxygen in portions of the CSSC, which can result in periodic fish kills (Figure 3).
5. USACE electric fish barrier—To impede the dispersion of exotic Asian carp from the Mississippi drainage into the Great Lakes, the USACE operates an electric fish barrier approximately 0.75 miles upstream of the Will County Station (Figure 4). While this barrier may prevent the movement of Asian carp, it also prevents the normal upstream and downstream movement of native fish. The barrier also limits the area available to sample biota upstream of the Station and can result in an accumulation of upstream migrating fish immediately downstream of the barrier.
6. Chemical management measure to control invasive fish species— In early December 2009, rotenone was applied into the water column of the CSSC from RM 296.7 to RM 291 and then detoxified with potassium permanganate. The Will County Station is within this area at RM 295.5. It was estimated that approximately 55,000 pounds of fish were removed (Wisconsin Sea Grant 2010, ANS Barrier Panel notes). At least one Bighead Carp and thousands of other fish, mainly Common Carp, were recovered in the three days

following the rotenone application (Asian Carp News Archive.htm). If such chemical management were to recur during the study period, it may affect the ability to collect representative samples of the fish community for a period of time thereafter until the fish community recovers.

7. Littoral habitat—Shallow littoral habitat, important to many aquatic species, is virtually non-existent in the vicinity of the Will County Station (Figure 5). The closest littoral habitat is more than two miles downstream of the Will County Station's discharge, near the Lockport Controlling Works.
8. Sediment quality—Persistent sediment contamination has resulted in longstanding advisories against consumption of fish.

In order for the December 2009 rotenone application to occur, the USACE prepared an Environmental Assessment. The assessment stated that "*The fish assemblage identified in the proposed eradication reach are for the most part nonnative, tolerant species that are able to withstand very poor water quality and inadequate habitat and fluvial function that is necessary to support a healthy riverine ecosystem. The portion of the Chicago Sanitary and Ship Canal to be treated is completely a man-made system and never was intended to support riverine fishes or riverine macroinvertebrates. The native fishes and macroinvertebrates that will be eradicated in consequence to removing Asian carps would quickly recolonize from both down and upstream reaches.*" (USACE 2009, p. 36).

The USACE also prepared an Environmental Assessment for a proposed upgrade of the Aquatic Nuisance Species Dispersal Barriers Project in the CSSC. This assessment stated that "*The CSSC is a created structure built to transport sewage through a heavily industrialized and urbanized area with poor water quality generally limiting the aquatic resources of the canal. For this reason, fisheries populations in the CSSC and the upper Illinois River declined over many years to a point where they were virtually nonexistent except for the most pollutant-tolerant of species. As a completely channelized structure, the CSSC only provides main channel and main channel order habitat with virtually no spawning habitat, and it significantly reduces the quality and quantity of habitat available for fish and wildlife resources.*" It also stated that "*The present day Lockport Pool of the CSSC supported no aquatic life prior to its construction. Fish species that colonized the new canal came from nearby waters including the Des Plaines River, Lake Michigan and several small streams that flowed into the CSSC.*" (USACE 2013, pp. EA 9-10).

A description of the CSSC is provided in the Great Lakes and Mississippi River Interbasin Study ("GLMRIS") Report prepared by the USACE. The GLMRIS Report presents the results of a multi-year study regarding the range of options and technologies available to prevent aquatic nuisance species movement between the Great Lakes and Mississippi River basins through aquatic connections. Concerning the CSSC, the GLMRIS Report states: "*The CSSC is a man-made channel that was constructed in 1900 to supplement and ultimately replace the Illinois and Michigan Canal as a conduit to the Mississippi River system. Its construction facilitated the reversal of the Chicago River. Industrial and commercial land use dominates the riparian zone along most of the CSSC. There is little to no canopy cover and instream habitat for aquatic life is limited. Areas of scouring, as well as pockets of deep silty sediments also occur near*

Lockport, although habitat improves slightly near the sunken barges on the west bank. Aquatic vegetation and snags are present in this shallow area with deep sand and silt deposits (MWRDGC 2008). Water and sediment quality is impaired throughout. Sediment samples collected near Lockport in 2006 contained elevated levels of cyanide and phenols. Ten-day Chironomus tentans toxicity testing on sediments collected at Lockport indicated poor habitat quality for benthic organisms (MWRDGC 2006)." (USACE 2014, Appendix B, p. B-12).

The waterway will continue to be subjected to these types of Asian carp monitoring and control activities in the future. Along with the minimal habitat provided by the CSSC environment, these activities will serve to limit any potential improvements in the aquatic community in the vicinity of Will County Station.

Given these conditions, the constraints on sampling methods and equipment, safety during sampling of this reach of the CSSC, and the relatively permanent and irreversible degradation of physical aquatic habitat, it was agreed at the 4 November 2015 meeting with IEPA that the collection of fish data as part of the ongoing sampling program in the UIW will be adequate to characterize aquatic community conditions in the vicinity of the Will County Station. It was further agreed that additional sampling of fish or other biotic categories will be impractical and is not expected to yield representative information. For these reasons, such additional sampling will not be required to support the §316(a) Demonstration for the Will County Station.

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6. STUDY PLAN FOR DEMONSTRATION TO SUPPORT ALTERNATIVE THERMAL LIMITS

6.1 PHYTOPLANKTON

Except in a few unusual circumstances, phytoplankton have generally been viewed as a biotic category with low potential for impact associated with thermal discharges to rivers. The 1977 Technical Guidance Manual supports this assumption. High reproductive capacity and short generation times of most phytoplankton species allow rapid recovery and limit potential effects to a small spatial and temporal extent. Thermal sensitivity testing has demonstrated that phytoplankton typically have relatively high thermal tolerance levels. Relatively high nutrient availability in the UIW further promotes rapid reproduction and growth.

Annual monitoring of phytoplankton productivity (chlorophyll *a*) since 2010 by the MRWG just downstream of the Lockport Lock and Dam in the upper portion of Brandon Pool provides data that could be used to assess the current status of the phytoplankton community in the vicinity of the Will County Station. Also, the MWRDGC has had weekly chlorophyll *a* data from a site in the lower Lockport Pool since at least 2003. Phytoplankton studies conducted as part of the UIW studies in 1991 and 1993 included the lower Lockport Pool and provide an historical context for changes in the phytoplankton community in response to other water quality changes over the last two decades. Given that phytoplankton are typically a low impact biotic category, the available existing information is considered adequate to characterize this component of the aquatic community and therefore, no additional studies of phytoplankton are proposed to support development of a §316(a) Demonstration.

Existing historical data for the CSSC and thermal tolerance data from scientific literature will be reviewed in the §316(a) Demonstration for the Will County Station to support the finding that phytoplankton is a low potential impact biotic category at this site.

6.2 SUBMERGED AQUATIC VEGETATION

Aquatic vegetation can provide cover and spawning habitat for some species/life stages of fish and invertebrates. Large, dense stands of macrophytes can, however, adversely affect the concentration of dissolved oxygen concentrations, particularly during the nighttime respiratory phase. During recent fisheries surveys, EA (2015) has documented significant increases in distribution and areal extent of macrophytes downstream of Lockport Lock and Dam and occasional low dissolved oxygen associated with dense mats of duckweed/algae, which impair habitat for some fish species.

The CSSC in the vicinity of the Will County Station does not provide conditions conducive to development of beds of submerged aquatic vegetation. Although water levels can fluctuate widely as a result of canal and flood control operations, typical water depth in this reach is uniformly greater than 21 ft to facilitate shipping. Both shores are lined by steep vertical limestone walls, providing no shallow littoral zone habitat and substrate is fine material that is routinely re-suspended by frequent commercial barge traffic. Limited littoral habitat is available

downstream of the Lockport Controlling Works, approximately 2.5 miles downstream from the Will County discharge. No survey of submerged aquatic vegetation is proposed for the CSSC in the vicinity of the Will County Station.

6.3 ZOOPLANKTON

Similar to phytoplankton (Section 6.1), zooplankton have generally been demonstrated to be a biotic category with low potential for impact associated with thermal discharges (USEPA 1977). High reproductive capacity and short generation times allow rapid recovery and limit potential effects to very small spatial and temporal extents. Thermal testing has demonstrated that zooplankton typically have relatively high thermal tolerance levels.

The annual monitoring of zooplankton since 2010 by the MRWG just downstream of the Lockport Lock and Dam in the upper portion of Brandon Pool provides data that could be used to assess the current status of the zooplankton community in the CSSC near the Will County Station. Given that zooplankton are typically a low impact biotic category, the available existing information is considered adequate to characterize this component of the aquatic community; therefore, no additional studies of zooplankton are proposed to support development of a §316(a) Demonstration.

Existing historical data for the CSSC, if available, and thermal tolerance data from scientific literature will be reviewed in the §316(a) Demonstration for the Will County Station to support the finding that zooplankton is a low potential impact biotic category at this site.

6.4 BENTHIC MACROINVERTEBRATES

The benthic macroinvertebrate community will be analyzed and discussed in the §316(a) Demonstration in a manner similar to that described above for the phytoplankton and zooplankton communities. Benthic macroinvertebrates were sampled during the summers of 1993 and 1994 in the vicinity of the Will County Station as part of the UIW study. Additionally, benthic macroinvertebrates have been sampled by MWRDGC at one or two locations near the Station.

The USACE Environmental Assessment (2009) stated that "*the macroinvertebrate assemblage, as indicated by the MWRDGC, identified in the proposed* [rotenone] *eradication reach is also for the most part made up of very tolerant species that are able to withstand very poor water quality and inadequate habitat and fluvial function that is necessary to support a healthy riverine ecosystem. The predominant species are native bloodworms (Chironomus), and the non-native zebra mussel (Driesenna polymorpha) and rusty crayfish (Orconectes rusticus)*" (USACE 2009, p 36-37).

Frequent tugboat/barge traffic in the CSSC causes frequent disturbance of the bottom habitat and re-suspension and settling of fine sediment throughout this reach. It is likely that this ongoing disturbance of the bottom habitat plays a significant role in the modification and simplification of the benthic macroinvertebrate community described by the USACE (2009). Therefore, this Plan

does not propose new sampling for benthic macroinvertebrates. However, existing historical data for the CSSC and thermal tolerance data from scientific literature will be reviewed in the §316(a) Demonstration for the Will County Station to determine whether it supports the finding that the thermal discharge from the Will County Station does not adversely affect the benthic macroinvertebrate community of the CSSC and Lower Lockport Pool.

6.5 FRESHWATER MUSSELS

The Illinois River and its headwaters once provided habitat to a diverse community of freshwater mussels; however, those populations declined dramatically following construction of the CSSC and the navigational lock and dam system.

The Illinois Natural History Survey (Price et al. 2012) conducted a regional survey for freshwater mussels in the Des Plaines River basin and other tributaries to Lake Michigan. Price et al. (2012) identified live specimens of nine freshwater mussel species; shells for another 10 species were identified, but with no live specimens. The authors reported that many species collected historically in the Des Plaines River basin have not been documented in the basin since at least 1920. Only three species (represented by dead specimens or relic shells) were identified from the one sampling location downstream of Lockport Lock and Dam in Brandon Pool. Price et al. (2012) also reported no evidence of successful reproduction (recruitment of individuals less than 30 mm or with three or fewer growth rings). Price et al. (2012) concluded that "*the Des Plaines River basin has undergone significant freshwater mussel species loss, and unless water and sediment quality improve, species loss will likely continue. Urbanization in the region has profoundly impacted the aquatic habitat available for freshwater mussels. The navigable waterways throughout the Des Plaines River basin are highly modified for navigation and waste disposal, and waterways that were formerly rivers exist now as dredged canals with artificial walls.*"

Although Price et al. (2012) did not sample for mussels in the CSSC, sampling in Brandon Pool indicates that mussel populations do not exist in the reach downstream of Lockport Lock and Dam where there is better potential mussel habitat than occurs in lower Lockport Pool. Information on current mussel distribution in the UIW is limited, however, the available evidence indicates that potential freshwater mussel habitat in the CSSC is of poor quality and that living mussel populations are not likely to exist in the vicinity of the Will County Station. Therefore, no mussel surveys are proposed in this Plan. Existing historical data, if available, will be reviewed in the §316(a) Demonstration for the Will County Station to determine whether it supports the finding that freshwater mussels are not expected to occur or be affected by the Will County Station's thermal discharge.

6.6 FISHERIES

The objective of this study will be to determine/compare the composition, distribution, abundance, condition, and incidence of anomalies of fish upstream, within the mixing zone, and downstream of the Will County Station's discharge. The ~~2016~~ 2015 and ~~2017~~ 2016 results from

the ongoing monitoring program will be compared with those obtained since 1994 to evaluate spatial and temporal trends within the fish community.

Sampling of the juvenile and adult fish community in the CSSC upstream of the Lockport Lock and Dam has been conducted for more than 25 years (1984-1995, 2000-2002, and 2005-2015) by Commonwealth Edison or Midwest Generation. Sampling has included the use of electrofishing and beach seines in appropriate habitat. Except as noted below, the overall geographic and temporal coverage of these surveys is more than adequate to characterize the fish communities in the vicinity of the Will County Station and any changes that have occurred over time in response to Station operation, upstream discharger operations, and other environmental changes in the aquatic system. Due to the change in electrofishing methods in 1994, any historical comparisons will be confined to data collected since then (Table 1).

6.6.1 Field Fisheries Study

The ongoing fish sampling program consists of one location upstream of the Will County Station's discharge (Location 301), a location within and downstream of the discharge canal (Location 302), and two locations downstream of the edge of the mixing zone near the Lockport Controlling Works (Locations 302A and 302B, upstream and downstream of the Route 7 Bridge in Lockport) (Figure 6). The ongoing fish sampling program fulfills the requirements of Special Condition 17 of the Joliet Station #9 NPDES Permit (Permit Number IL0002216) and Special Condition 18 of the Joliet Station #29 NPDES Permit (Permit Number IL0064254).

Electrofishing will be conducted at all four lower Lockport Pool locations using a boat-mounted electrofishing system energized by a 230-volt, 5,000-watt three-phase AC generator. Each electrofishing zone is 500 m long. Electrofishing will be conducted in a downstream direction at all locations. Electrofishing will begin no earlier than 0.5 hours after sunrise and will finish no later than 0.5 hours before sunset. The sampling crew will consist of a driver and a netter. Both crew members will have long-handled dip nets for catching stunned fish.

Seining will be conducted at Location 302A using a 25-ft long x 6-ft deep straight seine with 3/16-inch Ace mesh. The sampling distance will depend on the area available at each location and, to the extent possible, will be kept constant during each sampling period. If electrofishing and seining are to be conducted in the same area on the same day, seining will be conducted first and at least one hour elapsed before electrofishing is conducted.

Ongoing sampling is conducted once in mid-May, once in June, and twice monthly in July, August, and September, for a total of eight sampling events. These sampling events will continue to be coordinated with MRWG to minimize cross-program interference.

6.6.2 Physicochemical Measurements

Water temperature, dissolved oxygen concentration, percent oxygen saturation, specific conductance, and Secchi disk depth will be measured at each electrofishing location during each

trip. Sampling techniques and calibration procedures/frequencies will be the same as those used historically during the UIW studies (EA 2015).

6.6.3 Sample Processing

All fish will be held in source water immediately after collection and until processing. All fish will be counted and identified to the lowest practical taxonomic level, usually species. For each location and gear, a maximum of 30 specimens of each species collected will be measured for total length (mm) and weight (g). If over 30 individuals of a species are collected at any location, then 30 representative individuals will be measured and weighed. The remaining individuals of that species will be counted and a group (batch) weight recorded. Minnows (excluding all carp species, Goldfish, and their hybrids) and other small species such as darters and topminnows will be identified, counted, and batch weighed. After processing, all live fish will be returned to the river. All fish not processed in the field will be preserved in formalin, labeled, and returned to the laboratory for processing. In the laboratory, fish will be processed in the same manner as in the field.

A voucher collection of unusual or taxonomically difficult species will be compiled. All observed threatened or endangered species will be photo documented and returned live, if possible, and will not be routinely included in the voucher collection.

All fish encountered will be examined for external anomalies. External anomalies will be classified as DELT anomalies (Deformities, Erosions, Lesions, and Tumors), parasites, or "other" abnormalities. The following is a review of DELT anomalies and their causes in freshwater fishes:

1) Deformities - These anomalies can affect the head, spine, fins, and have a variety of causes including toxic chemicals, viruses, bacteria (e.g., *Mycobacterium* sp.), and protozoan parasites (e.g., *Myxosoma cerebalis*).

2) Eroded fins - These are the result of chronic disease principally caused by flexibacteria invading the fins causing a necrosis of the tissue. Necrosis of the fins may also be caused by gryodactylids, a small trematode parasite. For this study, fin erosion will be separated into three categories: slight erosion <1/3 of fin eroded; moderate erosion 1/3 to 2/3 of fin eroded, and severe erosion >2/3 of fin eroded.

3) Lesions and Ulcers - These appear as open sores or exposed tissue and can be caused by viral (e.g., *Lymphocystis* sp.) or bacterial (e.g., *Flexibacter columnaris*, *Aeromonas* spp., *Vibrio* sp.) infections.

4) Tumors - Tumors result from the loss of carefully regulated cellular proliferative growth in tissue and are generally referred to as neoplasia. In wild fish populations, tumors can be the result of exposure to toxic chemicals such as polycyclic aromatic hydrocarbons (PAHs). Viral infections (e.g., *Lymphocystis*) can also cause tumors. Parasites (e.g., *Glugea anomala* and *Ceratomyxa shasta*) may cause tumor-like masses, but are not considered tumors. Parasite masses can be squeezed and broken between the thumb and forefinger whereas true tumors are firm and not easily broken.

An external anomaly will be defined as the presence of externally visible skin or subcutaneous disorders, and is expressed as percent of affected fish among all fish processed. Only those anomalies visible to the naked eye will be recorded. The exact counts of anomalies present (e.g., the number of tumors or lesions per fish) will not be recorded.

6.6.4 Data Analysis and Interpretation

Data from electrofishing and seining will be reported as number, catch-per-unit-effort ("CPE", No./km for electrofishing and No./haul for seining), and percent abundance for each species. Index of Well-Being ("IWB") and modified IWB ("IWBmod") scores will be calculated for the electrofishing data and species richness will be calculated for both gears.

Electrofishing and seining data will be segregated by location, segment, and trip. Mean electrofishing and seining community parameters (i.e., CPEs, species richness, and IWBmod scores [electrofishing only]) will be compared on intra-year (segment vs. segment by year) and inter-year (year vs. year by segment) basis. Statistical testing (ANOVA and Tukey's Studentized Range Test) will be conducted on the electrofishing data. Analyses of relative weight and DELT anomaly data will also be on inter-year and intra-year basis. Physicochemical data collected in conjunction with these studies will be compared on a spatial basis (e.g., location vs. location and segment vs. segment).

An entrainment study conducted at the Will County Station in 2005 is a source of ichthyoplankton data in the immediate vicinity of the Station. In addition, ichthyoplankton entrainment data ~~is currently planned to be~~was collected at the Will County Station in 2016 as part of §316(b) requirements. These data will be used to characterize the species and life stages susceptible to the Station's thermal plume. No additional ichthyoplankton studies are proposed to support development of the §316(a) Demonstration.

6.7 AQUATIC HABITAT

During the UIW studies conducted from 1993 through 1995, the habitat at each fish and macroinvertebrate sampling location in lower Lockport Pool was evaluated using the Qualitative Habitat Evaluation Index ("QHEI") developed by Rankin (1989). The habitat results were summarized in *Aquatic Ecological Study of the Upper Illinois Waterway* (Commonwealth Edison 1996). They generally showed that habitat was poor upstream of Brandon Road Lock and Dam, particularly in lower Lockport Pool. Although habitat conditions improved moving downstream of the Brandon Road Lock and Dam, QHEI scores were still typically in the "poor" range of the scale. The predominant habitat in lower Lockport Pool is deep channel; other types of habitat that would contribute to the diversity and quality of overall aquatic habitat are not present or spatially limited. The habitat within each lower Lockport Pool electrofishing location will again be evaluated using the QHEI in 2016 ~~and 2017~~.

New bathymetric information for the reaches influenced by the Station's discharge will be collected. These data, combined with the new QHEI survey data, will be used to generate habitat maps for this reach of the CSSC and used in the predictive portion of the §316(a) Demonstration

to interpret availability and distribution of preferred habitat for the RIS within and outside of the thermal mixing zone and selected thermal isothermal contours of the Station's thermal plume. Given the extreme physical constraints on and homogeneity of habitat in lower Lockport Pool, no additional habitat mapping is proposed in this reach.

6.8 THERMAL PLUME SURVEYS AND HYDROTHERMAL MODELING

A series of thermal plume surveys were conducted during the summer of 2011 to characterize the distribution of temperatures in the thermal mixing zone at the Will County Station. The surveys included measurement of surface temperatures along a series of transects, plus 3-4 vertical temperature profiles along each transect (Figure 7). The survey area extended from approximately 3,700 ft upstream of the Will County Station's discharge to approximately 7,000 ft downstream of the discharge (Figure 7).

In order to more completely document the downstream distribution and dissipation of thermal plume temperatures and support hydrothermal modeling of the plume for the predictive assessment, the Plan proposes the addition of three transects downstream of the 7,000-ft transect (Figure 8). Because Midwest Generation mothballed Will County Unit 3 in 2015, new thermal surveys will be conducted under winter (during late 2016-early 2017) and summer (during 2016) operations. The survey data collected in 2011, along with new data collected, will be used to calibrate and validate the MIKE 3 thermal model that will be used to predict the configuration of the plume under various canal flow, meteorological, and operating conditions.

6.8.1 Bathymetry Survey

Bathymetric data will be collected along each study transect (Figures 7 and 8). They will be collected along 16 transects oriented perpendicular to flow beginning downstream of the USACE electric fish barrier to immediately upstream of the Lockport Lock and Dam. Labeled headstakes and transect markings will be set on each shore to provide visual cues during the survey. As part of the survey effort, additional data will be obtained along a diagonal line between the end of one transect and the beginning of the next transect for all but the three most downstream transects (Transects 13 to 14, Transects 14 to 15, and Transects 15 to 16) and as a continuous transect along the approximate centerline of the river to serve as cross-lines for each of the 16 survey transects. Cross-line data will be used following processing as part of the quality assurance/quality control procedures. Figures 7 and 8 show the estimated location of the 16 survey transects; the exact locations may be adjusted in the field based on observed flow conditions, location of barges tied along the canal wall, and other safety considerations.

Individual depth soundings will be collected acoustically using a Teledyne Odom Hydrotrac precision survey fathometer interfaced with a 200 kHz, narrow beam (3°) transducer (or equivalent system). The transducer will be set at a fixed depth below the waterline of the survey vessel (draft) and a correction will be applied to the soundings by the fathometer to reflect the actual depth between the water surface and riverbed. The raw depth soundings obtained by the fathometer will be ported directly to HYPACK and saved as a negative elevation value. During the survey operation, HYPACK will merge the raw soundings with time and RTK GPS position

information, and store these data in files for post-processing. As HYPACK collects the raw soundings, it will also employ a geoid model to convert the negative elevation values (water depths) to elevation relative to the vertical control of North American Vertical Datum of 1988 ("NAVD 88"). This first order conversion can be accomplished in real time using the precision ellipsoid height data provided by the RTK GPS system. These elevation data will later be refined as part of the post-processing routines.

As part of the survey activity, profile measurements of the physical characteristics of the water column will be obtained three or more times on each survey date using a Seabird SBE 19 Conductivity, Temperature, and Depth ("CTD") probe in order to determine sound velocity. Sound velocity is a product of water density, which is primarily influenced by temperature in a freshwater river system. The CTD profiles will be used to calculate a series of sound velocity correctors that will later be employed in the post-processing phase of the project to adjust the raw soundings obtained by the fathometer using a fixed, assumed sound velocity.

During the post-processing phase, all the raw depth soundings will be reviewed, corrected for water column sound velocity, and normalized to a vertical datum of NAVD 88 in HYPACK's single beam editor module. At the conclusion of the processing step, the data will be compiled into a single *.XYZ text file consisting of X and Y position information and depth represented as Z. The files will be ported to a geographic information system ("GIS") database for gridding and development of a digital elevation model for the study reach.

6.8.2 Temperature Surveys

The Will County Station sampling grid will consist of the same 13 primary transects used for the 2011 survey with three new transects (transects 14, 15, and 16); transects 14-16 in Figure 8 are approximate locations for the 2016-early 2017 surveys. The transect locations (negative distances indicate distance upstream from the discharge canal) and the number of vertical stations along each transect are summarized in the following table:

Transect	Distance from Will County Discharge (ft)	No. of Verticals	Transect (cont.)	Distance from Will County Discharge (ft)	No. of Verticals
1	-3,380	3	9	3,000	3
2	-250	3	10	4,000	3
3	0	4	11	5,000	3
4	180	3	12	6,000	3
5	525	3	13	7,000	3
6	1,000	3	14	14,000	3
7	1,500	3	15	21,000	3
8	2,200	3	16	28,000	3

Transect distances are determined from the end of Will County Station's discharge canal. The end of the Will County Station discharge canal is located at Transect 3.

In addition to the cross channel transects, surface temperature data will also be collected along diagonal transects between the primary transects from transect 1 to transect 13. Upstream transects 1 and 2 will be used to establish ambient temperature conditions and to evaluate potential upstream intrusion of the thermal plume, particularly under low canal flow conditions.

Vertical profiling stations will be established along each of the primary transects. The vertical stations will be evenly spaced along each transect. More stations are located along the transect placed at the discharge canal to better characterize the lateral spread of the plumes in that area. Transect 3 has four vertical stations located at one-fifth, two-fifths, three-fifths, and four-fifths of the distance between the left and right banks. All other transects with three vertical stations have stations located at one-quarter, one-half, and three-quarters of the distance between the left and right banks. Vertical profiling stations are numbered from the left descending bank (i.e., 1/4 or 1/5 is near the left bank). In addition, one vertical station will be located at the mid-point of the Will County Station's discharge canal cross-channel transect. The thermal plume survey transects and vertical profile stations from the 2011 surveys are illustrated in Figure 7. For the 2016-early 2017 surveys, the locations of the 2011 thermal survey transects will be re-established using GPS coordinates recorded during the 2011 surveys. The approximate location of new transects (14-16) downstream of the Will County Station are shown on Figure 8; these transects and the location of the vertical profiles will be adjusted as necessary during the field surveys. The Illinois State Plane (East) NAD83 coordinate system will be used for the Will County Station surveys.

In order to reduce the total elapsed time of the surveys, particularly during the winter, the surface transect temperature measurements and the vertical temperature profile measurements will be collected concurrently by two different field crews. The surface temperature recording system consists of a Logan Enterprises thermistor probe (model 4701-2.50-25ft-TH44018-PH) interfaced with a Deban 500 module and a Trimble GeoXH DGPS (or equivalent system). The Deban module receives the signal from the thermistor and sends a voltage that responds linearly with temperature to the Campbell CR10X datalogger. The Logan/Deban temperature system has an accuracy of 0.1% full span, which corresponds to 0.05°C (0.09°F). Output from the thermistor will be stored at one second intervals in the datalogger. The DGPS stores the X and Y coordinates of the temperature probe position at one second intervals to internal memory. The system clocks on the datalogger and the DGPS are set to identical times at the beginning of each survey. Synchronized temperature and DGPS data are recorded along the primary transects, as well as along the diagonal or centerline transects.

The thermistor is attached to a fixed strut mounted on the side of the boat at a depth of 18 inches. Two thermistors, a primary and a replicate, are used during each survey. During collection of surface temperatures, the boat is driven along each transect, turned as close as possible to the shoreline, and then typically moved on a diagonal to the next transect, producing a zigzag pattern. This method is used to assist in the delineation of the surface plume between the primary transects.

Plume definition within the water column is obtained by measuring vertical temperature profiles using a Seabird CTD profiler (model SBE 19 plus). The instrument collects temperature and

depth data at 0.25 second intervals as it is slowly lowered to the bottom and pulled back up to the surface. This typically results in the collection of four to six data points within every 1-ft depth interval. The DGPS is used to position the boat at the same vertical profiling stations during each survey.

Pre- and post-calibration of temperature and pressure (depth) for the Seabird CTD Profiler will be performed and documented by the vendor. During each surface plume mapping survey, two temperature probes will be deployed (designated primary and secondary) to provide a backup in case of equipment malfunctions. For each survey date, the surface temperature thermistor will be compared to the Seabird CTD by placing both instruments side-by-side in the water.

For each survey date, hourly CSSC flows will be obtained from the USGS Station at Lemont, IL (05536890). The Lemont gage is located approximately five miles upstream of the Will County Station.

6.8.3 Thermal Model

In order to predict the lateral and longitudinal dispersion of the Will County Station's thermal plume, it will be necessary to develop a hydrothermal model of the CSSC between the USACE electric fish barrier and the Lockport Lock and Dam. The Danish Hydraulic Institute's MIKE 3 model will be used to evaluate operational and ATL scenarios. MIKE 3 is a state-of-art, three-dimensional hydrodynamic model that has been accepted for use in §316(a) Demonstrations by various state environmental agencies, including IEPA. For the Will County Station, the upstream model boundary will be downstream of the USACE Electric fish barrier. The downstream model boundary will be at the Lockport Lock and Dam. A finer cell grid will be used in the vicinity of the Will County Station's discharge to the CSSC to provide increased resolution in the initial mixing region. Each cell is typically divided into 8-10 vertical layers. The model grid will include the Will County Station's intake area and discharge canal. The upstream model boundaries are parameterized by providing temperature and flow time-series files. The temperature boundary file can incorporate vertical stratification. The downstream boundary is parameterized by a time-series file of flow and/or elevation.

The MIKE 3 model will be calibrated using thermal field survey data. A calibration model run is typically started a day prior to the thermal survey to allow build-up to conditions present at the time of the survey. Hourly Station cooling water flow, intake temperature, and discharge temperature data will be provided by the Will County Station. The upstream boundary temperatures will be based on the thermographs deployed during the surveys and flow data from the Lemont USGS gage. Stratification as observed during the survey's vertical profiles in the vicinity of the upstream boundaries will be incorporated into the model. Surface heat exchange is calculated from hourly meteorological data provided to the model. Model calibration primarily consists of adjusting horizontal and vertical dispersion, and bottom friction coefficients.

During 2011, six thermal plume surveys were conducted between 13 July and 21 September and concurrent Station operational, temperature, and river flow data were compiled. The 2016-early

2017 hydrothermal modeling effort will augment the 2011 study. A final model calibration will be completed following the performance of ~~two~~ three additional thermal plume surveys, once during the summer of 2016 and ~~once~~ twice during the winter of 2016-early 2017. Station operational, river flow, and temperature data will be updated from the 2011 study data using 2016-early 2017 information. Various model scenarios will be executed with the final calibrated model. The output files from the model scenarios will be processed with particular attention given to plume behavior and zone-of-passage as a function of operations and flow.

The MIKE 3 model provides the capability to predict the three-dimensional and temporal extent of the thermal plume under complex operating conditions. The model will be used to predict plume temperatures and configuration (e.g., surface and bottom temperature distribution maps, area and volume within selected isotherms) relative to available aquatic habitat for the predictive component of the §316(a) Demonstration. The analysis for the §316(a) Demonstration will focus on isotherms representing critical thermal thresholds (e.g., acute mortality, chronic mortality, avoidance, preference, spawning temperatures) for the RIS. This model was recently used for the predictive thermal assessment at the Dresden Generating Station on LDIP, which has been accepted by the IEPA. The analysis will utilize approximately two years (~~2016~~2015-~~2017~~2016) of hourly temperature monitoring data from the Will County Station intake and discharge, and cooling water flow under the current operating conditions to support the thermal modeling effort.

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7. SCHEDULE FOR DATA COLLECTION

Multiple study years are required in order to characterize the potential variability in aquatic communities and habitat conditions, as well as decipher their trends. Although the long-term fishery program for the UIW provides a robust database for evaluating temporal trends and spatial patterns, ~~it has not been conducted during a full year of~~ two years of data will be needed under one-unit operation at Will County Station, which began in mid-April 2015. Therefore, ~~2 years (2016-2017)~~2015 and 2016 ~~of additional data are required~~will be used to document the response of the fish community to changes in the temporal and geographical extent of the thermal plume under one-unit operation. Specifically, fish sampling in lower Lockport Pool was or will be conducted once in early May, once in early June, and twice per month in July, August, and September in ~~2016~~2015 and ~~2017~~2016. This sampling in 2016 will also include the collection of new habitat data using the QHEI.

New hydrothermal surveys will be conducted once during the summer (July-August) of 2016 and ~~once~~ twice during the winter (~~January-February) of 2017~~2016-early 2017) to characterize the thermal plume under one-unit operation. The timing of the surveys will be coordinated to coincide with periods of typical operation at the Will County Station. In addition, ~~a minimum of~~approximately 2 years (~~2016~~2015-~~2017~~2016) of flow and temperature monitoring data from the Station's cooling water intake and discharge will be necessary to reasonably document and characterize the thermal loading patterns and capacity factors associated with one-unit operation. These data are required for the development of the MIKE 3 model that will be used for the predictive assessment of potential thermal effects to RIS under the new operating scenario for the Will County Station.

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8. REPORTING

Will County Station operational data, thermal modeling results, and data from the field studies will be compiled into a series of reports. These reports will then be used, in part, to develop a separate §316(a) Demonstration. Current and historical biological data will be used to describe the biotic categories of the at-risk aquatic community while the hydrothermal modeling results will determine the potential for regulatory compliance as well as describe conditions to which the aquatic community will be exposed (e.g., temperature range, areal extent, and zone of passage). Part of this overall evaluation will be based on the selected RIS. Collectively, the analyses presented in these reports will be used to determine whether a balanced indigenous community is present in the CSSC and, if so, whether the requested Alternative Thermal Limits will adversely affect that community. If it is determined that a balanced indigenous community is not present, the analyses presented in these reports will determine whether the establishment of such a community would be prevented by continued operation of the Will County Station under the requested Alternative Thermal Limits.

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FIGURES

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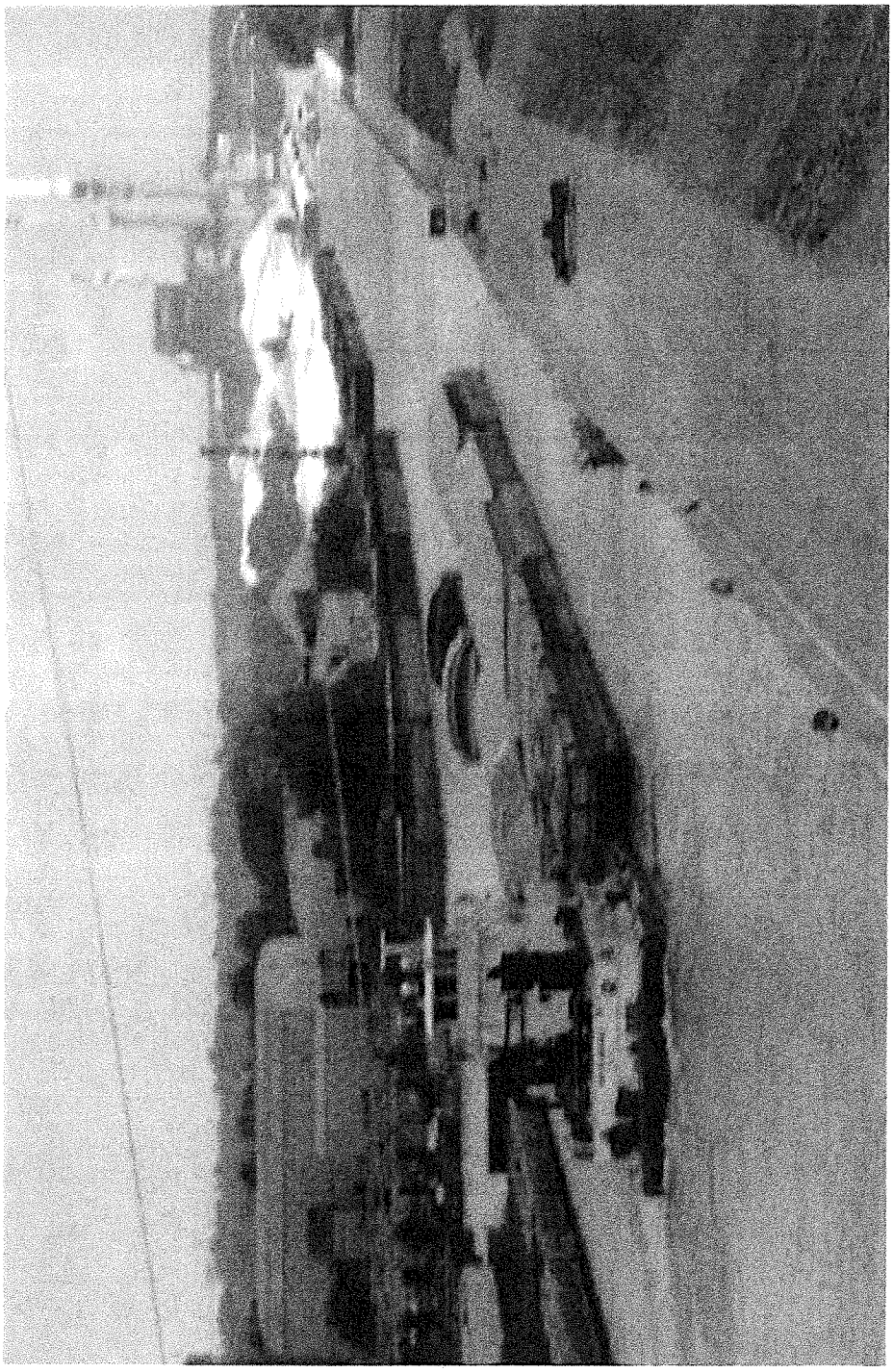
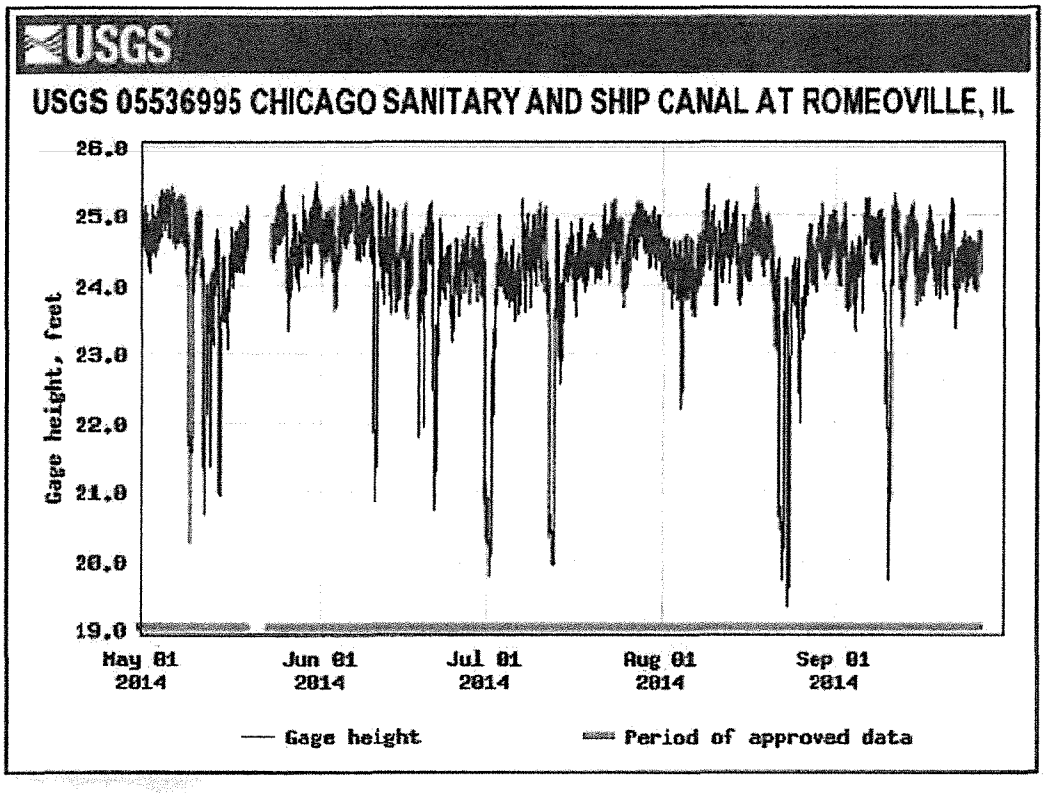


Figure 1. Commercial barge traffic and material barges tied up along the CSSC downstream of Will County Generating Station.



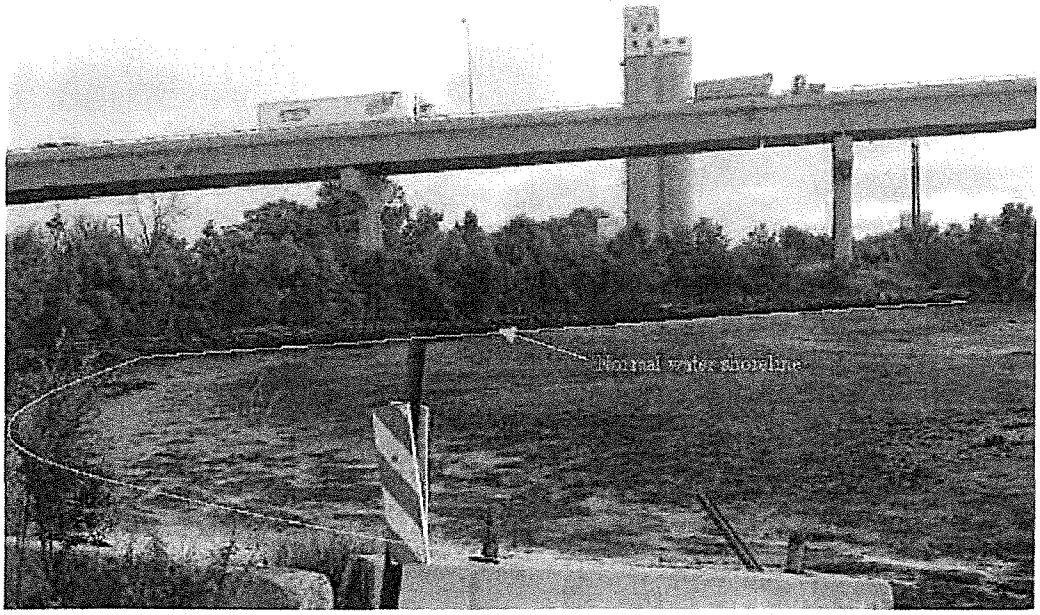


Figure 2. USGS data showing manipulations of water level in the CSSC near Will County Station and exposed littoral habitat above Lockport Lock and Dam during drawdown event, July 1, 2014.

Figure 3. Stressed and dead fish in the CSSC near Will County Station following a CSO event, 2014.

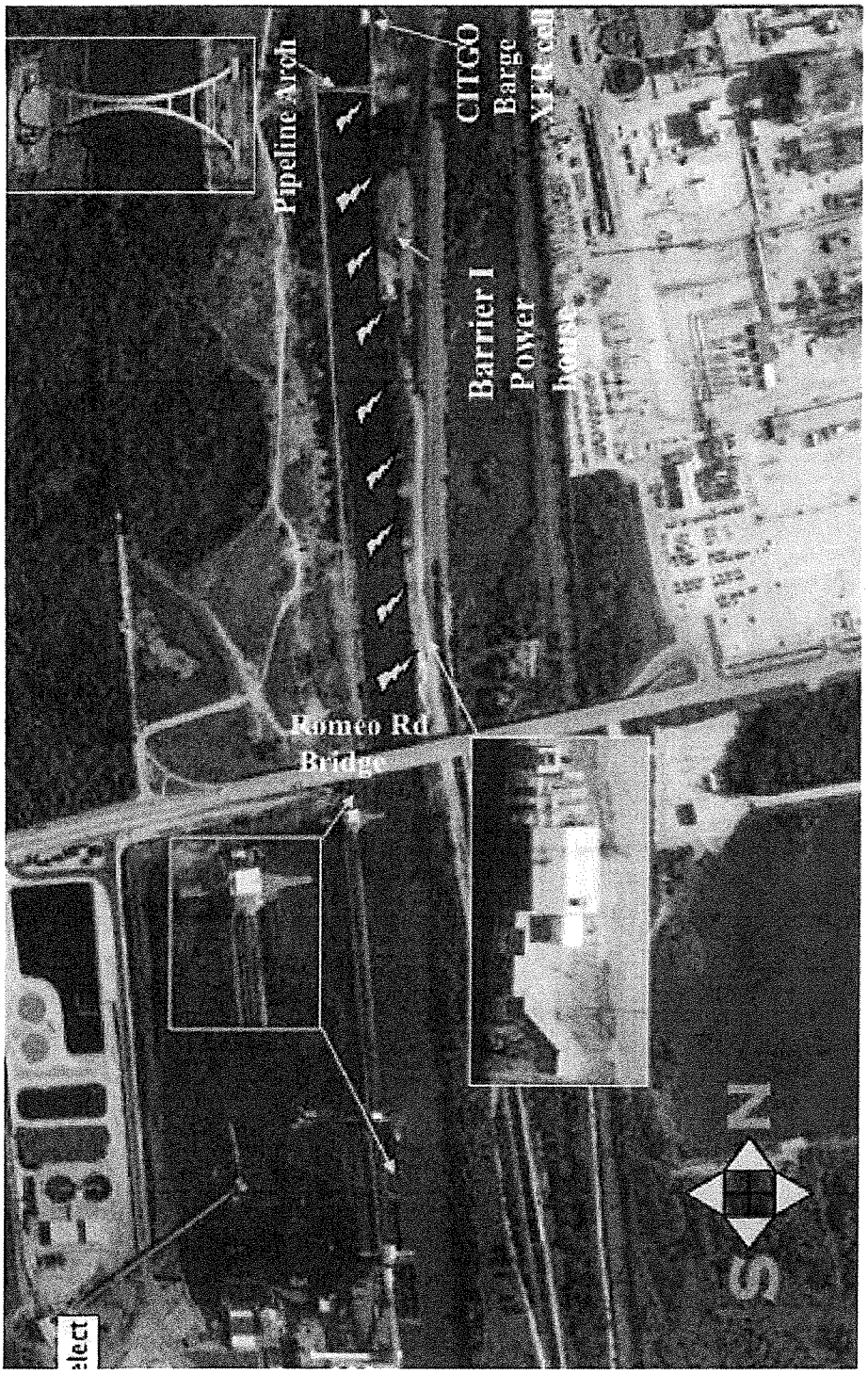


Figure 4. Location of USACE electric fish barrier in the CSSC immediately upstream of the Will County Station.

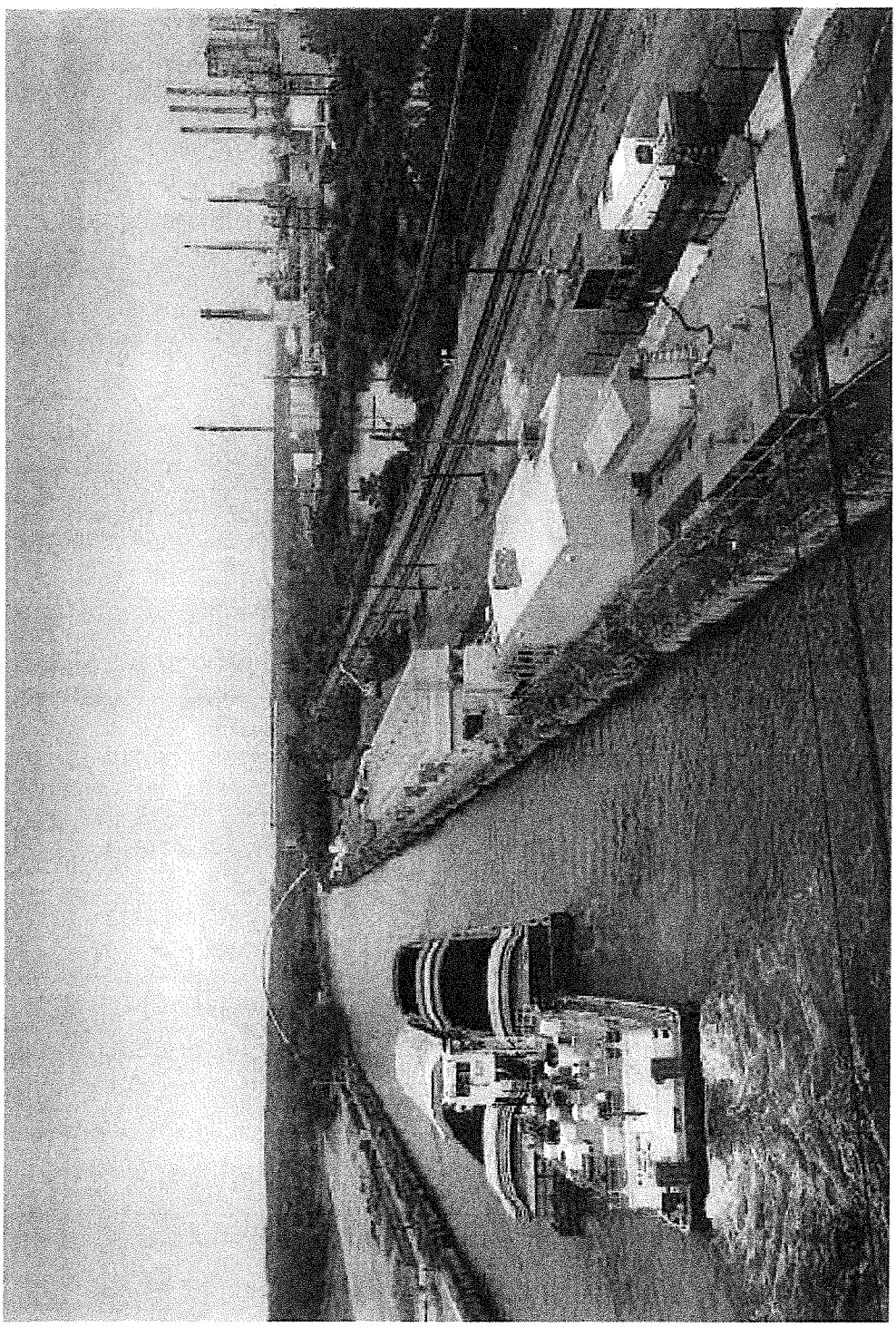


Figure 5. Reach of the CSSC in the vicinity of the electric fish barrier and the Will County Station with vertical walls and no littoral habitat.

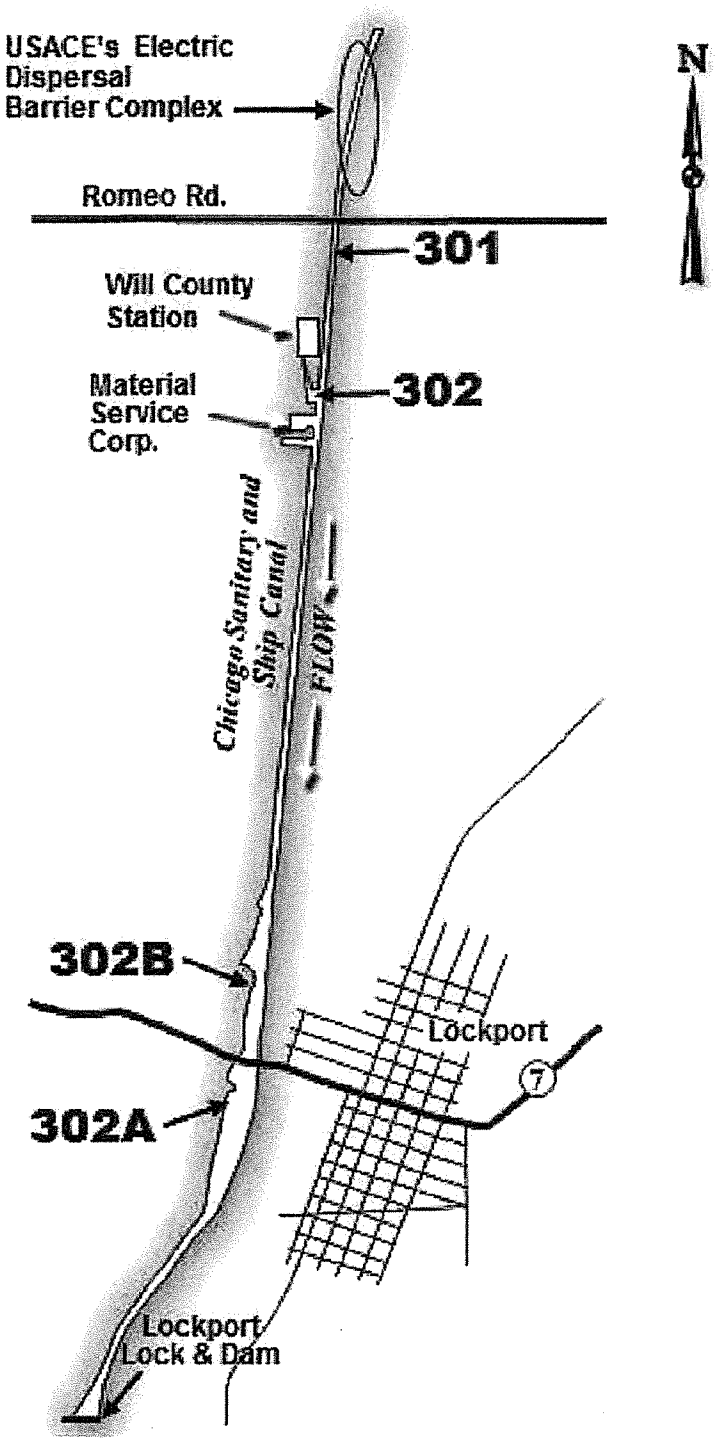
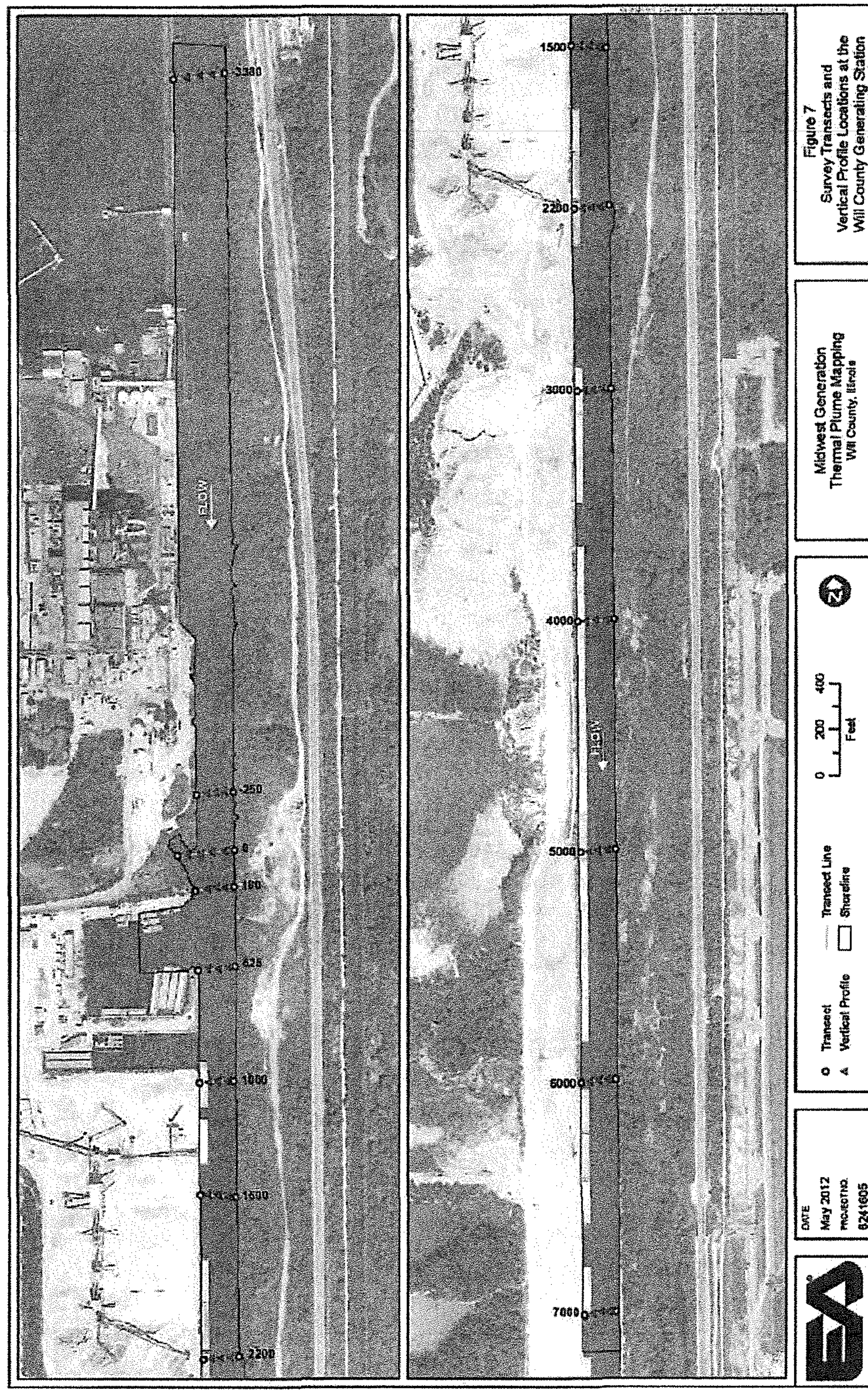


Figure 6. Fish sampling locations in Lower Lockport Pool in the vicinity of the Will County Station.



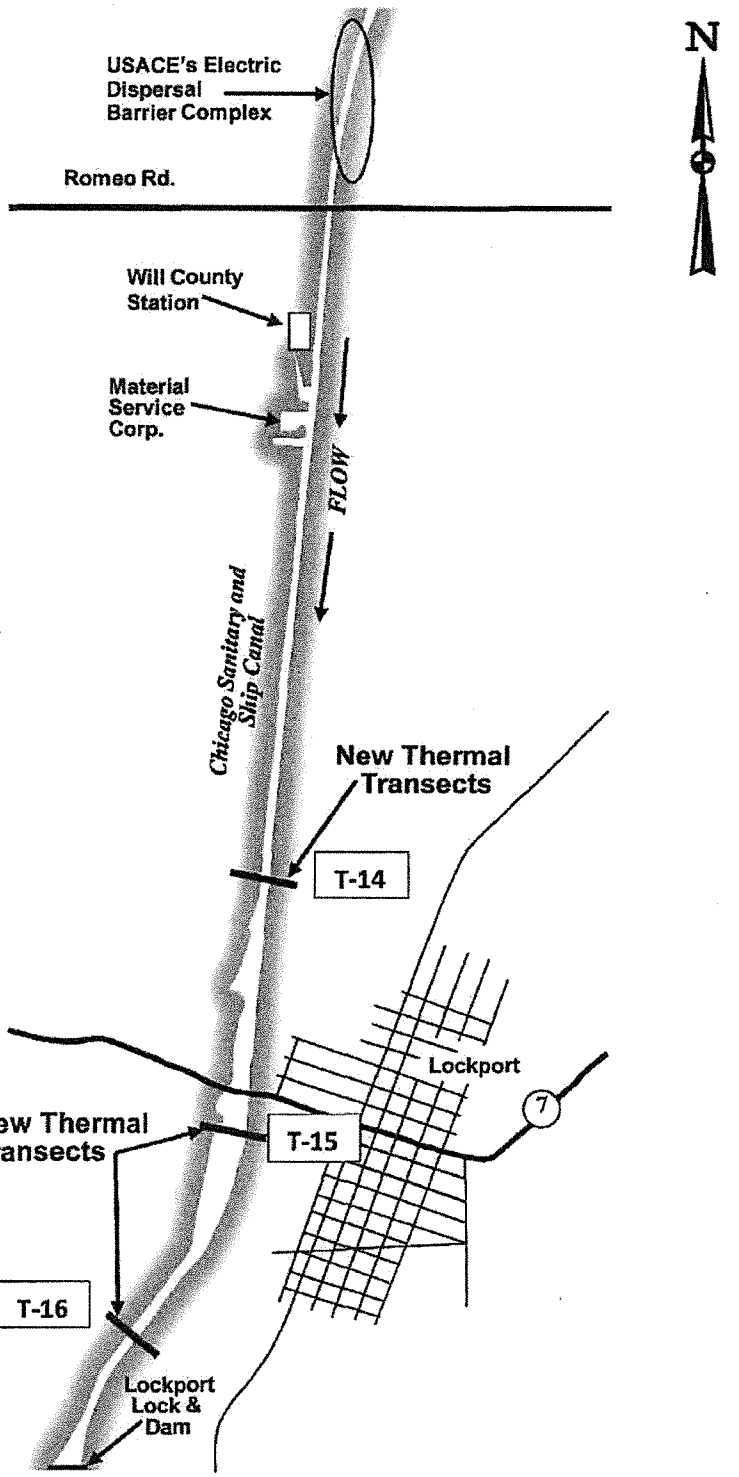


Figure 8. Approximate location of new surface temperature transects for the 2016-early 2017 hydrothermal surveys in Lower Lockport Pool in the vicinity of the Will County Station.

TABLE

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Table 1. Summary of fish abundance and relative abundance (%) in the Chicago Sanitary and Ship Canal in the vicinity of the Will County Station during 15 sampling years from 1994-2014.

	1994		1995		2000		2001		2002		2005		2006		2007		2008	
SPECIES	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
GIZZARD SHAD	1	1.7	33	20.6	404	64	1,615	66.8	2,500	75.8	1,245	71.2	629	61.5	1,113	61.7	932	53.2
BLUNTNOSE MINNOW	2	3.4	2	1.3	37	5.9	383	15.8	188	5.7	314	18	140	13.7	272	15.1	414	23.6
GREEN SUNFISH	1	1.7	6	3.8	16	2.5	75	3.1	110	3.3	14	0.8	31	3	84	4.7	85	4.9
EMERALD SHINER	3	5.2	21	13.1	50	7.9	178	7.4	178	5.4	24	1.4	59	5.8	134	7.4	46	2.6
BLUEGILL	2	3.4	--	--	4	0.6	19	0.8	27	0.8	10	0.6	7	0.7	24	1.3	45	2.6
PUMPKINSEED	--	--	--	--	3	0.5	3	0.1	10	0.3	--	--	55	5.4	20	1.1	69	3.9
COMMON CARP	29	50	18	11.3	53	8.4	70	2.9	140	4.2	80	4.6	38	3.7	41	2.3	26	1.5
LARGEMOUTH BASS	--	--	64	40	28	4.4	22	0.9	17	0.5	23	1.3	27	2.6	19	1.1	44	2.5
WESTERN MOSQUITOFISH	4	6.9	--	--	2	0.3	--	--	27	0.8	1	0.1	1	0.1	7	0.4	5	0.3
THREADFIN SHAD	--	--	--	--	4	0.6	--	--	--	--	--	--	--	--	--	--	8	0.5
CHANNEL CATFISH	--	--	1	0.6	5	0.8	20	0.8	22	0.7	10	0.6	13	1.3	11	0.6	5	0.3
GOLDFISH	8	13.8	2	1.3	--	--	--	--	2	0.1	--	--	--	--	1	0.1	1	0.1
ORIENTAL WEATHERFISH	--	--	--	--	1	0.2	--	--	--	--	1	0.1	3	0.3	2	0.1	2	0.1
SPOTFIN SHINER	1	1.7	--	--	16	2.5	6	0.2	20	0.6	2	0.1	--	--	7	0.4	16	0.9
ROUND GOBY	--	--	--	--	--	--	--	--	4	0.1	1	0.1	1	0.1	18	1	17	1
GOLDEN SHINER	1	1.7	--	--	--	--	--	--	15	0.5	--	--	--	--	4	0.2	--	--
YELLOW BULLHEAD	--	--	--	--	--	--	--	--	4	0.1	3	0.2	1	0.1	5	0.3	3	0.2
BANDED KILLIFISH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FRESHWATER DRUM	--	--	--	--	--	--	1	<0.1	3	0.1	5	0.3	6	0.6	4	0.2	6	0.3
FATHEAD MINNOW	1	1.7	1	0.6	--	--	1	<0.1	8	0.2	1	0.1	1	0.1	--	--	--	--
ORANGESPOTTED SUNFISH	--	--	--	--	--	--	--	--	3	0.1	--	--	1	0.1	1	0.1	--	--
NORTHERN SUNFISH	--	--	1	0.6	--	--	1	<0.1	--	--	--	--	--	--	7	0.4	--	--
WHITE PERCH	--	--	--	--	--	--	10	0.4	--	--	--	--	--	--	--	--	--	--
CENTRAL MUDMINNOW	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BLACKSTRIPE TOPMINNOW	--	--	--	--	1	0.2	--	--	3	0.1	1	0.1	--	--	--	--	1	0.1
SMALLMOUTH BASS	--	--	1	0.6	--	--	1	<0.1	1	<0.1	--	--	1	0.1	4	0.2	1	0.1
SPOTTAIL SHINER	--	--	--	--	--	--	3	0.1	1	<0.1	--	--	2	0.2	--	--	--	--
ALEWIFE	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LONGNOSE GAR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GRASS PICKEREL	--	--	--	--	5	0.8	1	<0.1	--	--	--	--	--	--	--	--	--	--
SKIPJACK HERRING	--	--	--	--	--	--	2	0.1	--	--	--	--	1	0.1	--	--	1	0.1
CREEK CHUB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
WARMOUTH	--	--	--	--	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--
WHITE SUCKER	--	--	--	--	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--
YELLOW BASS	--	--	1	0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BULLHEAD MINNOW	--	--	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--	--	--
BLACK CRAPPIE	--	--	1	0.6	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--
WHITE CRAPPIE	--	--	--	--	--	--	--	--	2	0.1	--	--	--	--	--	--	--	--
BLACK BULLHEAD	--	--	--	--	--	--	--	--	3	0.1	--	--	--	--	--	--	--	--
NORTHERN PIKE	--	--	--	--	--	--	--	--	--	--	--	--	1	0.1	--	--	--	--
SAND SHINER	--	--	--	--	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--
TADPOLE MADTOM	--	--	--	--	--	--	1	<0.1	1	<0.1	--	--	--	--	--	--	--	--
BROOK SILVERSIDE	--	--	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--	--	--
WHITE BASS	--	--	--	--	--	--	1	<0.1	--	--	--	--	--	--	--	--	1	0.1
CENTRAL STONEROLLER	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RAINBOW TROUT	--	--	--	--	1	0.2	--	--	--	--	--	--	--	--	--	--	--	--
THREESPINE STICKLEBACK	1	1.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
REDEAR SUNFISH	--	--	--	--	--	--	--	--	--	--	1	0.1	--	--	--	--	--	--
YELLOW PERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LOGPERCH	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Taxa[b]	4	6.9	8	5.0	1	0.2	2	0.1	4	0.1	12	0.7	4	0.4	27	1.5	23	1.3
TOTAL FISH	58	100	160	100	631	100	2,417	100	3,297	100	1,748	100	1,022	100	1,805	100	1,751	100
CATCH PER GEAR EFFORT	4		11		16		60		82		44		26		45		44	
TOTAL SPECIES	12		13		16		22		28		17		20		20		21	

Table 1 (continued)

SPECIES	2009		2010[a]		2011		2012		2013		2014		Average	# Years
	#	%	#	%	#	%	#	%	#	%	#	%	#	Collected
GIZZARD SHAD	354	27.8	906	61.4	807	68.3	966	30.4	212	18.5	934	47.3	843.4	15
BLUNTNOSE MINNOW	354	27.8	237	16.1	69	5.8	417	13.1	141	12.3	138	7	207.2	15
GREEN SUNFISH	133	10.4	97	6.6	175	14.8	657	20.6	183	15.9	353	17.9	134.7	15
EMERALD SHINER	122	9.6	80	5.4	1	0.1	50	1.6	11	1	3	0.2	64.0	15
BLUEGILL	26	2	8	0.5	14	1.2	287	9	226	19.7	66	3.3	51.0	14
PUMPKINSEED	72	5.7	6	0.4	5	0.4	217	6.8	211	18.4	86	4.4	50.5	12
COMMON CARP	22	1.7	14	0.9	33	2.8	15	0.5	17	1.5	76	3.8	44.8	15
LARGEMOUTH BASS	33	2.6	29	2	22	1.9	25	0.8	53	4.6	74	3.7	32.0	14
WESTERN MOSQUITOFISH	--	--	--	--	2	0.2	265	8.3	--	--	--	--	20.9	9
THREADFIN SHAD	64	5	61	4.1	--	--	44	1.4	26	2.3	4	0.2	14.1	7
CHANNEL CATFISH	12	0.9	6	0.4	7	0.6	2	0.1	13	1.1	19	1	9.7	14
GOLDFISH	3	0.2	1	0.1	--	--	8	0.3	--	--	108	5.5	8.9	9
ORIENTAL WEATHERFISH	2	0.2	1	0.1	17	1.4	65	2	19	1.7	14	0.7	8.5	11
SPOTFIN SHINER	6	0.5	4	0.3	2	0.2	23	0.7	4	0.3	1	0.1	7.2	13
ROUND GOBY	45	3.5	--	--	1	0.1	1	<0.1	7	0.6	--	--	6.3	9
GOLDEN SHINER	4	0.3	1	0.1	--	--	25	0.8	4	0.3	17	0.9	4.7	8
YELLOW BULLHEAD	4	0.3	1	0.1	3	0.3	3	0.1	5	0.4	15	0.8	3.1	11
BANDED KILLIFISH	--	--	--	--	--	--	1	<0.1	3	0.3	39	2	2.9	3
FRESHWATER DRUM	1	0.1	2	0.1	1	0.1	--	--	3	0.3	--	--	2.1	10
FATHEAD MINNOW	--	--	1	0.1	1	0.1	7	0.2	--	--	1	0.1	1.5	10
ORANGESPOTTED SUNFISH	1	0.1	--	--	1	0.1	4	0.1	1	0.1	4	0.2	1.1	8
NORTHERN SUNFISH	--	--	--	--	1	0.1	--	--	2	0.2	--	--	0.8	5
WHITE PERCH	--	--	2	0.1	--	--	--	--	--	--	--	--	0.8	2
CENTRAL MUDMINNOW	1	0.1	4	0.3	1	0.1	1	<0.1	--	--	3	0.2	0.7	5
BLACKSTRIPE TOPMINNOW	--	--	2	0.1	--	--	--	--	1	0.1	--	--	0.6	6
SMALLMOUTH BASS	--	--	--	--	--	--	--	--	--	--	--	--	0.6	6
SPOTTAIL SHINER	--	--	1	0.1	--	--	--	--	--	--	2	0.1	0.6	5
ALEWIFE	--	--	--	--	9	0.8	--	--	--	--	--	--	0.6	1
LONGNOSE GAR	--	--	--	--	1	0.1	1	<0.1	2	0.2	3	0.2	0.5	4
GRASS PICKEREL	--	--	--	--	1	0.1	--	--	--	--	--	--	0.5	3
SKIPJACK HERRING	--	--	2	0.1	--	--	--	--	--	--	--	--	0.4	4
CREEK CHUB	--	--	2	0.1	--	--	--	--	--	--	4	0.2	0.4	2
WARMOUTH	--	--	--	--	1	0.1	2	0.1	1	0.1	--	--	0.3	4
WHITE SUCKER	--	--	--	--	--	--	--	--	--	--	4	0.2	0.3	2
YELLOW BASS	--	--	4	0.3	--	--	--	--	--	--	--	--	0.3	2
BULLHEAD MINNOW	--	--	2	0.1	--	--	--	--	1	0.1	--	--	0.3	3
BLACK CRAPPIE	--	--	1	0.1	--	--	--	--	--	--	--	--	0.2	3
WHITE CRAPPIE	--	--	1	0.1	--	--	--	--	--	--	--	--	0.2	2
BLACK BULLHEAD	--	--	--	--	--	--	--	--	--	--	--	--	0.2	1
NORTHERN PIKE	--	--	--	--	--	--	--	--	--	--	1	0.1	0.1	2
SAND SHINER	--	--	--	--	--	--	--	--	--	--	1	0.1	0.1	2
TADPOLE MADTOM	--	--	--	--	--	--	--	--	--	--	--	--	0.1	2
BROOK SILVERSIDE	--	--	--	--	1	0.1	--	--	--	--	--	--	0.1	2
WHITE BASS	--	--	--	--	--	--	--	--	--	--	--	--	0.1	2
CENTRAL STONEROLLER	--	--	--	--	--	--	--	--	--	--	2	0.1	0.1	1
RAINBOW TROUT	--	--	--	--	--	--	--	--	--	--	--	--	0.1	1
THREESPINE STICKLEBACK	--	--	--	--	--	--	--	--	--	--	--	--	0.1	1
REDEAR SUNFISH	--	--	--	--	--	--	--	--	--	--	--	--	0.1	1
YELLOW PERCH	--	--	--	--	1	0.1	--	--	--	--	--	--	0.1	1
LOGPERCH	1	0.1	--	--	--	--	--	--	--	--	--	--	0.1	1
Other Taxa[b]	13	1.0	--	--	5	0.4	96	3.0	3	0.3	3	0.2	13.7	--
TOTAL FISH	1,273	100	1,476	100	1,182	100	3,182	100	1,149	100	1,975	100	1,541.7	
CATCH PER GEAR EFFORT	34		37		30		80		29		49		--	
TOTAL SPECIES	20		27		25		23		23		26		50	

(a) 2010 results were likely affected by the rotenone application that occurred in December 2009.
(b) Other Taxa represent hybrids and non-species level identifications. RIS Species State-listed RIS Species

EXHIBIT 4

A compact disc (two copies) containing Exhibit 4 has been delivered to the Illinois Pollution Control Board

EXHIBIT 5

NPDES Permit No. IL0002208

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue East

Post Office Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Modified (NPDES) Permit

Expiration Date: April 30, 2019

Issue Date: May 15, 2014
Modification Date: April 24, 2017

Name and Address of Permittee:
Midwest Generation, LLC
529 E. 135th Street
Romeoville, IL 60446

Facility Name and Address:
Will County Generating Station
529 East Romeo Road
Romeoville, IL 60446 (Will County)

Discharge Number and Name:
001 Condenser Cooling Water and House Service Water
A01 Reverse Osmosis Wastes
B01 Boiler Blowdown, Boiler Drain and Turbine Drain
002 Recycle Wastewater Treatment System Blowdown
A02 Non-Chemical Metal Cleaning Wastes
003 Sewage Treatment Plant Effluent

Receiving Waters:
Chicago Sanitary and Ship Canal

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of Ill. Adm. Code, Subtitle C and/or Subtitle D, Chapter 1, and the Clean Water Act (CWA), the above-named permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.
Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

SAK:JAR:17011301

Modification Date: April 24, 2017

NPDES Permit No. IL0002208

Effluent Limitations and Monitoring

From the modification date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 001 Condenser Cooling and House Service Water (DAF = 741.4 MGD)

PARAMETER	LOAD LIMITS lbs/day DAF (DMF) 30 DAY AVERAGE	LOAD LIMITS lbs/day DAF (DMF) DAILY MAXIMUM	CONCENTRATION LIMITS mg/L 30 DAY AVERAGE	CONCENTRATION LIMITS mg/L DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
This discharge consists of:				Approximate Flow		
1. Condenser Cooling Water				587 MGD		
2. House Service Water				78.9 MGD		
3. Reverse Osmosis Wastes				0.27 MGD		
4. Boiler Blowdown				0.023 MGD		
5. Boiler Drain				Intermittent		
6. Turbine Drain				Intermittent		
7. Intake Screen Backwash				0.433 MGD		
Flow (MGD)	See Special Condition 1				Daily	Continuous
pH	See Special Condition 2				Daily	Grab
Total Residual Chlorine	See Special Condition 3			0.05	*	Grab
Temperature	See Special Condition 4				Daily	Continuous

*Total Residual Chlorine shall be sampled whenever chlorination or biocide addition is being performed or residuals are likely to be present in the discharge. If chlorination and biocide addition are not used during the month it shall be so indicated on the DMR.

Modification Date: April 24, 2017

NPDES Permit No. IL0002208

Effluent Limitations and Monitoring

From the modification date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: A01 Reverse Osmosis Wastes (DAF = 0.27 MGD)

	LOAD LIMITS lbs/day DAF (DMF)		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVERAGE	DAILY MAXIMUM	30 DAY AVERAGE	DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Flow(MGD)	See Special Condition 1				2/Month	24-Hour Total
Total Suspended Solids			15	30	2/Month	8-Hour Composite
Oil and Grease			15	20	1/Year	Grab

Effluent Limitations and Monitoring

From the modification date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: B01 Boiler Blowdown, Boiler Drain and Turbine Drain (DAF = 0.023 MGD)

PARAMETER	LOAD LIMITS lbs/day DAF (DMF) 30 DAY AVERAGE	LOAD LIMITS lbs/day DAF (DMF) DAILY MAXIMUM	CONCENTRATION LIMITS mg/L 30 DAY AVERAGE	CONCENTRATION LIMITS mg/L DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
This discharge consists of:				Approximate Flow		
1. Boiler Blowdown (main boilers)				0.01 MGD		
2. Boiler Blowdown (auxiliary boilers)				250 gpd		
3. Boiler Drains (main and auxiliary boilers)				Intermittent Discharge		
4. Turbine Drain				Intermittent Discharge		
Flow (MGD)	See Special Condition 1				2/Month	24-Hour Total
Total Suspended Solids			15	30	2/Month	8-Hour Composite
Oil and Grease			15	20	1/Year	Grab

Modification Date: April 24, 2017

NPDES Permit No. IL0002208

Effluent Limitations and Monitoring

From the modification date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 002 Recycle Wastewater Treatment System Blowdown (DAF = 0.88 MGD)

PARAMETER	LOAD LIMITS lbs/day DAF (DMF) 30 DAY AVERAGE	LOAD LIMITS lbs/day DAF (DMF) DAILY MAXIMUM	CONCENTRATION LIMITS mg/l 30 DAY AVERAGE	CONCENTRATION LIMITS mg/l DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
This discharge consists of:				Approximate Flow		
1. Ash Sluice System Blowdown				0.88 MGD		
a. Bottom ash sluice water				Intermittent		
b. Unit no. 1, 2,3 and 4 slag tank overflow sumps				Intermittent		
c. Non-chemical metal cleaning wastes				Intermittent		
d. South area runoff collection basin effluent				Intermittent		
i. Trona Mill Wash				400 gpd		
2. North area runoff collection basin effluent				Intermittent		
3. Chemical and control building floor drainage				Intermittent		
4. Coal Pile Runoff				Intermittent		
Flow(MGD)	See Special Condition 1				Daily	Continuous
pH	See Special Condition 2				1/Week	Grab
Total Suspended Solids			15	30	1/Week	24-Hour Composite
Oil and Grease			15	20	1/Week	Grab

Modification Date: April 24, 2017

NPDES Permit No. IL0002208

Effluent Limitations and Monitoring

From the modification date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: A02 Non-Chemical Metal Cleaning Wastes (Intermittent Discharge)

	LOAD LIMITS lbs/day DAF (DMF)		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVERAGE	DAILY MAXIMUM	30 DAY AVERAGE	DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition 1				Daily	Continuous
Total Suspended Solids			30	100	Daily	Grab
Oil and Grease			15	20	Daily	Grab
Iron			1.0	1.0	Daily	24-Hour Composite
Copper			1.0	1.0	Daily	24-Hour Composite

Sampling is only required when discharging.

Modification Date: April 24, 2017

NPDES Permit No. IL0002208

Effluent Limitations and Monitoring

From the modification date of this permit until the expiration date, the effluent of the following discharge(s) shall be monitored and limited at all times as follows:

Outfall: 003 Sewage Treatment Plant Effluent (DAF = 0.015 MGD, DMF = 0.03125 MGD)

	LOAD LIMITS lbs/day DAF (DMF)		CONCENTRATION LIMITS mg/l			
PARAMETER	30 DAY AVERAGE	DAILY MAXIMUM	30 DAY AVERAGE	DAILY MAXIMUM	SAMPLE FREQUENCY	SAMPLE TYPE
Flow (MGD)	See Special Condition 1				Daily	Continuous
pH	See Special Condition 2				1/Week	Grab
Total Suspended Solids	3.1	13	25	50	1/Week	24-Hour Composite
BOD_5	2.5	10	20	40	1/Week	24-Hour Composite
Total Residual Chlorine	See Special Condition 3			0.05	Daily when Chlorinating	Grab

NPDES Permit No. IL0002208

Special Conditions

SPECIAL CONDITION 1. Flow shall be measured in units of Million Gallons per Day (MGD) and reported as a monthly average and a daily maximum value on the monthly Discharge Monitoring Report.

SPECIAL CONDITION 2. The pH shall be in the range 6.0 to 9.0. The monthly minimum and monthly maximum values shall be reported on the DMR form.

SPECIAL CONDITION 3. All samples for TRC shall be grab samples and analyzed by an applicable method contained in 40 CFR 136, equivalent in accuracy to low-level amperometric titration. Any analytical variability of the method used shall be considered when determining the accuracy and precision of the results obtained.

SPECIAL CONDITION 4. Pursuant to Illinois Pollution Control Board Order AS 96-10, dated October 3, 1996 and amended March 16, 2000 the facility shall comply with the following temperature limitations:

A. At the point of discharge the receiving waters are designated as Secondary Contact and Indigenous Aquatic Life Waters by Section 302.408, Illinois Administration Code, Title 35, Chapter 1, Subtitle C, as amended. In the Chicago Sanitary and Ship Canal at the edge of the 26-acre mixing zone, temperatures shall not exceed 93°F (34°C) more than 5% of the time, or 100°F (37.8°C) at any time.

B. In the main channel of the Lower Des Plaines River, at the I-55 Bridge, the effluent shall not alone or in combination with other sources cause temperatures to exceed the temperatures set forth in the following table, except in accordance with the allowable monthly excursions detailed below:

	Jan	Feb	Mar	Apr 1-15	Apr 16-30	May 1-15	May 16-31	June 1-15	June 16-30	July	Aug	Sept	Oct	Nov	Dec
°F	60	60	65	73	80	85	90	90	91	91	91	90	85	75	65

These standards are in lieu of the requirements of 35 Ill. Adm. Code 302.211(d) and (e) and may be exceeded by no more than 3°F during 2% of the hours in the 12-month period ending December 31, except that at no time shall Midwest Generation's plants cause the water temperature at the I-55 Bridge to exceed 93°F.

C. When it appears that discharges from Outfall 001 have the reasonable potential to cause either the water temperatures at the downstream modeled compliance point to exceed the values set forth in Part (A) and/or the main channel of the Lower Des Plaines River at the I-55 Bridge to exceed the values set forth in Part (B), the permittee shall determine whether, and the extent to which, station operations must be restricted to avoid violating the above-stated limits.

D. Compliance Monitoring
   1. For compliance monitoring of the temperature limitations set fourth in Part (A) above, the permittee shall develop and submit to the Agency within six months of the issuance date, a thermal model taking into account upstream flow characteristics and temperature in the receiving stream, effluent flow, temperature and any other factors required, for the purposes of predicting downstream river temperatures at points up to and including the edge of the mixing zone and for monitoring the use of excursion hours under all conditions of temperature and flow reasonably likely to occur.
   2. For compliance monitoring of the temperature limitations set forth in Part (B) above, the permittee shall maintain and operate a water temperature monitor and a suitable back-up monitor at the I-55 Bridge downstream monitoring location.

E. Reporting
   1.
      a. From the effective date of the permit until approval by the Agency of a thermal model for determining the temperature at the edge of the allowed mixing zone in the Chicago Sanitary and Ship Canal in accordance with Part (D)(1) above, the permittee is required to report on the DMR the monthly maximum temperature at the point of discharge for outfall 001.
      b. Upon the approval by the Agency of a thermal model for determining the temperature at the edge of the allowed mixing zone in the Chicago Sanitary and Ship Canal in accordance with Part (D)(1) above, the permittee is required to report on the DMR the monthly maximum temperature and the cumulative number of hours used in a 12 month calendar period in which temperatures exceed the thermal standards (the "excursion hours") set forth in Part (A) above.
   2. For the I-55 Bridge adjusted thermal standards set fourth in Part (B) above, the cumulative number of excursion hours used in a 12 month calendar period shall be reported separately on the monthly DMR in accordance with Part (B).

SPECIAL CONDITION 5. The Agency has determined that the effluent limitations in this permit constitute BAT/BCT for storm water which is treated in the existing treatment facilities for purposes of this permit reissuance, and no pollution prevention plan will be required for such storm water. In addition to the chemical specific monitoring required elsewhere in this permit, the permittee shall conduct an annual inspection of the facility site to identify areas contributing to a storm water discharge associated with industrial activity, and determine whether any facility modifications have occurred which result in previously-treated storm water discharges no longer receiving treatment. If any such discharges are identified the permittee shall request a modification of this permit within 30 days after the inspection. Records of the annual inspection shall be retained by the permittee for the term of this permit and be made available to the Agency on request.

Special Conditions

SPECIAL CONDITION 6. There shall be no discharge of polychlorinated biphenyl compounds.

SPECIAL CONDITION 7. The bypass provisions of 40 CFR 122.41(m) and upset provisions of 40 CFR 122.41(n) are hereby incorporated by reference.

SPECIAL CONDITION 8. Samples taken in compliance with the effluent monitoring requirements of outfalls 001, 002 and 003 shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

Samples taken in compliance with the effluent monitoring requirements of outfall A01, B01, and A02 shall be taken at a point representative of the discharge, but prior to comingling with other wastestreams.

SPECIAL CONDITION 9. The Permittee shall record monitoring results on Discharge Monitoring Report (DMR) Forms using one such form for each outfall each month.

In the event that an outfall does not discharge during a monthly reporting period, the DMR Form shall be submitted with no discharge indicated.

The Permittee will be required to submit electronic DMRs (NetDMRs) instead of mailing paper DMRs to the IEPA beginning December 21, 2016 unless a waiver has been granted by the Agency. More information, including registration information for the NetDMR program, can be obtained on the IEPA website, http://www.epa.state.il.us/water/net-dmr/index.html.

The completed Discharge Monitoring Report forms shall be submitted to IEPA no later than the 28th day of the following month, unless otherwise specified by the permitting authority.

Permittees that have been granted a waiver shall mail Discharge Monitoring Reports with an original signature to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attention: Compliance Assurance Section, Mail Code # 19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 10. Cooling Water Intake Structure. This Permit may be modified with public notice to establish cooling water intake structure limitations and/or operating conditions if appropriate, based on information obtained from this condition or to comply with State or Federal law.

A. The permittee shall submit the following information/studies within 180 days from the permit effective date:

1. Source Water Physical Data to include:

   a. A narrative description and scaled drawings showing the physical configuration of all source water bodies used by the facility including aerial dimensions, depths, salinity and temperature regimes;

   b. Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods used to conduct any physical studies to determine the intake s area of influence and the results of such studies; and

   c. Location maps.

2. Source Waterbody Flow Information

   The permittee shall provide the annual mean flow of the waterbody, any supporting documentation and engineering calculations to support the analysis of whether the design intake flow is greater than five percent of the mean annual flow of the river or stream for purposes of determining applicable performance standards. Representative historical data (from a period of time up to 10 years) shall be used, if available.

3. Impingement Mortality and Entrainment Characterization Study

   The permittee shall submit an Impingement Mortality and Entrainment Characterization Study whose purpose is to provide information to support the development of a calculation baseline for evaluating impingement mortality and entrainment and to

characterize current impingement mortality and entrainment. The Study shall include the following in sufficient detail to support establishment of baseline conditions:

a. Taxonomic identification of all life stages of fish and shellfish and any species protected under Federal, State, or Tribal law (including threatened or endangered species) that are in the vicinity of the cooling water intake structure(s) and are susceptible to impingement and entrainment;

b. A characterization of all life stages of fish and shellfish, and any species protected under Federal, or State law, including a description of the abundance and temporal and spatial characteristics in the vicinity of the cooling water intake structure(s). These may include historical data that are representative of the current operation of the facility and of biological conditions at the site; and

c. Documentation of the current impingement mortality and entrainment of all life stages of fish, shellfish, and any species protected under Federal , State, or Tribal Law (including threatened or endangered species) and an estimate of impingement mortality and entrainment to be used as the calculation baseline. The documentation may include historical data that are representative of the current operation of the facility and of biological conditions at the site. Impingement mortality and entrainment samples to support the calculations required must be collected during periods of representative operational flows for the cooling water intake structure and the flows associated with the samples must be documented.

B. The permittee shall comply with the following requirements:

1. At all times properly operate and maintain the intake equipment.

2. Inform IEPA of any proposed changes to the cooling water intake structure or proposed changes to operations at the facility that affect impingement mortality and/or entrainment.

3. Debris collected on intake screens is prohibited from being discharged back to the canal. Debris does not include living fish or other living aquatic organisms.

4. Compliance Alternatives. The permittee must evaluate each of the following alternatives for establishing best available technology for minimizing adverse environmental impacts at the facility due to operation of the intake structure:

a. Evaluate operational procedures and/or propose facility modifications to reduce the intake through-screen velocity to less than 0.5 ft/sec. The operational evaluation may consider modified circulating water pump operation; reduced flow associated with capacity utilization, recalculation or determination of actual total water withdrawal capacity. The evaluation report and any implementation plan for the operational changes and/ or facility modification shall be submitted to the Agency with the renewal application for this permit.

b. Complete a fish impingement and entrainment mortality minimization alternatives evaluation. The evaluation may include an assessment of modification of the traveling screens, consideration of a separate fish and debris return system and include time frames and cost analysis to implement these measures. The evaluation report and implementation plan for any operational changes and/ or facility modifications shall be submitted to the Agency with the renewal application for this permit.

C. All required reports shall be submitted to the Permit Section and Compliance Assurance Section at the address in special condition 9.

SPECIAL CONDITION 11. The Permittee shall monitor the effluent from outfalls 001 and 002 for the following parameters on a semi-annual basis. This Permit may be modified with public notice to establish effluent limitations if appropriate, based on information obtained through sampling. The sample shall be a 24-hour effluent composite except as otherwise specifically provided below and the results shall be submitted to the address in special condition 9 in June and December. The parameters to be sampled and the minimum reporting limits to be attained are as follows:

STORET CODE	PARAMETER	Minimum reporting limit
01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01027	Cadmium	0.001 mg/L
01032	Chromium (hexavalent) (grab)	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00718	Cyanide (grab) (weak acid dissociable)	5.0 ug/L
00720	Cyanide (grab not to exceed 24 hours) (total)	5.0 ug/L
00951	Fluoride	0.1 mg/L

Special Conditions

01045	Iron (total)	0.5 mg/L
01046	Iron (Dissolved)	0.5 mg/L
01051	Lead	0.05 mg/L
01055	Manganese	0.5 mg/L
71900	Mercury (grab)**	1.0 ng/L*
01067	Nickel	0.005 mg/L
00556	Oil (hexane soluble or equivalent) (Grab Sample only)	5.0 mg/L
32730	Phenols (grab)	0.005 mg/L
01147	Selenium	0.005 mg/L
01077	Silver (total)	0.003 mg/L
01092	Zinc	0.025 mg/L

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined, including all oxidation states.

*1.0 ng/L = 1 part per trillion.
**Utilize USEPA Method 1631E and the digestion procedure described in Section 11.1.1.2 of 1631E. Mercury shall be monitored monthly for the first two years and quarterly thereafter. This Permit may be modified with public notice to establish effluent limitations if appropriate, based on information obtained through sampling. The quarterly monitoring results shall be submitted on the March, June, September and December DMRs.

SPECIAL CONDITION 12. The use or operation of this facility shall be by or under the supervision of a Certified Class K operator.

SPECIAL CONDITION 13. In the event that the permittee shall require a change in the use of water treatment additives, the permittee must request a change in this permit in accordance with the Standard Conditions -- Attachment H.

SPECIAL CONDITION 14. The permittee shall notify the Agency within 30 days of decommissioning or permanently removing from service any generating units. The notice shall identify which units were removed from service and any changes to the discharge quality, including temperature or quantity.

SPECIAL CONDITION 15. The cooling water prior to entering the intake structure and at outfall 001 shall be sampled once per week as a grab sample at the same time of day within ½ hour of each other between 9:00 a.m. and 3:00 p.m. in a random fashion for dissolved oxygen. The results in mg/l and the time of day the influent and effluent sample was taken shall be reported to the Agency as an attachment to the DMR. After 2 years of data has been submitted to the Agency, the permittee may apply to Agency to have the monitoring reduced or eliminated.

SPECIAL CONDITION 16. The effluent, alone or in combination with other sources, shall not cause a violation of any applicable water quality standard outlined in 35 Ill. Adm. 302.

Attachment H

Standard Conditions

Definitions

Act means the Illinois Environmental Protection Act, 415 ILCS 5 as Amended.

Agency means the Illinois Environmental Protection Agency.

Board means the Illinois Pollution Control Board.

Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) means Pub. L 92-500, as amended. 33 U.S.C. 1251 et seq.

NPDES (National Pollutant Discharge Elimination System) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318 and 405 of the Clean Water Act.

USEPA means the United States Environmental Protection Agency.

Daily Discharge means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Maximum Daily Discharge Limitation (daily maximum) means the highest allowable daily discharge.

Average Monthly Discharge Limitation (30 day average) means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Discharge Limitation (7 day average) means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Aliquot means a sample of specified volume used to make up a total composite sample.

Grab Sample means an individual sample of at least 100 milliliters collected at a randomly-selected time over a period not exceeding 15 minutes.

24-Hour Composite Sample means a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

8-Hour Composite Sample means a combination of at least 3 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over an 8-hour period.

Flow Proportional Composite Sample means a combination of sample aliquots of at least 100 milliliters collected at periodic intervals such that either the time interval between each aliquot or the volume of each aliquot is proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot.

(1) **Duty to comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirements.

(2) **Duty to reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. If the permittee submits a proper application as required by the Agency no later than 180 days prior to the expiration date, this permit shall continue in full force and effect until the final Agency decision on the application has been made.

(3) **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

(4) **Duty to mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(5) **Proper operation and maintenance.** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up, or auxiliary facilities, or similar systems only when necessary to achieve compliance with the conditions of the permit.

(6) **Permit actions.** This permit may be modified, revoked and reissued, or terminated for cause by the Agency pursuant to 40 CFR 122.62 and 40 CFR 122.63. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

(7) **Property rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

(8) **Duty to provide information.** The permittee shall furnish to the Agency within a reasonable time, any information which the Agency may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also furnish to the Agency upon request, copies of records required to be kept by this permit.

(9) **Inspection and entry.** The permittee shall allow an authorized representative of the Agency or USEPA (including an authorized contractor acting as a representative of the Agency or USEPA), upon the presentation of credentials and other documents as may be required by law, to:
  (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
  (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
  (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
  (d) Sample or monitor at reasonable times, for the purpose of assuring permit compliance, or as otherwise authorized by the Act, any substances or parameters at any location.

(10) **Monitoring and records.**
  (a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
  (b) The permittee shall retain records of all monitoring information, including all calibration and maintenance records, and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of this permit, measurement, report or application. Records related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503). This period may be extended by request of the Agency or USEPA at any time.
  (c) Records of monitoring information shall include:
    (1) The date, exact place, and time of sampling or measurements;
    (2) The individual(s) who performed the sampling or measurements;
    (3) The date(s) analyses were performed;
    (4) The individual(s) who performed the analyses;
    (5) The analytical techniques or methods used; and
    (6) The results of such analyses.
  (d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. Where no test procedure under 40 CFR Part 136 has been approved, the permittee must submit to the Agency a test method for approval. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to ensure accuracy of measurements.

(11) **Signatory requirement.** All applications, reports or information submitted to the Agency shall be signed and certified.
  (a) **Application.** All permit applications shall be signed as follows:
    (1) For a corporation: by a principal executive officer of at least the level of vice president or a person or position having overall responsibility for environmental matters for the corporation;
    (2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
    (3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.
  (b) **Reports.** All reports required by permits, or other information requested by the Agency shall be signed by a person described in paragraph (a) or by a duly authorized representative of that person. A person is a duly authorized representative only if:
    (1) The authorization is made in writing by a person described in paragraph (a); and
    (2) The authorization specifies either an individual or a position responsible for the overall operation of the facility, from which the discharge originates, such as a plant manager, superintendent or person of equivalent responsibility; and
    (3) The written authorization is submitted to the Agency.
  (c) Changes of Authorization. If an authorization under (b) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of (b) must be submitted to the Agency prior to or together with any reports, information, or applications to be signed by an authorized representative.
  (d) Certification. Any person signing a document under paragraph (a) or (b) of this section shall make the following certification:

    I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

(12) Reporting requirements.
  (a) Planned changes. The permittee shall give notice to the Agency as soon as possible of any planned physical alterations or additions to the permitted facility.
    Notice is required when:
    (1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source pursuant to 40 CFR 122.29 (b); or
    (2) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements pursuant to 40 CFR 122.42 (a)(1).
    (3) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.
  (b) Anticipated noncompliance. The permittee shall give advance notice to the Agency of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
  (c) Transfers. This permit is not transferable to any person except after notice to the Agency.
  (d) Compliance schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(e) **Monitoring reports.** Monitoring results shall be reported at the intervals specified elsewhere in this permit.
  (1) Monitoring results must be reported on a Discharge Monitoring Report (DMR).
  (2) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
  (3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Agency in the permit.

(f) **Twenty-four hour reporting.** The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24-hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The following shall be included as information which must be reported within 24-hours:
  (1) Any unanticipated bypass which exceeds any effluent limitation in the permit.
  (2) Any upset which exceeds any effluent limitation in the permit.
  (3) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Agency in the permit or any pollutant which may endanger health or the environment.

  The Agency may waive the written report on a case-by-case basis if the oral report has been received within 24-hours.

(g) **Other noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs (12) (d), (e), or (f), at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12) (f).

(h) **Other information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to the Agency, it shall promptly submit such facts or information.

(13) **Bypass.**
  (a) Definitions.
    (1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.
    (2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
  (b) Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs (13)(c) and (13)(d).
  (c) Notice.
    (1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.
    (2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph (12)(f) (24-hour notice).
  (d) Prohibition of bypass.
    (1) Bypass is prohibited, and the Agency may take enforcement action against a permittee for bypass, unless:
      (i) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
      (ii) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
      (iii) The permittee submitted notices as required under paragraph (13)(c).
    (2) The Agency may approve an anticipated bypass, after considering its adverse effects, if the Agency determines that it will meet the three conditions listed above in paragraph (13)(d)(1).

(14) Upset.
  (a) Definition. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
  (b) Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph (14)(c) are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
  (c) Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
    (1) An upset occurred and that the permittee can identify the cause(s) of the upset;
    (2) The permitted facility was at the time being properly operated; and
    (3) The permittee submitted notice of the upset as required in paragraph (12)(f)(2) (24-hour notice).
    (4) The permittee complied with any remedial measures required under paragraph (4).
  (d) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

(15) **Transfer of permits.** Permits may be transferred by modification or automatic transfer as described below:
  (a) Transfers by modification. Except as provided in paragraph (b), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued pursuant to 40 CFR 122.62 (b) (2), or a minor modification made pursuant to 40 CFR 122.63 (d), to identify the new permittee and incorporate such other requirements as may be necessary under the Clean Water Act.
  (b) Automatic transfers. As an alternative to transfers under paragraph (a), any NPDES permit may be automatically transferred to a new permittee if:
    (1) The current permittee notifies the Agency at least 30 days in advance of the proposed transfer date;
    (2) The notice includes a written agreement between the existing and new permittees containing a specified date for transfer of permit responsibility, coverage and liability between the existing and new permittees; and
    (3) The Agency does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement.

(16) All manufacturing, commercial, mining, and silvicultural dischargers must notify the Agency as soon as they know or have reason to believe:
  (a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant identified under Section 307 of the Clean Water Act which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:
    (1) One hundred micrograms per liter (100 ug/l);
    (2) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6 dinitrophenol; and one milligram per liter (1 mg/l) for antimony.
    (3) Five (5) times the maximum concentration value reported for that pollutant in the NPDES permit application; or
    (4) The level established by the Agency in this permit.
  (b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the NPDES permit application.

(17) All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Agency of the following:
  (a) Any new introduction of pollutants into that POTW from an indirect discharge which would be subject to Sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and
  (b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
  (c) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(18) If the permit is issued to a publicly owned or publicly regulated treatment works, the permittee shall require any industrial user of such treatment works to comply with federal requirements concerning:
  (a) User charges pursuant to Section 204 (b) of the Clean Water Act, and applicable regulations appearing in 40 CFR 35;
  (b) Toxic pollutant effluent standards and pretreatment standards pursuant to Section 307 of the Clean Water Act; and
  (c) Inspection, monitoring and entry pursuant to Section 308 of the Clean Water Act.

(19) If an applicable standard or limitation is promulgated under Section 301(b)(2)(C) and (D), 304(b)(2), or 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked, and reissued to conform to that effluent standard or limitation.

(20) Any authorization to construct issued to the permittee pursuant to 35 Ill. Adm. Code 309.154 is hereby incorporated by reference as a condition of this permit.

(21) The permittee shall not make any false statement, representation or certification in any application, record, report, plan or other document submitted to the Agency or the USEPA, or required to be maintained under this permit.

(22) The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $25,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or both.
Additional penalties for violating these sections of the Clean Water Act are identified in 40 CFR 122.41 (a)(2) and (3).

(23) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

(24) The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(25) Collected screening, slurries, sludges, and other solids shall be disposed of in such a manner as to prevent entry of those wastes (or runoff from the wastes) into waters of the State. The proper authorization for such disposal shall be obtained from the Agency and is incorporated as part hereof by reference.

(26) In case of conflict between these standard conditions and any other condition(s) included in this permit, the other condition(s) shall govern.

(27) The permittee shall comply with, in addition to the requirements of the permit, all applicable provisions of 35 Ill. Adm. Code, Subtitle C, Subtitle D, Subtitle E, and all applicable orders of the Board or any court with jurisdiction.

(28) The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit is held invalid, the remaining provisions of this permit shall continue in full force and effect.

EXHIBIT 6

History of Plant Shutdowns for Past 5 Years (Planned and Emergency) (Section 106.1130(a)(7)-(9))

The planned and emergency shutdowns of WCGS Unit 3 lasting longer than 24 hours for the past 5 years were as follows:

- 1/25/2013 to 1/29/2013 (4 days) – Planned
- 3/27/2013 to 4/1/2013 (4 days) – Emergency
- 4/1/213 to 4/2/2013 (2 days) – Emergency
- 4/2/2013 to 4/11/2013 (9 days) – Planned
- 5/6/2013 to 5/7/2013 (1 day) – Emergency
- 8/10/2013 to 8/15/2013 (4 days) – Planned
- 8/29/2013 to 8/31/2013 (2 days) – Emergency
- 10/30/2013 to 11/1/2013 (2 days) – Emergency
- 11/1/2013 to 11/7/2013 (6 days) – Planned
- 1/10/2014 to 1/13/2014 (3 days) – Planned
- 4/18/2014 to 5/1/2014 (12 days) – Planned
- 5/8/2014 to 5/13/2014 (5 days) – Emergency
- 7/15/2014 to 7/20/2014 (5 days) – Planned
- 9/8/2014 to 9/10/2014 (2 days) – Planned
- 1/16/2015 to 1/20/2015 (4 days) – Emergency
- 4/8/2015 to 4/16/2015 (8 days) – Planned

The planned and emergency shutdowns of WCGS Unit 4 lasting longer than 24 hours for the past 5 years were as follows:

- 5/2/2013 to 5/8/2013 (6 days) – Planned
- 7/10/2013 to 7/14/2013 (4 days) – Planned
- 7/31/2013 to 8/2/2013 (2 days) – Planned
- 10/15/2013 to 10/26/2013 (11 days) – Planned
- 5/2/2014 to 5/20/2014 (18 days) – Planned
- 7/30/2014 to 8/3/2014 (4 days) – Planned
- 8/9/2014 to 8/12/2014 (3 days) – Emergency

- 8/21/2014 to 8/25/2014 (4 days) – Emergency
- 8/26/2014 to 8/30/2014 (4 days) – Emergency
- 9/2/2014 to 9/11/2104 (9 days) – Emergency
- 9/23/2014 to 9/30/2014 (7 days) – Emergency
- 3/2/2015 to 3/5/2015 (3 days) – Emergency
- 3/11/2015 to 3/15/2014 (4 days) – Emergency
- 3/26/2015 to 4/1/2015 (6 days) – Emergency
- 5/2/2015 to 5/29/2015 (27 days) – Planned
- 6/2/2015 to 6/9/2015 (7 days) – Emergency
- 8/12/2015 to 8/20/2015 (8 days) – Planned
- 9/14/2015 to 9/18/2015 (4 days) – Emergency
- 9/26/2015 to 9/29/2015 (3 days) – Emergency
- 12/13/2015 to 12/18/2015 (5 days) – Planned
- 12/28/2015 to 12/29/2015 (1 day) – Planned
- 1/6/2016 to 1/8/2016 (2 days) – Emergency
- 2/19/2016 to 2/23/2016 (4 days) – Emergency
- 2/26/2016 to 2/27/2016 (1 day) – Emergency
- 4/9/2016 to 5/27/16 (47 days) - Planned
- 6/7/2016 to 6/8/2016 (1 day) – Planned
- 10/15/2016 to 12/12/2016 (58 days) – Planned
- 3/25/2017 4/1/2017 (7 days) – Planned
- 4/29/2017 6/10/2017 (42 days) – Planned
- 6/11/2017 to 1/26/2018 (229 days) – Emergency