AMBIENT WATER QUALITY MONITORING
QUALITY ASSURANCE PROJECT PLAN

Revision 2.5
Effective Date: September 1, 2015

Organization: Metropolitan Water Reclamation District
of Greater Chicago
Monitoring and Research Department

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GROUP A: PROJECT MANAGEMENT

A1: Approval Sheet:

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Date 10/26/15

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Analytical Laboratories Division
Date 10/8/15

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Analytical Laboratories Division
Date 10/8/2015

TABLE OF CONTENTS

Page

A3: Distribution List

A copy of this Quality Assurance Project Plan (QAPP) will be distributed to each person signing the approval sheet and each person involved with project tasking identified in Section A4. A copy of this QAPP shall be available on request to any person participating in the project from any of the personnel listed in Section A4. Persons not employed by the Metropolitan Water Reclamation District of Greater Chicago (District) may obtain a copy of this QAPP from the Director of the Monitoring and Research (M&R) Department.

As this document will be updated periodically, the reader is advised to check with the Project Manager for the latest revision if his copy is more than one year old. Revision 2.5 has been prepared following the United States Environmental Protection Agency (USEPA) guidance document EPA QA/R-5 titled "EPA Requirements for Quality Assurance Project Plans," March 2001.

A4: Project/Task Organization

The responsible persons for project management are:

Project Director:
Thomas Granato
Director of Monitoring and Research

Project Manager:
Heng Zhang
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division

IEPA Project Manager:
Gregg Good
Surface Water Section Manager

Project Coordinator:
Jennifer Wasik
Supervising Aquatic Biologist

Environmental Monitoring Manager:
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Assistant Aquatic Biologist

Stickney Analytical Laboratory Manager:
Joseph Calvano
Supervising Environmental Chemist

Calumet Analytical Laboratory Manager:
Victor Olchowka
Supervising Environmental Chemist

Industrial Waste Analytical Laboratory Manager:
Robert Polis
Supervising Environmental Chemist

Egan Analytical Laboratory Manager:
John Chavich
Supervising Environmental Chemist

Analytical Microbiology Laboratory Manager:
Geeta K. Rijal
Supervising Environmental Microbiologist

Organic Compounds Analytical Laboratory Manager:
Anna Liao
Instrument Chemist IV

Laboratory Information Management System (LIMS) Manager:
Diane Moe
Senior Environmental Chemist

Data Review and Reporting Manager:
Zainul Abedin
Biostatistician

Quality Assurance Officer:
John McNamara
Quality Assurance Coordinator

Illinois Environmental Protection Agency Quality Assurance Officer:
Michelle Rousey
Quality Assurance Officer, Bureau of Water

Figure 1 is the organization chart for the project. Primary lines of communication are shown as dashed lines. However, within the District, communication between any of the project participants may occur and is, in fact, encouraged as questions or issues arise.

The Project Director is responsible for the execution of the entire project. The Project Manager has many responsibilities including planning the scope of the project, execution, and reviewing project reports. The Project Coordinator coordinates project activities, prepares project reports, and completes QAPP revisions. The Quality Assurance (QA) Officer is responsible for oversight of quality control for the project.

The Illinois Environmental Protection Agency (IEPA) Project Manager coordinates the efforts of both agencies to ensure that project data will be usable by the IEPA for assessment of water quality. He is assisted by the IEPA QA Officer, who oversees project activities and project quality control.

The Environmental Monitoring Manager is responsible for the execution of field activities and assists with QAPP revisions. The sampling teams collect and preserve samples, make field measurements, and transport the samples to the District laboratories. Several District laboratories analyze project samples. Participant laboratories include the Stickney Analytical Laboratory (SAL), the Egan Analytical Laboratory (EAL) the Industrial Waste Analytical Laboratory (IWAL), the Calumet Analytical Laboratory (CAL), the Analytical Microbiology Laboratory (AML), the Organic Compounds Analytical Laboratory (OCAL), and the Aquatic Ecology and Water Quality Section (AEWQ). All project data is maintained in the District laboratory information management system (LIMS) database.

The LIMS Manager is responsible for collection of project test results and data verifications for SAL, IWAL, EAL, and CAL data. The Data Review and Reporting Manager maintains the District project database in SAS® software and prepares annual summary reports for the project.

A5: Background

The District routinely collects and analyzes water samples from the District service area waterways. "Waterways" as used in this document will mean natural and modified rivers or streams, and man-made canals. This monitoring has been undertaken by the District to determine water quality on an ongoing basis and establish a historical record. A historical water quality database exists back to project inception in 1970.

The Illinois Pollution Control Board (IPCB) designates District service area waterways based on their recreational and aquatic life use potential. Recreational use designations in these waterways include: General Use, Primary Contact, Incidental Contact, Non-Contact, Non-Recreational, and Secondary Contact. Aquatic Life Uses are General Use, Chicago Area Waterway System (CAWS) Aquatic Life Use A, CAWS Aquatic Life Use B, and Indigenous Aquatic Life Use.

The IPCB has established separate water quality standards to support the designated uses for each waterway. Comprehensive assessments of the water quality data from this project are made annually using all applicable water quality standards established by the IPCB.

The water quality data collected from this project have been used, often in conjunction with data from other monitoring studies, to evaluate the impact of District operations and projects, including the WRPs, the pretreatment program, the flood and pollution control Tunnel and Reservoir Plan, the Sidestream Elevated Pool Aeration Stations, and the Instream Aeration Stations.

The water quality data provide a broad surveillance of significant discharges to the waterways. The data also may have potential use for evaluation of other factors affecting water quality, including intermittent stormwater releases and release of pollutants from bottom sediment in the waterways.

Another goal of this project is to coordinate the waterway monitoring performed by the District with the waterway monitoring performed by the IEPA's Bureau of Water. The District will review key aspects of its program, including sampling locations, sampling frequency, sampling methods, parameters analyzed, and analytical capability, to determine how to best provide water quality data usable by both agencies.

This QAPP will address how to conduct the monitoring of the waterways in a manner that will efficiently utilize available resources and produce water quality data that will meet or exceed the measurement quality objectives for all intended uses of the data.

A6: Project/Task Description

Monitoring is conducted on 13 waterbodies at 28 sampling stations. The total number of river miles monitored is approximately 225. The following rivers, creeks, man-made channels, and a canal are monitored for water quality.

Des Plaines River System

- Higgins Creek
- Salt Creek
- Des Plaines River
- West Branch DuPage River

Chicago River System

- North Branch Chicago River
- North Shore Channel
- Chicago River
- South Branch Chicago River
- South Fork South Branch Chicago River
- Chicago Sanitary and Ship Canal

Calumet River System

- Grand Calumet River
- Little Calumet River
- Calumet-Sag Channel

Figure 2 is a map showing the waterways in the Chicago metropolitan area and the current sampling locations.

A description of the 28 monitoring stations is provided in Tables 1, 2, and 3. Table 1 lists all current and discontinued sampling locations with their station identification number and IPCB use classifications. Table 2 shows the latitude and longitude of each sampling station. Table 3 shows the United States Geological Survey quadrant, township, range, section, and quarter section of each sampling station.

All locations are sampled monthly, except Lockport Powerhouse and Lock (92) which is sampled weekly. Grab samples taken at the surface are collected at each sample location for the analysis of most measured analytes. These water samples are analyzed for a wide range of parameters, including alkalinity, solids, ammonia, nitrate, phosphorus, total or dissolved metals, cyanide, phenol, fecal coliform, organic priority pollutants, nonylphenols, gross alpha radioactivity, and gross beta radioactivity. A special sampling device is used to collect samples at a depth of 3 feet for dissolved oxygen analysis and bacterial analysis. Water temperature and pH are measured onsite at each sampling location. After login, metals samples are transported to EAL for analysis, sulfate and low level mercury samples are transported to CAL, and the rest of the samples are analyzed at SAL.

Following collection, the samples are transported to the Cecil Lue-Hing Research and Development Complex at the Stickney WRP and the OCAL at the John E. Egan WRP for login. After login, metals samples are transported to EAL for analysis, sulfate and low level mercury samples are transported to CAL, and the rest of the samples are analyzed at SAL. The waterways monitoring data are maintained in computer databases. Exceedances of water quality standards are reported quarterly to the Project Coordinator. Annual summary reports are prepared that summarize water quality and compare data upstream and downstream of the District's WRPs.

A7: Quality Objectives and Criteria for Measurement Data

Many analytes measured for this project are present in low concentrations throughout the waterway systems. Analyte concentrations will vary as discharged effluents and stormwater runoffs are introduced into the waterways. All analytes are subject to chemical, biological, and physical processes that will alter their presence in the waterway. It is the intent of this project to employ methods of measurement that will detect and quantify all analytes of interest wherever possible.

Although there are several intended and potential uses of the data, minimum measurement criteria will be established at the lowest analyte concentration required for actual uses of the measurement data. Where no minimum measurement criteria can be identified, the water samples will be analyzed to the lowest concentration readily achievable by District laboratories.

Currently, except for the IPCB water quality standards, there are no other specified minimum measurement criteria for waterways monitoring data. Therefore, this project will use the most restrictive water quality standard applicable to waterways within the District's service area to establish the minimum measurement criteria for each parameter. The minimum measurement criteria will apply for all samples irrespective of the IPCB waterway designation in order to maintain uniform measurement objectives for the project.

The monitored parameters and the established minimum measurement criteria are shown in columns 1 and 3 of Attachment A. Analytes not subject to an IPCB water quality standard will not have specified minimum measurement criteria. The minimum measurement criteria will be adjusted accordingly when IPCB water quality standards are changed or as dictated by other planned uses of the data.

Column 2 of Attachment A gives the Reporting Limits (RLs) for the project, which are established by ALD. RLs are mathematically derived from MDLs. For parameters where RLs are not applicable, such as pH, solids, temperature, and dissolved oxygen, the minimum measurement criteria shown in column 3 of Attachment A are the sensitivities, to be obtained by the measurement method. Sensitivity of a method shall be defined as the difference in concentration that can be distinguished by measurement.

A8: Special Training/Certification

1. Sample collection personnel shall be trained in proper sample collection methods by their supervising Aquatic Biologist.

2. Microbiological analysis shall be performed by analysts who have been certified as competent by the Illinois Department of Public Health (IDPH).

3. Each section of the Analytical Laboratories Division (ALD) has successfully maintained accredited status as certified by the IEPA following the NELAC Institute (TNI) standards.

4. The laboratory contracted to perform radiochemical analyses shall possess National Environmental Laboratory Accreditation Program accreditation and maintain certification for the examination of radiochemical parameters from any state within the United States.

A9: Documents and Records

1. The Project Coordinator and QA Officers for the District and the IEPA shall retain copies of all annual updates and revisions of this QAPP.

2. The Analytical Laboratory Managers and QA Officers for the District and the IEPA shall retain copies of all analytical procedures used for analysis of project samples.

3. The Project Coordinator shall retain copies of all laboratory analytical reports and correspondence with the laboratories.

4. The Project Coordinator shall retain copies of all communications to and from outside agencies and other interested parties.

5. All the records and reports listed above will be retained for 10 years at the Cecil Lue-Hing R&D Complex located at the Stickney WRP.

GROUP B: DATA GENERATION AND ACQUISITION

B1: Sampling Process Design (Experimental Design)

Selection of Sampling Locations. The 28 sampling locations have been previously identified in Tables 1, 2, and 3. Criteria for selecting sampling locations include:

1. Downstream of the point at which major tributaries enter the District's service area.

2. Near the intake control structures where water is diverted into the waterways from Lake Michigan.

3. Upstream and downstream of District facilities, including WRPs, aeration stations, and pumping stations.

4. At the confluence of significant waterway branches.

5. At the Lockport control facility where most flow from the District service area leaves the waterways system.

6. Near the downstream end of a reach designated by the IEPA as a waterbody segment or assessment unit.

Sampling locations must be readily accessible and judged safe for all sampling activities. Bridges over the waterways have provided ideal sampling locations. For locations where bridge access or height will not allow for safe sampling, samples may be collected by boat. Occasionally, if a bridge is under construction or if the sampling schedule required it, water samples that are normally collected by bridge may also be sampled by boat, in accordance with the procedures described in Appendix 1.

The IEPA utilizes water quality data to prepare its annual water quality report as required by Section 305(b) of the Clean Water Act. For this purpose, the IEPA assesses conditions for waterbody segments and has defined these segments for all waters in the state.

Sampling locations may be added or removed from the monitoring network based upon periodic assessments of monitoring needs and resources available.

Sampling Frequency. All 28 sampling locations are monitored monthly, except Lockport Powerhouse and Lock (92), which is sampled weekly. The sampling frequency for each parameter is shown in Attachment B. This schedule provides sampling through seasonal changes and a sufficient number of samples to adequately characterize water quality annually and to

identify long-term trends over many years. Monthly sampling may also detect an abrupt degradation of water quality, allowing the opportunity for the District to respond appropriately.

Water quality samples are collected weekly at the Lockport Powerhouse and Lock because this facility controls the release of water from the Chicago Sanitary and Ship Canal, which contains, at that location, the combined flow from the Chicago and Calumet River Systems. The treated wastewater from four District WRPs covering most of the District's service area flows through the Lockport Powerhouse and Lock.

Sampling frequency may be modified temporarily if there is a specific need to acquire additional data.

Selection of Parameters for Monitoring. Parameters selected for analysis are those that have IPCB water quality standards, and other parameters that have been used to characterize instream water quality. Certain parameters may only be analyzed at stations in a particular designated use category waterway. These are identified in Attachment A. Periodically, the parameters monitored are reviewed. A parameter may be dropped from monitoring if the parameter is found to be non-essential for the goals of the project or if the parameter is judged too resource intensive to analyze. If parameters are needed for a monitoring purpose, they will be added to the project.

B2: Sampling Methods

Manual sampling from a bridge or boat is conducted on each Monday of the month. When a Monday is a District paid holiday the sampling will be performed on the following Tuesday. Two person teams, each comprised of Pollution Control Technicians or available trained Aquatic Ecology and Water Quality (AEWQ) Section personnel, perform the sampling under the direction of the supervising Assistant Aquatic Biologist.

The eleven locations on the Des Plaines River System are sampled on the first Monday of each month. The four most northern sampling locations on the Chicago River System are sampled on the second Monday of each month. The remaining six locations on the Chicago River System are sampled on the third Monday of each month. The six sampling locations on the Calumet River System are sampled on the fourth Monday of each month. The Lockport sampling location on the powerhouse forebay catwalk is sampled weekly.

The surface water grab samples are collected using a stainless steel bucket. The bucket is lowered into the waterway from the upstream side of the bridge at the most central location of the waterway. The sampling time is recorded on the sample collection sheet (Appendix 2). The bucket is submerged, filled, and then raised to the top of the bridge. The water temperature and pH are measured immediately from the stainless steel bucket with a calibrated pH/temperature probe and recorded on the sample collection sheet. The contents of the bucket are then discarded and the bucket is lowered and refilled as necessary to provide sample for the individual sample aliquots. A separate water sample is taken for measurement of DO using a special sampling device that prevents aeration of the sample during collection. The sterile sample container for bacterial analysis is filled separately in the waterway to prevent contact of the sample with non-sterile surfaces.

There are exceptions to sampling from bridges. Stephen Street (48) is sampled from the District's Pollution Control Boat in the center of the waterway, since the bridge no longer exists. Water samples are also routinely collected from the boat for safety reasons at Cicero Avenue (75) and Harlem Avenue (41) on the Chicago Sanitary and Ship Canal, Route 83 on the Cal-Sag Channel (43), and Ashland Avenue on the Little Calumet River (57). Occasionally, other stations may also be sampled by boat for logistical reasons, including bridge construction or coordination with other special sampling activities.

The individual sample containers are filled in accordance with the sampling procedures described in Appendix I. The individual containers for sample collection are prepared by the laboratory performing the sample analysis. Chemical preservatives as necessary are placed in the containers by the laboratory of origin before sample collection. Specific information regarding sample containers and chemical preservatives is found in Table 4.

Preprinted adhesive sample labels with unique LIMS identification numbers are placed on each container prior to filling. The sampling team completes the sample collection sheet (Appendix II) in the field as each sample is collected.

B3: Sample Handling and Custody

All sample containers are chilled in an ice-filled cooler immediately after collection and kept in ice during transport to the laboratories except for low level mercury samples.

All water samples are transported to the SAL after collection accompanied by sample collection sheets. The laboratory physically receives the samples from the Industrial Waste Division transporter. An environmental chemist, or a laboratory technician under the direct supervision of a environmental chemist, "receives" the samples into the District's LIMS using a barcode scanner. Each sample is inspected against the laboratory's sample receiving checklist for proper container, proper labeling, sufficient volume, and general appearance. Any missing samples or aliquots are noted on the sample receiving checklist. Sample arrival temperatures are measured using an infrared thermometer calibrated against a NIST traceable certified thermometer ("NIST" is the National Institute of Standards and Technology, United States Department of Commerce), and recorded. Since the time between sampling and arrival at the laboratory is only a few hours, samples may not always reach the 0.1 to 6 degrees C (°C) required for thermal preservation. Samples are acceptable if "evidence of chilling" has begun. Samples that require thermal preservation are refrigerated after sample acceptance in the laboratory. Samples for biological analysis and radiochemical analysis are then routed to the appropriate laboratories at the Cecil Lue-Hing R&D Complex. Samples for organics analysis are transported to the OCAL at the John E. Egan WRP. The remaining samples for inorganic analysis are received by the SAL. Following log-in at the SAL, the samples for metals analyses are transported to the Egan Laboratory, and the aliquot for sulfate and mercury analysis are transported to the CAL within 24 hours by the Maintenance and Operations courier.

Each laboratory receives the samples by logging them into the laboratory logbook and/or laboratory LIMS. Maximum holding times before analysis, as stated in applicable laboratory

method standard operating procedures (SOPs), are adhered to. Parameters of particular concern, because of short maximum holding times, include: bacterial analysis (six hours), dissolved oxygen (eight hours), and hexavalent chromium (24 hours).

Copies of the sample collection sheets, along with the sample receiving checklist, are retained by the SAL. The pH and temperature for each field sample are entered into the LIMS by AEWQ Section personnel.

The original sample collection sheets are returned to Environmental Monitoring Manager for review. The Environmental Monitoring Manager is responsible for the execution of field operations and corrective actions for field related quality control problems or other nonconformance issues.

B4: Analytical Methods

The analytical methods shown in Table 5 have been selected to meet the minimum measurement criteria presented in Attachment A. Column 1 of Table 5 gives the analytes to be measured, column 2 shows the method to be used by the laboratory, and column 3 the method reference. Except for chloride, chlorophyll, and nonylphenol, all methods used by the District are USEPA approved methods listed in 40 CFR Parts 136, 141, and 145. Approved USEPA methods are not available for the determination of chlorophyll and nonylphenols.

Table 6 shows laboratory preservation and maximum holding time from the time of sampling for each analyzed parameter. Column 2 of Table 6 gives the laboratory preservation requirements. The maximum holding time for each parameter is given in column 3 of Table 6. Refrigeration of samples that require thermal preservation is maintained at 4°C, but temperatures in the range of 0.1 to 6°C are considered acceptable. Preservation and maximum holding times are in accord with those given in 40 CFR Part 136.

The laboratory where each analysis will be performed is identified in column 2 of Table 7. Column 3 of Table 7 identifies the laboratory method SOP. The analytical method SOPs are incorporated into this QAPP by reference in column 3 of Table 7. SOPs for analytical methods are available from the the responsible Laboratory Manager identified in Section A4.

Attachment A compares the minimum measurement criteria against the reporting limit (RL) achieved by the designated District laboratory. All analytes meet the minimum measurement criteria.

All data collected for this project will be reported to the analyte RL. Test results less than the RL will be reported as either zero or as less than the numerical value of the RL.

B5: Quality Control

Equipment blanks will be used to verify that field samples are free of contamination. Each sampling team will prepare equipment blanks for the appropriate parameters at a sampling location on each day of sampling. The SAL will review the test results. Whenever significant contamination is found, the laboratory will initiate an investigation and implement the necessary corrective actions.

The individuals responsible for verification that proper procedures are followed in matters concerning sampling methods, sample preservation, and sample custody to the delivery of samples to the SAL will be the Environmental Monitoring Manager and his/her supervisor. For more information please see sections B2: Sampling Methods, B3: Sample Handling and Custody, and C1: Assessment and Response Actions. For any quality control or other nonconformance issue, the Environmental Monitoring Manager and his/her supervisor will submit an investigation and corrective action report to the Project Manager, who will send copies to the persons listed on the approval page.

It shall be understood that all measurements, regardless of the sample concentration, must have known and satisfactory accuracy and precision. Because various analytical procedures will be employed for sample analysis, specific criteria for accuracy and precision will not be provided in this document. Rather, satisfactory accuracy and precision shall be considered to be that which is consistent with the USEPA approved methods used to analyze the samples. All measurements must be derived in an environment of an adequate quality control program including statistical process control wherever applicable. The laboratory QAP and laboratory SOPs should be referred to for specific information relating to quality control. Each section of ALD has successfully maintained accredited status as certified by the IEPA following TNI standards.

The individuals responsible for verification that analytical methods and other laboratory procedures are being properly executed are the Laboratory Managers. The Laboratory Managers are also responsible for the reliability of project analytical data. For any quality control or other nonconformance issue that may have affected the reliability of project data, the responsible Laboratory Manager will submit an investigation and corrective action report to the Project Manager, who will send copies to the persons listed on the approval page.

B6: Instrument/Equipment Testing, Inspection, and Maintenance

All instrumentation and equipment used in the laboratory are maintained as required by the manufacturer’s manuals and the laboratory SOPs.

Each laboratory is responsible for maintaining an adequate supply of spare parts to perform normal maintenance procedures. The three regional WRPs, at which the participating laboratories are located, maintain storerooms where frequently used supplies and consumables are inventoried. Major laboratory instrumentation is covered by maintenance/service contracts with qualified service representatives. Each laboratory also has an account to purchase any

needed parts or consumables not inventoried in the WRP storeroom or in an emergency or other unforeseen situation.

The YSI Model 63 handheld pH/temperature meters used for field measurements (or similar model) are maintained by AEWQ Section. These instruments are calibrated for pH in the laboratory on the first day of the week before use. Calibration records are kept by the AEWQ laboratory. Sample collection personnel sign out a calibrated instrument on the day of sampling and return it on the same day after sampling. The meter operation and calibration are checked when each instrument is returned to the laboratory. The temperature calibration is verified at least annually against a NIST traceable thermometer. The SAL is responsible for stocking spare parts for these meters, performing routine maintenance, and securing service from qualified service representatives as needed.

B7: Instrument Calibration and Frequency

All instrumentation used for testing shall be calibrated each day of use as directed by manufacturer's manuals and laboratory SOPs. General guidelines and requirements regarding calibration of laboratory equipment are contained in the laboratory SOPs. Laboratories that participate in an accreditation program also will comply with the requirements for calibration maintained by the accreditation program.

All instrumentation is uniquely identified by serial number or other means. Wherever possible, NIST traceable standards are used for calibration of instruments. Calibration records are kept each time laboratory instrumentation and equipment are calibrated, and the calibration records and quality control samples are unmistakably identified for each batch of test results.

B8: Inspection/Acceptance of Supplies and Consumables

Supplies and consumables shall be inspected by the laboratories and accepted in accordance with all laboratory procedures and specifications contained in laboratory QAPs or SOPs. The laboratory section supervisors are responsible for verifying that supplies and consumables meet the specifications contained in the method SOPs.

B9: Non-direct Measurements

Non-direct measurements are not required for this project.

B10: Data Management

The District maintains several networked servers. The network may be accessed by personal computers and workstations from any District facility. Computer software used for this project includes a fully networked LIMS and Excel® software and SAS® software on selected

workstations. The Thermo LabSystems SMW (SampleManager for Windows) version 10.2.0.0 is customized to incorporate procedures employed at District laboratories. The District LIMS supports numerous features including: barcode usage, prelogging of samples by either the sample submitter or laboratory personnel, label generation, sample login, sample receiving of prelogged samples, sample batching, instrument interfacing, manual data entry, automated calculations, control limit checking for each laboratory control sample, control chart maintenance, NPDES limit checking, industrial waste limit checking, facilitated data handling, and data reporting. The LIMS is utilized by all laboratories participating in this project.

Most chemical analytical data have resided in the District LIMS since 1996. Historical data back to 1970 are stored in Excel® spreadsheet files and SAS® files. Whenever data are manually entered into a software file from hardcopy reports, each number is verified to ensure accuracy of manual entry.

As the waterways are sampled routinely, the samples are prelogged into the District's LIMS. Environmental Monitoring Manager generates sample labels for sample containers before sample collection. The labels contain information including sample location, sample type, and unique sample ID with barcode. Each sample container has a unique sample ID comprised of the sample number and aliquot designation.

The AML, AEWQ, and the OCAL follow documented procedures for sample login, sample acceptance, analysis, and data verification. Test data from the AML and AEWQ are manually entered into LIMS, while OCAL data is automatically uploaded from instrument to LIMS.

Water samples for radiochemical analysis are received and logged in by the SAL. Samples are preserved by AEWQ staff and picked up by the contracted laboratory, who completes a chain of custody form. The analytical results are reviewed and manually entered into LIMS by an Aquatic Biologist.

While the SAL employs the most computerized system for sample tracking and data handling, all participating laboratories follow similar procedures. The analyst assigned to receive the samples in the SAL uses a barcode scanner to log as received the “general chemistry” samples. All samples are checked and any missing sample containers are noted in the sample log. The analyst checks to make certain that sample acceptance criteria, including appropriate sample containers and thermal preservation, are satisfactory.

After the laboratory receives the samples, sub-samples are poured as required. The samples are then distributed to the appropriate analytical sections for analysis. As analyses are completed, the test results are entered into the LIMS generally by data file upload from the laboratory instrument. Test results are reviewed and verified by each analytical section supervisor. Water quality limits are checked for each sampling station for the applicable General Use or Secondary Contact water quality limit. An exceedance of these limits prompts retesting for confirmation. The highest confirmed value is reported.

Retesting for analytes with regulatory limits is only done for a confirmed QC problem in the execution of analysis or if the regulatory limit has been exceeded. No retesting will be

performed on the basis of historical limits or multi-day limits without consulting first with the sample submitter for information about any unusual conditions that would corroborate the test results. When such information is not available and a retest is requested, the sample submitter's authorization to conduct the retest should be in writing for documentation purposes. In those instances where retesting is performed for reasons other than a QC failure or to confirm a regulatory limit exceedance, then the highest confirmed value is reported unless otherwise specified above.

As sample analysis in the Analytical Laboratories Division (ALD) Laboratories is completed each month, the approved test data are collected from the LIMS Oracle® database and transferred into an Excel® spreadsheet. To simplify data handling, this spreadsheet is also used to collect field test data (pH and temperature) and test data from the AML (fecal coliform) and the radiochemistry analyses (gross alpha and gross beta radioactivity). The ALD Excel® spreadsheet includes all parameters, except for organics data. Generally, analytical data from any month is expected to be completed and available to data users within 30 days after the end of that month.

The monthly spreadsheet from the ALD laboratories is checked for completeness and atypical test data. This review is performed by the LIMS Manager. When atypical test data are found, they are reported to the appropriate analytical section supervisor for further investigation. If the investigation does not reveal a reason for the atypical data, the section supervisor is requested to reanalyze the sample provided that sufficient sample is available and the maximum holding time has not been exceeded. The retest result is reported as the valid result except when the original test result exceeds a water quality standard. If a water quality standard is exceeded by the original test result, and no error is found that invalidates the original test result, then the highest test result (original or retest) is reported.

Following final approval of ALD laboratory data, the ALD Excel® spreadsheet file is sent to the Biostatistician who creates a file in SAS® (Statistical Analysis Software) from the Excel® data file. A second Excel® file from the Organic Compounds Analytical Laboratory containing the organics test data for BETX is sent to the Biostatistician, and it is also uploaded into SAS®. SAS® is the statistical analysis software used to review and analyze the data.

Currently, the Biostatistician produces a comprehensive water quality report annually.

The annual water quality report presents the following:

1. Annual parameter averages at each sampling location for each of the previous 11 years.

2. Statistical comparison of water quality data upstream and downstream of the District's WRPs.

GROUP C: ASSESSMENT AND OVERSIGHT

C1: Assessment and Response Actions

Random surveillance of a sampling team is conducted by the Environmental Monitoring Manager to verify that water samples are being collected properly and sampling procedures are followed. The results of each surveillance are documented by the Environmental Monitoring Manager. As stated in Section B5, the Environmental Monitoring Manager and his/her supervisor will submit investigation and corrective action reports for all quality control and other nonconformance problems dealing with field procedures to the Project Coordinator with copies to the persons listed on the approval page of this QAPP.

All laboratories maintain internal quality control programs that are described in their quality assurance plans. The ALD Laboratories maintain statistical process control for most analytical procedures. Laboratory assessment activities require investigation and corrective actions for all quality control problems and other nonconformance issues. As stated in Section B5, when the reliability of project data may have been affected by a quality control problem or other nonconformance issue, the responsible Laboratory Manager will submit a copy of the investigation and corrective action report to the Project Coordinator with copies to the persons listed on the approval page of this QAPP.

Also, the responsible Laboratory Manager shall make certain that the project data associated with any quality control or other nonconformance issue is made available to data users with the appropriate data qualification. When data previously released to data users may have been affected by a quality control problem or other nonconformance issue, the Manager shall notify data users of the problem and put in the appropriate data qualifiers in databases used by the District for storage of project data.

The SAL, CAL, EAL, and IWAL participate in two proficiency-testing studies each year. These proficiency studies are the semi-annual Water Pollution Study where data from the fist study is combined with the National Pollutant Discharge Elimination System (NPDES) Discharge Monitoring Report Quality Assurance (DMR-QA) Study. The NPDES DMR-QA Study may be a combined study with one of the Water Pollution Studies. Systematic investigations are conducted for all unacceptable results. The investigation and corrective action reports prepared by the Laboratory Manager and his/her staff are reviewed by the ALD Assistant Director of M&R, by the QA Coordinator, and often by the Director of M&R.

The Organic Compounds Analytical Laboratory participates in two proficiency-testing studies each year and conducts investigations for unacceptable results in a manner similar to that followed by the other ALD Laboratories.

The AML is certified by the IDPH and must successfully pass a biannual on-site audit conducted by the IDPH.

All ALD laboratories as a requirement of their accreditation are audited annually by their Quality Assurance Coordinator and bi-annually by the IEPA.

C2: Reports to Management

The Project Manager and all those on the approval list will receive all investigation and corrective action reports concerning quality control problems and other nonconformance issues from field personnel and participating laboratories.

Project-related systems audits or special data quality assessments are undertaken on a random basis.

GROUP D: DATA VALIDATION AND USABILITY

D1: Data Review, Verification, and Validation

The laboratory data are reviewed and verified as described in Section B10, Data Management. The Biostatistician also reviews the data after it is transferred into the SAS® software. If errors are discovered, the Biostatistician reports them to the Project Coordinator for investigation and resolution.

D2: Verification and Validation Methods

Sample collection records can be verified by the Environmental Monitoring Manager identified in Section A4. Laboratory data shall be verified as necessary by the LIMS Manager identified in Section A4 and the Laboratory Manager of the laboratory that produced the data. All field and laboratory records will be kept for a minimum of five years. Laboratory records that are stored include calibration data, raw data, bench records, and data for quality control samples.

When verification of data results in a change to the project-related data, the Project Manager shall inform data users of the problem and make certain that all databases known to contain the affected data are corrected as necessary.

The person designated as the Project Coordinator (Section A4) has all calculations used for checking applicable IPCB water quality standards. She should be consulted regarding any questions pertaining to compliance with water quality standards and the reporting of data. All data handling and calculations for the water quality report are performed by the Biostatistician using SAS® software and SAS® user programs.

The Project Manager and the QA Officer shall be informed of all situations where data integrity has been found compromised by errors including storage of incorrect data or the corruption of stored data. All responsible persons identified in Section A4 and all known data users shall be informed of data problems when they are discovered and the corrective action taken. The QA Officer shall prepare the disclosure report for distribution.

D3: Reconciliation with User Requirements

The QAPP shall govern the operation of the project at all times. Each responsible person shall adhere to the procedural requirements of the QAPP and ensure that subordinate personnel do likewise.

This QAPP shall be reviewed annually by the Project Coordinator to ensure that the project will achieve all intended purposes. The annual review shall address every aspect of the program including:

1. The adequacy and location of sampling stations.
2. The adequacy of sampling frequency at each location.
3. Sampling procedures.
4. The appropriateness of parameters monitored.
5. Changes in data quality objectives and minimum measurement criteria.
6. Whether the data obtained met minimum measurement criteria.
7. Analytical procedures.
8. The quarterly violations reports and the annual project report.
9. Corrective actions taken during the previous year for field and laboratory operations.
10. Coordination of the project with the IEPA.
11. Review of other user requirements and recommendations.

The project will be modified as directed by the Project Director. The Project Manager shall be responsible for the implementation of changes to the project and shall document the effective date of all changes made.

It is expected that from time to time, ongoing and perhaps unexpected changes will need to be made to the project. Changes or deviations in the operation of the project shall not be made without authorization by the Project Director. The need of a change in project operation should be conveyed by the appropriate responsible person to the Project Coordinator. Data users and other interested persons may also suggest changes to the project to the Project Coordinator.

The Project Coordinator shall evaluate the need for the change, consult with other responsible persons as appropriate, and make a recommendation to the Project Director for approval. The Project Coordinator shall, in a timely manner, inform the appropriate project personnel of approved changes in project operation.

Following approval, a memorandum documenting each authorized change shall be prepared by the Project Coordinator and distributed to those on the approval list, as well as the other Assistant Directors of the M&R Department. Approved changes shall be considered an amendment to the QAPP and shall be incorporated into the QAPP when it is updated.

The Project Coordinator will prepare a QAPP update if major changes have taken place.

REFERENCES

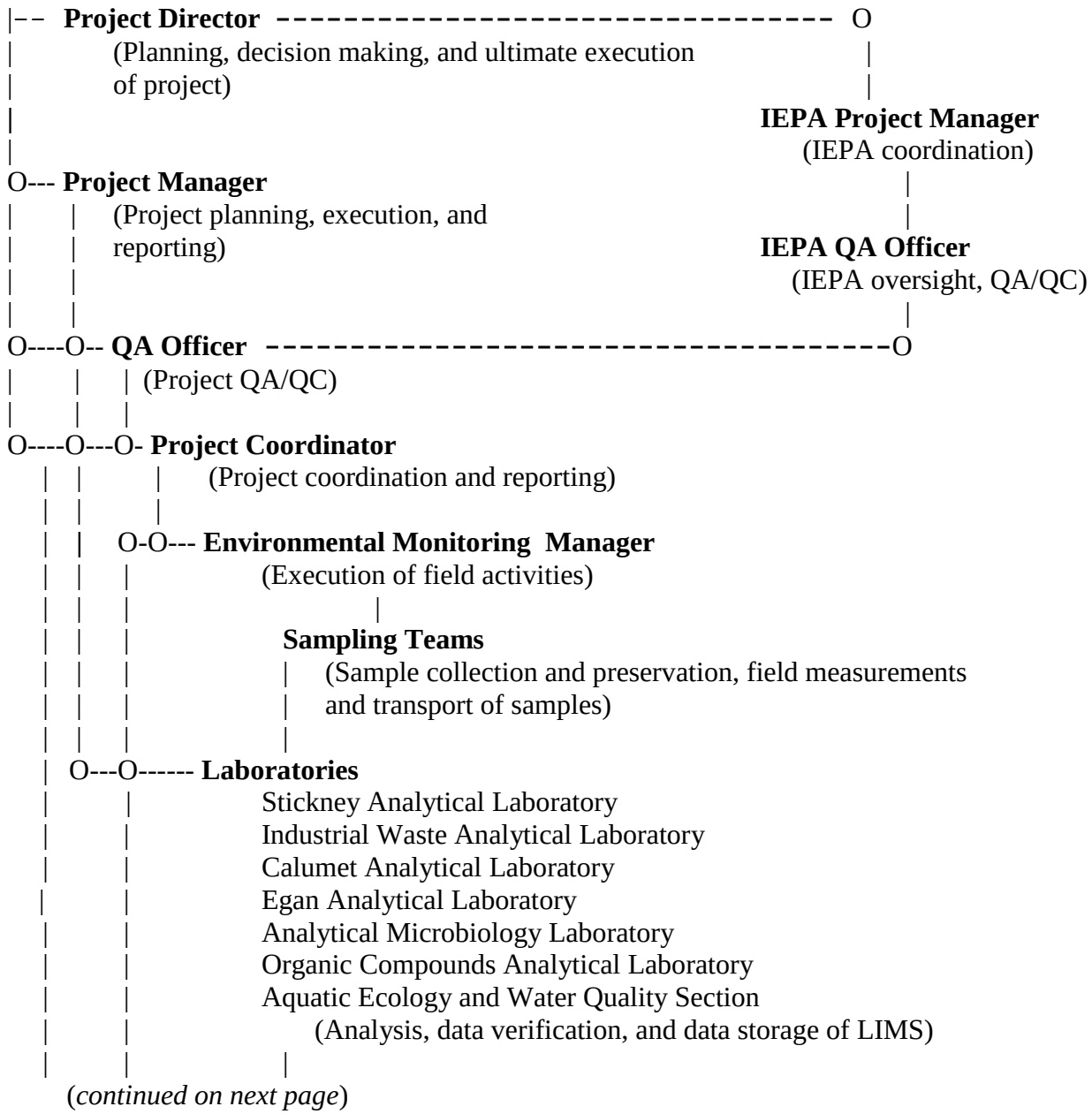
"1999 Annual Summary Report, Water Quality Within the Waterways System of the Metropolitan Water Reclamation District of Greater Chicago," Report No. 01-12, Metropolitan Water Reclamation District of Greater Chicago, October 2001.

Environmental Protection Agency, "Guidelines Establishing Test Procedures for the Analysis of Pollutants," Code of Federal Regulations, Volume 40, Part 136, March 26, 2007.

Standard Methods for the Examination of Water and Wastewater, Prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation, Washington, DC, 20th ed., 1998.

State of Illinois Rules and Regulations, Title 35: Environmental Protection, Subtitle C: Water Pollution, Chapter I: Pollution Control Board, August 1, 2015.

FIGURE 1: AMBIENT WATER QUALITY MONITORING PROJECT ORGANIZATION CHART



(*continued on next page*)

FIGURE 1 (Continued): AMBIENT WATER QUALITY MONITORING PROJECT ORGANIZATION CHART

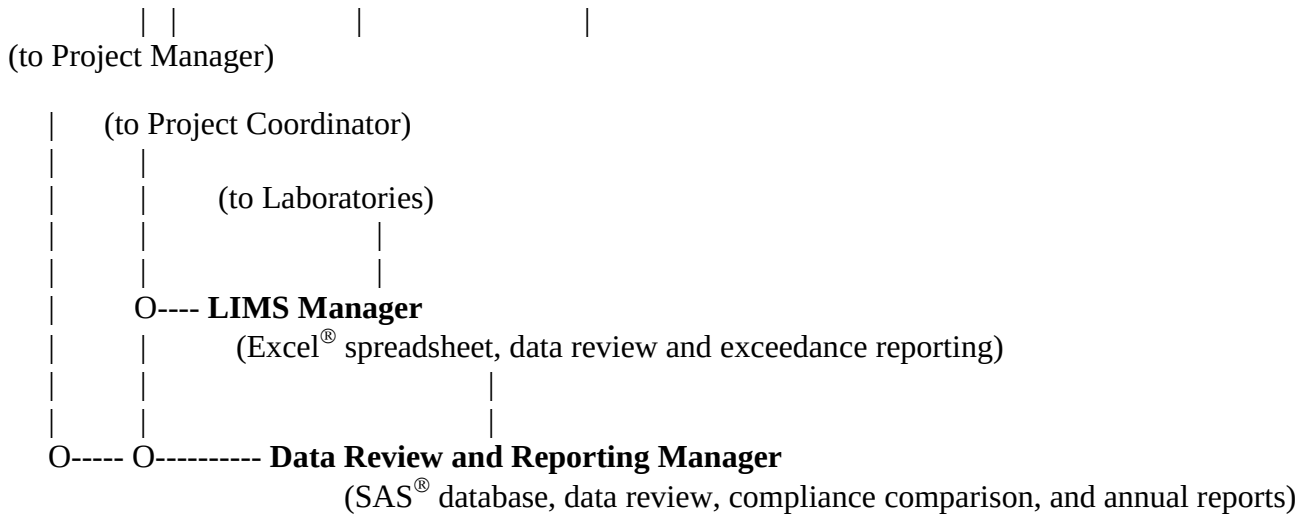


FIGURE 2: AMBIENT WATER QUALITY MONITORING PROGRAM
WATERWAY SAMPLE STATIONS

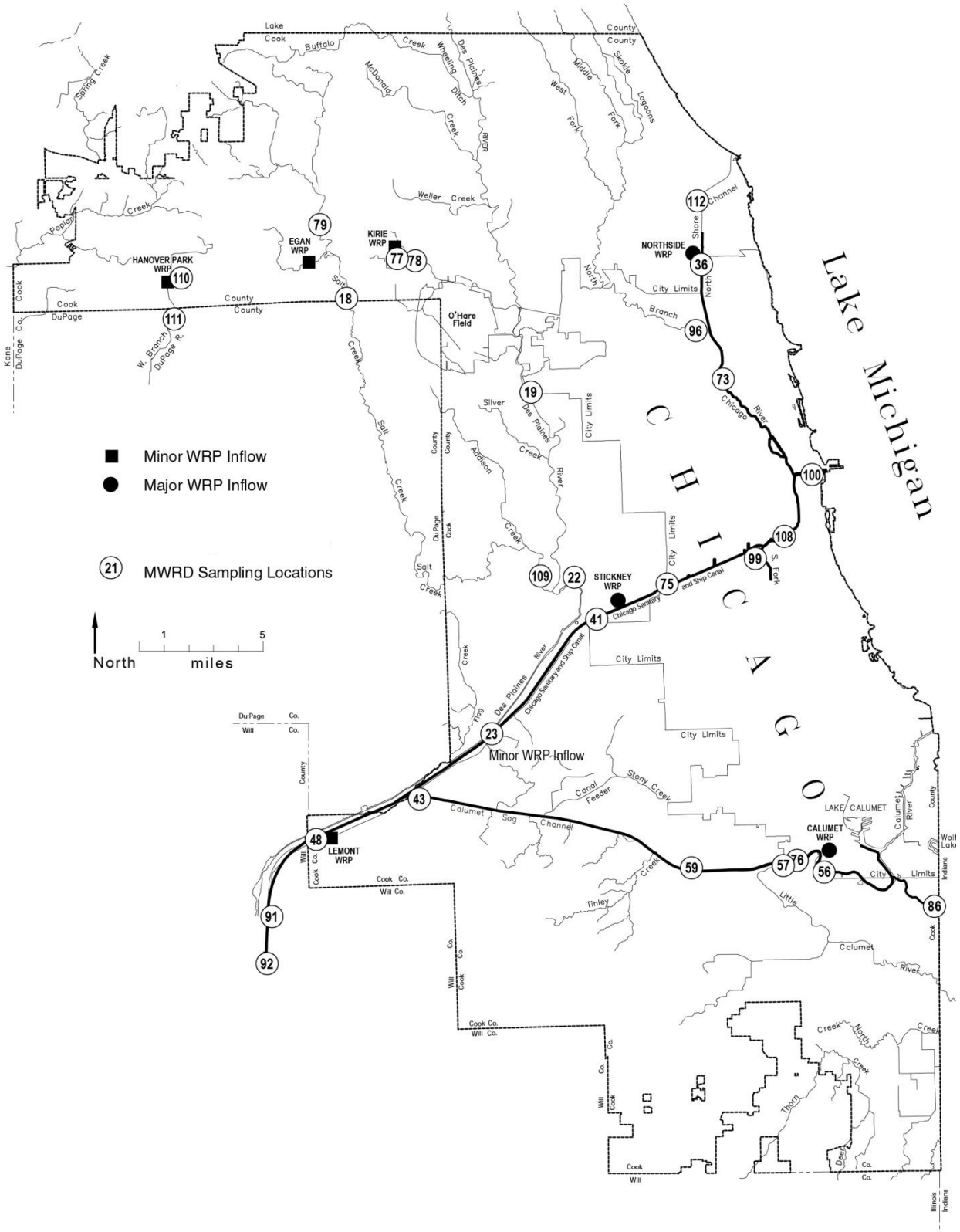


TABLE 1: SAMPLING LOCATIONS

Station	Location	IEPA Classification
	Chicago River System	
106	Dundee Road, West Fork North Branch of Chicago River	General Use
103	Golf Road, West Fork North Branch of Chicago River	General Use
31	Lake-Cook Road, Middle Fork North Branch of Chicago River	General Use
104	Glenview Road, Middle Fork North Branch of Chicago River	General Use
32	Lake-Cook Road, Skokie River	General Use
105	Frontage Road, Skokie River	General Use
34	Dempster Street, North Branch of Chicago River	General Use
96	Albany Avenue, North Branch of Chicago River*	General Use
35	Central Street, North Shore Channel	General Use
112	Dempster Street, North Shore Channel*	General Use
102	Oakton Street, North Shore Channel	General Use
36	Touhy Avenue, North Shore Channel*	CAWS A/PC
101	Foster Avenue, North Shore Channel	CAWS A/PC
37	Wilson Avenue, North Branch of Chicago River	CAWS A/PC
73	Diversey Parkway, North Branch of Chicago River*	CAWS A/PC
46	Grand Avenue, North Branch of Chicago River	CAWS A/PC
74	Lake Shore Drive, Chicago River	General Use
100	Wells Street, Chicago River*	General Use
39	Madison Street, South Branch of Chicago River	CAWS A/PC
108	Loomis Street, South Branch of Chicago River*	CAWS A/PC
99	Archer Avenue, South Fork South Branch of Chicago River*	IAL/SC
40	Damen Avenue, Chicago Sanitary and Ship Canal	CAWS B/ICR
75	Cicero Avenue, Chicago Sanitary and Ship Canal*	CAWS B/ICR
41	Harlem Avenue, Chicago Sanitary and Ship Canal*	CAWS B/ICR
42	Route 83, Chicago Sanitary and Ship Canal	CAWS B/ICR
48	Stephen Street, Chicago Sanitary and Ship Canal*	CAWS B/NR
92	Lockport Powerhouse Forebay*	CAWS B/NR
	Calumet River System	
49	Ewing Avenue, Calumet River	CAWS A/NCR
50	Wolf Lake, Burnham Avenue	General Use
55	130th Street, Calumet River	CAWS A/ICR
86	Burnham Avenue, Grand Calumet River*	CAWS A/ICR

TABLE 1 (Continued): SAMPLING LOCATIONS

Station	Location	IEPA Classification
	Calumet Waterway System (Continued)	
56	Indiana Avenue, Little Calumet River*	CAWS A/PC
76	Halsted Street, Little Calumet River*	CAWS A/PC
52	Wentworth Avenue, Little Calumet River	General Use
54	Joe Orr Road, Thorn Creek	General Use
97	170th Street, Thorn Creek	General Use
57	Ashland, Little Calumet River*	General Use
58	Ashland Avenue, Calumet-Sag Channel	CAWS A/PC
59	Cicero Avenue, Calumet-Sag Channel*	CAWS A/PC
43	Route 83, Calumet-Sag Channel*	CAWS A/PC
	Des Plaines River System	
12	Lake-Cook Road, Buffalo Creek	General Use
13	Lake-Cook Road, Des Plaines River	General Use
17	Oakton Street, Des Plaines River	General Use
19	Belmont Avenue, Des Plaines River*	General Use
20	Roosevelt Road, Des Plaines River	General Use
22	Ogden Avenue, Des Plaines River*	General Use
23	Willow Springs Road, Des Plaines River*	General Use
29	Stephen Street, Des Plaines River	General Use
91	Material Service Road, Des Plaines River*	General Use
110	Springinsguth Road, West Branch of DuPage River*	General Use
89	Walnut Lane, West Branch of DuPage River	General Use
111	Arlington Drive, West Branch of DuPage River*	General Use
79	Higgins Road, Salt Creek*	General Use
80	Arlington Heights Road, Salt Creek	General Use
18	Devon Avenue, Salt Creek*	General Use
24	Wolf Road, Salt Creek	General Use
109	Brookfield Avenue, Salt Creek*	General Use
77	Elmhurst Road, Higgins Creek*	General Use
78	Wille Road, Higgins Creek*	General Use
	Fox River	
90	Route 19, Poplar Creek	General Use

*Current sampling location as of September, 2015
PC=Primary Contact
ICR = Incidental Contact Recreation
NCR = Non-Contact Recreation
NR = Non-Recreational
SC=Secondary Contact
IAL = Indigenous Aquatic Life

TABLE 2: LATITUDE AND LONGITUDE OF CURRENT SAMPLING LOCATIONS

Station	Description	North Latitude	West Longitude
96	North Branch Chicago River @ Albany Ave.	41° 58.475’	87° 42.375’
112	North Shore Channel @ Dempster St.	42° 02.460’	87° 42.583’
36	North Shore Channel @ Touhy Ave.	42° 00.690’	87° 42.600’
73	North Branch Chicago River @ Diversey Ave.	41° 55.920’	87° 40.940’
100	Chicago River Main Stem @ Wells St.	41° 53.259’	87° 38.045’
108	South Branch Chicago River @ Loomis St.	41° 50.752’	87° 39.642’
99	South Fork, South Branch Chicago River @ Archer Ave.	41° 50.331’	87° 39.849’
75	Chicago Sanitary & Ship Canal @ Cicero Ave.	41° 49.169’	87° 44.616’
41	Chicago Sanitary & Ship Canal @ Harlem Ave.	41° 48.263’	87° 48.104’
48	Chicago Sanitary & Ship Canal @ Stephen St.	41° 40.750’	88° 00.683’
92	Chicago Sanitary & Ship Canal @ Lockport Powerhouse Forebay	41° 34.256’	88° 04.704’
86	Grand Calumet River @ Burnham Ave.	41° 37.870’	87° 32.352’
56	Little Calumet River @ Indiana Ave.	41° 39.136’	87° 35.828’
76	Little Calumet River @ Halsted St.	41° 39.440’	87° 38.476’
57	Little Calumet River @ Ashland Ave.	41° 39.099’	87° 39.633’
59	Calumet-Sag Channel @ Cicero Ave.	41° 39.282’	87° 44.284’
43	Calumet-Sag Channel @ Route 83	41° 41.790’	87° 56.480’
19	Des Plaines @ Belmont Ave.	41° 56.236’	87° 50.975’
22	Des Plaines River @ Ogden Ave.	41° 49.256’	87° 48.654’
23	Des Plaines River @ Willow Springs Rd.	41° 44.135’	87° 52.901’
91	Des Plaines River @ Material Service Rd.	41° 35.794’	88° 04.112’
110	West Branch DuPage River @ Springinsguth Rd.	42° 00.495’	88° 07.142’
111	West Branch DuPage River @ Arlington Drive	41° 58.500’	88° 08.316’
79	Salt Creek @ Higgins Rd.	42° 01.880’	88° 00.679’
18	Salt Creek @ Devon Ave.	41° 59.546’	87° 59.924’
109	Salt Creek @ Brookfield Ave.	41° 49.370’	87° 50.494’
77	Higgins Creek @ Elmhurst Rd.	42° 01.287’	87° 56.436’
78	Higgins Creek @ Wille Rd.	42° 01.120’	87° 56.201’

TABLE 3: QUADRANT, TOWNSHIP, AND RANGE OF CURRENT SAMPLING LOCATIONS

Station	Description	Quadrant	TWP	Range	Sec.	¼ Sec
96	North Branch Chicago River @ Albany Ave.	Chicago Loop	40N	13E	12	SW
112	North Shore Channel @ Dempster St.	Evanston	41N	13E	14	SE
36	North Shore Channel @ Touhy Ave.	Evanston	42N	13E	26	SE
73	North Branch Chicago River @ Diversey Ave.	Chicago Loop	40N	14E	30	SW
100	Chicago River Main Stem @ Wells St.	Chicago Loop	39N	14E	9	SW
108	South Branch Chicago River @ Loomis St.	Englewood	39N	14E	28	NW
99	South Fork, South Branch Chicago River @ Archer Ave.	Englewood	39N	14E	29	SW
75	Chicago Sanitary & Ship Canal @ Cicero Ave.	Englewood	38N	13E	3	NW
41	Chicago Sanitary & Ship Canal @ Harlem Ave.	Berwyn	38N	12E	7	NW
48	Chicago Sanitary & Ship Canal @ Stephen St.	Romeoville	37N	11E	20	NW
92	Chicago Sanitary & Ship Canal @ Lockport Powerhouse	Joliet	36N	10E	27	SW
86	Grand Calumet River @ Burnham Ave.	Lake Calumet	36N	15E	5	SW
56	Little Calumet River @ Indiana Ave.	Lake Calumet	37N	14E	34	SW
76	Little Calumet River @ Halsted St.	Blue Island	37N	14E	33	NW
57	Little Calumet River @ Ashland Ave.	Blue Island	37N	14E	32	SW
59	Calumet-Sag Channel @ Cicero Ave.	Blue Island	37N	13E	34	NW
43	Calumet-Sag Channel @ Route 83	Calumet-Sag Bridge	37N	11E	14	SE
19	Des Plaines @ Belmont Ave.	River Forest	40N	12E	22	SE
22	Des Plaines River @ Ogden Ave.	Berwyn	38N	12E	1	NE
23	Des Plaines River @ Willow Springs Rd.	Calumet-Sag Bridge	38N	12E	33	SW
91	Des Plaines River @ Material Service Rd.	Joliet	36N	10E	22	SW
110	West Branch DuPage River @ Springinsguth Rd.	Streamwood	41N	10E	26	SW
111	West Branch DuPage River Arlington Drive	West Chicago	40N	10E	6	SE
79	Salt Creek @ Higgins Rd.	Palatine	41N	11E	20	NW
18	Salt Creek @ Devon Ave.	Elmhurst	41N	11E	33	SW
109	Salt Creek @ Brookfield Ave.	Berwyn	39N	12E	35	SW
77	Higgins Creek @ Elmhurst Rd.	Arlington Hts.	41N	11E	25	NW
78	Higgins Creek @ Wille Rd.	Arlington Hts.	41N	11E	25	NW

TABLE 4: SAMPLE CONTAINERS AND FIELD PRESERVATION

	Parameter	Container and Field Preservation
1.	Dissolved oxygen	300 mL glass stoppered bottle, sample is fixed immediately after collection with manganous sulfate solution, alkali-iodide solution and sulfuric acid. Chill the fixed sample with ice and protect from light. See Appendix AI page AI-5 for the detailed procedure.
2.	Fecal coliform	125 mL square polypropylene bottle, sterilized and sealed with 0.45 mL of 15% disodium salt of EDTA adjusted to pH of 6.5, and 0.15 mL of 10% sodium thiosulfate. Chill sample with ice. See Appendix I page AI-4 and AI-5 for the correct procedure.
3.	General chemistry[1] (see footnote for parameters)	1 gallon polyethylene bottle. Chill sample with ice.
4.	Metals, total	250 mL polyethylene bottle with 2.5 mL conc. HNO_3 to adjust pH<2. Chill sample with ice.
5.	Metals, dissolved	900 mL certified clean polyethylene bottle. Chill sample with ice. (Sample filtered in laboratory with 0.45 µm membrane filter into a 250 mL certified clean polyethylene bottle and acidified with 1 mL of conc. HNO_3.)
6.	Mercury (total and low level)	4 – 40 mL vials, each with 200µL BrCl. Do not put sample on ice.
7.	Cyanide, total and chlorine amenable	½ gallon plastic bottle with 5 mL 10% NaOH to adjust pH>12. Chill sample with ice.
8.	Phenol	1 quart glass bottle with 2 mL of conc. H_2SO_4 to adjust pH<2. Chill sample with ice.
9.	n-Hexane extractable materials	2-1 quart glass bottles. Chill sample with ice.
10.	Alkalinity, chloride	250 mL polyethylene bottle. Chill sample with ice.
11.	Sulfate	250 mL polyethylene bottle. Chill sample with ice.

TABLE 4 (Continued): SAMPLE CONTAINERS AND FIELD PRESERVATION

Parameter	Container and Field Preservation
12. Total Phosphorus, Total Kjeldahl Nitrogen	250 mL polyethylene bottle with 0.3 mL of sulfuric acid to acidify sample. Chill sample with ice.
13. Fluoride	250 mL polyethylene bottle. Chill sample with ice.
14. Ammonia, NO_2+NO_3	250 mL polyethylene bottle, preserved with 0.3 mL of sulfuric acid upon collection.
14. Carbon, total organic	500 mL wide-mouth glass bottle with 1 mL H_2SO_4 to adjust pH<2. Chill sample with ice.
15. Radiochemistry	1 liter polyethylene bottle.
16. Chlorophyll	1 liter HDPE Nalgene amber, wide-mouth bottle with 1 mg powdered $MgCO_3$. Chill sample with ice.
17. Volatile organics, BETX (benzene, ethyl benzene, toluene, and xylenes)	Three 40-mL vials with Teflon-lined septum screw caps, each with 25 mg ascorbic acid, filled to top with minimal overflow and no air bubbles. Chill sample with ice.
18. Base/neutral and acid extractable compounds, pesticides, PCBs, OPPs and nonylphenols[2]	1 gallon glass with 0.7 mL of 50% sodium thiosulfate solution. Chill sample with ice.

[1]General chemistry parameters include total dissolved solids, total suspended solids
[2]Nonylphenol analyzed from same container as OPPs.

TABLE 5: ANALYTICAL METHODS

Parameter	Method	Method Reference
Dissolved oxygen	Titration	SM 4500-O C
Temperature	Electrode	SM 2550 B
pH	Electrode	SM 4500-H^+ B
Ammonia nitrogen	Colorimetric	EPA 350.1
Ammonia nitrogen, un-ionized[1]	Calculation	
Nitrate and nitrite nitrogen	Colorimetric	EPA 353.2 R.2.0
Kjeldahl nitrogen	Colorimetric	EPA 351.2 R.2.0
Phosphorus, total	Colorimetric	EPA 365.4
Sulfate	Colorimetric	EPA 375.2
Total dissolved solids	Gravimetric	SM 2540 C
Suspended solids	Gravimetric	SM 2540 D
Volatile suspended solids	Gravimetric	SM 2540 E
Alkalinity	Titration	SM 2320 B
Chloride	Potentiometric	SM 4500-Cl D
Fluoride	Potentiometric	SM 4500 F-C
Organic carbon, total	UV-Oxidation	SM 5310 C
Phenol	Colorimetric	EPA 420.2
Cyanide, total	Colorimetric	EPA Kelada-01
Cyanide, chlorine amenable	Colorimetric	SM 4500-CN G
Barium, total	ICP	EPA 200.7, SM 3120 B
Boron, total	ICP	
Calcium, total	ICP	EPA 200.7, SM 3120 B
Chromium, trivalent[2]	ICP	EPA 200.7, SM 3120 B
Chromium, hexavalent	Colorimetric	SM 3500-Cr B
Magnesium, total	ICP	EPA 200.7, SM 3120 B
Manganese, total	ICP	EPA 200.7, SM 3120 B
Mercury, low-level, total; General Use	Cold vapor AFS	EPA 1631 E
Selenium, total	ICP	EPA 200.7, SM 3120 B
Silver, total	ICP	EPA 200.7, SM 3120 B
Arsenic, dissolved	ICP	SM 3030 B, SM 3120 B
Cadmium, dissolved	ICP	SM 3030 B, SM 3120 B
Chromium, dissolved	ICP	SM 3030 B, SM 3120 B
Copper, dissolved	ICP	SM 3030 B, SM 3120 B
Iron, dissolved	ICP	SM 3030 B, SM 3120 B
Lead, dissolved	ICP	SM 3030 B, SM 3120 B
Nickel, dissolved	ICP	SM 3030 B, SM 3120 B
Silver, dissolved	ICP	SM 3030 B, SM 3120 B
Zinc, dissolved	ICP	SM 3030 B, SM 3120 B
Fecal coliform	Membrane	SM 9222 D

TABLE 5 (Continued): ANALYTICAL METHODS

Parameter	Method	Method Reference
n-Hexane extractable materials	Gravimetric	EPA 1664, Rev. A
Gross alpha radioactivity	Gas proportional	SM 7110
Gross beta radioactivity	Gas proportional	SM 7110
Chlorophyll	Colorimetric	SM 10200 H
BETX (Benzene, ethyl Benzene, toluene, xylenes)	Purge and trap GC/MS	EPA 624
Organic Priority Pollutants		
Volatile organic compounds	Purge and trap GC/MS	EPA 624
Base/neutral and acid extractable compounds	GC/MS	EPA 625
Pesticides	GC/ECD	EPA 608
PCBs	GC/ECD	EPA 608
Nonylphenols	GC/MS	GCMS004[3]

[1]Calculated from pH, temperature, and ammonia nitrogen.
[2]Trivalent chromium measured as total chromium.
[3]USEPA Region V Method, Revision 1 dated June 6, 2003.

TABLE 6: LABORATORY PRESERVATION AND MAXIMUM HOLDING TIME

Parameter	Laboratory Preservation[1,2]	Maximum Holding Time
Dissolved oxygen (Fixed)	Refrigerate	8 hours
Temperature	NA	0.25 hours
pH	NA	0.25 hours
Ammonia nitrogen	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Ammonia nitrogen, Un-ionized[3]	NA	NA
Nitrate and nitrite nitrogen	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Nitrite	Refrigerate	48 hours
Kjeldahl nitrogen	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Phosphorus, total	(a) Refrigerate, (b) with H_2SO_4 to pH<2	24 hours, 28 days
Sulfate	Refrigerate	28 days
Total dissolved solids	Refrigerate	7 days
Suspended solids	Refrigerate	7 days
Volatile suspended solids	Refrigerate	7 days
Turbidity	Refrigerate, store in dark	48 hours
Alkalinity	Refrigerate	14 days
Chloride	None required	28 days
Fluoride	None required	28 days
Organic carbon, total	Refrigerate, H_2SO_4 to pH<2	28 days
Phenol	Refrigerate, H_2SO_4 to pH<2	28 days
Cyanide, total	Refrigerate, NaOH to pH>12	14 days
Cyanide, chlorine amenable	Refrigerate, NaOH to pH>12	14 days
Chromium, hexavalent	Refrigerate	24 hours
Metals, total (excluding mercury)	HNO_3 to pH<2	6 months
Mercury, low-level, total	BrCl	90 days
Metals, dissolved (excluding mercury)	Filter, HNO_3 to pH<2	6 months
Fecal coliform	Refrigerate	6 hours

TABLE 6 (Continued): LABORATORY PRESERVATION AND MAXIMUM HOLDING TIME

Parameter	Laboratory Preservation[1,2]	Maximum Holding Time
n-Hexane extractable materials	Refrigerate, H_2SO_4 to pH<2	28 days
Gross alpha radioactivity	HNO_3 to pH<2	None
Gross beta radioactivity	HNO_3 to pH<2	None
Chlorophyll	Refrigerate	30 days
BETX (Benzene, ethyl benzene, toluene, xylenes)	Refrigerate	7 days
Organic priority pollutants	Refrigerate	7 days
Nonylphenols	Refrigerate	7 days

NA = Not applicable.
[1]All samples stored in ice after collection and in transport to laboratory except for low-level mercury.
[2]Refrigeration at 4ºC.
[3]Calculated from pH, temperature, and ammonia nitrogen.

TABLE 7: RESPONSIBLE LABORATORIES AND METHOD STANDARD OPERATING PROCEDURE IDENTIFICATION

Parameter	Laboratory	Method SOP ID
Dissolved oxygen (Fixed)	Industrial Waste	IW-DO-WINKLER
Temperature	Field measurement	M90 Oper. Instr.
pH	Field measurement	M90 Oper. Instr.
Ammonia nitrogen	Stickney	ST-NH3
Ammonia nitrogen, un-ionized[1]	Calculation	NA
Nitrate and nitrite nitrogen	Stickney	ST-NO3/NO2
Kjeldahl nitrogen	Stickney	ST-TKN
Phosphorus, total	Stickney	ST-TP
Sulfate	Calumet	CaSO4
Total dissolved solids	Stickney	ST-TDS
Suspended solids	Stickney	ST-TSS/VSS
Volatile suspended solids	Stickney	ST-TSS/VSS
Alkalinity	Stickney	ST-Alk
Chloride	Stickney	ST-Cl
Fluoride	Stickney	ST-F
Organic carbon, total	Industrial Waste	IW-TOC
Phenol	Industrial Waste	IW-PHENOL-A
Cyanide, total	Industrial Waste	IW-CN-AUTO
Cyanide, chlorine amenable	Industrial Waste	IW-CN-AMEN
Chromium, hexavalent	Industrial Waste	IW-CR6
Metals, total and dissolved (except mercury)	Egan	ICP-SOP V. 1.13
Mercury, low-level, total	Calumet	CaLLHg
Fecal coliform	Microbiology	
n-Hexane extractable materials	Industrial Waste	IW-FOG-SPE
Gross alpha radioactivity	Contracted Lab	A/B.TSD
Gross beta radioactivity	Contracted Lab	A/B.TSD
Chlorophyll	Aquatic Ecology	
Benzene, ethyl benzene, toluene, xylenes	Organic Compounds Analytical	SOPEPA624
Organic priority pollutants	Organic Compounds Analytical	SOPEPA624[2] SOPEPA625[3] SOPEPA608[4]
Nonylphenols	Organic Compounds Analytical	GCMS004[5]

[1]Calculated from pH, temperature and ammonia nitrogen.
[2]Volatile organic compounds.
[3]Base/neutral and acid extractable compounds.
[4]Pesticides and PCBs.
[5]USEPA Region V Method, Revision 1 dated June 6, 2003.

AMBIENT WATER QUALITY MONITORING PROJECT
QUALITY ASSURANCE PROJECT PLAN

APPENDIX I

SAMPLING PROCEDURES

WATERWAY SAMPLING

Sampling Procedures

1) Before sample collection day, scrub the stainless steel sampling bucket, stirrers, and DO sampling device with a solution of non-interfering residue-free critical cleaning liquid detergent and water. Rinse with de-ionized water.

2) Samples should be collected from the upstream side of the bridge.

3) Samples may be collected from the District's Pollution Control (PC) boats if approved by an Aquatic Biologist, when circumstances deem necessary. Boat sampling should not be performed in areas where sediment could be disturbed. When sampling from a District PC boat, the following steps should be followed:

   a. Ensure the PC boat is in the correct location and the engines/motors are in idle.

   b. Communicate with the Patrol Boat Operator to ensure it is safe to collect the sample.

   c. Collect the sample from the side of the PC boat, away from the propellers and exhaust.

4) Take the samples from a representative location - the center of the river at the deepest point. DO NOT SAMPLE FROM THE BANK OF THE WATERWAY.

5) If boat traffic is encountered when sampling from a navigable body of water, delay sampling until the unnatural turbulence caused by the vessel's wake subsides. Indicate in the "Remarks" section of the sample collection sheet that sampling was interrupted due to a passing vessel.

6) Upon arrival at each prescribed sampling location, the following steps should be followed:

   a. Collect samples routinely collected from pail. See Section A.

   b. Collect DO and bacterial samples with modified DO sampler. See Section B.

   c. When required, collect equipment blanks from pail. See Section C.

d. When required, collect organics samples from pail. See Section D.

6. Complete the sample collection sheet as appropriate at each sampling location.

   a. Sample collection date.

   b. Sampler's name(s).

   c. Weather conditions during sampling (Example: Clear, Cloudy, Rain, Snow, Air Temperature, if possible).

   d. Type of aliquots obtained.

   e. Time aliquots were obtained.

   f. Sample pH as obtained with the handheld meter.

   g. Sample temperature as obtained with the handheld meter.

   h. Sample storage temperature.

   i. In the "Remarks" column, describe visual observation of sample (Clear, Semi-Clear, Lt. Sed., etc.), indicate if there was any passing boat traffic and any unusual observations of the waterway quality, such as oil, discoloration, or debris. Also provide the LIMS number.

   j. At the bottom of the collection sheet, a space is available for additional remarks.

7. Upon completion of the sampling assignment, immediately transport the samples to the laboratory for analysis.

8. Upon relinquishing the samples to the laboratory analyst record the following pertinent information on the sample collection sheet to complete chain-of-custody requirements (Appendix II).

   a. Signature of transporter.

   b. Signature of the person who relinquished the sample.

   c. Signature of the laboratory analytical staff member who received the sample.

   d. Time sample relinquished.

Section A: Routine Samples Collected in Pail

1. Properly identify (label) each sample container and arrange in order specified on sample trays.

2. Lower the clean stainless steel bucket into the river/stream water. Retrieve the bucket and immediately obtain a pH and temperature reading with the handheld meter.

3. Empty the bucket, lower and retrieve it two more times rinsing thoroughly to acclimate it to the waterway.

4. When sampling during precipitation events (rain or snow), cover the sample bucket at all times with the lid provided, except when the bucket is being raised or lowered from the bridge.

5. Whenever the sampling bucket is being raised or lowered from the bridge, give special attention to insure there is no contact with the bridge structure. If there is contact, discard the sample and start over. Also, make sure that the rope does not come in contact with the ground. Place the rope into the gray, plastic container.

6. Only after acclimating the sampling bucket three times should the actual sample be obtained. After the sample is obtained, stir the sample with the stirring rod 5x in one direction and then 5x in the other direction. Pour it into the individual sample aliquot bottles filling the aliquot bottles half way from right to left. Then stir the sample water in the bucket with the same procedure as above to ensure a homogeneous distribution of suspended solids and finish filling the bottles from left to right.

7. Samples to be collected and order in trays:

    a. General chemistry sample: 1-gallon (wide-mouth plastic) container.

    b. Alkalinity, chloride sample: plastic 250 mL container, fill to shoulder.

    c. Cyanide sample: fill the plastic half-gallon container (containing 5 mL of 10% NaOH preservative) to shoulder.

    d. Phenol sample: fill the glass sample bottle to the shoulder; exercise CAUTION as bottle contains 2 mL sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative.

e. Radiochemistry sample: fill 1 liter plastic bottle to shoulder. Do not overfill.

f. Dissolved metals sample: fill a 900 mL certified clean, plastic bottle.

g. Total organic carbon: fill a 500-mL glass bottle.

h. Trace metals sample: fill 8 oz. plastic bottle. Leave approximately l/4-inch air space at top of bottle. NOTE: The bottle contains 2 mL of nitric acid. (Overfilling may cause a loss of preservative.)

i. Sulfate: fill a 250 mL square plastic bottle.

j. Total Phosphorus, Total Kjeldahl Nitrogen: fill a 250 mL plastic bottle to the shoulder; exercise CAUTION as bottle contains 0.3 mL sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative

k. Fluoride: fill a 250 mL plastic bottle to the shoulder.

l. Ammonia, NO_2+NO_3: fill a 250 mL polyethylene bottle to the shoulder; exercise CAUTION as bottle contains 0.3 mL sulfuric acid as a preservative. Do not breathe the vapors that may be emitted by the sulfuric acid preservative.

m. Chlorophyll: fill an opaque, brown 1-liter bottle (obtained from Room LE213). Leave approximately 1/2-inch air space at top of bottle.

n. n-Hexane extractable materials sample: fill two glass quart jars.

8. After all the sample aliquots have been poured-off, rinse the sample bucket and stirring rod with de-ionized water.

9. Place each sample aliquot into the 72-quart thermal ice chest filled from 1/3 to 1/2 full of ice cubes. Insure the sample bottles are surrounded in ice.

Section B: Dissolved Oxygen and Bacterial Samples

The DO sample and bacterial sample are collected at the same time using a DO sampler that has been modified to hold the bacterial sample container. The DO and bacterial samples are collected as follows:

1. The bacterial container is a sterilized 4 oz. plastic bottle with foil covered plastic screw cap. The DO container is a 300-mL glass bottle.

2. Do not open bacterial bottle until sampling, and replace foil covered plastic cap as soon as possible.

3. Care should be taken not to touch the neck or the mouth of the bacterial bottle, or the inside of the plastic cap to prevent contamination of the sample.

4. Insert bacterial bottle into the compartment attached to the outside of the DO sampling can making sure not to allow the top of the bottle to touch any part of the sample can.

5. Place a 300-mL DO glass bottle into the special DO sampling device.

6. Slowly lower the DO sampling device with the bacterial bottle and DO bottle into the waterway to the depth of approximately 3 feet from the surface taking care to prevent turbulence and the formation of air bubbles while filling.

7. Raise the sampling device when all the air bubbles have stopped rising.

8. Remove the bacterial bottle from the DO sampling device.

9. Obtain a second bacterial bottle, label, and then remove the foil-covered cap without removing the foil from the cap.

10. Care should be taken not to touch the neck or the mouth of the bottle, or the inside of the plastic cap to prevent contamination of the sample.

11. Pour the aliquot obtained with the DO sampling device into the second bacterial bottle. Fill the bottle approximately 80 percent full. DO NOT OVERFILL.

12. Close the bottle with the foil-covered cap and place the sample into the cooler on ice

13. Return the bacterial bottle used to collect the sample to the Microbiology Laboratory.

14. Place the sample into the cooler on ice.

15. Remove the DO bottle. Replace the glass stopper and pour off excess water at the top of the bottle.

15. Remove the glass stopper and add 1 mL of manganous sulfate (use Reagent Dispenser #1). Then, add 1-mL potassium hydroxide – potassium iodide solution (alkali-iodide-azide reagent) (use Reagent Dispenser #2). NOTE:

The tips of the Reagent Dispensers, #1 and #2, should be at the surface of the liquid in the DO bottle when the reagents are added. Add reagents slowly, allowing them to run down the inside of the bottle neck, to avoid introducing air into the sample. This prevents the introduction of extraneous oxygen into the sample.

16. Replace the glass stopper on the DO bottle carefully to exclude air bubbles.

17. Rinse the bottle with river water or fresh water, if available.

18. Mix the sample by inverting the bottle several times until dissolution is complete. NOTE: The initial precipitate, manganous hydroxide, combines with the DO in the sample to form manganic hydroxide, a brown precipitate. Place the bottle in an area protected from direct sunlight while precipitate is settling.

19. When the precipitate settles approximately half way in the sample, add 1-ml sulfuric acid (Reagent #3), by removing the glass stopper on the sample bottle and placing the tip of the Reagent Dispenser #3 in the inside neck of the bottle above the level of the sample. This allows the acid to run down the inside of bottleneck, and mix with the sample. Once again, this eliminates the introduction of extraneous oxygen into the sample.

20. Replace the glass stopper on the DO bottle.

21. Rinse the bottle with river water or fresh water if it is available.

22. Mix the sample by inverting bottle several times.

23. Place sample into cooler on ice. (Protect from sunlight.)

24. Complete appropriate entries on sample collection sheet.

Section C: Equipment Blanks. If sampling is occurring at one of the following stations, then equipment blanks must be obtained: WW_78, WW_23, WW_110, WW_36, WW_108, WW_41, and WW_57. Equipment blanks are collected as follows:

1. Properly identify (label) each sample container and arrange in order specified on sample trays.

2. Fill the stainless steel bucket two-thirds full with reagent water obtained from the laboratory.

3. Proceed with the filling of the sample containers as is done in Section A, steps g through i, refilling the bucket as necessary to fill all sample containers.

4. Complete sample collection sheet as appropriate.

Section D: Organics Samples. Organic priority pollutants (OPP), nonylphenol, and BETX (benzene, ethylbenzene, and total xylenes) samples are collected as follows:

1. The amber colored glass containers provided by the OCAL must be used for BETX and OPP/nonylphenols samples. These containers contain a preservative and should not be rinsed prior to filling.

2. OPP/nonylphenol samples require one (1) gallon bottle and three (3) vials per sampling location.

3. BETX samples require three (3) vials per sampling location.

4. Each sampling team will transport a clearly marked, "Trip Blank" sample, consisting of two (2) amber vials filled with Milli-Q de-ionized water, with the other organic samples collected during the sampling trip.

5. Obtain a water sample in the stainless steel pail and fill sample containers.

6. When filling the containers care should be taken to minimize air bubbles in the sample container. Gallons and vials are to be filled to the top with minimal overflow. A slight bulge of water at the neck of the container caused by surface tension should be evident at the time the cap is tightened to insure elimination of excess air.

7. Place samples into cooler on ice.

8. Complete sample collection sheet as appropriate.

9. After transport to the laboratory, store the samples in the laboratory cooler for later transportation to the Organic Compounds Analytical Laboratory by the night transporter.

Section E: Low Level Mercury Samples. Low level Mercury (LLHg) samples and field blanks are collected as follows:

1. Obtain the labeled LLHg sampling kit provided by CAL. The sampling kit contains four pairs of clean gloves, four 40 mL sample vials, two empty 40 mL field blank vials, and three 40 mL field blank vials filled with reagent water.

2. Do not expose the sample to anything that may contain significant amounts of mercury. Potential contamination sources: Sampling

equipment, bailers, sampling tubing (including peristaltic pump tubing), gloves, clothing, bottles, exhaled breath from mercury amalgam fillings, precipitation, dirt, dust and airborne vapor.

3. Collect LLHg samples according to the following procedure:

   a. Obtain a water sample in the stainless steel pail.

   b. Sampler #1: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample.

   c. Sampler #2: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample. Do not touch anything that may contaminant your gloves.

   d. Sampler #1: Set up sampling equipment, open cooler, remove double bagged bottle kit from cooler and its bubble pack bag, open outer bag and hold it open so sampler #2 can reach inside.

   e. Sampler #2: Do not touch the outer bag. Open the inner bag, remove one 40 mL vial from the bag, remove the cap and fill with water sample to the top, screw cap onto vial and return filled vial to the innermost bag. There is no need to rinse the bottle or add a preservative. Repeat until 4 vials have been filled from the same sampling point. Close the zip-lock seal most of the way, squeeze the inner bag to expel most of the air, complete the seal, push the inner bag inside the outer bag.

   f. Sampler #1: Close the outer bag zip-lock seal most of the way, squeeze the bag to expel most of the air, complete the seal. Place the double-bagged bottle kit in the bubble pack bag, remove the adhesive strip cover and seal the bubble bag closed. Place the kit in the cooler. NOTE: LLHg samples should <u>not</u> be placed on ice.

4. Collect LLHg field blanks according to following procedure:

   a. Sampler #1: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the person to the sample.

   b. Sampler #2: Put on clean gloves and sufficient protective clothing to ensure dust and debris is not transferred from the

person to the sample. Do not touch anything that may contaminant your gloves.

c. Sampler #1: Open cooler, remove double bagged kit labeled field blank bottle kit from cooler and its bubble pack bag, apply client label to the outer zip-lock bag, open outer bag and hold it open so the clean hands person can reach inside.

d. Sampler #2: Do not touch the outer bag. Open the inner bag, remove one full 40 mL vial from the bag, and one empty 40 mL vial, remove the caps and pour the reagent water from one vial into the other under the same conditions to which regular samples were exposed, screw caps onto vials and return filled vial to the innermost bag discard the empty vial. There is no need to rinse the bottle or add a preservative. Repeat until 2 vials have been filled. There is an extra filled reagent water vial in case a spill occurs, discard if not needed. Close the zip-lock seal most of the way, squeeze the inner bag to expel most of the air, complete the seal, push the inner bag inside the outer bag.

e. Sampler #1: Close the outer bag zip-lock seal most of the way, squeeze the bag to expel most of the air, complete the seal. Place the double-bagged bottle kit in the bubble pack bag, remove the adhesive strip cover and seal the bubble bag closed. Place the kit in the cooler. NOTE: LLHg field blanks should not be placed on ice.

5. Complete Sample collection sheet as appropriate.

Materials Required for Sampling

1. Labels - Electronically generated adhesive backed labels with identifying LIMS barcode.

2. Bottles (per station, note: an equipment blank will require an additional set of sample containers a through l).

   a. Gallon (polyethylene) – General chemistry.

   b. 250-mL rectangular (polyethylene) – Alkalinity, chloride.

   c. 1/2 Gallon (polyethylene) – Cyanide.

   d. Quart (glass) – Phenol.

e. Quart (polyethylene) – Radiochemistry.

f. 900 mL (polyethylene – certified clean) – Dissolved metals.

g. 500-mL (glass) – Total organic carbon.

h. 8 oz. (polyethylene) – Trace metals (total).

i. 250-mL rectangular (polyethylene) – Sulfate.

j. Two quarts (glass) – n-Hexane extractable materials (2).

k. 250-mL rectangular (polyethylene) – Ammonia, NO2 + NO3, Fluoride.

l. 250-mL rectangular (polyethylene) - Total Phosphorus, Total Kjeldahl Nitrogen

m. Mercury Kit (General Use waters only; see Appendix I, Section E).

n. 1 liter brown, opaque (plastic) – Chlorophyll.

o. Two 4 oz. (polypropylene w/foil covered stopper) – Fecal coliform.

p. 300 mL (narrow-mouth glass w/ ground glass stopper) – Dissolved oxygen.

q. Three 40-mL vials (amber colored glass) – BETX.

r. Three 40-mL vials (amber colored glass); and 1 gallon (glass) – Organic priority pollutants and nonylphenols, .

3. Sampling Devices.

a. 13 quart stainless steel bucket and lid.

b. Stainless steel DO sampling device equipped with a lid and a fill tube that extends into the glass 300 mL DO sample bottle stopping just below the bottom. This device is designed to bleed sample into the bottle through the tube and the bottle is filled to overflowing inside the device to prevent turbulence and the formation of air bubbles while filling. Attached to this device is a stainless steel holder for a bacti-bottle.

c. Portable handheld electronic pH and temperature meter.

d. Sufficient length of 3/8-inch nylon rope (approximately 100 feet).

4. Miscellaneous.

a. Waterway Field Collection Sheet, for locations to be sampled.

b. 72-quart ice chests as needed.

c. Ice.

d. DO reagents.

e. Gray plastic container for storage of sampling rope during sampling events.

f. Wood tray to hold sample bottles with each compartment labeled with name of the sample bottle in the order the aliquot will be poured off.

g. Stainless steel stirring rod.

h. Two carboys of reagent water provided by the SAL.

Safety

1. DO NOT park District vehicle on a bridge. Attempt off-road parking, if possible.

2. Use rotating lights on the vehicle when stopped.

3. When parking on the road, use safety cone markers.

5. Wear red warning vests and life vests when bridge sampling.

6. Wear life vests when boat sampling.

5. Wear gloves and eye protection when handling DO reagents. Do not allow reagents to come into contact with each other outside of the DO bottle since they are extremely reactive.

6. When sampling during winter months, do not attempt to sample if the waterway is frozen. Do not walk on the ice. Indicate the circumstances on the sample collection sheet.

AMBIENT WATER QUALITY MONITORING PROJECT
QUALITY ASSURANCE PROJECT PLAN

APPENDIX II

SAMPLE COLLECTION SHEET

#1 **WEEK 1**

Des Plaines River Watershed

DATE COLLECTED:_____ COLLECTED BY: _____ WEATHER: _____

DATA CODE	LOCATION	TIME	TEMPERATURE	GEN. CHEM. (gallon)	F.O.G. (glass quart x2)	ALK / CL (250mL rect.)	CYN. (1/2 gallon)	PHEN. (glass quart)	T.M. (8oz cylinder preserved x2)	SOL. T.M. (40DmL)	BACT (4oz w/ tsol x2)	D.O. (300mL w/ glass stopper)	RAD. (quart)	TOC (250mL glass)	PRIORITY POLL. (amber glass OAW) 40mL vials x3 BETX	SO4 (250mL rectangular)	CHLOROPHYLL a (1L opaque brown)	LACHAT (250mL rect. 25dmL preserved red)	pH	REMARKS
77	Higgins Creek, Upstream O'Hare WRP at Elmhurst Road										MST				BETX OAWOPP				6.5-9.0	LIMS#
78	Higgins Creek, Downstream, O'Hare WRP. At Wille Road										MST				BETX OAWOPP				6.5-9.0	LIMS#
	EQUIPMENT BLANK																			LIMS#
19	Des Plaines River at Belmont Ave.										MST				BETX OAWOPP				6.5-9.0	LIMS #
																			6.5-9.0	LIMS #
																			6.5-9.0	LIMS #

STORED AT 4°C YES_____ NO_____ IN CUSTODY OF _____ METER #_____

TRANSPORTED BY: _____ VEHICLE #_____

RELINQUISHED BY: _____ DATE: _____ TIME: _____

RECEIVED BY LABORATORY: _____ DATE: _____ TIME: _____

RELINQUISHED BY SAL LAB: _____ RECEIVED BY CAL LAB: _____

ATTACHMENT A: LABORATORY REPORTING LIMITS AND ILLINOIS POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA

Parameter	Reporting Limit (RL)	Minimum Measurement Criteria
Dissolved oxygen	NA	0.1 mg/L[1]
Temperature	NA	0.1 degree C[1]
pH	NA	0.1 pH unit[1]
Ammonia nitrogen	0.1 mg/L	15.0 mg/L
Ammonia nitrogen, un-ionized[2]	NA	0.1 mg/L[3]
Nitrate and nitrite nitrogen	0.15 mg/L	No standard
Kjeldahl nitrogen	1 mg/L	No standard
Phosphorus, total	0.2 mg/L	No standard
Sulfate	5 mg/L	500 mg/L
Total dissolved solids	60 mg/L	No standard
Suspended solids	4 mg/L	No standard
Volatile suspended solids	NA	No standard
Alkalinity	10 mg/L	No standard
Chloride	10 mg/L	500 mg/L
Fluoride	0.1 mg/L	15 mg/L[4]
Organic carbon, total	1 mg/L	No standard
Phenol	0.005 mg/L	0.1 mg/L
Cyanide, total	0.005 mg/L	0.1 mg/L[3]
Cyanide, chlorine amenable	0.001 mg/L	0.022 mg/L
Arsenic, total	0.05 mg/L	0.36 mg/L[3]
Barium, total	0.004 mg/L	5.0 mg/L[3]
Boron, total	0.05 mg/L	40.1 mg/L[5]
Calcium, total	1 mg/L	No standard
Chromium, trivalent[6]	0.005 mg/L	1.0 mg/L[3]
Chromium, hexavalent	6 µg/L	0.016 mg/L
Magnesium, total	1 mg/L	No standard

ATTACHMENT A: (Continued): LABORATORY REPORTING LIMITS AND ILLINOIS POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA

Parameter	Reporting Limit (RL)	Minimum Measurement Criteria
Manganese, total	0.001 mg/L	1.0 mg/L[3]
Mercury, total	0.0002 mg/L	0.0005 mg/L[3]
Mercury, low level, total	0.0005 µg/L	0.012 µg/L[7]
Selenium, total	0.005 mg/L	1.0 mg/L
Silver, total	0.001 mg/L	0.005 mg/L
Arsenic, dissolved	0.02 mg/L	340 µg/L
Cadmium, dissolved	0.001 mg/L	19.5 µg/L[4]
Chromium, dissolved	0.005 mg/L	968 µg/L[4]
Copper, dissolved	0.005 mg/L	27.3 µg/L[4]
Iron, dissolved	0.1 mg/L	0.5 mg/L[3]
Lead, dissolved	0.02 mg/L	160 µg/L[4]
Mercury, dissolved	0.0002 mg/L	1.2 µg/L
Nickel, dissolved	0.005 mg/L	148 µg/L[4]
Silver, dissolved	0.001 mg/L	11.4 µg/L[4,8]
Zinc, dissolved	0.01 mg/L	215 µg/L[4]
Fecal coliform	10 cfu/100 mL	200 cfu/100 mL[5]
n-Hexane extractable materials	3 mg/L	15 mg/L[3]
Gross alpha radioactivity	3 pCi/L[9]	No standard
Gross beta radioactivity	4 pCi/L[9]	100 pCi/L[5]
Chlorophyll	1 µg/L	No standard
Benzene	2 µg/L	310 µg/L
Ethyl benzene	2 µg/L	150 µg/L
Toluene	2 µg/L	2,000 µg/L

ATTACHMENT A: (Continued): LABORATORY REPORTING LIMITS AND ILLINOIS POLLUTION CONTROL BOARD MINIMUM MEASUREMENT CRITERIA

Parameter	Reporting Limit (RL)	Minimum Measurement Criteria
Xylenes	3 µg/L	920 µg/L
Organic priority pollutants[10]	Variable[11]	No standards
Nonylphenols	5 µg/L	No standard

NA = Not applicable.
[1]Required sensitivity.
[2]Calculated from pH, temperature, and ammonia nitrogen. Significant figures for pH, temperature, and ammonia nitrogen allow calculation to 0.01 mg/L.
[3]Indigenous Aquatic Life Use water quality standard only.
[4]Calculated standard based on a minimum water hardness of 200 mg/L as $CaCO_3$.
[5]General Use water quality standard only.
[6]Trivalent chromium measured as total chromium.
[7]Human Health Standard.
[8]CAWS A and B Aquatic Life Use water quality standard only.
[9]RL varies with total solids concentration of the sample
[10]Organic priority pollutants are identified in 40 CFR Part 122, Appendix D, Table II as amended.
[11]The RLs will be provided in the data report.

ATTACHMENT B: SAMPLING FREQUENCY

Station	Description	General Sampling[1]	n-Hexane Extractable Materials	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
96	Albany Avenue, North Branch Chicago River	Monthly 2nd Mon.		Monthly 2nd Mon.	Bi-monthly	Semi-annually	
112	Dempster Street, North Shore Channel	Monthly 2nd Mon.	Monthly 2nd Mon.	Monthly 2nd Mon.	Bi-monthly	Semi-annually	Quarterly
36	Touhy Avenue, North Shore Channel	Monthly 2nd Mon.	Monthly 2nd Mon.	Monthly 2nd Mon.	Bi-monthly	Semi-annually	Quarterly
73	Diversey Parkway, North Branch Chicago River	Monthly 2nd Mon.	Monthly 2nd Mon.		Bi-monthly	Semi-annually	
100	Wells Street, Chicago River	Monthly 3rd Mon.		Monthly 3rd Mon.	Bimonthly	Semi-annually	
108	Loomis Street, South Branch Chicago River	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	
99	Archer Avenue, South Fork South Branch Chicago River	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	
75	Cicero Avenue, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.	Monthly 3rd Mon.	Bi-monthly	Semi-annually	Bimonthly
41	Harlem Avenue, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.	Monthly 3rd Mon.	Bi-monthly	Semi-annually	Bimonthly
48	Stephen Street, Chicago Sanitary & Ship Canal	Monthly 3rd Mon.	Monthly 3rd Mon.		Bi-monthly	Semi-annually	Quarterly
92	Lockport Powerhouse Chicago Sanitary & Ship Canal	Weekly Every Mon.	Monthly 3rd Mon.	Monthly 3rd Mon.	Bi-monthly	Semi-annually	Bimonthly

ATTACHMENT B (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling[1]	n-Hexane Extractable Materials	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
86	Burnham Avenue, Grand Calumet River	Monthly 4th Mon.	Monthly 4th Mon.	Monthly 4th Mon.	Bi-monthly	Semi-annually	
56	Indiana Avenue, Little Calumet River	Monthly 4th Mon.	Monthly 4th Mon.	Monthly 4th Mon.	Bi-monthly	Semi-annually	Quarterly
76	Halsted Street, Little Calumet River	Monthly 4th Mon.	Monthly 4th Mon.	Monthly 4th Mon.	Bi-monthly	Semi-annually	Quarterly
57	Ashland Avenue, Little Calumet River	Monthly 4th Mon.		Monthly 4th Mon.	Bi-monthly	Semi-annually	
59	Cicero Avenue, Calumet-Sag Channel	Monthly 4th Mon.	Monthly 4th Mon.		Bi-monthly	Semi-annually	Quarterly
43	Route 83, Calumet-Sag Channel	Monthly 4th Mon.	Monthly 4th Mon.		Bi-monthly	Semi-annually	
19	Belmont Avenue, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
22	Ogden Avenue, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
23	Willow Springs Road, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
91	Material Service Road, Des Plaines River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
110	Springinsguth Road, West Branch DuPage River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	

ATTACHMENT B (Continued): SAMPLING FREQUENCY

Station	Description	General Sampling[1]	n-Hexane Extractable Materials	Radio-Activity	BETX[2]	OPPs	Nonyl-phenols
111	Arlington Drive, West Branch DuPage River	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
79	Higgins Road, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Quarterly
18	Devon Avenue, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
109	Brookfield Avenue, Salt Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	
77	Elmhurst Road, Higgins Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Bimonthly
78	Wille Road, Higgins Creek	Monthly 1st Mon.		Monthly 1st Mon.	Bi-monthly	Semi-annually	Bimonthly

[1]The parameters included in the general sampling performed monthly include temperature, pH, dissolved oxygen, fecal coliform, total metals, soluble metals, hexavalent chromium, ammonia nitrogen, combined nitrate and nitrite nitrogen, Kjeldahl nitrogen, total phosphorus, total cyanide, cyanide amenable to chlorination, phenol, alkalinity, chloride, fluoride, turbidity, total dissolved solids, total suspended solids, total organic carbon, and chlorophyll. General sampling excluded oil and grease, radioactivity, *E.coli*, BETX, priority organics, and nonylphenol.

[2]BETX is the sum of benzene, ethyl benzene, toluene, and xylenes.