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AMBIENT WATER QUALITY MONITORING IN THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS: A SUMMARY OF BIOLOGICAL, HABITAT, AND SEDIMENT QUALITY DURING 2009

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AMBIENT WATER QUALITY MONITORING IN THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS: A SUMMARY OF BIOLOGICAL, HABITAT, AND SEDIMENT QUALITY DURING 2009

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DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY AND CONCLUSIONS

During 2009, biological and habitat monitoring focused on the Northern Portion of the Chicago River System (NPCRS) as well as 15 annual Ambient Water Quality Monitoring (AWQM) Program stations located throughout the Chicago, Calumet, and the Des Plaines River Systems (DPRS). Sediment chemistry and toxicity analyses were also performed on samples from the NPCRS. Chlorophyll samples were collected at each of the 59 AWQM stations monthly.

Chlorophyll

Chlorophyll *a* concentrations decreased directly downstream of water treatment plants due to dilution of the waterway with effluent. In the Chicago River System, mean chlorophyll *a* concentrations ranged from 1 µg/L at Lake Shore Drive on the Chicago River to 11 µg/L at Oakton Street on the North Shore Channel (NSC). The maximum recorded chlorophyll *a* concentration in the Chicago River System during 2009 was 74 µg/L at Central Street on the NSC.

Mean chlorophyll *a* values in the Calumet River System ranged from 2 µg/L at Ewing Avenue on the Calumet River to 31 µg/L at Burnham Avenue on the Grand Calumet River (GCR). The maximum concentration measured was 137 µg/L at Burnham Avenue on the GCR.

The range of mean chlorophyll *a* concentrations in the DPRS was 2 µg/L at Wille Road on Higgins Creek to 30 µg/L at Stephen Street on the Des Plaines River (DPR). The maximum concentration measured in this system was 157 µg/L at Willow Springs Road on the DPR.

Habitat

The NPCRS consists largely of waterways that are man-made or man-altered. The waterways in this system are channelized with low sinuosity and limited flow. These alterations are limiting factors for diverse aquatic life in the NPCRS. This system also has limited amounts of instream cover for fish and other aquatic organisms, and the riparian land uses are predominantly urban residential or commercial. Silt and sand were the most prominent components in sediment samples collected at most of the stations in the NPCRS. Excessive amounts of fine sediment and the lack of heterogeneous substrate in this system provides inadequate stability and habitat for a balanced benthic invertebrate community.

Fish

Forty-one species of fish, including 16 game fish species, were collected from Chicago area waterways during 2009. The most abundant species in the catch from the deep-draft waterways of the Chicago and Calumet River Systems included bluntnose minnow, pumpkinseed, common carp, bluegill, and gizzard shad. Green sunfish, largemouth bass, white sucker, fathead

minnow, and bluegill were the most abundant species in the wadeable portions of the Chicago River and DPR Systems. In general, all three waterway systems would be considered fair in terms of their biological integrity as measured by the Index of Biotic Integrity (IBI).

Benthic Invertebrates

Benthic invertebrates were collected from side and center locations using two methods at 27 stations in 13 different waterways during 2009. Total species richness for Ponar and Hester-Dendy samplers combined was 110 species, while total Ephemeroptera, Plecoptera, and Trichoptera (EPT) richness was 16 species. EPT taxa are considered relatively sensitive to pollution. Chironomidae was the most taxa rich group, with 52 taxa, followed by Ephemeroptera and Trichoptera, each with eight taxa. A Trichoptera species, *Chimarra*, that has not been collected previously while sampling for the AWQM program, was found at Lake Cook Road on the Des Plaines River. Comprehensive benthic invertebrate data from 2009 are catalogued in a separate report published at mwrd.org (MWRD 2009 Chicago Waterways Benthic Report).

Sediment Chemistry

During 2009, sediment samples were collected from the side and center of the waterway at 15 stations. Sediment samples were analyzed for eight general chemistry constituents, 11 trace metals, and a total of 111 organic priority pollutants. In addition, a contracted laboratory performed simultaneously extracted metals/acid volatile sulfide (SEM/AVS) analysis, particle size determinations, and total organic carbon analysis. Overall, sediment from Grand Avenue on the North Branch Chicago River (NBCR) at both side and center contained the highest levels of sediment chemistry analytes (general chemistry, trace metals, and organic priority pollutants [OPPs]).

Sediment Toxicity

Ten-day *Chironomus tentans* toxicity testing was performed using sediment from side and center locations at 15 stations, for a total of 30 samples. The percent survival rate in 18 of the 30 samples was significantly less than the control sites, indicating that the sediment was unsuitable for *Chironomus* survival. Ash-free dried weights in 25 samples were significantly less than the control sites, indicating that the sediment was unsuitable for *Chironomus* growth. Only ten percent of sediment samples exhibited both *Chironomus* growth and survival similar to control sediments. These data exemplify the generally poor quality sediments throughout the northern portion of the Chicago River System.

INTRODUCTION

The Metropolitan Water Reclamation District of Greater Chicago (District) began monitoring the biological component of the AWQM Program at 59 sampling stations on 21 waterways in 2001. This report focuses on the biological, habitat, and sediment quality during 2009. The biological monitoring portion of the AWQM Program operates on a four-year cycle, with a primary focus on a different river system in the entire service area each year. The four river systems of interest are the NPCRS, the southern portion of the Chicago River System, the Calumet River System, and the DPRS. Fifteen of the 59 stations located across all of the waterways are monitored annually based on their proximity to District water reclamation plants (WRPs) or municipal boundaries. Of the remaining 44 sampling stations, 12 are on the NPCRS, 8 are on the southern portion of the Chicago River System, 10 are on the Calumet River System, 13 are on the DPRS, and 1 station is on the Fox River System. During 2009, biological monitoring focused on the NPCRS, including the Chicago River, NSC, Skokie River, NBCR, Middle Fork North Branch Chicago River (MFNBCR), and West Fork North Branch Chicago River (WFNBCR).

Characterization of physical habitat, fish, and benthic invertebrate populations, along with sediment toxicity and chemistry, are among the most crucial components for a comprehensive evaluation of a waterway. Each parameter represents a piece of the overall picture that is necessary to identify problem areas, make regulatory decisions, and determine plausible, attainable uses for a waterway.

In addition to analyzing the AWQM Program data to assess and manage the impact of the District's WRPs, our data are often shared with other government agencies, non-governmental organizations, and academic institutions. For instance, the AWQM Program data are shared with the Illinois Environmental Protection Agency (IEPA) to support their efforts to make regulatory decisions, prepare the 305(b) report in accordance with the Clean Water Act, and perform use attainability analyses.

DESCRIPTION OF THE STUDY AREA

Chicago, Calumet, and Des Plaines River Systems

The Chicago area waterways consist of man-made canals as well as natural streams which have been altered to varying degrees. Some natural waterways have been modified by being deepened, straightened, and/or widened to such an extent that reversion to their natural state would be impossible. The waterways serve the Chicago area by draining urban stormwater runoff and treated municipal wastewater effluent and allowing commercial navigation in the deep-draft portions.

The primary man-made waterways are in the Chicago River System, including the NSC, connecting Lake Michigan at Wilmette to the NBCR; the Chicago Sanitary and Ship Canal (CSSC), extending from Damen Avenue to the Lockport Powerhouse; and the Cal-Sag Channel (CSC), connecting the Little Calumet River (LCR) with the CSSC. The primary natural waterways include the wadeable branches of the NBCR, flowing south from Lake County into the confluence with the NSC and continuing as the deep-draft portion of the NBCR, which joins the Chicago River and becomes the South Branch Chicago River; the DPR, flowing south from Lake County and joining with the discharge from the CSSC downstream of the Lockport Powerhouse; and the Calumet River System, which flows south and west into the CSC.

Sampling Stations

The sampling stations for the AWQM Program are located on natural and man-made waterways throughout the District's service area. A map of the Chicago area waterways, including the 59 sampling stations and the District's WRPs, is shown in Figure 1. Stations were primarily selected so that there was at least one monitoring station on the lower end of an IEPA 303(d)-impaired waterway segment in 1998. Secondary criteria for selecting sampling locations included: (1) above and below District WRPs, (2) below Lake Michigan diversion points, (3) above junction of two major waterways, (4) below county municipal boundaries, and (5) in areas of environmental concern. Fifteen of the 59 stations were chosen for annual biological monitoring.

In addition to the 15 annual stations, biological sampling was performed at 12 additional stations in the NPCRS during 2009, including the Skokie River, MFNBCR, WFNBCR, NBCR, and NSC. Table 1 displays the 2009 field monitoring schedule for biological, physical habitat, and sediment quality assessments.

FIGURE 1: AMBIENT WATER QUALITY MONITORING PROGRAM
SAMPLING STATIONS

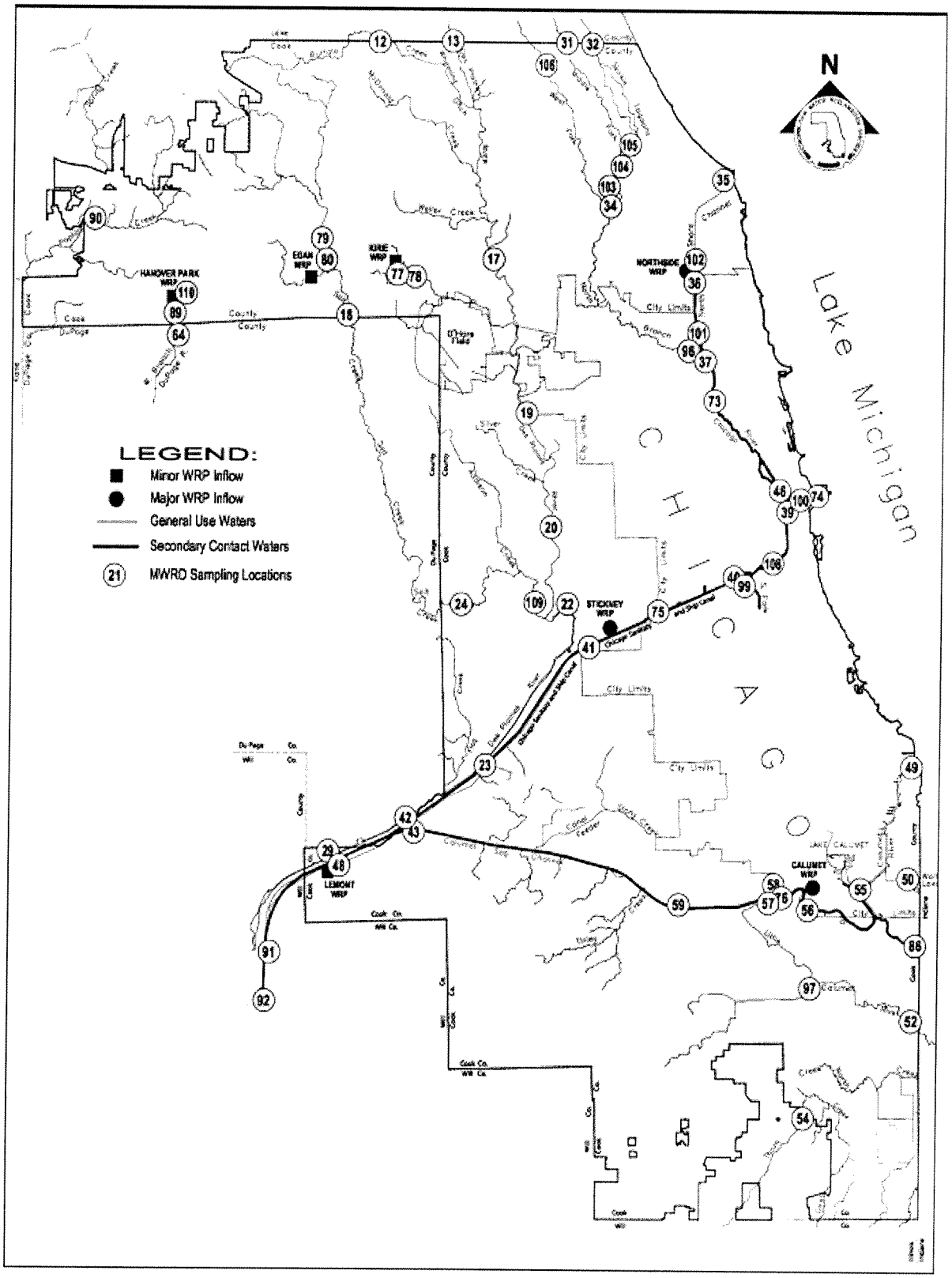


TABLE 1: DATES THAT AMBIENT WATER QUALITY MONITORING PROGRAM STATIONS WERE SAMPLED DURING 2009

Station No.	Sampling Station	Waterway	Date Sampled
		CHICAGO RIVER SYSTEM	
106	Dundee Road	West Fork North Branch	07/28/2009, 08/26/2009[1]
103	Golf Road	West Fork North Branch	07/27/2009, 08/26/2009[1]
31	Lake-Cook Road	Middle Fork North Branch	07/15/2009, 08/24/2009[1]
32	Lake-Cook Road	Skokie River	07/13/2009, 08/24/2009[1]
105	Frontage Road	Skokie River	08/04/2009, 08/25/2009[1]
104	Glenview Road	North Branch Chicago River	07/29/2009, 08/25/2009[1]
34	Dempster Street	North Branch Chicago River	08/05/2009, 08/31/2009[1]
96	Albany Avenue[2]	North Branch Chicago River	08/06/2009, 08/31/2009[1]
35	Central Street	North Shore Channel	08/20/2009
102	Oakton Street	North Shore Channel	08/19/2009[3], 08/20/2009[4]
36	Touhy Avenue[2]	North Shore Channel	08/19/2009
101	Foster Avenue	North Shore Channel	08/18/2009
37	Wilson Avenue	North Branch Chicago River	08/18/2009[4], 09/03/2009[3]
73	Diversey Parkway	North Branch Chicago River	08/17/2009
46	Grand Avenue[2]	North Branch Chicago River	08/17/2009[4], 08/21/2009[3]
75	Cicero Avenue[2]	Chicago Sanitary & Ship Canal	07/20/2009
41	Harlem Avenue[2]	Chicago Sanitary & Ship Canal	07/21/2009
92	Lockport[2]	Chicago Sanitary & Ship Canal	07/16/2009
		CALUMET RIVER SYSTEM	
55	130th Street[2]	Calumet River	07/23/2009
76	Halsted Street[2]	Little Calumet River	07/30/2009
59	Cicero Avenue[2]	Calumet-Sag Channel	07/14/2009
		DES PLAINES RIVER SYSTEM	
78	Wille Road[2]	Higgins Creek	06/29/2009
18	Devon Avenue[2]	Salt Creek	07/22/2009

TABLE 1 (Continued): DATES THAT AMBIENT WATER QUALITY MONITORING PROGRAM STATIONS WERE SAMPLED DURING 2009

Station No.	Sampling Station	Waterway	Date Sampled
		DES PLAINES RIVER SYSTEM (Continued)	
13	Lake-Cook Road[2]	Des Plaines River	07/10/2009
22	Ogden Avenue[2]	Des Plaines River	07/02/2009[4], 07/09/2009[3]
91	Material Service Rd.[2]	Des Plaines River	07/09/2009
64	Lake Street[2]	West Branch DuPage River	06/30/2009

[1] Sediment chemistry sampling only on this date.
[2] Annual sampling station.
[3] Electrofishing and habitat assessment conducted on this date.
[4] Invertebrate sampling only on this date.

MATERIALS AND METHODS

Chlorophyll

Water samples for chlorophyll analysis were collected monthly at each AWQM station along with the water samples for various chemical analyses.

Sample Collection. Surface water grab samples for chlorophyll analysis were collected using a stainless steel bucket. The bucket was lowered into the waterway generally from the upstream side of the bridge at the most central location. The bucket was submerged, filled, and then raised to the top of the bridge. An aliquot was poured into an amber, plastic one-liter sample bottle containing 1 mg magnesium carbonate as a preservative, and a 1/2-inch airspace was left at the top of the bottle. Samples were then placed in a cooler with ice and returned to the lab for processing.

Laboratory Analysis. *Filtration.* Prior to filtering samples, water was mixed by rapidly inverting sample bottles 25 times before the first pour. Samples were filtered through Whatman type GF/F glass-fiber filters (0.7 micrometers) using Millipore filtration equipment and vacuum pressure. Water samples were filtered until the rate of flow decreased but before it became clogged, and the amount of water that was filtered was measured with a graduated cylinder. Following filtration, sample filters were folded and wrapped with aluminum foil and extracted the following day.

Extraction. Filters were placed in glass extraction tubes with 5 mL of 90 percent aqueous acetone solution. Using a motorized tissue grinder set at 500 rpm and a pestle, the top layer of the filter was separated. Samples were then transferred to centrifuge tubes, and additional acetone was added until the total volume equaled 10 mL. These tubes were inverted five times and then placed at 4°C for approximately 24 hours to steep.

Spectrophotometric Analysis. After removing samples from refrigeration, they were centrifuged for 20 minutes at 2,500 rpm. Three mL of the supernatant was transferred into a spectrophotometric cell, and the absorbance read at 750, 664, 647, and 630 nm. To correct for the degradation product, pheophyton, 0.1 mL of 1 percent hydrochloric acid was added, and after one minute, absorbance was read again at 750 and 665 nm. The spectrophotometer was programmed to calculate corrected chlorophyll *a, b,* and *c* values based on the volumes filtered and used to extract samples.

Quality Control. A reagent blank of 90 percent acetone was placed in the spectrophotometer every tenth sample and read between -0.1 and 0.1 ug/L. A method blank of distilled water was prepared for each group of samples and run through the entire laboratory procedure. One duplicate sample was chosen randomly for each group of samples and would have to be within

20 relative percent difference of the original sample. Chlorophyll *a* and *b* standards from spinach were also analyzed every 20 samples and displayed at least a 90 percent recovery.

Habitat

Data Collection. Physical habitat assessment data sheets (Appendix A-1) were completed by a staff biologist in the field at each station. Assessments made in the field included weather conditions, channel morphology, bank erosion, shore cover, aquatic vegetation, man-made structures, floatable materials, riparian land-use, sediment composition, sediment color and odor, depth of fine sediments (fines), and presence of oil in sediment. Channel width was determined using a Yardage Pro 800 rangefinder in the non-wadeable waterways. A fiberglass telescoping leveling rod was used to measure water depth and depth of fines (in sediment). The smallest extension of the round leveling rod (1" diameter) was pushed into the sediment with reasonable force as far as possible to determine depth of fines in feet. A 6- x 6-inch petite Ponar grab sampler was used to collect sediment for analysis. Staff biologists estimated the percent composition of plant debris, clay, inorganic silt, organic sludge, sand (0.06-2 mm diameter), gravel (>2-64 mm diameter), cobble (>64-256 mm diameter), boulder (>256 mm diameter), or bedrock/concrete in the sediment. Sediment color and odor were recorded as well as the appearance of oil in the sample.

Assessment Locations. Physical habitat was evaluated at the beginning and end of the fishing range in the center and on one side of the waterway at each station. The range was 40 meters for wadeable sites and 400 meters for deep-draft waterways.

Fish

Boatable Stream Sampling. Fish were collected at each sampling station using a boat-mounted electrofisher powered by a direct current (DC) generator. Stunned fish were picked out of the water with long-handled dip nets. For deep-draft sites, the section of canal sampled extended for 400 meters. Whenever possible, both sides of the waterways were electrofished.

Wadeable Stream Sampling. Fish were collected at each sampling station using a DC backpack electrofisher and a bag seine. Conductivity and temperature (°C) were recorded before each sample collection. In most instances, two 40-meter long backpack electrofisher collections were conducted at each station. A 40-meter reach of the creek was electrified by moving upstream parallel to the bank. Additional personnel followed the electrofisher collecting the stunned fish with dip nets. Following the first collection, a second 40-meter electrofishing survey was conducted on the opposite bank. If the creek was less than five meters wide, electrofishing occurred only once along a 40-meter reach. The total electrofishing time during each 40-meter collection was noted.

A 15-foot bag seine with 3/16-inch mesh was also used to collect fish. Staff pulled the seine for 40 meters traveling upstream parallel to the bank. In most instances, a separate 40-meter seine collection was done along each bank.

Fish Processing. In the field, most fish were identified to species, weighed to the nearest gram or nearest 0.1 gram (depending on size), measured for standard and total length to the nearest millimeter, and examined for the incidence of disease, parasites, or other anomalies. Following processing, these fish were returned live to the river. Minnows and other small fish that were difficult to identify were preserved in a 10 percent formalin solution and returned to the laboratory for further analysis. These fish were processed in a similar manner to the field-measured fish except that they were weighed to the nearest 0.01 gram.

Index of Biotic Integrity. Biological integrity of aquatic ecosystems has been defined as the ability to support and maintain a balanced, integrated, and adaptive community having a species composition, diversity, and functional organization comparable to that of a natural habitat (Karr et al., 1986). Karr's 1986 IBI was used to analyze fish data from 2009.

The limitations of using this tool, which was meant to apply to wadeable streams for some of the man-made, channelized waterways in the Chicago area, should be recognized.

Karr's IBI integrates information from 12 fish community metrics that fall into three major categories: (1) species richness and composition, (2) trophic composition, and (3) fish abundance and condition. Each metric is scored 1, 3, or 5 based on whether its evaluation deviates strongly, deviates somewhat, or approximates expectations, respectively, as compared to an undisturbed site located in a similar geographical region and on a stream of comparable size. Individual metrics are added to calculate a total IBI score. A high IBI indicates high biological integrity or health and low disturbance or lack of perturbations. A low IBI indicates low biological integrity and high disturbance or degradation. Separate IBI metric scores were determined based on the relative abundance of fish collected with each fishing gear. IBI categories of good (IBI 41-60), fair (IBI 21-40) or poor (IBI <21), as derived by the IEPA (IEPA, 1996), were determined.

Benthic Invertebrates

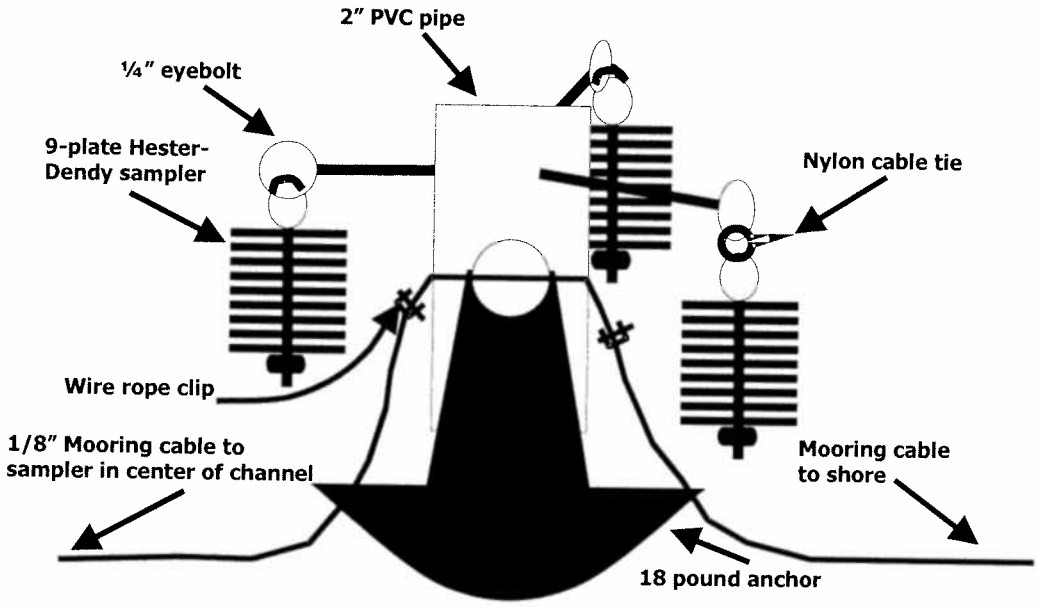
Ponar Sediment Sampling. Triplicate sediment samples were collected with a petite Ponar grab (0.023 m^2) from the center and one side of the deep-draft and wadeable waterway stations. Grab samples were taken at locations upstream from any prior sampling disturbance, such as Hester-Dendy retrievals (see description in next section), to avoid collecting disturbed sediment. An appropriate area for Ponar sampling was chosen by a staff biologist to avoid obstructions such as large rocks or plants. The sediment samples were sieved in the field using a field-sieving bucket with 250 micrometer (μm) openings. The sieved material was poured into

one-gallon plastic containers, preserved in a 10 percent formalin solution, and brought back to the laboratory for analysis. All samples were stored at 4°C until processed.

Artificial Substrate Sampling. Hester-Dendy artificial substrate samplers were deployed at each station between May and early June of 2009. Figure 2 shows a diagram of the plate configuration that was assembled prior to deployment in the waterways. A total of 27, 3- x 3-inch sampling plates were attached to two 18-pound river anchors, connected to an object on shore (usually a tree) by a cable, and then placed on the bottom of the waterway in the center and on one side. These substrates were left in the waterway for an average of seven weeks and then retrieved at the time of other biological sampling. Hester-Dendy set-ups were located and the anchors were lifted out of the waterway with a 250 micron mesh plankton net underneath to avoid organism loss at the water surface. The plates were then cut from the anchors and placed into a one-gallon bucket with a secure leak-proof lid. Invertebrates from the plankton net reservoir were also rinsed into the buckets, which were then filled with river water and brought to a 10 percent final concentration of formalin. These samples are then brought back to the laboratory and stored at 4°C until processed.

Benthic Invertebrate Processing. Samples were fixed in formalin for thirty days. Next, the Ponar sediment samples were gently washed with water and screened through a United States Standard number 60 mesh sieve (250 µm openings) and transferred to a 70 percent ethanol solution. Each Hester-Dendy plate was removed from the sampler and gently brushed with a paintbrush on both sides while under a slow stream of running water in order to rinse the attached invertebrates into the sieve. The formalin solution remaining in the Hester-Dendy sample container was rinsed into the sieve in order to capture any invertebrates that fell from the Hester-Dendy plates. The contents of this sieve were then rinsed back into the bucket with a 70 percent ethanol solution. The Ponar and Hester-Dendy samples were then stored at 4°C until processed. Before processing, the samples were sieved to remove the ethanol solution. The sieved material was then examined in small batches under a compound microscope in a 100- x 50-mm glass crystallizing dish filled about 1 cm high. We then counted oligochaete worms and removed all other invertebrates from the finer residual material. In situations where large numbers of any one taxon (usually worms) were encountered (>3000), estimates of their abundance were made by using a sub-sampling device. Invertebrates, besides worms, were sent to a consultant (EA Engineering) for identification to genus or species when possible.

FIGURE 2: CONFIGURATION OF HESTER-DENDY LARVAL PLATE SAMPLER



Sediment Chemistry

Sample Collection. Prior to sample collection, the Ponar grab sampler and the metal and plastic pans and scoops were cleaned with hot water and lab detergent, rinsed with de-ionized water, and allowed to air dry. The Ponar and metal pans and scoops were then rinsed with acetone, allowed to air dry, and dried in an oven at 105°C for one hour. When dry and cool, each set was placed in a plastic bag and sealed to prevent contamination until ready for use.

Sediment samples were collected from the center and side of the waterway using separate cleaned 6- x 6-inch Ponar grab samplers. The sediment samples were transferred into plastic or metal pans and then put into the appropriate container using plastic or metal scoops. The constituents analyzed in sediment, sample containers used, and preservation methods are summarized in Table 2. Metal scoops and pans were used for samples collected in glass containers, whereas plastic scoops and pans were used for sediment collected in plastic containers. The samples were placed on ice until they could be refrigerated.

Sample Analyses. The sediment samples were analyzed for total solids, total volatile solids, ammonia nitrogen, nitrate plus nitrite nitrogen, total Kjeldahl nitrogen (TKN), total phosphorus (TP), total cyanide, phenols, total metals (including arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc), and OPPs (listed in Table 3) by the District's Analytical Laboratory Division. Sediment samples were sent on ice to a contract laboratory for SEM/AVS, total organic carbon (TOC), and particle size. All constituents were analyzed using procedures established by the United States Environmental Protection Agency (USEPA) or described in *Standard Methods for the Examination of Water and Wastewater* (19^{th} edition, 1998).

Sediment Toxicity

Sediment samples were collected using a 6- x 6-inch Ponar grab sampler from the center and side of the waterways and scooped into one-gallon plastic buckets (at least one-half full). Buckets were kept on ice until they could be refrigerated. These samples were sent in coolers on ice to a contractor for ten-day *Chironomus tentans* toxicity testing (USEPA, Test Method 100.2, 2000). Tests were performed within 14 days of sediment collection. The survival data were analyzed using the TOXCALC Version 5.0 software package. The survival and growth data were checked for normality using the Kolmogorov D statistical analysis. The Heteroscedastic-t hypothesis test was utilized to indicate significant differences.

TABLE 2: CONSTITUENTS ANALYZED, SAMPLE CONTAINERS, AND PRESERVATION METHODS FOR SEDIMENT SAMPLES COLLECTED FOR THE AMBIENT WATER QUALITY MONITORING PROGRAM

Constituents	Units of Measure[1]	Sample Container	Preservative
Total Solids	percent	Glass	Cool, 4°C
Total Volatile Solids	percent	Glass	Cool, 4°C
Un-ionized Ammonia	mg/kg	Glass	Cool, 4°C
Nitrite plus Nitrate Nitrogen	mg/kg	Glass	Cool, 4°C
Total Kjeldahl Nitrogen	mg/kg	Glass	Cool, 4°C
Total Phosphorus	mg/kg	Glass	Cool, 4°C
Phenols	mg/kg	Glass	Cool, 4°C
Total Cyanide	mg/kg	Glass	Cool, 4°C
Acid Volatile Sulfide	µmoles/g	Plastic	Cool, 4°C
Simultaneously Extracted Metal	µmoles/g	Plastic	Cool, 4°C
Total Organic Carbon	mg/kg	Glass	Cool, 4°C
Particle Size	percent	Plastic	Cool, 4°C
Toxicity (survival)	percent	Plastic	Cool, 4°C
Toxicity (growth)	mg/org[2]	Plastic	Cool, 4°C
Total Metals (Arsenic, Cadmium, Chromium Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, and Zinc)	mg/kg	Glass	Cool, 4°C
Organic Priority Pollutants (Volatile Organic Compounds, Polynuclear Aromatic Hydrocarbons, Polychlorinated Biphenyls, Pesticides)	µg/kg	Glass	Cool, 4°C

[1]Expressed on a dry weight basis.
[2]Org = organism.

TABLE 3: LIST OF ORGANIC PRIORITY POLLUTANTS ANALYZED IN SEDIMENT SAMPLES COLLECTED FOR THE AMBIENT WATER QUALITY MONITORING PROGRAM DURING 2009

Volatile Organic Compounds	Acid Extractables	Base/Neutral Extractables	Pesticides and PCBs
Acrolein	2-Chlorophenol	Acenaphthene	Aldrin
Acrylonitrile	2,4-Dichlorophenol	Acenaphthylene	alpha -BHC
Benzene	2,4-Dimethylphenol	Anthracene	beta -BHC
Bromoform	4,6-Dinitro-o-cresol	Benzidine	gamma- BHC
Carbon tetrachloride	2,4-Dinitrophenol	Benzo(a)anthracene	delta- BHC
Chlorobenzene	2-Nitrophenol	Benzo(a)pyrene	Chlordane
Chlorodibromomethane	4-Nitrophenol	3,4-Benzofluoranthene	4,4'-DDT
Chloroethane	Parachlorometacresol	Benzo(ghi)perylene	4,4'-DDE
2-Chloroethylvinyl ether	Pentachlorophenol	Benzo(k)fluoranthene	4,4'-DDD
Chloroform	Phenol	Bis(2-chloroethoxy)methane	Dieldrin
1,2 13– Dichlorobenzene	2,4,6-Trichlorophenol	Bis(2-chloroethyl)ether	Endosulfan-I
1,3 – Dichlorobenzene		Bis(2-chloroisopropyl)ether	Endosulfan-II
1,4 - Dichlorobenzene		Bis(2-ethylhexyl)phthalate	Endosulfan sulfate
Dichlorobromomethane		4-Bromophenyl phenyl ether	Endrin
1,1-Dichloroethane		Butylbenzyl phthalate	Endrin aldehyde
1,2-Dichloroethane		2-Chloronaphthalene	Heptachlor
1,1-Dichloroethylene		4-Chlorophenyl phenyl ether	Heptachlor epoxide
1,2-Dichloropropane		Chrysene	PCB-1242
1,3-Dichloropropene		Dibenzo(a,h)anthracene	PCB-1254
Ethyl benzene		3,3-Dichlorobenzidine	PCB-1221
Methyl bromide		Diethyl phthalate	PCB-1232
Methyl chloride			PCB-1248
Methylene chloride			PCB-1260
1,1,2,2-Tetrachloroethane			
Tetrachloroethylene			
Toluene			

TABLE 3 (Continued): LIST OF ORGANIC PRIORITY POLLUTANTS ANALYZED IN SEDIMENT SAMPLES COLLECTED FOR THE AMBIENT WATER QUALITY MONITORING PROGRAM DURING 2009

Volatile Organic Compounds	Acid Extractables	Base/Neutral Extractables	Pesticides and PCBs
1,2-trans-Dichloroethylene		Dimethyl phthalate	PCB-1016
1,1,1-Trichloroethane		Di-n-butyl phthalate	Toxaphene
1,1,2-Trichloroethane		2,4-Dinitrotoluene	
Trichloroethylene		2,6-Dinitrotoluene	
Vinyl chloride		Di-n-octyl phthalate	
Trichlorofluoromethane		1,2-Diphenylhydrazine	
		Fluoranthene	
		Fluorene	
		Hexachlorobenzene	
		Hexachlorobutadiene	
		Hexachlorocyclopentadiene	
		Hexachloroethane	
		Indeno(1,2,3-cd)pyrene	
		Isophorone	
		Naphthalene	
		Nitrobenzene	
		N-Nitrosodimethylamine	
		N-Nitrosodi-n-propylamine	
		N-Nitrosodiphenylamine	
		Phenanthrene	
		Pyrene	
		1,2,4-Trichlorobenzene	

RESULTS AND DISCUSSION

Chlorophyll

As a photosynthetic component of all algae cells, chlorophyll *a* analysis is an accepted method of quantifying algal biomass in lakes and streams. Chlorophyll *a* values are of interest to regulatory agencies since it is also widely accepted that high algae concentrations may indicate nutrient impairment. The IEPA is cooperating with other state and local agencies to develop regional water quality criteria for nutrients and possibly chlorophyll. In light of this consideration, the District began monitoring chlorophyll on a monthly basis in August 2001 as part of the AWQM Program.

A summary of the chlorophyll *a* results for 2009 is shown in Table 4. During 2009, the highest mean chlorophyll *a* value in the Chicago area waterways was at Burnham Avenue on the GCR (31 µg/L). The lowest mean chlorophyll *a* concentration throughout the system was 1 µg/L at Lake Shore Drive on the Chicago River. The highest measured chlorophyll *a* concentration was 157 µg/L at Willow Springs Road on the DPR.

Habitat

Habitat is one of the most crucial factors limiting aquatic life in urban environments. Channelization, limited instream and canopy cover, siltation, and lack of adequate flood plain area are some of the physical characteristics that may limit aquatic life in waterways in the Chicago area. The observed and measured habitat characteristics of all sampling stations located in the NPCRS during 2009 are shown in Tables 5 through 10.

Over half of the stations sampled on the NPCRS are shallow and wadeable sampling stations. The other stations are located on the deeper segments in the NBCR and NSC and are considered deep draft. The maximum water depth in the deep-draft stations was 21 feet (Grand Avenue, NBCR). The deepest wadeable station sampled was Golf Road, on the WFNBCR, at a maximum depth of 2.7 feet. Man-made structures like bridges, riprap, and sheet piling were prevalent throughout the northern portion of the system. The Albany Avenue station, on the NBCR, is largely man-made with the streambed consisting of concrete. All the waterways in the NPCRS have some riparian areas that are dominated by residential or commercial/industrial uses, resulting in variable canopy cover. However, the majority of the wadeable stations have forested riparian areas. Where instream cover was present, boulders, brush-debris jams, aquatic vegetation, and logs were the main types of instream habitat in the NPCRS.

Sand and silt were the predominant components in most sediment samples. Albany Avenue on the NBCR had the most stable substrate because concrete was the dominant constituent. Heavy amounts of oil were observed in sediments from the Diversey Parkway station. The stations with the greatest depth of fine sediments were Grand Avenue on the NBCR (>5 feet), and Lake-Cook Road on the Skokie River (2.7 feet).

TABLE 4: RANGE AND MEAN CHLOROPHYLL *a* VALUES IN THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Station No.	Station Name	Waterway	N[1]	Mean µg/L	Minimum µg/L	Maximum µg/L	Standard Deviation µg/L
106	Dundee Road	W Fork N Branch Chicago River[2]	11	7	3	11	2
103	Golf Road	W Fork N Branch Chicago River[2]	11	8	2	22	5
31	Lake-Cook Road	M Fork N Branch Chicago River[3]	10	5	1	13	4
32	Lake-Cook Road	Skokie River	10	6	2	11	3
105	Frontage Road	Skokie River	12	10	<1	18	6
104	Glenview Road	North Branch Chicago River	12	6	2	13	4
34	Dempster Street	North Branch Chicago River	12	6	2	14	3
96	Albany Avenue	North Branch Chicago River	12	7	1	24	7
35	Central Street	North Shore Channel	9	10	1	74	24
102	Oakton Street	North Shore Channel	11	11	1	72	21
36	Touhy Avenue	North Shore Channel	10	2	1	10	3
101	Foster Avenue	North Shore Channel	12	2	<1	9	2
37	Wilson Avenue	North Branch Chicago River	12	3	<1	7	2
73	Diversey Avenue	North Branch Chicago River	12	2	1	5	1
46	Grand Avenue	North Branch Chicago River	12	3	2	5	1
74	Lake Shore Drive	Chicago River	9	1	1	2	1
100	Wells Street	Chicago River	11	2	1	4	1
39	Madison Street	South Branch Chicago River	11	2	1	4	1
108	Loomis Street	South Branch Chicago River	11	2	1	4	1
99	Archer Avenue	Bubbly Creek	11	9	2	25	8
40	Damen Avenue	Chicago Sanitary and Ship Canal	11	8	2	58	17
75	Cicero Avenue	Chicago Sanitary and Ship Canal	11	3	1	5	2
41	Harlem Avenue	Chicago Sanitary and Ship Canal	11	2	1	6	2
42	Route 83	Chicago Sanitary and Ship Canal	8	3	1	6	2
48	Stephen Street	Chicago Sanitary and Ship Canal	9	5	2	20	6

TABLE 4 (Continued): RANGE AND MEAN CHLOROPHYLL *a* VALUES IN THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Station No.	Station Name	Waterway	N[1]	Mean µg/L	Minimum µg/L	Maximum µg/L	Standard Deviation µg/L
92	Lockport	Chicago Sanitary and Ship Canal	50	6	1	32	6
49	Ewing Avenue	Calumet River	7	2	<1	6	2
55	130th Street	Calumet River	9	6	2	15	4
50	Burnham Avenue	Wolf Lake	9	6	2	10	3
86	Burnham Avenue	Grand Calumet River	5	31	3	137	59
56	Indiana Avenue	Little Calumet River	8	27	2	99	36
76	Halsted Street	Little Calumet River	10	13	1	51	16
52	Wentworth Avenue	Little Calumet River	10	8	3	25	6
54	Joe Orr Road	Thorn Creek	9	5	1	11	3
97	170th Street	Thorn Creek	9	9	5	16	4
57	Ashland Avenue	Little Calumet River	9	10	4	18	5
58	Ashland Avenue	Calumet-Sag Channel	11	11	1	40	11
59	Cicero Avenue	Calumet-Sag Channel	10	12	2	49	15
43	Route 83	Calumet-Sag Channel	10	9	2	30	9
90	Route 19	Poplar Creek	11	9	2	14	3
110	Springinsguth Road	West Branch DuPage River	9	14	1	34	12
89	Walnut Lane	West Branch DuPage River	12	7	1	20	7
64	Lake Street	West Branch DuPage River	12	19	2	40	12
79	Higgins Road	Salt Creek	8	21	5	40	12
80	Arlington Heights Road	Salt Creek	12	12	2	36	11
18	Devon Avenue	Salt Creek	11	15	2	47	13
24	Wolf Road	Salt Creek	12	8	1	19	7
109	Brookfield Avenue	Salt Creek	11	9	2	23	7
77	Elmhurst Road	Higgins Creek	4	8	1	16	7
78	Wille Road	Higgins Creek	12	2	<1	5	1

TABLE 4 (Continued): RANGE AND MEAN CHLOROPHYLL *a* VALUES IN THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Station No.	Station Name	Waterway	N[1]	Mean µg/L	Minimum µg/L	Maximum µg/L	Standard Deviation µg/L
12	Lake-Cook Road	Buffalo Creek	9	19	2	47	13
13	Lake-Cook Road	Des Plaines River	12	11	2	27	7
17	Oakton Street	Des Plaines River	11	19	2	73	22
19	Belmont Avenue	Des Plaines River	12	14	1	51	14
20	Roosevelt Road	Des Plaines River	11	20	2	106	30
22	Ogden Avenue	Des Plaines River	11	20	2	106	29
23	Willow Springs Road	Des Plaines River	11	28	2	157	45
29	Stephen Street	Des Plaines River	11	30	2	123	39
91	Material Service Road	Des Plaines River	12	24	<1	130	36

[1]N = Number of Observations.
[2]West Fork North Branch Chicago River.
[3]Middle Fork North Branch Chicago River.

TABLE 5: SUMMARY OF HABITAT OBSERVATIONS FOR STATIONS ON THE SKOKIE RIVER DURING 2009

	Skokie River	
	Station #32 Lake-Cook Rd.	Station #105 Frontage Rd.
Depth Range (ft)	0.7–1.7	0.8–2.6
Man-Made Structure Present	Bridge, Riprap	Bridge, Outfall
Floatable Materials	Vegetative Material	Vegetative Material
Instream Cover for Fish (Side)	Aquatic Vegetation Boulders, Logs	Brush-Debris Jams, Logs, Submerged Tree Roots, Under Cut Bank
Canopy Cover	Open to Shaded	Partly Shaded to Shaded
Immediate Shore Cover	Grasses, Trees, Shrubs	Trees, Shrubs, Denuded, Grasses
Riparian Land Use	Forest, Urban Residential, Grassland	Urban Residential, Grassland, Forest
Sediment Composition (Descending Percentage)	Sand, Silt, Plant Debris	Silt, Sand, Gravel, Asiatic Clams, Plant Debris, Cobble
Amount of Oil in Sediment	None	None
Depth of Fines Range (ft.)	0.7-2.7	0.2-0.7

TABLE 6: SUMMARY OF HABITAT OBSERVATIONS FOR THE LAKE-COOK ROAD STATION ON THE MIDDLE FORK NORTH BRANCH CHICAGO RIVER DURING 2009

	Middle Fork North Branch Chicago River Station #31 Lake-Cook Rd.
Depth Range (ft)	1.3-2.1
Man-Made Structure Present	Bridge, Outfall
Floatable Materials	Vegetative Material
Instream Cover for Fish (Side)	Boulders, Aquatic Vegetation, Brush-Debris Jams, Logs, Under Cut Bank
Canopy Cover	Partly Shaded to Shaded
Immediate Shore Cover	Denuded, Shrubs, Trees
Riparian Land Use	Urban Residential, Urban Commercial/Industrial, Forest
Sediment Composition (Descending Percentage)	Gravel, Silt, Sand, Plant Debris, Cobble
Amount of Oil in Sediment	None
Depth of Fines Range (ft.)	NA

TABLE 7: SUMMARY OF HABITAT OBSERVATIONS FOR STATIONS ON THE WEST FORK NORTH BRANCH CHICAGO RIVER DURING 2009

	West Fork North Branch Chicago River	
	Station #106 Dundee Rd.	Station #103 Golf Rd.
Depth Range (ft)	0.4–0.6	1.2–2.7
Man-Made Structure Present	Bridge	Bridge
Floatable Materials	Vegetative Material	Vegetative Material
Instream Cover for Fish (Side)	Aquatic Vegetation, Boulders, Brush-Debris Jams, Under Cut Bank	Aquatic Vegetation, Boulders, Brush-Debris Jams, Logs
Canopy Cover	Partly Shaded to Shaded	Partly Shaded
Immediate Shore Cover	Trees, Shrubs, Grasses, Denuded	Denuded, Grasses, Shrubs, Trees, Road
Riparian Land Use	Forest, Road	Forest, Golf Course
Sediment Composition (Descending Percentage)	Sand, Silt, Gravel, Clay	Boulder, Sand, Woody Debris, Bricks, Silt, Clay, Gravel, Cobble
Amount of Oil in Sediment	None	None
Depth of Fines Range (ft.)	<0.1-1.5	<0.1-0.6

TABLE 8: SUMMARY OF HABITAT OBSERVATIONS FOR STATIONS ON THE WADEABLE PORTION OF THE NORTH BRANCH CHICAGO RIVER DURING 2009

	North Branch Chicago River		
	Station #104 Glenview Rd.	Station #34 Dempster St.	Station #96 Albany Ave.
Depth Range (ft)	0.6-1.4	1.1-2.3	0.5-2.2
Man-Made Structure Present	Bridge, Outfall	Bridge	Bridge, Sheet Piling
Floatable Materials	None	Vegetative Material	None
Instream Cover for Fish (Side)	Brush-Debris Jams, Logs, Submerged Tree Roots	Boulders, Brush-Debris Jams, Logs, Tires	Boulders, Brush-Debris Jams
Canopy Cover	Open to Shaded	Open to Partly Shaded	Open to Partly Shaded
Immediate Shore Cover	Trees, Grasses, Shrubs, Denuded	Denuded, Trees, Shrubs, Grasses	Grasses, Sheet Piling, Concrete Wall, Boulders, Denuded, Trees
Riparian Land Use	Forest	Forest	Urban Residential
Sediment Composition (Descending Percentage)	Silt, Sand, Asiatic Clams, Gravel, Clay	Sand, Silt, Gravel, Asiatic Clams, Plant Debris, Cobble	Concrete, Boulder, Cobble, Gravel, Sand, Plant Debris
Amount of Oil in Sediment	None	None	None
Depth of Fines Range (ft.)	0.4 - 1.0	0.2 - 0.6	<0.1

TABLE 9: SUMMARY OF HABITAT OBSERVATIONS FOR STATIONS ON THE DEEP-DRAFT PORTION OF THE NORTH BRANCH CHICAGO RIVER DURING 2009

	North Branch Chicago River		
	Station #37 Wilson Ave.	Station #73 Diversey Pkwy.	Station #46 Grand Ave.
Depth Range (ft)	1-9	3-12	15-21
Man-Made Structure Present	Bridge, Riprap	Bridge, Riprap	Bridge, Sheet Piling, Concrete Wall
Floatable Materials	Vegetative Material	Vegetative Material	Vegetative Material
Instream Cover for Fish (Side)	Boulders, Brush-Debris Jams, Bridge Abutment	Aquatic Vegetation, Boulders, Brush-Debris Jams	Sheet Piling, Wood Piling
Canopy Cover	Open to Partly Shaded	Open to Partly Shaded	Open
Immediate Shore Cover	Denuded, Shrubs, Trees, Grasses	Shrubs, Concrete, Trees, Denuded	Concrete, Grasses, Trees
Riparian Land Use	Urban Residential	Urban Commercial/Industrial	Urban Commercial/Industrial
Sediment Composition (Descending Percentage)	Gravel, Sand, Cobble, Boulder, Shells	Silt, Sand, Plant Debris, Gravel	Silt, Sludge, Gravel, Sand, Cobble, Detritus
Amount of Oil in Sediment	None	None to Heavy	Light to Moderate
Depth of Fines Range (ft.)	<0.1 - 1.3	0.6 - 3.6	0.3 - >5

TABLE 10: SUMMARY OF HABITAT OBSERVATIONS FOR STATIONS ON THE NORTH SHORE CHANNEL DURING 2009

	North Shore Channel		
	Station #35 Central St.	Station #102 Oakton St.	Station #36 Touhy Ave.
Depth Range (ft)	1-10	2-7	3-11
Man-Made Structure Present	Bridge	Bridge, Riprap	Bridge, Wood Piling
Floatable Materials	Vegetative Material	Vegetative Material	Vegetative Material
Instream Cover for Fish (Side)	Aquatic Vegetation, Boulders, Brush-Debris Jams, Logs, Under Cut Bank, Bridge Abutment	Aquatic Vegetation, Boulders, Submerged Tree Roots, Submerged Terrestrial Vegetation, Under Cut Bank, Bridge Abutment	Aquatic Vegetation, Boulders, Under Cut Bank
Canopy Cover	Open to Partly Shaded	Open to Partly Shaded	Open to Shaded
Immediate Shore Cover	Shrubs, Trees, Denuded	Shrubs, Trees, Denuded	Trees, Shrubs, Denuded
Riparian Land Use	Urban Residential, Forest	Urban Commercial/Industrial, Park	Urban Commercial/Industrial
Sediment Composition (Descending Percentage)	Silt, Detritus, Clay, Sand, Plant Debris	Silt, Detritus, Sand, Gravel	Gravel, Sand, Detritus, Cobble, Boulder, Plant Debris, Silt
Amount of Oil in Sediment	None	None to Light	None
Depth of Fines Range (ft.)	0.25 - 1.0	0.1 - 3.2	0.2 - 1.9

TABLE 10 (Continued): SUMMARY OF HABITAT OBSERVATIONS FOR STATIONS ON THE NORTH SHORE CHANNEL DURING 2009

	North Shore Channel Station #101 Foster Ave.
Depth Range (ft)	2-9
Man-Made Structure Present	Bridge, Erosion Control Jacks
Floatable Materials	Vegetative Material
Instream Cover for Fish (Side)	Aquatic Vegetation, Boulders
Canopy Cover	Open to Partly Shaded
Immediate Shore Cover	Trees, Grasses, Shrubs, Denuded
Riparian Land Use	Grassland, Urban Commercial/Industrial
Sediment Composition (Descending Percentage)	Sand, Gravel, Silt, Plant Debris, Clay, Cobble
Amount of Oil in Sediment	None
Depth of Fines Range (ft.)	0.1–0.9

Fish

The fish species collected in the river systems during 2009 are shown in Table 11. The number of individuals, total species and game species collected, and weight of total catch at each station are shown in Table 12. During 2009, 3,382 fish comprised of 41 species, including 16 game species and two hybrids, were collected from Chicago area waterways. The numbers of fish collected from each AWQM station are shown in Appendix Tables B-1 through B-4. Bluntnose minnow, pumpkinseed sunfish, and common carp were the most abundant species in the deep-draft waterways. Green sunfish, largemouth bass, and white sucker were the most abundant species at the wadeable streams stations.

IBI scores calculated for each AWQM station and collection method are shown in Table 13. All of the stations were rated as "fair" in terms of biological integrity.

Benthic Invertebrates

The benthic invertebrate taxa collected by two sampling methods are presented in Table 14. A report focusing on detailed benthic invertebrate data from 2009 is available at mwrd.org (MWRD 2009 Chicago Waterways Benthic Report). Total species richness for Ponar and Hester-Dendy samplers combined was 110 species, while total EPT richness was 16 species.

Northern Portion of the Chicago River System. In 2009, biological sampling focused on the NBCR, WFNBCR, MFNBCR, Skokie River, and the NSC. Fifteen stations were sampled using Hester-Dendy and Ponar collection methods. The Hester-Dendy at Albany Avenue on the NBCR was destroyed due to stream maintenance performed by heavy machinery. Total taxa richness for Hester-Dendys was highest at Lake Cook Road on the Skokie River (38 taxa), and EPT taxa richness for Hester-Dendys was highest at Lake Cook Road on the MFNBCR (five taxa) within this system. The highest number of EPT taxa (three) for Ponar samples was at Dundee Road on the WFNBCR, and Lake Cook Road on the Skokie River. These stations also exhibited the largest total taxa richness for this river system (34 and 26, respectively). Within this system, Chironomid head capsule deformities were highest at Central Street on the NSC for Ponar and Hester-Dendy samples (27.8 percent and 2.6 percent of total midges, respectively). Chironomid head capsule deformities were also slightly elevated for the Ponar sample at Touhy Avenue on the NSC (4.1 percent of total midges).

Southern Portion of the Chicago River System. Benthic samples were collected from three stations in the CSSC. Total Hester-Dendy taxa richness was nine taxa at Cicero Avenue, 15 taxa at Harlem Avenue, and 24 taxa at Lockport. Harlem contained two EPT taxa within the Hester-Dendy sample. No other Hester-Dendy or Ponar samples contained EPT taxa. The only Chironomid head capsule deformities observed in the samples from this system was at the Lockport CSSC Hester-Dendy, which had one deformed organism out of 197 total (incidence of 0.5 percent).

TABLE 11: COMMON AND SCIENTIFIC NAMES OF FISHES COLLECTED FROM THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Common Name	Scientific Name	River System		
		Chicago	Calumet	Des Plaines
HERRING FAMILY	CLUPEIDAE			
Gizzard shad	*Dorosoma cepedianum*	X	X	
Alewife	*Alosa pseudoharengus*	X		
MUDMINNOW FAMILY	UMBRIIDAE			
Central mudminnow	*Umbra limi*	X		X
PIKES FAMILY	ESOCIDAE			
Northern pike[1]	*Esox lucius*		X	
Grass pickerel[1]	*Esox americanus*			X
MINNOW FAMILY	CYPRINIDAE			
Spottail shiner	*Notropis hudsonius*			X
Goldfish	*Carassius auratus*	X	X	
Common carp	*Cyprinus carpio*	X	X	X
Common carp x Goldfish	*C. carpio x C. auratus*	X		
Spotfin shiner	*Cyprinella spiloptera*	X	X	X
Golden shiner	*Notemigonus crysoleucas*	X	X	
Emerald shiner	*Notropis atherinoides*	X	X	
Sand shiner	*Notropis stramineus*			X
Bluntnose minnow	*Pimephales notatus*	X	X	X
Fathead minnow	*Pimephales promelas*	X	X	X
Creek chub	*Semotilus atromaculatus*		X	
SUCKER FAMILY	CATOSTOMIDAE			
Quillback	*Carpiodes cyprinus*		X	
White sucker	*Catostomus commersonii*	X	X	X
Spotted sucker	*Minytrema melanops*	X		
Black buffalo	*Ictiobus niger*		X	
CATFISH FAMILY	ICTALURIDAE			
Yellow bullhead[1]	*Ameiurus natalis*	X	X	X
Channel catfish[1]	*Ictalurus punctatus*	X		
Black bullhead[1]	*Ameiurus melas*	X	X	

TABLE 11 (Continued): COMMON AND SCIENTIFIC NAMES OF FISHES COLLECTED FROM THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Common Name	Scientific Name	River System		
		Chicago	Calumet	Des Plaines
KILLIFISH FAMILY	FUNDULIDAE			
Blackstripe topminnow	*Fundulus notatus*	X		X
LIVEBEARER FAMILY	POECILIIDAE			
Western mosquitofish	*Gambusia affinis*	X		
STICKLEBACKS FAMILY	GASTEROSTEIDAE			
Brook Stickleback	*Culaea inconstans*	X		
TEMPERATE BASS FAMILY	MORONIDAE			
White perch[1]	*Morone Americana*		X	
Yellow bass[1]	*Morone mississippiensis*	X		
GOBY FAMILY	GOBIIDAE			
Round goby	*Neogobius melanostomus*	X	X	X
SUNFISH FAMILY	*CENTRARCHIDAE*			
Rock bass[1]	*Ambloplites rupestris*	X	X	X
Green sunfish[1]	*Lepomis cyanellus*	X	X	X
Pumpkinseed[1]	*Lepomis gibbosus*	X	X	X
Orangespotted sunfish[1]	*Lepomis humilis*	X	X	X
Bluegill[1]	*Lepomis macrochirus*	X	X	X
Pumpkinseed x Bluegill	*L. gibbosus x L. macrochirus*	X		
Smallmouth bass[1]	*Micropterus dolomieu*		X	
Largemouth bass[1]	*Micropterus salmoides*	X	X	X
Black crappie[1]	*Pomoxis nigromaculatus*	X		X
PERCH FAMILY	*PERCIDAE*			
Iowa darter[2]	*Etheostoma exile*	X		
Johnny darter	*Etheostoma nigrum*			X
Yellow perch[1]	*Perca flavescens*	X	X	

TABLE 11 (Continued): COMMON AND SCIENTIFIC NAMES OF FISHES COLLECTED FROM THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Common Name	Scientific Name	River System		
		Chicago	Calumet	Des Plaines
DRUM FAMILY	SCIAENIDAE			
Freshwater drum	*Aplodinotus grunniens*		X	
LOACH FAMILY	COBITIDAE			
Oriental weatherfish	*Misgurnus anguillicaudatus*	X		X
	Total Number of Species	30	26	21
	Total Number of Hybrids	2	0	0

[1]Game fish species.
[2]Threatened species in Illinois.

TABLE 12: NUMBER, WEIGHT, AND NUMBER OF SPECIES OF FISH COLLECTED FROM THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Station No.	Location	Waterway	Sample Gear	Number of Fish	Weight (grams)	Number of Species		Most Abundant Species
						Total	Game	
106	Dundee Road	W Fork N Branch Chicago River[1]	BP/Seine	46	155	6	2	White sucker
103	Golf Road	W Fork N Branch Chicago River[1]	BP/Seine	17	124	8	3	Green sunfish
31	Lake-Cook Road	M Fork N Branch Chicago River[2]	BP	10	79	4	2	Central mudminnow Green sunfish
32	Lake-Cook Road	Skokie River	BP/Seine	76	234	9	4	Largemouth bass
105	Frontage Road	Skokie River	BP/Seine	42	374	6	3	Largemouth bass
104	Glenview Road	North Branch Chicago River	BP	3	18	1	0	Central mudminnow
34	Dempster Street	North Branch Chicago River	BP/Seine	31	305	6	4	Green sunfish
96	Albany Avenue[3]	North Branch Chicago River	BP/Seine	38	134	6	2	Goldfish
35	Central Street	North Shore Channel	Large EF Boat	207	57,764	16	7	Pumpkinseed
102	Oakton Street	North Shore Channel	Large EF Boat	356	12,092	20	9	Pumpkinseed
36	Touhy Avenue[3]	North Shore Channel	Large EF Boat	84	113,825	11	4	Common carp
101	Foster Avenue	North Shore Channel	Large EF Boat	226	28,421	13	5	Bluegill
37	Wilson Avenue	North Branch Chicago River	Large EF Boat	264	48,566	17	8	Spotfin shiner Golden shiner
73	Diversey Parkway	North Branch Chicago River	Large EF Boat	189	66,860	15	5	Spotfin shiner
46	Grand Avenue[3]	North Branch Chicago River	Large EF Boat	118	20,152	9	3	Gizzard shad
75	Cicero Avenue[3]	Chicago Sanitary & Ship Canal	Large EF Boat	285	209,707	15	7	Common carp
41	Harlem Avenue[3]	Chicago Sanitary & Ship Canal	Large EF Boat	266	124,973	13	5	Bluntnose minnow
92	Lockport[3]	Chicago Sanitary & Ship Canal	Large EF Boat	148	141,181	10	6	Gizzard shad
55	130th Street[3]	Calumet River	Large EF Boat	221	84,273	17	7	Bluntnose minnow
76	Halsted Street[3]	Little Calumet River	Large EF Boat	392	203,172	18	8	Pumpkinseed

TABLE 12 (Continued): NUMBER, WEIGHT, AND NUMBER OF SPECIES OF FISH COLLECTED FROM THE CHICAGO, CALUMET, AND DES PLAINES RIVER SYSTEMS DURING 2009

Station No.	Location	Waterway	Sample Gear	Number of Fish	Weight (grams)	Number of Species		Most Abundant Species
						Total	Game	
59	Cicero Avenue[3]	Calumet-Sag Channel	Large EF Boat	86	55,523	10	4	Bluntnose minnow
64	Lake Street[3]	West Branch DuPage River	BP/Seine	41	3,000	9	5	Largemouth bass
18	Devon Avenue[3]	Salt Creek	BP/Seine	28	314	6	5	Largemouth bass
78	Wille Road[3]	Higgins Creek	BP/Seine	28	44	2	1	Fathead minnow
13	Lake-Cook Road[3]	Des Plaines River	BP/Seine	89	1,331	9	5	Green sunfish
22	Ogden Avenue[3]	Des Plaines River	BP/Seine	59	2,442	13	6	Green sunfish
91	Material Service Road[3]	Des Plaines River	BP/Seine	32	248	10	3	Green sunfish
		TOTAL		3,382	1,048 kg	41	16	

[1]West Fork North Branch Chicago River.
[2]Middle Fork North Branch Chicago River.
[3]Annual sampling station.

TABLE 13: INDEX OF BIOTIC INTEGRITY SCORE AND CATEGORY BY STATION DURING 2009

Station No.	Location	Waterway	Sample Gear	IBI[1] Score	IBI[1] Category
106	Dundee Road	West Fork North Branch Chicago River	BP	28	Fair
106	Dundee Road	West Fork North Branch Chicago River	Seine	30	Fair
103	Golf Road	West Fork North Branch Chicago River	BP	30	Fair
103	Golf Road	West Fork North Branch Chicago River	Seine	ND	Fair
31	Lake-Cook Road	Middle Fork North Branch Chicago River	BP	28	Fair
31	Lake-Cook Road	Middle Fork North Branch Chicago River	Seine	ND	Fair
32	Lake-Cook Road	Skokie River	BP	32	Fair
32	Lake-Cook Road	Skokie River	Seine	ND	Fair
105	Frontage Road	Skokie River	BP	32	Fair
105	Frontage Road	Skokie River	Seine	34	Fair
104	Glenview Road	North Branch Chicago River	BP	24	Fair
104	Glenview Road	North Branch Chicago River	Seine	ND	Fair
34	Dempster Street	North Branch Chicago River	BP	28	Fair
34	Dempster Street	North Branch Chicago River	Seine	ND	Fair
96	Albany Avenue	North Branch Chicago River	BP	24	Fair
96	Albany Avenue	North Branch Chicago River	Seine	24	Fair
35	Central Street	North Shore Channel	Large EF Boat	36	Fair
102	Oakton Street	North Shore Channel	Large EF Boat	38	Fair
36	Touhy Avenue	North Shore Channel	Large EF Boat	32	Fair
101	Foster Avenue	North Shore Channel	Large EF Boat	36	Fair
37	Wilson Avenue	North Branch Chicago River	Large EF Boat	38	Fair
73	Diversey Parkway	North Branch Chicago River	Large EF Boat	36	Fair
46	Grand Avenue	North Branch Chicago River	Large EF Boat	30	Fair
75	Cicero Avenue	Chicago Sanitary and Ship Canal	Large EF Boat	30	Fair
41	Harlem Avenue	Chicago Sanitary and Ship Canal	Large EF Boat	32	Fair
92	Lockport	Chicago Sanitary and Ship Canal	Large EF Boat	26	Fair

TABLE 13 (Continued): INDEX OF BIOTIC INTEGRITY SCORE AND CATEGORY BY STATION DURING 2009

Station No.	Location	Waterway	Sample Gear	IBI[1] Score	IBI[1] Category
55	130th Street	Calumet River	Large EF Boat	36	Fair
76	Halsted Street	Little Calumet River	Large EF Boat	34	Fair
59	Cicero Avenue	Calumet-Sag Channel	Large EF Boat	24	Fair
13	Lake-Cook Road	Des Plaines River	BP	26	Fair
13	Lake-Cook Road	Des Plaines River	Seine	32	Fair
78	Wille Road	Higgins Creek	BP	26	Fair
78	Wille Road	Higgins Creek	Seine	ND	ND
18	Devon Avenue	Salt Creek	BP	30	Fair
18	Devon Avenue	Salt Creek	Seine	34	ND
22	Ogden Avenue	Des Plaines River	BP	32	Fair
22	Ogden Avenue	Des Plaines River	Seine	36	ND
91	Material Service Road	Des Plaines River	BP	26	Fair
91	Material Service Road	Des Plaines River	Seine	28	Fair
64	Lake Street	West Branch DuPage River	BP	36	Fair
64	Lake Street	West Branch DuPage River	Seine	32	Fair

[1]IBI = Index of Biotic Integrity.
ND = No fish were caught in the seine or conditions were unfavorable for seining.

TABLE 14: BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2009

Taxa	Hester-Dendy	Petite Ponar
COELENTERATA (Hydroids)		
Hydra	X	X
PLATYHELMINTHES (Flat worms)		
Turbellaria	X	X
ECTOPROCTA (Bryozoans)		
Plumatella	X	
ANNELLIDA		
Oligochaeta (Aquatic Worms)	X	X
Hirudinea (Leeches)		
Helobdella[1]	X	X
Helobdella stagnalis	X	X
Placobdella[1]		X
Placobdella papillifera	X	
Erpobdella punctata punctata	X	X
Mooreobdella microstoma	X	X
CRUSTACEA		
Ostracoda (Seed Shrimp)	X	X
Isopoda (Sow Bugs)		
Caecidotea	X	X
Amphipoda (Side Swimmers)		
Hyalella azteca	X	X
Gammarus	X	X
Echinogammarus ischusa	X	
DECAPODA (Crayfish)		
Orconectes virilis	X	

TABLE 14 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2009

Taxa		Hester-Dendy	Petite Ponar
ARACHNOIDEA			
	Hydracarina (Water Mites)	X	
INSECTA			
	Ephemeroptera (Mayflies)		
	Baetis intercalaris	X	X
	Heptageniidae	X	
	Leucrocuta	X	
	Maccaffertium integrum	X	
	Maccaffertium terminatum	X	
	Stenacron	X	
	Stenonema femoratum	X	
	Tricorythodes	X	X
	Anthopotamus myops grp.	X	
	Odonata (Damselflies and Dragonflies)		
	Coenagrionidae[1]		X[1]
	Argia	X	
	Enallagma	X	X
	Stylurus		X
	Hemiptera (True Bugs)		
	Metrobates	X	
	Trepobates	X	
	Trichoptera (Caddisflies)		
	Chimarra	X	
	Cyrnellus fraternus	X	
	Ceratopsyche morosa	X	X

TABLE 14 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2009

Taxa	Hester-Dendy	Petite Ponar
Trichoptera (Caddisflies) (Continued)		
Cheumatopsyche	X	X
Hydropsyche simulans	X	
Hydroptila	X	X
Nectopsyche	X	
Oecetis	X	X
Lepidoptera (Aquatic Moths)		
Petrophila		X
Coleoptera (Beetles)		
Peltodytes		X
Dubiraphia	X	X
Macronychus glabratus	X	
Stenelmis	X	X
Tropisternus	X	
Diptera (True Flies)		
Culex	X	
Simulium	X	X
Chironimidae (Midges)		
Procladius	X	X
Tanypus		X
Ablabesmyia janta	X	
Ablabesmyia mallochi	X	X
Labrundinia	X	
Natarsia sp. A		X
Thienemannimyia grp.	X	X
Corynoneura lobata	X	X
Cricotopus bicinctus grp.	X	X

TABLE 14 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2009

Taxa	Hester-Dendy	Petite Ponar
Chironimidae (Midges) (Continued)		
Cricotopus sylvestris grp.	X	X
Cricotopus tremulus grp.	X	X
Cricotopus trifascia grp.		X
Nanocladius crassicornus/rectinervis	X	X
Nanocladius distinctus	X	X
Rheocricotopus robacki	X	X
Thienemanniella similis	X	
Thienemanniella xena	X	X
Tvetenia discoloripes grp.	X	
Chironomus	X	X
Cladopelma	X	X
Cryptochironomus	X	X
Dicrotendipes fumidus	X	X
Dicrotendipes lucifer	X	X
Dicrotendipes modestus	X	X
Dicrotendipes neomodestus	X	X
Dicrotendipes simpsoni	X	X
Endochironomus nigricans	X	X
Glyptotendipes	X	X
Harnischia	X	X
Microtendipes	X	X
Parachironomus	X	X
Paracladopelma		X
Paralauterborniella nigrohalteralis	X	X
Paratendipes	X	X
Phaenopsectra flavipes	X	X
Phaenopsectra obediens	X	X

TABLE 14 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2009

Taxa		Hester-Dendy	Petite Ponar
Chironimidae (Midges) (Continued)			
	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	X
	Xenochironomus xenolabis	X	
	Cladotanytarsus mancus grp.	X	X
	Cladotanytarsus vanderwulpi grp.		X
	Micropsectra	X	X
	Paratanytarsus	X	X
	Rheotanytarsus	X	X
	Tanytarsus	X	X
	Tanytarsus glabrescens grp.	X	X
	Tanytarsus sepp	X	X
GASTROPODA (Snails)			
	Ferrissia	X	X
	Bithynia tentaculata	X	
	Amnicola	X	X
	Physa	X	X
	Helisoma	X	X
	Menetus	X	X
PELECYPODA (Mussels and Clams)			
	Corbicula fluminea	X	X
	Dreissena bugensis	X	X

TABLE 14 (Continued): BENTHIC INVERTEBRATE TAXA COLLECTED BY PONAR AND HESTER-DENDY SAMPLERS DURING 2009

Taxa	Hester-Dandy	Petite Ponar
PELECYPODA (Mussels and Clams) (Continued)		
Dreissena polymorpha	X	X
Sphaerium[1]	X	X
Musculium	X	X
Pisidium	X	X
TOTAL SPECIES RICHNESS BY SAMPLE TYPE	101	81
EPT[2] SPECIES RICHNESS BY SAMPLE TYPE	16	6
TOTAL SPECIES RICHNESS FOR 2009	110	
EPT[2] SPECIES RICHNESS FOR 2009	16	

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

Calumet River System. This watershed includes the Calumet River, LCR, and the CSC. Benthic invertebrate samples were collected in each waterway. The Hester-Dendy sample from the 130th Street station on the Calumet River was dominated by the invasive species *Dreissena polymorpha* (Zebra mussel) (84 percent of total organisms). Zebra mussels are well established in Lake Michigan, which greatly influences this station. Halsted Street on the LCR exhibited the highest total taxa in this system for Hester-Dendy and Ponar samples (26 and 10, respectively). Cicero Avenue on the CSC exhibited the next highest number of total taxa richness for Hester-Dendy samples with 19, followed by Hester-Dendy samples at 130th Street on the Calumet River with 12 species. EPT taxa were present at Cicero Avenue on the CSC and Halsted Street on the LCR, but none were present at 130th Street. The highest total taxa richness of the Ponar samples was observed at Halsted Street on the LCR (10 species). No Chironomid head capsule deformities were observed at 130th Street. There were slightly elevated levels of head capsule deformities observed in the Halsted Street Hester-Dendy sample (5 percent of total midges) and the Cicero Avenue Ponar sample (4.8 percent of total midges).

Des Plaines River System. Benthic invertebrate samples were collected from six AWQM stations on the DPR, WBDR, Salt Creek, and Higgins Creek during 2009. The Hester-Dendy sample from Devon Avenue on Salt Creek exhibited the highest total taxa richness (33 taxa) within this system. The Hester-Dendy sample from Lake Cook Road on the DPR had the highest EPT taxa richness (10). The Ponar samples with the highest total and EPT taxa richness were Lake Street on the West Branch Des Plaines River (WBDR) (25 total taxa) and Ogden Avenue on the DPR (three EPT taxa). Lake Street on the WBDR showed slightly elevated levels of head capsule deformities for both Ponar and Hester-Dendy samples (1.3 and 2.6 percent, respectively).

Sediment Chemistry

Sediment quality can considerably impact overlying water quality, benthic community structure, food chain dynamics, and other elements of freshwater ecosystems. Since sediment acts as a reservoir for persistent or bioaccumulative contaminants, sediment data reflects a long-term record of quality. It should be noted that interpretation of grab sample sediment data is difficult because it may not be representative of the area. For example, a "hot spot" could occur due to an accidental release or spill of a contaminant that sinks down through the water column and remains in the sediment. Also, sediment chemistry can vary widely between side and center samples from the same station.

General Chemistry. The concentrations of the eight general chemistry constituents measured in the sediment from 15 sampling stations are presented in Table 15. Overall, Grand Avenue on the NBCR exhibited the highest concentrations for most of these constituents. The side sample contained 12 percent total volatile solids. Both side and center samples contained the highest values for ammonia nitrogen (NH_3-N) (197 mg/kg and 255 mg/kg, respectively), nitrite plus nitrate (NO_2+NO_3-N) (both 5 mg/kg), TKN (5,050 mg/kg and 4,706 mg/kg), TP (4,272 mg/kg and 5,580 mg/kg), and phenols (2.803 mg/kg and 8.584 mg/kg). The side sample at Diversey Parkway on the NBCR contained 5.064 mg/kg total cyanide (TCN), which was the highest concentration observed for this study year.

TABLE 15: CHEMICAL CHARACTERISTICS OF SEDIMENT COLLECTED FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

WATERWAY	SITE NO.	LOCATION		Constituents (dry weight basis) TS (%)	TVS (%)	NH_3-N (mg/kg)	$NO_2 + NO_3$-N (mg/kg)	TKN (mg/kg)	TP (mg/kg)	Phenols (mg/kg)	TCN (mg/kg)
Skokie River	32	Lake Cook Road	Side	66	3	9	2	680	226	0.579	0.146
Skokie River	32	Lake Cook Road	Center	75	1	3	2	250	147	0.232	0.027
Skokie River	105	Frontage Road	Side	45	11	1	<1	2,327	1,495	0.482	0.231
Skokie River	105	Frontage Road	Center	61	7	1	<1	1,458	1,951	0.228	0.167
MFNBCR	31	Lake Cook Road	Side	48	11	22	4	2,451	662	0.334	0.228
MFNBCR	31	Lake Cook Road	Center	71	4	19	3	874	378	0.288	0.104
NBCR	104	Glenview Road	Side	71	4	<1	<1	823	401	0.181	0.102
NBCR	104	Glenview Road	Center	69	4	1	<1	743	388	0.167	0.091
WFNBCR	106	Dundee Road	Side	77	3	11	2	699	452	0.175	0.051
WFNBCR	106	Dundee Road	Center	85	2	1	1	279	259	0.123	0.053
WFNBCR	103	Golf Road	Side	65	4	8	1	1,070	455	0.487	0.141
WFNBCR	103	Golf Road	Center	70	3	10	1	739	290	0.517	0.115
NBCR	34	Dempster Street	Side	63	4	13	2	1,026	629	0.323	0.130
NBCR	34	Dempster Street	Center	82	2	2	1	389	282	0.218	0.055
NBCR	96	Albany Avenue	Side	69	4	16	2	1,324	504	0.285	0.097
NBCR	96	Albany Avenue	Center	81	2	<1	1	141	198	0.234	0.017
North Shore Channel	35	Central Street	Side	61	4	10	2	1,389	391	0.510	0.060
North Shore Channel	35	Central Street	Center	55	5	18	2	1,556	653	0.232	0.138
North Shore Channel	102	Oakton Street	Side	62	5	8	1	1,616	384	0.571	0.149
North Shore Channel	102	Oakton Street	Center	41	9	90	2	2,887	1,297	0.622	0.329
North Shore Channel	36	Touhy Avenue	Side	72	3	6	2	615	251	0.131	<0.007
North Shore Channel	36	Touhy Avenue	Center	69	4	4	1	445	422	0.138	0.033
North Shore Channel	101	Foster Avenue	Side	75	4	8	2	611	245	0.443	0.007
North Shore Channel	101	Foster Avenue	Center	68	3	6	1	634	403	0.167	0.044
NBCR	37	Wilson Avenue	Side	60	4	11	2	1,106	614	0.460	0.139
NBCR	37	Wilson Avenue	Center	69	3	4	2	524	947	0.357	0.039

TABLE 15 (Continued): CHEMICAL CHARACTERISTICS OF SEDIMENT COLLECTED FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

WATERWAY	SITE NO.	LOCATION		Constituents (dry weight basis) TS (%)	TVS (%)	NH_3-N (mg/kg)	$NO_2 + NO_3$-N (mg/kg)	TKN (mg/kg)	TP (mg/kg)	Phenols (mg/kg)	TCN (mg/kg)
NBCR	73	Diversey Parkway	Side	38	10	87	4	3,791	3,098	0.550	5.064
NBCR	73	Diversey Parkway	Center	54	4	33	1	1,222	1,232	0.274	0.145
NBCR	46	Grand Avenue	Side	37	12	197	5	5,050	4,272	2.803	2.548
NBCR	46	Grand Avenue	Center	31	11	255	5	4,706	5,580	8.584	0.827

ND= No Data

Trace Metals. The 11 measured trace metal concentrations for each station are presented in Table 16. The side sample at Grand Avenue contained the highest concentrations of chromium (525 mg/kg), copper (320 mg/kg), iron (31,247 mg/kg), mercury (2.902 mg/kg), nickel (97 mg/kg), and zinc (1,223 mg/kg). The side sample at Albany Avenue on the NBCR exhibited an unusually high concentration of lead (2,141 mg/kg).

Acid Volatile Sulfide, Simultaneously Extracted Metals, Total Organic Carbon, and Particle Size. Table 17 presents the AVS, SEM, TOC, and particle size data for 15 sampling stations. The ratio of SEM to AVS can affect the bioavailability of divalent metals for which sulfide ions have a high affinity. For instance, if AVS is greater than the SEM concentration (SEM/AVS<1), it is less likely that metals are available for biological uptake, thus rendering them less toxic to organisms. As a measure of oxidizable organic material, the TOC concentration in sediment affects nonionic organic chemicals as well as metal bioavailability. Three stations had samples with relatively high SEM/AVS ratios, two of which were estimated because the AVS value was non-detectable. These two samples were collected from Touhy and Foster on the NSC, with estimated SEM/AVS ratios above 9.1. The center sample at Dundee Road exhibited a SEM/AVS ratio of 3.5. The Diversey Parkway side and Grand Avenue side and center samples contained the highest concentrations of TOC (77,500 mg/kg, 74,200 mg/kg, and 84,600 mg/kg, respectively).

Particle size is useful information since it influences chemical reactions in the sediment and the type of invertebrate taxa that colonize the substrate (USEPA, 2001). Overall, particle size distribution analysis demonstrated that sand was the most dominant substrate in the NPCRS.

Organic Priority Pollutants. Eash sample was analyzed for 111 total OPPs (Table 3). Tables 18 - 21 present the concentrations of 22 OPPs that were detected in sediment samples during 2009. The fewest OPPs were detected in side samples collected from Foster Avenue on the NSC, Touhy on the NSC, and Glenview Road on the NBCR (0, 1, and 2 total OPPs, respectively). The highest number of OPPs was detected at Grand Avenue in the side sample (20). Other samples with a similar number of OPP detections were Wilson Avenue on the NBCR (center sample 18 OPPs) and Diversey Parkway (side and center 19 and 18 OPPs, respectively). Wilson Avenue on the NBCR (center sample) exhibited the highest concentrations for 15 of the 22 OPPs detected in the NPCRS.

Sediment Toxicity

The *Chironomus tentans* ten-day sediment toxicity data are presented in Table 22. A significantly lower *Chironomus* ash-free dried weight compared to the control sediment indicates that the collected sediment constitutes an unsuitable habitat for optimal *Chironomus* growth.

TABLE 16: TRACE METALS IN SEDIMENT COLLECTED FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

WATERWAY	SITE NO.	LOCATION		As	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn
				(mg/kg dry weight)										
Skokie River	32	Lake Cook Road	Side	<10	<2	8	13	6,751	24	223	<0.250	7	<1	77
Skokie River	32	Lake Cook Road	Center	<10	<2	6	10	5,268	31	164	<0.250	6	<1	59
Skokie River	105	Frontage Road	Side	<10	<2	15	40	17,998	44	586	<0.250	16	<1	132
Skokie River	105	Frontage Road	Center	<10	<2	12	24	11,736	99	369	<0.250	10	<1	121
MFNBCR	31	Lake Cook Road	Side	<10	<2	21	32	17,725	48	393	<0.250	20	<1	125
MFNBCR	31	Lake Cook Road	Center	<10	<2	22	19	16,974	54	425	<0.250	18	<1	266
NBCR	104	Glenview Road	Side	<10	<2	12	17	14,209	18	411	<0.250	18	<1	58
NBCR	104	Glenview Road	Center	<10	<2	6	13	7,160	24	607	<0.250	6	<1	42
WFNBCR	106	Dundee Road	Side	<10	<2	14	18	17,434	15	449	<0.250	20	<1	55
WFNBCR	106	Dundee Road	Center	<10	<2	11	14	14,424	14	732	<0.250	18	<1	58
WFNBCR	103	Golf Road	Side	<10	<2	12	18	9,737	37	213	0.529	10	<1	74
WFNBCR	103	Golf Road	Center	<10	<2	17	13	9,418	20	236	0.627	10	<1	54
NBCR	34	Dempster Street	Side	<10	<2	11	16	9,828	29	375	<0.250	9	<1	65
NBCR	34	Dempster Street	Center	<10	<2	8	8	8,653	36	574	<0.250	8	<1	53
NBCR	96	Albany Avenue	Side	<10	<2	20	27	20,823	2,141	383	<0.250	27	<1	75
NBCR	96	Albany Avenue	Center	<10	<2	10	8	17,364	42	478	<0.250	11	<1	48
North Shore Channel	35	Central Street	Side	<10	<2	17	35	13,216	51	462	1.489	16	<1	93
North Shore Channel	35	Central Street	Center	<10	<2	28	63	13,438	128	361	1.353	16	<1	195
North Shore Channel	102	Oakton Street	Side	<10	<2	12	30	13,731	33	340	<0.250	17	<1	100
North Shore Channel	102	Oakton Street	Center	<10	<2	33	90	16,258	123	362	1.242	22	<1	249
North Shore Channel	36	Touhy Avenue	Side	<10	<2	17	20	23,695	18	441	<0.250	28	<1	49
North Shore Channel	36	Touhy Avenue	Center	<10	4	29	53	10,337	74	248	<0.250	21	<1	186
North Shore Channel	101	Foster Avenue	Side	<10	<2	14	49	19,379	25	406	<0.250	25	<1	44
North Shore Channel	101	Foster Avenue	Center	<10	2	13	33	7,672	44	182	<0.250	13	<1	148
NBCR	37	Wilson Avenue	Side	<10	4	23	64	6,190	88	159	0.267	11	1	172
NBCR	37	Wilson Avenue	Center	<10	3	26	169	5,223	484	141	0.381	9	2	224

TABLE 16 (Continued): TRACE METALS IN SEDIMENT COLLECTED FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

WATERWAY	SITE NO.	LOCATION		As	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn
				(mg/kg dry weight)										
NBCR	73	Diversey Parkway	Side	<10	35	160	220	12,921	358	237	1.851	86	8	693
NBCR	73	Diversey Parkway	Center	<10	7	47	185	9,072	493	180	1.347	40	2	327
NBCR	46	Grand Avenue	Side	<10	34	525	320	31,247	703	408	2.902	97	3	1,223
NBCR	46	Grand Avenue	Center	<10	9	104	222	22,059	260	336	1.364	43	6	713

ND = No Data

TABLE 17: ACID VOLATILE SULFIDE/SIMULTANEOUSLY EXTRACTED METALS, TOTAL ORGANIC CARBON, AND PARTICLE SIZE SEDIMENT DATA FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

WATERWAY	SITE NO.	LOCATION		AVS	SEM	SEM/AVS	TOC	(Particle Size) GRAVEL	SAND	SILT	CLAY
				(umoles/g)			(mg/kg)	(%)	(%)	(%)	(%)
Skokie River	32	Lake Cook Road	Side	19.4	1.4	0.1	14,800	2.6	83.8	11.4	2.2
Skokie River	32	Lake Cook Road	Center	19.1	1.1	0.1	8,010	0.0	96.3	2.8	0.8
Skokie River	105	Frontage Road	Side	44.2	3.7	0.1	38,600	9.7	71.0	12.6	6.7
Skokie River	105	Frontage Road	Center	8.4	2.6	0.3	35,800	0.3	86.1	10.0	3.7
MFNBCR	31	Lake Cook road	Side	51.3	3.6	0.1	49,300	0.1	84.3	4.7	10.0
MFNBCR	31	Lake Cook road	Center	67.4	2.3	0.0	18,100	8.8	81.0	5.0	5.2
NBCR	104	Glenview Road	Side	2.0	1.5	0.7	11,600	5.0	81.4	4.9	8.6
NBCR	104	Glenview Road	Center	25.7	1.0	0.0	15,000	4.9	89.3	4.8	1.1
WFNBCR	106	Dundee Road	Side	2.1	1.2	0.6	9,510	13.5	78.6	2.7	5.1
WFNBCR	106	Dundee Road	Center	0.3	1.0	3.5	4,910	17.1	79.4	0.1	3.4
WFNBCR	103	Golf Road	Side	31.6	3.5	0.1	18,200	1.4	75.7	17.8	4.1
WFNBCR	103	Golf Road	Center	11.6	0.6	0.1	7,460	22.0	75.5	1.7	0.9
NBCR	34	Dempster Street	Side	13.4	1.5	0.1	19,400	0.2	89.2	7.9	2.7
NBCR	34	Dempster Street	Center	0.9	0.7	0.8	5,480	27.7	70.5	1.1	0.7
NBCR	96	Albany Avenue	Side	53.5	1.6	0.0	13,600	14.3	75.3	1.1	9.4
NBCR	96	Albany Avenue	Center	1.0	0.7	0.7	7,380	60.3	39.3	0.5	0.0
North Shore Channel	35	Central Street	Side	53.5	2.4	0.0	28,900	12.4	64.0	18.9	5.3
North Shore Channel	35	Central Street	Center	44.3	4.6	0.1	31,800	1.0	80.0	13.6	5.5
North Shore Channel	102	Oakton Street	Side	9.2	0.7	0.1	17,800	14.3	78.2	4.8	2.8
North Shore Channel	102	Oakton Street	Center	39.6	7.2	0.2	46,300	0.7	65.2	25.6	8.5
North Shore Channel	36	Touhy Avenue	Side	<0.15	1.3	>9.1	25,200	0.0	87.4	2.8	3.5
North Shore Channel	36	Touhy Avenue	Center	5.3	2.5	0.5	26,900	2.2	96.5	0.3	0.9
North Shore Channel	101	Foster Avenue	Side	<0.15	1.4	>9.1	10,300	ND	ND	ND	ND
North Shore Channel	101	Foster Avenue	Center	2.4	2.0	0.8	10,600	0.0	96.1	0.4	1.1
NBCR	37	Wilson Avenue	Side	42.4	5.8	0.1	34,000	0.9	91.2	5.3	2.6
NBCR	37	Wilson Avenue	Center	8.8	4.1	0.5	8,370	0.4	98.3	0.1	1.1

TABLE 17 (Continued): ACID VOLATILE SULFIDE/SIMULTANEOUSLY EXTRACTED METALS, TOTAL ORGANIC CARBON, AND PARTICLE SIZE SEDIMENT DATA FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

WATERWAY	SITE NO.	LOCATION		AVS	SEM	SEM/AVS	TOC	(Particle Size) GRAVEL	SAND	SILT	CLAY
				(umoles/g)			(mg/kg)	(%)	(%)	(%)	(%)
NBCR	73	Diversey Parkway	Side	96.9	26.7	0.3	77,500	21.9	69.6	7.1	1.5
NBCR	73	Diversey Parkway	Center	18.2	10.1	0.6	46,000	0.3	94.8	3.9	1.0
NBCR	46	Grand Avenue	Side	108.0	35.7	0.3	74,200	12.7	69.6	11.1	6.6
NBCR	46	Grand Avenue	Center	43.9	21.6	0.5	84,600	2.7	72.9	17.7	6.6

ND = No Data

TABLE 18: ORGANIC PRIORITY POLLUTANTS DETECTED IN SEDIMENT COLLECTED FROM THE SKOKIE RIVER AND THE MIDDLE FORK OF THE NORTH BRANCH CHICAGO RIVER DURING 2009

Compound[1]	Skokie River				Middle Fork North Branch Chicago River	
	32 side	32 center	105 side	105 center	31 side	31 center
Toluene	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND
Anthracene	ND	505	ND	ND	ND	ND
Benzo(a)anthracene	1,330	1,600	ND	677	3,170	1,420
Benzo(a)pyrene	1,750	1,580	439	678	4,130	1,680
3,4-Benzofluoranthene	3,740	2,760	938	1,280	8,480	2,980
Benzo(ghi)perylene	644	469	ND	ND	1,590	709
Benzo(k)fluoranthene	766	907	ND	617	2,790	900
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND
Chrysene	2,160	1,770	660	994	4,970	2,120
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND
Fluoranthene	4,500	4,450	1,200	2,050	9,340	4,820
Fluorene	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	584	455	ND	ND	1,510	657
Naphthalene	ND	ND	ND	ND	ND	ND
Phenanthrene	2,090	2,530	464	760	2,960	2,210
Pyrene	3,420	3,410	904	1,560	7,130	3,780
4,4'-DDT	9.61	ND	12.5	72.0	ND	ND
4,4'-DDE	32.5	18.9	27.6	63.9	37.1	ND
4,4'-DDD	52.9	73.8	107	577	73.6	ND
PCB-1242	ND	ND	ND	ND	ND	ND
PCB-1248	ND	ND	ND	ND	ND	ND

[1]Concentrations expressed as µg/kg dry weight.
ND = Not Detectable.

TABLE 19: ORGANIC PRIORITY POLLUTANTS DETECTED IN SEDIMENT COLLECTED FROM THE NORTH BRANCH CHICAGO RIVER DURING 2009

Compound[1]	104 side	104 center	34 side	34 center	96 side	96 center
Toluene	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND
Anthracene	ND	799	ND	ND	ND	ND
Benzo(a)anthracene	ND	2,230	1,010	656	725	ND
Benzo(a)pyrene	ND	2,210	1,160	708	639	ND
3,4-Benzofluoranthene	ND	3,510	2,080	1,160	983	ND
Benzo(ghi)perylene	ND	649	465	ND	ND	ND
Benzo(k)fluoranthene	ND	1,160	730	429	ND	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND
Chrysene	ND	2,480	1,730	1,050	951	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	5,120	3,810	2,610	1,900	442
Fluorene	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	648	509	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	2,190	1,630	1,490	1,160	ND
Pyrene	ND	4,060	2,920	1,960	1,580	387
4,4'-DDT	ND	59.4	13.0	ND	ND	6.38
4,4'-DDE	7.79	71.0	36.1	20.2	ND	8.82
4,4'-DDD	13.0	337	59.3	66.6	16.6	25.8
PCB-1242	ND	ND	ND	ND	ND	ND
PCB-1248	ND	ND	ND	ND	ND	ND

TABLE 19 (Continued): ORGANIC PRIORITY POLLUTANTS DETECTED IN SEDIMENT COLLECTED FROM THE NORTH BRANCH CHICAGO RIVER DURING 2009

Compound[1]	37 side	37 center	73 side	73 center	46 side	46 center
Toluene	1,270	ND	ND	ND	48.6	ND
Acenaphthene	ND	2,410	921	984	1,400	ND
Anthracene	ND	6,050	2,070	2,720	3,030	ND
Benzo(a)anthracene	2,060	15,000	6,720	7,030	8,480	2,980
Benzo(a)pyrene	2,440	14,200	6,880	6,370	7,320	3,130
3,4-Benzofluoranthene	4,530	21,000	10,500	10,200	11,800	6,340
Benzo(ghi)perylene	1,600	7,960	1,940	2,890	4,720	2,000
Benzo(k)fluoranthene	1,770	7,760	4,080	3,390	3,630	2,100
Bis(2-ethylhexyl)phthalate	6,480	ND	11,000	3,560	20,600	21,600
Chrysene	2,740	14,900	9,280	7,630	10,300	4,380
Dibenzo(a,h)anthracene	ND	2,410	668	1,050	1,470	ND
Fluoranthene	4,950	41,500	15,500	17,900	14,100	7,210
Fluorene	ND	2,890	1,160	1,560	2,100	ND
Indeno(1,2,3-cd)pyrene	1,640	8,060	2,250	2,960	4,440	1,640
Naphthalene	ND	779	ND	ND	ND	ND
Phenanthrene	2,730	34,400	10,800	16,200	15,800	4,150
Pyrene	4,020	25,700	13,500	15,400	14,900	6,560
4,4'-DDT	10.8	ND	12.9	ND	80.6	ND
4,4'-DDE	40.0	11.9	186	35.9	494	67.9
4,4'-DDD	55.4	18.8	160	83.8	165	59.1
PCB-1242	ND	ND	ND	ND	ND	ND
PCB-1248	ND	274	8,980	959	42,600	1,750

[1]Concentrations expressed as µg/kg dry weight.
ND = Not Detectable.

TABLE 20: ORGANIC PRIORITY POLLUTANTS DETECTED IN SEDIMENT COLLECTED FROM THE WEST FORK NORTH BRANCH CHICAGO RIVER DURING 2009

Compound[1]	106 side	106 center	103 side	103 center
Toluene	ND	ND	ND	ND
Acenaphthene	ND	969	ND	ND
Anthracene	ND	3,770	ND	ND
Benzo(a)anthracene	ND	5,390	1,230	ND
Benzo(a)pyrene	ND	4,000	1,510	ND
3,4-Benzofluoranthene	724	5,750	3,240	429
Benzo(ghi)perylene	ND	1,520	557	ND
Benzo(k)fluoranthene	ND	1,840	943	ND
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND
Chrysene	521	4,920	1,910	318
Dibenzo(a,h)anthracene	ND	453	ND	ND
Fluoranthene	866	17,600	3,860	466
Fluorene	ND	1,200	ND	ND
Indeno(1,2,3-cd)pyrene	ND	1,570	596	ND
Naphthalene	ND	ND	ND	ND
Phenanthrene	333	16,900	1,310	ND
Pyrene	674	13,200	3,050	374
4,4'-DDT	ND	ND	30.7	ND
4,4'-DDE	12.3	ND	54.2	16.8
4,4'-DDD	ND	ND	153	66.7
PCB-1242	ND	ND	ND	ND
PCB-1248	ND	ND	ND	ND

[1]Concentrations expressed as µg/kg dry weight.
ND = Not Detectable.

TABLE 21: ORGANIC PRIORITY POLLUTANTS DETECTED IN SEDIMENT COLLECTED FROM THE NORTH SHORE CHANNEL DURING 2009

Compound[1]	35 side	35 center	102 side	102 center	36 side	36 center	101 center[2]
Toluene							
Acenaphthene	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	782	ND	ND	579	ND
Benzo(a)pyrene	2,250	919	3,310	800	ND	1,360	1,420
3,4-Benzofluoranthene	2,350	1,070	3,930	730	ND	1,350	1,490
Benzo(ghi)perylene	3,930	2,030	7,140	1,080	ND	1,930	2,580
Benzo(k)fluoranthene	1,660	916	1,390	ND	ND	544	627
Bis(2-ethylhexyl)phthalate	1,490	ND	2,660	435	ND	854	907
Chrysene	ND	ND	9,840	ND	ND	ND	ND
Dibenzo(a,h)anthracene	2,750	960	5,740	1,030	ND	1,650	1,850
Fluoranthene	ND	ND	ND	ND	ND	ND	ND
Fluorene	5,160	1,990	9,470	1,650	ND	2,660	2,880
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1,520	578	1,610	ND	ND	617	813
Phenanthrene	ND	ND	ND	ND	ND	ND	ND
Pyrene	3,130	1,030	4,770	1,080	ND	1,960	1,450
4,4'-DDT	4,070	1,580	7,510	1,790	ND	2,750	2,700
4,4'-DDE	30.8	32.3	39.0	77.1	11.7	ND	ND
4,4'-DDD	196	99.1	189	63.5	ND	35.1	27.8
PCB-1242	377	104	290	94.3	ND	78.2	38.8
PCB-1248	ND	ND	ND	ND	ND	ND	574
	637	ND	ND	ND	ND	1,040	ND

[1]Concentrations expressed as µg/kg dry weight.
[2]No organic priority pollutants found in sediment from side sample at Station 101
ND = Not Detectable.

TABLE 22: TOXICITY DATA FROM SEDIMENT COLLECTED FROM THE NORTHERN PORTION OF THE CHICAGO RIVER SYSTEM DURING 2009

Waterway	Site No.	Location		(*Chironumus tentans* Ten-Day Test Data) Survival (%)	Ash-free Dried Weight (mg/org)
Skokie River	32	Lake Cook Road	Side[1]	51*	0.39*
Skokie River	32	Lake Cook Road	Center[1]	100	0.62
Skokie River	105	Frontage Road	Side[2]	55*	0.40
Skokie River	105	Frontage Road	Center[2]	70	0.45
MFNBCR	31	Lake Cook Road	Side[2]	26*	0.15*
MFNBCR	31	Lake Cook Road	Center[2]	20*	0.06*
NBCR	104	Glenview Road	Side[2]	11*	0.24*
NBCR	104	Glenview Road	Center[2]	16*	0.56
WFNBCR	106	Dundee Road	Side[2]	24*	0.18*
WFNBCR	106	Dundee Road	Center[2]	26*	0.21*
WFNBCR	103	Golf Road	Side[2]	70	0.29*
WFNBCR	103	Golf Road	Center[2]	44*	0.28*
NBCR	34	Dempster Street	Side[2]	98	0.18*
NBCR	34	Dempster Street	Center[2]	89	0.36*
NBCR	96	Albany Avenue	Side[2]	36*	0.23*
NBCR	96	Albany Avenue	Center[2]	90	0.15*
North Shore Channel	35	Central Street	Side[1]	75*	0.23*
North Shore Channel	35	Central Street	Center[1]	70*	0.20*
North Shore Channel	102	Oakton Street	Side[2]	59*	0.05*
North Shore Channel	102	Oakton Street	Center[2]	76	0.11*
North Shore Channel	36	Touhy Avenue	Side[1]	53*	0.11*
North Shore Channel	36	Touhy Avenue	Center[1]	98	0.54
North Shore Channel	101	Foster Avenue	Side[1]	40*	0.13*
North Shore Channel	101	Foster Avenue	Center[1]	100	0.36*
NBCR	37	Wilson Avenue	Side[1]	68*	0.17*
NBCR	37	Wilson Avenue	Center[1]	98	0.27*
NBCR	73	Diversey Parkway	Side[1]	48*	0.04*
NBCR	73	Diversey Parkway	Center[1]	89	0.26*
NBCR	46	Grand Avenue	Side[1]	6*	0.06*
NBCR	46	Grand Avenue	Center[1]	85	0.21*

*Significantly lower than the West Bearskin Lake control results.
[1] Trial 1, West Bearskin Lake Control Survival 89.0 percent, Ash-free Dried Weight 0.47 mg/org.
[2] Trial 2, West Bearskin Lake Control Survival 84.0 percent, Ash-free Dried Weight 0.50 mg/org.

The side sample at Grand Avenue on the NBCR exhibited the lowest survival rate (6 percent). The lowest ash-free dried weight (0.04 mg/org) occurred in the side sample from Diversey Parkway on the NBCR. Eighteen out of 30 samples exhibited a survival rate that was significantly lower than the control sediment. Twenty five samples exhibited Chironomid growth that was significantly lower than the control site. Only three sediment samples (center location at Lake Cook Road and Frontage Road on the Skokie River and Touhy Avenue on the North Shore Channel) impaired neither the survival or growth of these aquatic organisms.

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APPENDIX A

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO
PHYSICAL HABITAT ASSESSMENT

FIGURE A-1: METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO
PHYSICAL HABITAT ASSESSMENT

Date _____ **Time** _____ **Station Number** _____

Station Name _____ **Latitude** _____

Waterbody _____ **Longitude** _____

Assessment Observer(s) _____

Weather Conditions SUNNY CLOUDY RAIN **(circle one)**

Stream Order _____ **Assessment Location** BEGINNING END **(circle one)**

Assessment Location Facing Upstream LEFT CENTER RIGHT **(circle one)**

Channel Habitat POOL RUN RIFFLE **(circle one)**

Water Depth (ft) _____ **Channel Width (ft)** _____

Water Level LOW NORMAL HIGH FLOODED **(circle one)**

Man-made Structures **(circle all applicable)**

DAM RIPRAP BRIDGE LEVEE ISLAND
OUTFALL SHEET PILING OTHER _____

Channelization YES NO **(circle one)**

Bank Erosion NONE SLIGHT MODERATE SEVERE **(circle one)**

Floatable Materials YES ⇩ NO **(circle one)**

If YES, characterize: **(circle all applicable)**

STREET LITTER SANITARY SEWAGE VEGETATIVE MATERIAL

Aquatic Vegetation YES ⇩ NO **(circle one)**

If YES, is vegetation: **(circle all applicable)**

ROOTED EMERGENT ROOTED SUBMERGENT ROOTED FLOATING
ATTACHED ALGAE FLOATING ALGAE OTHER (specify)

Instream Cover for Fish **(circle all applicable)**

AQUATIC VEGETATION BOULDERS BRUSH-DEBRIS JAMS LOGS
SUBMERGED TREE ROOTS SUBMERGED TERRESTRIAL VEGETATION
UNDER CUT BANK ROCK LEDGE OTHER (Specify) _____

Canopy Cover OPEN PARTLY SHADED SHADED **(circle one)**

Immediate Shore Cover

DENUDED _____ %
GRASSES _____ %
SHRUBS _____ %
TREES _____ %
OTHER (Specify) _____ %

Riparian Land Use

GRASSLAND _____ %
URBAN RESIDENTIAL _____ %
URBAN COMMERCIAL/INDUSTRIAL _____ %
WETLAND _____ %
FOREST _____ %
ROW CROPS _____ %
OTHER (Specify) _____ _____ %

FIGURE A-1 (Continued): METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO PHYSICAL HABITAT ASSESSMENT

Station Number _____

Sediment Composition	Plant Debris	_____ %
	Clay	_____ %
	Inorganic Silt	_____ %
	Organic Sludge	_____ %
	Sand (0.06 mm to 2 mm diameter)	_____ %
	Gravel (>2 mm to 64 mm diameter)	_____ %
	Cobble (>64 mm to 256 mm diameter)	_____ %
	Boulder (>256 mm diameter)	_____ %
	Bedrock or Concrete	_____ %

Sediment Color _____ **Sediment Odor** _____

Oil in Sediment	NONE	LIGHT	MODERATE	HEAVY	**(circle one)**
Embeddedness	NONE	NORMAL	MODERATE	EXTENSIVE	**(circle one)**
Sinuosity	NONE	LOW	MODERATE	HIGH	**(circle one)**

Depth of Fines (In feet using 1 inch diameter probe) _____

Photo Numbers Looking Upstream _____ Looking Downstream _____

Site Location/Map (Draw a map of the site and indicate the area assessed)

Additional Remarks

_____

_____

_____

_____

_____

_____

_____

(Complete both sides of page)

APPENDIX B

NUMBER OF FISH COLLECTED FROM EACH STATION

TABLE B-1: NUMBER OF FISH COLLECTED FROM EACH STATION ON THE CHICAGO SANITARY AND SHIP CANAL, CALUMET-SAG CHANNEL, LITTLE CALUMET RIVER, AND CALUMET RIVER DURING 2009

Fish Species or Hybrid (x)	Chicago Sanitary and Ship Canal			Cal-Sag Channel	Little Calumet River	Calumet River
	Station No. 75 Cicero Avenue	Station No. 41 Harlem Avenue	Station No. 92 Lockport (16th Street)	Station No. 59 Cicero Avenue	Station No. 76 Halsted Street	Station No. 55 130th Street
Gizzard shad	1	8	82	10	15	1
Northern pike	0	0	0	0	1	0
Goldfish	3	2	0	0	96	0
Common carp	96	35	0	17	56	14
Golden shiner	10	2	0	0	12	0
Emerald shiner	1	6	2	0	2	15
Spotfin shiner	6	21	2	1	1	0
Bluntnose minnow	63	82	11	30	5	81
Creek chub	0	0	0	1	0	0
Fathead minnow	0	0	0	0	0	5
Quillback	0	0	0	0	0	2
White sucker	0	0	0	0	17	2
Black buffalo	0	0	0	0	0	4
Channel catfish	5	3	2	0	0	0
Black bullhead	0	0	0	0	4	0
Yellow bullhead	14	16	1	1	5	0
Mosquitofish	1	0	0	0	0	0
Brook silverside	0	0	0	0	0	0
White perch	0	0	0	1	0	0
Yellow bass	2	0	0	0	0	0

TABLE B-1 (Continued): NUMBER OF FISH COLLECTED FROM EACH STATION ON THE CHICAGO SANITARY AND SHIP CANAL, CALUMET-SAG CHANNEL, LITTLE CALUMET RIVER, AND CALUMET RIVER DURING 2009

Fish Species or Hybrid (x)	Chicago Sanitary and Ship Canal			Cal-Sag Channel	Little Calumet River	Calumet River
	Station No. 75 Cicero Avenue	Station No. 41 Harlem Avenue	Station No. 92 Lockport (16th Street)	Station No. 59 Cicero Avenue	Station No. 76 Halsted Street	Station No. 55 130th Street
Rock bass	0	0	0	0	0	31
Green sunfish	8	10	6	9	0	7
Pumpkinseed	44	71	29	0	112	5
Orangespotted sunfish	0	0	0	0	1	0
Bluegill	30	9	4	0	47	4
Pumpkinseed x Bluegill	0	0	3	0	0	0
Largemouth bass	1	0	6	11	15	13
Smallmouth bass	0	0	0	0	0	12
White crappie	0	0	0	0	0	0
Black crappie	0	0	0	0	0	0
Yellow perch	0	0	0	0	1	3
Freshwater drum	0	0	0	5	1	1
Round goby	0	1	0	0	1	21
Total Number of Fish	285	266	148	86	392	221

TABLE B-2: NUMBER OF FISH COLLECTED FROM EACH STATION ON THE DEEP-DRAFT PORTION OF THE NORTH BRANCH CHICAGO RIVER AND NORTH SHORE CHANNEL DURING 2009

Fish Species or Hybrid (x)	North Branch Chicago River			North Shore Channel			
	Station No. 37 Wilson Avenue	Station No. 17 Diversey Parkway	Station No. 46 Grand Avenue	Station No. 35 Central Street	Station No.102 Oakton Street	Station No. 36 Touhy Avenue	Station No. 101 Foster Avenue
Alewife	0	0	0	7	0	1	0
Gizzard shad	4	10	53	6	1	1	37
Goldfish	0	2	0	2	13	0	5
Common carp	13	14	6	13	2	30	5
Common carp x Goldfish	1	0	0	0	0	0	0
Golden shiner	65	31	1	2	49	0	23
Emerald shiner	4	0	1	0	0	0	0
Spotfin shiner	65	36	29	0	13	8	30
Bluntnose minnow	16	12	3	29	86	15	33
Fathead minnow	2	2	0	0	3	3	0
White sucker	22	1	0	8	18	0	10
Spotted sucker	0	0	0	0	0	0	1
Oriental weatherfish	0	1	0	0	2	1	0
Black bullhead	0	0	0	0	1	0	0
Yellow bullhead	4	4	0	2	1	0	2
Channel catfish	1	0	0	0	0	1	1
Blackstripe topminnow	0	1	0	1	3	0	0
Rock bass	0	0	0	17	1	0	0
Green sunfish	1	7	0	4	1	0	0
Pumpkinseed	19	18	2	60	116	11	23

TABLE B-2 (Continued): NUMBER OF FISH COLLECTED FROM EACH STATION ON THE DEEP-DRAFT PORTION OF THE NORTH BRANCH CHICAGO RIVER AND NORTH SHORE CHANNEL DURING 2009

Fish Species or Hybrid (x)	North Branch Chicago River			North Shore Channel			
	Station No. 37 Wilson Avenue	Station No. 17 Diversey Parkway	Station No. 46 Grand Avenue	Station No. 35 Central Street	Station No.102 Oakton Street	Station No. 36 Touhy Avenue	Station No. 101 Foster Avenue
Bluegill	28	18	4	27	10	9	43
Largemouth bass	16	32	19	23	19	4	13
Black crappie	1	0	0	0	2	0	0
Yellow perch	1	0	0	4	3	0	0
Round goby	1	0	0	2	12	0	0
Total Number of Fish	264	189	118	207	356	84	226

TABLE B-3: NUMBER OF FISH COLLECTED FROM EACH STATION ON THE MIDDLE FORK, WEST FORK AND WADEABLE PORTION OF THE NORTH BRANCH CHICAGO RIVER AND SKOKIE RIVER DURING 2009

Fish Species or Hybrid (x)	MFNBCR[1]	WFNBCR[2]		Skokie River		North Branch Chicago River		
	Station No. 31 Lake-Cook Road	Station No. 106 Dundee Road	Station No. 103 Golf Road	Station No. 32 Lake-Cook Road	Station No. 105 Frontage Road	Station No. 104 Glenview Road	Station No.34 Dempster Street	Station No. 96 Albany Avenue
Central mudminnow	4	0	0	0	5	3	3	2
Goldfish	0	0	1	1	0	0	0	14
Common carp	0	3	1	0	0	0	0	0
Golden shiner	0	0	1	0	0	0	0	0
Bluntnose minnow	0	0	1	0	0	0	0	0
Fathead minnow	0	4	0	2	1	0	0	11
White sucker	1	36	0	6	0	0	2	8
Black bullhead	0	0	0	0	0	0	1	0
Yellow bullhead	0	0	2	0	0	0	1	0
Blackstripe topminnow	0	0	2	1	4	0	0	0
Brook stickleback	0	0	0	18	0	0	0	0
Green sunfish	4	1	5	4	14	0	22	2
Pumpkinseed	0	0	0	1	0	0	0	0
Orangespotted sunfish	0	0	0	6	0	0	0	0
Bluegill	0	0	0	0	3	0	0	0
Largemouth bass	1	1	4	37	15	0	2	1
Iowa darter	0	1	0	0	0	0	0	0
Total Number of Fish	10	46	17	76	42	3	31	38

[1]Middle Fork North Branch Chicago River
[2]West Fork North Branch Chicago River

TABLE B-4: NUMBER OF FISH COLLECTED FROM EACH STATION ON HIGGINS CREEK, DES PLAINES RIVER, AND WEST BRANCH DUPAGE RIVER DURING 2009

Fish Species or Hybrid (x)	Higgins Creek	Des Plaines River			WBDPR
	Station No. 78 Wille Road	Station No. 13 Lake-Cook Road	Station No. 22 Ogden Avenue	Station No. 91 Material Service Road	Station No. 64 Lake Street
Central mudminnow	0	0	0	1	0
Grass pickerel	0	0	0	1	0
Common carp	0	0	1	0	1
Spottail shiner	0	0	2	0	0
Spotfin shiner	0	9	9	0	3
Sand shiner	0	0	2	0	0
Bluntnose minnow	0	0	4	2	0
Fathead minnow	27	0	0	0	1
White sucker	0	1	5	7	6
Oriental weatherfish	0	0	0	2	0
Yellow bullhead	0	2	0	2	2
Blackstripe topminnow	0	22	0	2	0
Rock bass	0	4	2	0	0
Green sunfish	0	35	17	8	7
Pumpkinseed	0	0	1	0	1
Orangespotted sunfish	0	0	1	0	0
Bluegill	0	0	10	0	9
Largemouth bass	1	13	3	0	11

TABLE B-4 (Continued): NUMBER OF FISH COLLECTED FROM EACH STATION ON HIGGINS CREEK, DES PLAINES RIVER, AND WEST BRANCH DUPAGE RIVER DURING 2009

Fish Species or Hybrid (x)	Higgins Creek	Des Plaines River			WBDPR[1]
	Station No. 78 Wille Road	Station No. 13 Lake-Cook Road	Station No. 22 Ogden Avenue	Station No. 91 Material Service Road	Station No. 64 Lake Street
Black crappie	0	2	0	0	0
Johnny darter	0	1	0	1	0
Round goby	0	0	2	6	0
Total Number of Fish	28	89	59	32	41

[1]West Branch DuPage River