

Chapter 8:

Monitoring

Key Topics:

- 1) Monitoring purposes
- 2) Canadian monitoring programs
- 3) U.S. monitoring programs and recommendations
- 4) Summary and conclusions

Our Goals:

- **Data and information is available to guide management decisions.**

One of the fundamental components of a successful watershed management plan is a well-orchestrated regional environmental monitoring strategy that provides policymakers useful information in a timely manner. Data collected through a well-planned, long-term monitoring strategy not only provides the objective means necessary to determine the environmental integrity of an ecosystem, it also provides the means necessary to measure the success of corrective actions.

Government agencies and other parties have established a variety of monitoring programs to support programs and policies to protect human health and evaluate different aspects of ecological systems in the Lake St. Clair watershed. Over the past fifteen years, the St. Clair River Remedial Action Plan (RAP) has resulted in a great deal of additional monitoring information being collected on this binational Area of Concern (AOC).

In 1998, Environment Canada, U.S. Environmental Protection Agency, Ontario Ministry of Environment and Michigan Department of Environmental Quality agreed to establish a Monitoring Upper Great Lakes Connecting Channels (MUGLCC) committee. This committee would identify and report biennially on the status of existing monitoring programs, identify gaps in monitoring activities to address management concerns, and facilitate collaboration and coordination of monitoring. In 2000, the MUGLCC committee released Monitoring Upper Great Lakes Connecting Channels Inventory of Activities report. In 2002 an updated report was released.

At its Fall 2001 meeting, the Binational Executive Committee (BEC), formed under the Great Lakes Water Quality Agreement, directed a U.S. and Canadian subcommittee to develop an on-line monitoring inventory for the Great Lakes watershed (including Lake St. Clair); host annual workshops to provide opportunities for enhancing monitoring coordination, and to prepare an annual status report for the BEC which may include identification of gaps and recommendations for additional steps to improve monitoring coordination.

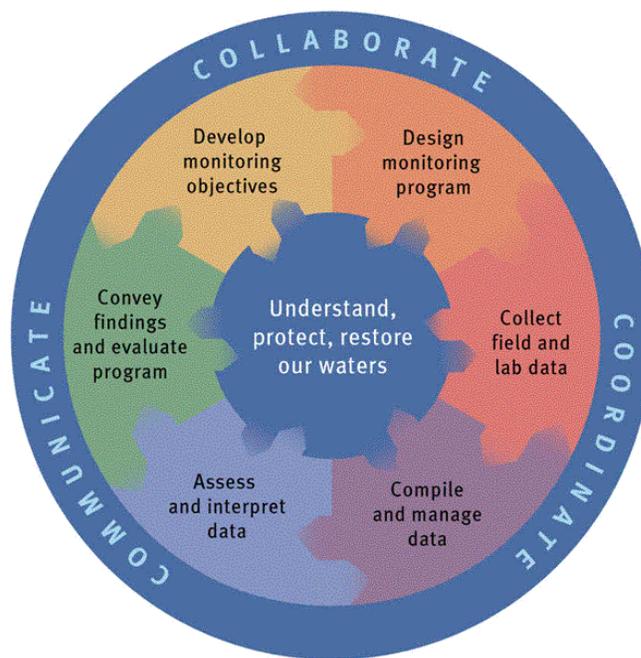
A multitude of organizations currently perform some type of monitoring within the Lake St. Clair watershed. Each has its own inherent mission and monitoring focus. As the number of monitoring organizations in the region expands and the environmental issues become more complex, the need for coordination, collaboration, and prioritization among monitoring agencies increases.

This chapter summarizes existing monitoring programs that are in place or have been completed in the past.

Monitoring Purposes

In general, monitoring programs and scientific studies are established to generate, collect and analyze information. For water management, this information is used to protect and manage water resources. Figure 8-1 presents the components of an effective monitoring program and shows how monitoring leads to the communication, collaboration, and coordination needed to understand, protect and restore our waters. For beneficial uses in Lake St. Clair, monitoring data can be used to protect human health, to determine ecosystem health and to evaluate the impacts of pollution on the environment.

Figure 8-1: Components of an effective monitoring program (Graphic courtesy of the National Water Quality Monitoring Council)



Sampling and monitoring associated with drinking water, recreational activities, and the consumption of fish and other wildlife are primarily focused on human uses of the ecosystem and safeguarding public health. At the same time, this monitoring can provide important insights into changes in the ecosystem.

Routine water quality, air quality and ecosystem monitoring programs provide background information and allow the analysis of trends over time. Specific studies may focus on emerging issues to collect and evaluate the information needed to develop policies and address impacts. Periodic studies help to assess both the status of the ecosystem and the success or failure of corrective actions.

Treated wastewater discharges, air emissions and other releases into the environment are monitored primarily to ensure the effectiveness of treatment processes and compliance with legal mandates. This information can be critical to predicting potential impacts or assessing expected improvements in the ecosystem when controls are enhanced.

Monitoring purposes or objectives are important when considering a merger of information from disparate programs within a single watershed like Lake St. Clair. Although information about the same parameter may be collected by two different programs, if the program objectives are appreciably different, the data may not be compatible.

Managing information from monitoring programs and related studies is critical to adaptive, results-oriented watershed management. Reporting is an end product of the information management process and providing the public, as well as policy makers, with up-to-date information is an important component. Fortunately, many agencies involved in monitoring programs are now taking advantage of modern technology to establish websites that provide public access to the information. Converting scientific data and reports into a format appropriate for communication to the general public remains a challenge for many government agencies and the scientific community.

Monitoring Programs



Monitoring programs in the United States and Canada were compiled separately by organizations in each nation. Recommendations related to the assessment of these programs are also included separately.

Canadian Monitoring Programs

Canada and Ontario have been actively involved in the monitoring inventories completed in 2000 and 2002 by the MUGLCC committee and in the development of a binational online monitoring inventory as directed by BEC. The ultimate goal of this online inventory wherein agency data are retained at source, regularly updated and accessed through the web. As a first step toward realizing this, the monitoring inventory includes information on where data/information is housed, and its accessibility. The following summary is intended to provide a brief reference for monitoring activities in the Lake St. Clair watershed. A more complete collection of monitoring programs in the Canadian waters of Lake St. Clair can be found in the 2000 and 2002 Monitoring Upper Great Lakes Connecting Channels Inventory of Activities report.

Human Health

- 1) Drinking Water
 - Ontario Drinking Water Surveillance Program – Ontario Ministry of the Environment (OMOE)
 - Mandatory Sampling required by Regulation - Owners/Operators
 - Recreational
 - Beach Sampling Programs - Health Units
 - Angler creel surveys – Ontario Ministry of Natural Resources (OMNR)
 - Fish and Wildlife Consumption
 - Ontario Sport Fish Contaminant Monitoring Program – OMOE and OMNR
 - Ontario Young-of-the-Year Monitoring Program - OMOE
 - St. Clair River RAP Studies – agencies and consultants supporting RAP program

Status of the Ecosystem

- 1) Ontario Provincial Water Quality (Surface) Monitoring Network (PWQMN) -
 - Sydenham River – eight sites – St. Clair Region Conservation Authority
 - Thames River – Upper Thames River Conservation Authority (15 sites) and Lower Thames Valley Conservation Authority (eight sites)
 - Essex Region Watershed -Turkey, Pike and Tilbury creeks; and Canard, Little, Puce, Belle and Ruscom rivers–Essex Region Conservation Authority
- 2) Sydenham River Habitat Stewardship sampling program - St. Clair Region Conservation Authority
- 3) Thames River Stewardship Initiative -Upper Thames River Conservation Authority, OMNR
- 4) Thames River Barrier Assessment - Upper Thames River Conservation Authority, OMNR
- 5) Municipal Drain Classification project - Fisheries and Oceans Canada and local conservation authorities.
- 6) Ontario Provincial Ground Water Monitoring Network Ontario Ground Water Studies - St. Clair, Lower Thames, Upper Thames and Essex Conservation Authorities
- 7) St. Clair River Water Quality Assessment Program - Sarnia-Lambton Environmental Association (SLEA)
- 8) The Great Lakes Marsh Monitoring Program - Bird Studies Canada
- 9) Southern Ontario Bald Eagle Monitoring Project - Canadian Wildlife Service
- 10) Great Lakes Herring Gull Egg Monitoring Program - Canadian Wildlife Service
- 11) Corridor Water Quality Monitoring - Environment Canada
- 12) St. Clair River Head and Mouth Water Quality Monitoring Program - Environment Canada
- 13) St. Clair River, Lake St. Clair and Detroit River Suspended Sediment Characterization - Environment Canada
- 14) Lake St. Clair Bottom Sediment Contaminant Characterization - Environment Canada
- 15) Benthic Sampling Programs -
 - St. Clair River – tributaries St. Clair Region Conservation Authority
 - Thames River – Upper Thames Region Conservation Authority
 - Sydenham River – St. Clair Region Conservation Authority
 - Essex Region Watershed – Essex Region Conservation Authority
 - St. Clair River RAP Studies –Agencies & consultants supporting RAP program
- 16) Species Research -
 - Sydenham River Recovery Plan, Synthesis Report – St. Clair Region Conservation Authority
 - Thames River Recovery Plan – Upper Thames Region Conservation Authority, OMNR
 - Lake St. Clair/St. Clair Delta Native Freshwater Mussel Study – Environment Canada
 - Thames River Migratory Walleye Spawning Assessment - OMNR
- 17) Lake St. Clair Studies -
 - Effects of zebra mussels of the benthic fauna of Lake St. Clair
 - Status of fish stocks - OMNR
 - Fish Community Monitoring – OMNR, Fisheries and Oceans Canada

Discharges to the Environment

- 1) Clean Water Regulation (MISA - Municipal-Industrial Strategy for Abatement) Monitoring Data Ontario Point Sources – OMOE
- 2) Other Point Source Monitoring Data – OMOE
- 3) Integrated Atmospheric Deposition Network – Environment Canada
- 4) Provincial Air Water Quality Monitoring Network – OMOE
- 5) National Pollutant Release Inventory (NPRI) - Environment Canada
- 6) Nutrient Management Plan registry under Nutrient Management Act - OMAF

Managing information from these and other monitoring programs and studies is critical to adaptive, results-oriented watershed management. Reporting is an end product of the information management process.

Providing the public with up-to-date information is an important component. Many agencies involved in the monitoring programs are now taking advantage of modern technology to establish websites that provide public access to the information. For example, local health units provide up-to-date sample results for their beach sampling programs, municipalities post drinking water quality information, and federal and provincial governments report monitoring information on their websites. Throughout the different chapters of this management plan a number of websites have been identified that provide information on water quality in the Lake St. Clair watershed.

The conversion of scientific data and reports into a format for communication to the general public is one of the challenges facing the scientific community.

Canadian Recommendations

The Canadian recommendations regarding Lake St. Clair will be developed following public review of and input into the management plan. A set of binational goals and objectives for the St. Clair River were established as part of the St. Clair River RAP.

Many Lake St. Clair issues are already being addressed, at least in part, by existing efforts to mediate problems in the watershed tributaries and the Great Lakes. Both public input and existing objectives will be important in developing the binational recommendations for Lake St. Clair.

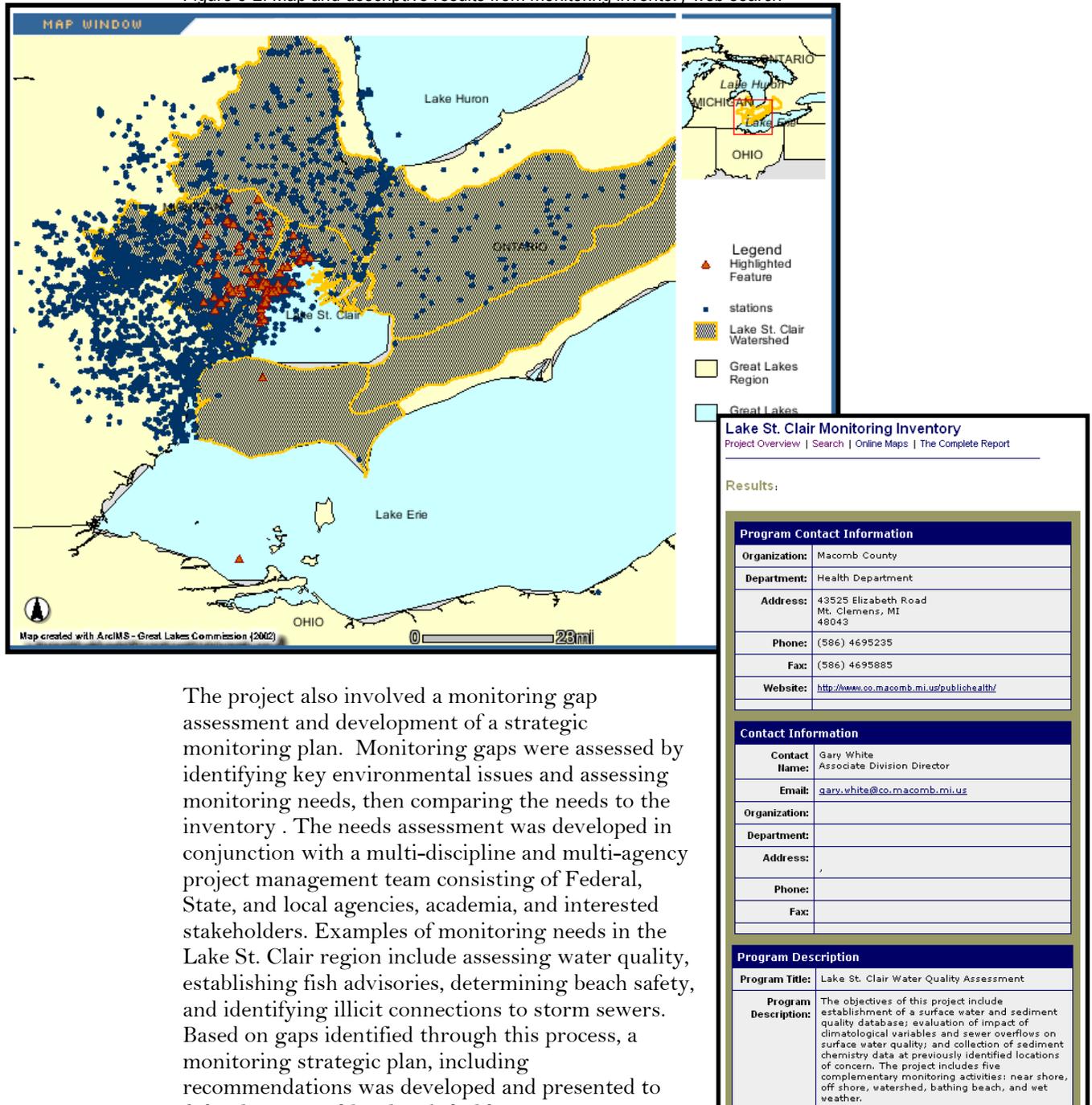
U.S. Monitoring Programs

Descriptions of U.S. monitoring programs in the St. Clair River –Lake St. Clair watershed were compiled as part of a separate monitoring inventory project sponsored by the Macomb-St. Clair Intercounty Watershed Management Advisory Group and conducted by the U.S. Army Corps of Engineers, Detroit District (USACE) and Great Lakes Commission. Some information regarding Canadian monitoring programs was captured, but efforts were primarily directed at creating a comprehensive inventory of U.S. monitoring programs.

The monitoring inventory effort involved working with federal, state, and local organizations. A web-based version of the monitoring inventory was developed and is accessible at <http://www.glin.net/gis/lkstclair/>. The inventory can be searched by area of interest. Search criteria include organization, project title, description,

monitoring medium, monitoring category, frequency, and parameters. Results of the search produce a list of monitoring programs matching the search criteria. Selection of one of the programs matching the search criteria yields information on organization, program manager, program descriptions and, when possible, a map of sampling stations. Figure 8-2 shows a sample of the available program and mapping.

Figure 8-2: Map and descriptive results from monitoring inventory web search



The project also involved a monitoring gap assessment and development of a strategic monitoring plan. Monitoring gaps were assessed by identifying key environmental issues and assessing monitoring needs, then comparing the needs to the inventory. The needs assessment was developed in conjunction with a multi-discipline and multi-agency project management team consisting of Federal, State, and local agencies, academia, and interested stakeholders. Examples of monitoring needs in the Lake St. Clair region include assessing water quality, establishing fish advisories, determining beach safety, and identifying illicit connections to storm sewers. Based on gaps identified through this process, a monitoring strategic plan, including recommendations was developed and presented to federal, state and local stakeholders.

The St. Clair River and Lake St. Clair Comprehensive Management Plan has identified a number of key management issues, each with a different set of management concerns and consequently a different set of monitoring needs. The following areas were identified as key management issues: habitat and biodiversity; human health; land use; and fisheries, recreational boating and commercial navigation.

Current monitoring programs for each issue identified in the management plan are discussed in greater detail below. Within each management issue, topics are grouped based on monitoring needs in the watershed. The analysis is limited to U.S. programs and the gaps that were identified pertain to only the U.S. portion of the watershed. In the following discussion, references to the Lake St. Clair watershed refer only to the U.S. portion of the watershed. In addition to the following discussion on monitoring programs, a list of U.S. monitoring programs is provided in Table 8-1 at the end of this chapter.

Habitat and Biodiversity



The primary monitoring needs for maintaining healthy habitats and biodiversity, as identified in the needs assessment and through analysis of current monitoring programs, include macroinvertebrate sampling, assessing quality of habitat and natural communities, and monitoring fish and wildlife population health. Although other needs, such as assessing water quality and sediment quality, also apply to habitat and biodiversity, these needs will be discussed in greater detail in the general monitoring section because they touch upon numerous environmental issues in the region.

Macroinvertebrate Sampling - Twelve monitoring programs in the Lake St. Clair watershed sample macroinvertebrate communities. Three of these programs are region-wide in scale and the other programs are more localized. Michigan Department of Environmental Quality runs a stream bioassessment program that samples every major watershed in the state on a rotating five-year cycle. Michigan Natural Features Inventory also looks at macroinvertebrates but only those officially considered as threatened or endangered. National Water-Quality Assessment (NAWQA) Program run by USGS samples benthic macroinvertebrates throughout Macomb, Oakland, and Sanilac counties. The Clinton River Coldwater Conservation Project, a joint program between Clinton River Watershed Council, Michigan Department of Natural Resources, and Trout Unlimited, assesses fish habitat including macroinvertebrate communities. There are various volunteer programs that also address macroinvertebrate sampling in the watershed. These include Clinton River Watershed Council's Stream Leaders and Adopt a Stream projects, Mill Creek Action Alliance's Mill Creek Volunteering Project Monitoring Program and Adopt-A-Stream, St. Clair County MSU Extension's Adopt-A-Stream Program, Oakland University's Interim Monitoring Program, and Lake Shore Public School's Great Lakes Education Program.

Assessing Quality of Habitat and Natural Communities – The monitoring inventory identifies two programs that are currently tracking natural communities. Michigan Natural Features Inventory (MNFI) inventories and tracks the State's endangered, threatened, and special concern species along with exceptional examples of natural communities. MDEQ's bioassessment program monitors habitat quality and fish populations. This program uses a habitat scoring system to rate habitat and natural community health for every major watershed in the state on a rotating five-year cycle. Several other efforts monitor aspects that relate to habitat or focus on more narrowly defined habitat (i.e. habitat of individual fish species).

Monitoring Fish and Wildlife Population Health – A wide range of fish population monitoring programs have been established in the Lake St. Clair watershed. Michigan and Ontario administer broad programs to track sport fish populations in the lake and St. Clair River. An integrated program has also been developed to assess the status and understand the population dynamics of Lake Sturgeon. Further, there are a few programs that assess fish populations in tributaries. While the monitoring of sport fish appears adequate, monitoring for other fish species may be lacking.

Monitoring for non-fish wildlife species is sparse. The Michigan Natural Features Inventory and Marsh Monitoring Programs are the only programs with significant coverage of a range of species in the Lake St. Clair watershed. A few other programs address individual species population health.

Human Health

Human health concerns in the Lake St. Clair watershed range in scope from safe drinking and swimming water to safe consumption of fish and wild game. Meeting existing guidelines and identifying and controlling sources of contamination remain two primary objectives for safeguarding human health in the Lake St. Clair watershed. Fish tissue contamination and pathogen levels in swimming areas remain critical components of the overall program for protecting public health. A number of U.S. monitoring programs address these issues. The following analysis provides a brief description of the scope of current monitoring programs for each issue.

Future real-time monitoring for Lake St. Clair

The Army Tank-Automotive and Armaments Command in Warren, Michigan received \$3.5 million in 2003 to develop a handheld water-monitoring device capable of providing real-time monitoring information. This device will analyze effluent from water treatment systems for the presence of biological and chemical warfare agents, as well as general environmental contaminants. The system is intended to be small in size, durable, reliable and able to be mass-produced at a cost that is viable in the commercial market.

Monitoring Drinking Water - The primary responsibility for drinking water quality regulation, including setting and enforcing standards, rests with US EPA and MDEQ. EPA maintains the Safe Drinking Water Information System that contains information about public water systems and EPA drinking water regulation violations at each of the facilities. Monitoring of intake waters is not required. Private wells are not required to monitor water quality and are therefore absent from this list. The U. S. Geological Survey runs the National Water Quality Assessment program (NAWQA) which collects data on streams, ground water, and aquatic ecosystems to generate some source water quality data. MDEQ is also completing a Source Water Assessment Program (SWAP) that identifies public drinking water sources; inventories contaminants and water's susceptibility to contamination; and informs public of the results. MDEQ also runs the Drinking Water Contamination Investigation Program that conducts drinking water testing in areas with known or suspected environmental contamination. Issuance of drinking water facility and well construction permits are primarily the responsibility of local government. The Oakland County Health Division manages the Drinking Water Supply Program, Well Protection and Education Code. Wayne County administers a Cross Connection Control program that monitors contamination of potable water through connections with non-potable sources.

Establishing Fish Advisories – Establishing fish consumption advisories requires that fish contamination data be collected from locations throughout the Lake St. Clair watershed. There are two programs collecting this information in the United States. One additional program, run by the U.S. Environmental Protection Agency, focuses on synthesizing these data and providing fish consumption advisory information to residents of the region. Fish contaminant sampling is clustered primarily along the St. Clair and Clinton rivers and in Lake St. Clair.

Determining Beach Safety – Beach monitoring for *E. coli* is conducted on at least a weekly basis through the summer months at five beaches along the Lake St. Clair shore south of Point Huron. The beach at New Baltimore Park is monitored, but no other beaches inside Anchor Bay are regularly monitored. However, St. Clair County monitors an additional 17 coastal beaches at unknown locations. It is not possible to determine the extent of monitoring along the St. Clair River. Inland beaches are regularly monitored only in Oakland County and a few other locations in other counties. There is no ongoing monitoring of environmental conditions in open Lake St. Clair that may result in beach contamination, though studies indicate that lake conditions have little impact on beach bacteria levels.

Land Use

Sustainable land use planning requires the development and implementation of local master plans and watershed management plans, identification and monitoring of impacts from land use, and development of mitigation strategies to minimize and avoid land use impacts. The primary monitoring needs for land use, as identified in the needs assessment and through analysis of current monitoring programs, include supporting sustainable zoning and master planning, identifying pollutant sources, monitoring sewage overflow events, identifying illicit discharges, supporting flood forecasting, and identifying hazardous waste sources.

Monitoring Impacts of Land Use on Water Quality – As industrial development and population expansion threatens the environmental integrity of the Lake St. Clair watershed, sustainable zoning and master planning will play an integral role in regional planning efforts. With the Geographic Information System Inventory of Land-based Data and the Environmental Stewardship Community Inventory of community master plans and ordinances, Oakland County appears to be collecting some level of sustainable zoning and master planning data. In addition, the Southeast Michigan Council of Governments' (SEMCOG) Aerial Photography and Demographic Data provide information for four counties in the Lake St. Clair watershed: Wayne, Oakland, Macomb, and St. Clair.

Identifying Pollutant Sources – Identification of pollutant sources is one of the critical steps to controlling pollution. A number of programs within the Lake St. Clair watershed focus on pollutant source identification. Eight of these programs are long-term databases maintained by the U.S. Environmental Protection Agency (U.S. EPA). Air pollutants are monitored by two programs – AirData and Aerometric Information Retrieval System (AIRS/AFS) – which have a total of 307 sampling locations in the Lake St. Clair watershed. Water pollution data is primarily reported by two programs – Permit Compliance System and STORET (storage and retrieval) – sampled within the watershed at 410 locations. Pollution created from waste or toxic products is reported by three programs – Toxics Release Inventory (TRI), Resource Conservation and Recovery Act Information (RCRAInfo), and Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS) – with a widespread sampling distribution throughout the basin. The U.S. EPA has a multipurpose environmental analysis system known as BASINS that reports on industrial discharges (among other variables) at 134 locations in the watershed. Pollution from illicit drain discharges are discussed in detail in another section.

Monitoring Combined Sewer Overflow (CSO)/Sanitary Sewer Overflow (SSO) Events – Only a few CSOs/SSOs are directly monitored in the basin. All sewer monitoring is

conducted in Oakland and Macomb counties. These programs are limited to monitoring *E. coli*. Other programs that monitor surface water for impacts from sewer overflow events in streams and at beaches exist, but this data cannot be directly related to sewers. MDEQ has CSO/SSO reports available on their website and also an SSO reporting form for individuals who recognize SSO problems in their communities.



Identifying Illicit Discharges – Identification of illicit connections and discharges remains a high level concern in the Lake St. Clair watershed. Eight programs were found that address identification of illicit connections and discharges by testing *E. coli* levels along creeks and drains. Nearly all identification of illicit connections and discharges takes place at the county level as part of the federal Phase II stormwater regulations Illicit Discharge Elimination Program (IDEP). Five illicit discharge identification programs take place in Macomb County. The Macomb County Health Department is currently focusing on identifying illicit discharges in the north branch of the Clinton River and Anchor Bay. Macomb County Public Works runs a similar program in Anchor Bay and Lake St. Clair. Macomb County Public Works also manages the Bear Creek Clean Water Initiative, which identifies sources of *E. Coli* contamination in Bear Creek. The Macomb County Department of Planning and Economic Development manages the Mapping Database of Macomb County Outfall Locations. The City of Centerline in Macomb County is also sampling its sewer tributaries for *E. coli*. St. Clair County Health Department's Saint Clair County Illicit Discharge Elimination Program focuses on the elimination of improper connections in Anchor Bay and the Pine River. The St. Clair County Drain Office manages another Saint Clair County Illicit Discharge Elimination Program that also focuses on the elimination of improper connections in Anchor Bay and Pine River watersheds. Oakland County's Drain Commissioner's Office manages the Oakland County Illicit Discharge Elimination Program that focuses on the elimination of improper connections to the storm sewer system.

Supporting Flood Forecasting – Despite the fact that the Great Lakes basin possesses a number of natural reservoirs, some areas of the basin are still subject to occasional flooding. Therefore, the need for flood forecasting monitoring exists. Flood-prone locations include river basins and areas with a high percentage of impervious surfaces. One program in the watershed generates flood forecasting data. The *Hydraulic Discharge Measurements* managed by the U. S. Army Corps of Engineers, Detroit District, collects river velocity, magnitude and direction at about 20 sites in the St. Clair and Detroit rivers. Sampling parameters include bathymetry, water depth, discharge/flow, rivers/streams, stage height, and water depth. A number of other programs discussed in the weather monitoring section also collect precipitation data, which in turn can also be used for flood forecasting.

Identifying Contaminant Sources – Monitoring contaminants occurrence and management is a necessary component to an effective environmental monitoring plan. Four programs in the Lake St. Clair watershed focus on contaminants monitoring and management. Three of these monitoring programs are long-term databases maintained by the U.S. Environmental Protection Agency (EPA). Included in this group are the Toxic Release Inventory (TRI) that contains information on specific toxic chemical releases and other waste management activities; the Resource Conservation and Recovery Act Information (RCRAInfo) which is a national program management and inventory system about hazardous waste handlers including generators, transporters, treaters, storers, and disposers of hazardous waste; and the Comprehensive Environmental Response, Compensation and Liability Act Information

System (CERCLIS) which tracks information on all Superfund sites. These programs have a widespread sampling distribution throughout the basin. Another program managed by Environment Canada, National Pollutant Release Inventory (NPRI), is a comprehensive program that monitors released pollutants in Canada.

Fisheries, Recreational Boating and Commercial Navigation

Ensuring that recreational and economic activities are sustainable is a key goal of the Lake St. Clair management plan. Accomplishing this will require identification and monitoring of impacts from recreational and commercial maritime activities, recreational fishing, ballast water management, public access sites, and support of general initiatives that promote sustainable recreation and economic activities.

At this time there are no known U.S. monitoring programs focused on recreational boating and commercial navigation. Some monitoring programs, such as those related to delisting Areas of Concern, weather monitoring, and permit compliance, address these issues indirectly. The general monitoring section below addresses these issues in greater detail. Monitoring of fish and wildlife population health is discussed in detail in the habitat and biodiversity section.

General Monitoring

Many monitoring categories did not correspond directly to the issues defined in the Lake St. Clair management plan. These monitoring categories either cut across multiple issues or do not directly match up with any specific issue. These general monitoring categories are addressed below.

Assessing Water Quality – Maintaining a long term comprehensive water quality monitoring system has been recognized as a monitoring need in the Lake St. Clair region. The data gathered through long term monitoring makes it possible to develop a baseline dataset to analyze water quality trends as well as predict and manage for water quality concerns. In the Lake St. Clair watershed, there are 18 U.S.-led programs performing water quality monitoring. These range from comprehensive monitoring programs with hundreds of stations scattered evenly through the entire watershed to programs sampling for one parameter at a single sampling location.

Monitoring in the region is largely organized by the U.S. EPA and the U.S. Geological Survey (USGS), but county level monitoring also significantly contributes to the water quality information collected in the watershed. The Water Quality Sample Database (USGS) manages 390 sampling stations distributed evenly throughout the watershed and is among the most intense of the sampling programs in the region. With 311 monitoring stations, STORET (U.S. EPA) manages a comparable number of sampling stations with the heaviest sampling in Oakland and Macomb counties as well as on the Black, Belle, and St. Clair rivers. Other federal programs sampling throughout the basin with a high number of sampling stations include PCS (U.S. EPA), BASINS (U.S. EPA), and Water Quality Sampling in Cooperation with State of Michigan (2001 - present) (USGS). At the county level, Macomb County's Lake St. Clair Water Quality Assessment Program samples at 120 locations scattered throughout the county. Macomb County's Surface Water Sampling Program samples at 63 locations. Similarly, the St. Clair County Monitoring Sites Other Than Beaches monitors 40 stations in that county. Because of their ability to focus intensely on specific areas, local monitoring programs also contribute valuable water quality monitoring

information. Some of the most effective monitoring programs in the region take place at the local level. The Bear Creek Clean Water Initiative (Macomb County) is a local monitoring program sampling 58 sites in the Bear Creek Watershed. Two additional localized monitoring programs include the Stream Leaders Program and Adopt-A-Stream (Clinton River Watershed Council) with 40 sites and the Mill Creek Volunteering Project (Mill Creek Action Alliance) with 9 sampling locations. A number of additional monitoring programs are active in the watershed. A complete description of all water quality monitoring programs can be found in the Lake St. Clair Watershed Monitoring Inventory.



Water quality monitoring in the region appears to be fairly well-represented. Monitoring sites are found throughout the entire watershed. The most intense sampling appears to be taking place in Oakland and Macomb counties. While each monitoring program currently collects a wealth of useful information, a much more powerful monitoring approach can begin as communication and collaboration among monitoring organizations increases. It is difficult to determine if the water chemistry monitoring is sufficient, however, without examining specific objectives, parameters and methods employed by programs. This requires expert examination, but the monitoring inventory provides a starting point for this analysis. In order to form an effective conservation strategy, it will also be important to identify specific water quality monitoring needs. A detailed analysis of critical water quality sampling parameters as well as key sampling locations is needed for the watershed on a priority needs basis.

Assessing Sediment Quality – Sediment quality monitoring in the Lake St. Clair watershed is fairly well-represented but there appear to be areas where program development may be needed. Geographic analysis shows solid coverage in Macomb County, along the St. Clair River, and at the outfall of all major tributaries. In addition there are focused projects underway at Bear Creek in Macomb County and Mill Creek in St. Clair and Lapeer Counties that address sediment quality. Although much of the Lake St. Clair watershed is currently being monitored for sediment quality, there may be a need to expand coverage into areas of St. Clair, Lapeer, and Sanilac counties including Belle, Pine and Black rivers to discover any emerging problem areas. Little information was included in the database describing sediment sampling parameters for each of sediment quality monitoring program. This information may be useful in order to get a true sense of exactly what data is available.

Monitoring Air Quality – Air quality monitoring appears to be fairly well represented throughout the Lake St. Clair watershed. In total, five programs were found that address air quality monitoring in the United States. U.S. EPA leads the effort to provide air quality data for the Lake St. Clair watershed. U.S. EPA's Aerometric Information Retrieval System (AIRS)/AIRS Facility Subsystem (AFS), Toxic Release Inventory, and AirData represent the region's most comprehensive U.S. air quality databases. The majority of air quality monitoring appears to be focused in the more heavily populated and industrially intense Detroit metropolitan and St. Clair River regions.

Weather Monitoring – Weather in the Lake St. Clair watershed is monitored by monitoring programs. One operational buoy in Lake St. Clair measures various physical parameters, including wind, air, and surface water conditions. Roughly 20 sampling locations in the Detroit and St. Clair rivers sample physical parameters as well. There is an extensive rain gauge monitoring network in Macomb, Oakland, and

Wayne counties, but this monitoring provides no data collection on other weather parameters, such as wind or atmospheric conditions. Based on available information, it appears that Sanilac, Lapeer, and St. Clair counties have no weather monitoring programs.

Monitoring Water Flow and Conditions – Maintaining the natural flow regime is a key factor in maintaining a healthy watershed. Sampling water flow and conditions in the Lake St. Clair watershed is the focus of three monitoring programs in the region. These programs collect data on stream flow, stream velocity, conductance, water depth and a number of other physical parameters. A few weather monitoring programs also collect data on physical parameters, including wind direction, wind speed, current direction, current speed, air temperature, water temperature, wave height, and wave period. See weather monitoring for a more detailed description of these programs. Most of the water flow and physical condition monitoring in the Lake St. Clair watershed appears to be focused in Oakland and Macomb counties and the St. Clair and Detroit Rivers. Sampling in St. Clair, Sanilac, Lapeer, and Wayne counties as well as in Lake St. Clair is very limited.

Quantifying Atmospheric Deposition – Quantifying atmospheric deposition in the Lake St. Clair watershed is addressed most directly by one monitoring program, Integrated Atmospheric Deposition Network (IADN), run by U.S. EPA and Environment Canada. IADN monitors chemical concentrations in air and precipitation at two stations in the Lake St. Clair watershed. The primary goal is to determine the atmospheric loadings and trends of toxic chemicals and to acquire air and precipitation concentration measurements. Four other monitoring programs in the region measure air quality. This data is valuable when determining potential atmospheric deposition and sources of contamination. Air quality monitoring appears to be fairly well represented throughout the Lake St. Clair watershed but there does appear to be slightly more monitoring in the more heavily populated and industrially intense Detroit metropolitan and St. Clair River regions.

Tracking Total Maximum Daily Load (TMDL) – One approved TMDL has been developed in the Lake St. Clair watershed along Crapaud Creek, where monitoring continues focused on determining the success of pollution control activities. Ten additional TMDLs are scheduled for development addressing different stream segments in the watershed. These will be developed between 2005 and 2011. Intensive monitoring is needed for these stream segments before and after TMDL development, which could augment regular monitoring. However, TMDL monitoring is limited in time, space and the parameters measured, so may be difficult to incorporate into larger-scale analyses.

Delisting Areas of Concern – Areas of Concern (AOC) are watersheds in the Great Lakes designated under the U.S.-Canada Great Lakes Water Quality Agreement, which because of historic and ongoing pollution, suffer from degraded environmental conditions. Two AOCs lie within the Lake St. Clair watershed. The St. Clair River AOC includes wetlands from St. Johns Marsh on the west (near Anchor Bay) to the north shore of Mitchell's Bay in Ontario. The Clinton River AOC includes the entire watershed. Although no programs in the Lake St. Clair monitoring inventory directly address delisting AOCs, many programs do collect information that may address this monitoring need. In order to determine if appropriate data is available to delist an AOC, a careful analysis of delisting criteria is needed. Once established, this delisting

criteria can be compared to current monitoring programs to establish what additional monitoring information is required.

Monitoring Permit Compliance – Assessing permit compliance has been established as an important monitoring need in the Lake St. Clair watershed. There are four U.S. programs in place in the Lake St. Clair watershed that collect permit compliance data. These programs include data associated with permits to discharge wastewater into rivers; compliance and permit data for stationary sources of air emissions; chemical manufacturers' permit requirements; and hazardous waste reporting requirements. Although there are a number of datasets, there are possible holes in permit compliance monitoring. For instance, there is no known tracking and reporting of compliance data for wetland permits and therefore no objective means to analyze the environmental impacts that wetlands development permits have on the basin.

New Water Quality Monitoring Initiative for Lake St. Clair

In 2002, \$2.5 million was provided to the Michigan Department of Environmental Quality (MDEQ) for monitoring efforts in the Lake St. Clair watershed. This funding will pay for a three-year effort to take water samples and collect data on pollution levels at hundreds of sites across Macomb, Oakland and St. Clair counties, plus a few locations in Wayne County. The water monitoring plan developed by the Macomb County Health Department is pending MDEQ approval. Monitoring could begin in 2004.

U.S. Monitoring Strategic Plan

As previously discussed, the results from the monitoring inventory analysis and gap identification process conducted as part of the monitoring inventory project were incorporated into a Lake St. Clair Monitoring Strategic Plan. This strategic plan was developed under the direction of a Project Management Team composed of representatives from environmental agencies in the Lake St. Clair watershed. The strategic plan includes a detailed description of monitoring inventory results, an analysis of each monitoring need, and presentation of monitoring recommendations.

The strategic plan and recommendations have been completed and presented to agencies in the Lake St. Clair watershed. Recommendations for the strategic plan are included in the U.S. recommendations section. The complete strategic plan and monitoring inventory will be available from the Great Lakes Commission's website at www.glc.org/monitoring/stclair/.

Monitoring Coordination Committee

The Lake St. Clair monitoring strategic planning process identified the creation of a broad-based monitoring coordination committee as the primary component needed for developing a comprehensive, coordinated, long-term monitoring strategy for the U.S. portion of the Lake St. Clair watershed. The function of this organization would be to establish monitoring needs in the watershed, maintain the inventory of current monitoring programs, coordinate among U.S. monitoring organizations, interface with national and binational priorities, and direct future regional monitoring in a way that best meets the previously identified needs for the Lake St. Clair watershed.

To be effective, the U.S. monitoring coordination committee for Lake St. Clair should be composed of representatives from all levels of monitoring organizations in the region and academia. It will be essential for this coordination committee to communicate and coordinate beyond immediate members into the larger monitoring community. The focus of this monitoring committee will be across disciplines and focus on broad watershed-wide monitoring goals, rather than discipline, geographic or media-focused goals that typically drive monitoring programs. It would be important for this group to interface with the Monitoring Upper Great Lakes Connecting Channels (MUGLCC) committee to ensure national and binational water quality goals

and needs are considered within the watershed and the upper Great Lakes Connecting Channel System.

A number of potential frameworks for this coordination committee have been proposed, including:

- An informal monitoring coordination committee composed of a network of representatives from various monitoring organizations in the watershed;
- A “super-watershed” monitoring coordination committee that would build up from watershed and subwatershed plans to ensure that Lake St. Clair watershed monitoring goals are met; and
- An independently funded and driven organization established through congressional mandate or bilateral agreement to conduct essential monitoring and synthesize data being collected by other organizations.

Many organizations have been set up across the country to address monitoring relative to specific regional environmental concerns. Although the approach of each of these monitoring programs differs, analysis of these programs could serve as a starting point to establishing a U.S. monitoring committee and structure for guiding monitoring in support of the management of the St. Clair River and Lake St. Clair. Selections of regional monitoring programs are discussed below.

- **Southern California Coastal Water Research Project (SCCWRP)** is a joint powers, publically funded, agency formed in 1969 to address the effects of wastewater and other discharges to the Southern California coastal marine environment. This agency formed because several government agencies had a common mission that could better be addressed by pooling resources and knowledge in one central organization. The mission of SCCWRP is to gather the necessary scientific information so that member agencies can effectively, and cost efficiently, protect the Southern California marine environment.

SCCWRP is governed by commission composed of nine members, including representatives of city, county, state, and federal government agencies responsible for monitoring and protecting the marine environment. Included in this group are the cities of Los Angeles and San Diego; the County Sanitation Districts of Los Angeles and Orange Counties; the Los Angeles, San Diego, and Santa Ana Regional Water Quality Control Boards; the State Water Resources Control Board, and the US Environmental Protection Agency.

In 1989, the National Research Council (NRC) conducted a review of monitoring in the Southern California Coast and found that despite the \$17 million spent annually it was not possible to properly assess the status of the Southern California marine environment. NRC found that nearly all monitoring was clustered in only 5% of the region, methodologies used by agencies were incomparable, and data storage differences limited data analysis and comparability possibilities.

At that point the SCCWRP, with the approval of regional regulatory agencies, developed a monitoring strategy that called for regional monitoring agencies, which included 63 agencies, to abandon their independent monitoring programs every fifth year to contribute to a

regional monitoring effort directed by SCCWRP scientists. By waiving normal regulatory requirements in exchange for participation in the regional effort, regulatory agencies were able to encourage most monitoring agencies to participate. Regional monitoring reports are currently available for 1994 and 1998 and data is being collected for 2003. (<http://www.sccwrp.org/>)

- **South Florida Water management District Water Quality Monitoring Program** monitors surface water in a variety of locations, including canals, pumping stations, agricultural discharges, and many other types of aquatic environments. The district also monitors sediments and fish for a variety of pollutants. The majority of the water quality monitoring programs provide data for legal mandates, such as the Everglades Forever Act and the Lake Okeechobee Protection Plan. Other government agencies assist in water quality sampling in Florida Bay, Everglades National Park and Biscayne Bay. Some state, federal, and private laboratories also assist with water quality analyses. (<http://www.sfwmd.gov/org/ema/envmon/wqm/>)
- The **Long Term Resource Monitoring Program** is being implemented by the U.S. Geological Survey (USGS) in cooperation with the five Upper Mississippi River System states (Illinois, Iowa, Minnesota, Missouri, and Wisconsin), with guidance and overall program responsibility provided by the U.S. Army Corps of Engineers. The mission of this program is to provide decision makers with the information needed to maintain the integrity of the Upper Mississippi River ecosystem. The long-term goals of the program are to understand the system, determine resource trends and impacts, develop management alternatives, manage information, and develop useful products. (<http://www.umesc.usgs.gov/ltrmp.html>)

The most effective method for monitoring coordination may be via the State or Federal establishment of a monitoring body to oversee monitoring in the watershed. However, absent directed leadership, funding, or authorization, a more feasible approach at this time may be the self-organization of a committee at the grass roots level based on representation from monitoring agencies and academia in the region. Furthermore, this tiered approach to creating a monitoring coordination body, rather than imposing an organizational structure, would allow the group to evolve and develop products and support on which to base a recommendation for a more formal structure and financing.

Monitoring

Candidate Management Plan Recommendations for Actions in the U.S. Watershed:

8-1. Create a U.S. monitoring coordination committee to develop and implement a comprehensive, coordinated, long-term monitoring strategy for the U.S. portion of the Lake St. Clair watershed. Committee membership should include but not limit itself to U.S. Environmental Protection Agency, Michigan Department of Environmental Quality, Michigan Department of Natural Resources, U.S. Army Corps of Engineers, Southeast Michigan Council of Governments, Great Lake Commission, county and municipal government agencies, and universities. The main objectives of the committee should be to:

8-1.a. Establish a priority list of detailed monitoring needs in the watershed

8-1.b. Encourage the sharing of data and information among all interested U.S., Canadian, and tribal/First Nation authorities

- 8-1.c. *Coordinate monitoring among monitoring organizations toward basinwide needs*
- 8-1.d. *Direct future regional monitoring in a way that best meets basinwide monitoring needs*
- 8-1.e. *Coordinate with existing binational monitoring efforts, such as the Monitoring Upper Great Lakes Connecting Channels (MUGLCC) committee*
- 8-1.f. *Address additional management plan monitoring recommendations (listed below)*
- 8-2. Align program objectives to address priority-monitoring needs and allow for an effective merger of information between disparate programs. Programs with conflicting or overlapping goals or objectives should be examined for areas of compromise or adaptation to better accommodate basinwide goals
- 8-3. Develop a set of critical indicators and identify parameters needed to produce monitoring results for these indicators
- 8-4. Develop standards for data collection methods, metadata creation, quality assurance and quality control (QA/QC) plans, data analysis comparability, and report generation
- 8-5. Identify sampling locations that are representative of the system being sampled and expand monitoring into key areas where currently none exists
- 8-6. Coordinate sampling frequency among monitoring programs so that the combined network addresses basinwide monitoring needs
- 8-7. Ensure that the combined network of monitoring programs results in a sampling design that is statistically powerful enough to detect change in the ecosystem
- 8-9. Analyze methodologies being used by monitoring organizations to ensure they produce comparable data.
- 8-10. Where possible, utilize remotely sensed data and modeling approaches to fill in data gaps, better connect monitoring information with management activities, & develop a better understanding of ecosystem interactions.
- 8-11. Maintain the publicly accessible inventory of current monitoring programs
- 8-12. Establish a financial plan for supporting monitoring coordination committee staff & addressing monitoring gaps
- 8-13. Utilize emerging technologies to develop a real-time monitoring system within the watershed for appropriate parameters, especially those related to human health and drinking water protection
- 8-14. Create a periodic environmental report card for the U.S. portion of the Lake St. Clair watershed that reports on status and trends in environmental indicators, the overall health of the watershed, and progress toward achieving management plan goals and objectives

Summary and Conclusions

Monitoring programs and scientific studies are established to generate, collect and analyze information to support established programs or policies of governmental or nongovernmental organizations. The review of monitoring programs and scientific studies in this chapter demonstrate that the St. Clair River and Lake St. Clair have been, and continue to be, the subject of substantial efforts from government agencies, industry, the scientific community, and concern citizens.

A large number of organizations currently perform some type of monitoring in the Lake St. Clair watershed and much data has been collected. However, little effort has been focused on reviewing collected data across disciplines and integrating the information relative to local, state, and national priorities. In addition, different groups have promoted monitoring systems or programs as necessary to address and solve Lake St. Clair problems. However, while such systems or programs may be necessary

to collect data to react to a specific problem, lake management requires a less piecemeal and more integrated approach to monitoring.

The challenge now lies in linking monitoring, including programs as well as techniques, across jurisdictions and disciplines at the watershed scale. To do this effectively, a monitoring strategy and structure to coordinate, collaborate and prioritize these efforts are necessary along with the development of monitoring indicators to provide a way to evaluate and track progress and effectiveness.

As a first step in this direction, the USACE, in partnership with the Macomb-St. Clair Inter-County Advisory Group and in collaboration with local, State and Federal agencies, environmental organizations and academia, compiled a web-based monitoring inventory, monitoring needs assessment and developed a gap analysis and monitoring strategic plan for the U.S. side of Lake St. Clair watershed. Since the Lake St. Clair watershed is binational, a similar Canadian effort would be necessary, then integration of both plans.

Once the baseline monitoring information and needs are available for the entire basin, a structure to coordinate and collaborate is developed, and U.S. monitoring coordination group formed, the development of a regional monitoring plan can be initiated. Accomplishing this task requires binational involvement, prioritization of monitoring needs, and an in-depth analysis of current monitoring efforts and collected data across disciplines and as related to regional and cross-jurisdictional watershed monitoring needs.

On the U.S. side, a U.S. monitoring coordination committee, ideally, would drive the collaboration and coordination needed to link monitoring across jurisdictions and disciplines within the U.S. portion of the watershed and promote data comparability, enhance data utility through development of data collection and analysis standards, extend resources and deliver efficient and timely reporting on environmental change and progress. It would be important for this group to interface with the Monitoring Upper Great Lakes Connecting Channels (MUGLCC) committee to ensure national and binational water quality goals and needs are considered within the watershed and the upper Great Lakes Connecting Channel System.

Many organizations have been set up across the country to address monitoring and could serve as a starting point to establishing a U.S. monitoring committee and structure for guiding monitoring in support of the management of the St. Clair River and Lake St. Clair. However, absent directed leadership, funding, or authorization, the most feasible approach at this time may be to allow for the evolution of such a monitoring body, rather than imposing an organizational structure, by the self-organization of a committee at the grass roots level based on representation from monitoring agencies and academia in the region.

Table 8-1. List of U.S. monitoring programs in the Lake St. Clair watershed grouped by agency.

Organization	Department	Title	Description
Federal Government			
National Oceanic and Atmospheric Administration	Great Lakes Environmental Research Laboratory	Great Lakes CoastWatch Node	CoastWatch is a nationwide program that delivers near real-time monitoring data of the Great Lakes to support environmental science, decision making, and research. CoastWatch data is used in a variety of ways including monitoring, two and three dimensional modeling of Great Lakes physical parameters, damage assessment modeling, research, and educational activities.
National Oceanic and Atmospheric Administration	Great Lakes Environmental Research Laboratory	Temporal and Spatial Variation in Lipid Content of the Mayfly Hexagenia	The objectives of this project are to: determine seasonal changes in lipid content and lipid class composition in Hexagenia at several different sites; document changes in lipid content as individuals develop through the various life stages; assess populations.
National Oceanic and Atmospheric Administration	National Data Buoy Center	National Data Buoy Center	Collection of weather related data.
U.S. Army Corps of Engineers, Detroit District	Environmental Analysis Branch	Operations and Maintenance of Federal Navigation Channels	Maintain project depths and monitor sediment quality.
U.S. Army Corps of Engineers, Detroit District	Great Lakes Hydraulics & Hydrology Office	Hydraulic Discharge Measurements	This program collects river velocity, magnitude and direction in the St. Clair and Detroit Rivers on a recurring basis. This information is used to verify the inflow and outflow for Lake St. Clair, to provide information for net basin supplies and water level forecasting, and for monitoring of flood and ice conditions.
U.S. Environmental Protection Agency & Environment Canada		Integrated Atmospheric Deposition Network (IADN)	Binational network measuring atmospheric deposition of toxic substances to the Great Lakes at various master and satellite stations around the basin.
U.S. Environmental Protection Agency		Toxic Release Inventory (TRI)	TRI is a publicly available EPA database that contains information on specific toxic chemical releases and other waste management activities reported annually by covered industry groups as well as federal facilities.
U.S. Environmental Protection Agency		STORET (Storage and Retrieval)	STORET contains raw biological, chemical, and physical surface and ground water data collected by federal, state and local agencies, Indian Tribes, volunteer groups, academics, and others. STORET contains information on why the data were gathered; sampling location; sampling and analytical methods used; the laboratory used to analyze the samples; the quality control checks used when sampling, handling the samples, and analyzing the data; and the personnel responsible for the data.
U.S. Environmental Protection Agency		Permit Compliance System (PCS)	The PCS database tracks permit, compliance and enforcement status, to meet the informational needs of the NPDES program under the Clean Water Act.
U.S. Environmental Protection Agency		AirData	The AirData website provides access to yearly summaries of U.S. air pollution data. AirData has information about where air pollution comes from (emissions) and how much pollution is in the air outside our homes and work places (monitoring).
U.S. Environmental Protection Agency		Aerometric Information Retrieval System/Air Facility Subsystem (AIRS/AFS)	AIRS/AFS contains compliance and permit data for stationary sources regulated by the U.S. EPA and state and local air pollution agencies.
U.S. Environmental Protection Agency		Fish Consumption Advisories	The National Listing of Fish and Wildlife Advisories (NLFWA) database includes all available information describing state, tribal, and federally issued fish consumption advisories in the United States for the 50 States, the District of Columbia, and four U.S. Territories, and in Canada for the 12 provinces and territories.

Organization	Department	Title	Description
U.S. Environmental Protection Agency		Resource Conservation and Recovery Act Information (RCRAInfo)	Hazardous waste information is contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. All generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies.
U.S. Environmental Protection Agency		Better Assessment Science Integrating Point and Nonpoint Sources (BASINS)	BASINS is a multipurpose environmental analysis system for use by regional, state, and local agencies in performing watershed and water quality based studies. Included in the database are water quality monitoring, bacteria monitoring, weather stations, USGS gaging stations, fish consumption advisories, national sediment inventory, shellfish classifications, GIS data, and point source data.
U.S. Environmental Protection Agency		Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS)	The system tracks information on all Superfund sites -- both the most hazardous (the National Priorities List) and those where cleanup is easier or less urgent. Data from other Federal agencies' sites (Federal Facilities) are also included.
U.S. Fish & Wildlife Service	Alpena Fishery Resources Office	Lake Sturgeon Monitoring	Main objectives of the program are to: develop a coordinated, multi-agency effort to assess the current status of lake sturgeon stocks in Lakes Huron, Erie, and the St. Clair System; continue and expand a tagging program to better define relative abundance and seasonal movement; conduct a qualitative and quantitative assessment of critical habitat parameters; develop a standardized database for the storage, management, and sharing of biotic and abiotic information; and create an information transfer system.
U.S. Geological Survey	National Water Quality Assessment Program	National Water-Quality Assessment (NAWQA) Program	The U. S. Geological Survey implemented the National Water-Quality Assessment (NAWQA) Program to support national, regional, and local information needs and decisions related to surface and ground water-quality management and policy. Sampling includes general water chemistry, pesticides, contaminants in bed sediments, and contaminants in fish and benthic invertebrates.
U.S. Geological Survey	Network Operations Section	Water Quality Sampling (2001 - present)	Water quality information is collected at 30 stream locations and 200 lakes around the state. Data has been collected since 2001. A website is being developed to distribute the data.
U.S. Geological Survey		Real-time Surface-Water (Streamflow) Monitoring	This program includes surface water gaging station data used for water quality studies, waste load allocations, distribution studies, and advanced waste treatment assessments.
U.S. Geological Survey		Daily Streamflow Surface Water	Daily streamflow data for the period of record at each site.
U.S. Geological Survey		Ground-water Levels	Depth to water or water-surface elevation in wells.
U.S. Geological Survey		Real-time Water Quality Data	Real-time water-quality data are returned directly from field instruments. Instantaneous data are recorded at 5-minute to 1-hour intervals and uploaded to the data base every 4 hours.
U.S. Geological Survey		Water Quality Sampling	Water-quality data from field and/or laboratory analysis of water, biological tissue, stream sediments, and other environmental samples.
U.S. Geological Survey		Surface-Water Historical Data	This database includes daily, monthly, and annual statistics computed from published daily data. Also included are annual maximum instantaneous peak stream flow and gage height and field measurements of streamflow and gage height.
Regional Government			
South Eastern Michigan Council of Governments (SEMCOG)	Information Services	Demographic Data	Southeastern Michigan Council of Governments (SEMCOG) collects and develops a wide range of demographic data across the seven county Southeast Michigan Region. Including: Regional Development Forecast (RDF), Community Profiles, Annual and monthly estimates of population and households, and Residential building permits.
South Eastern Michigan Council of Governments (SEMCOG)		Precipitation Data	For over 30 years, South Eastern Michigan Council of Governments (SEMCOG) has maintained a Rain Gauge Network covering much of Southeast Michigan. The network covers Wayne, Oakland, Macomb, Livingston, and parts of Washtenaw counties. Data are collected by independent observers from

Organization	Department	Title	Description
			approximately 75 precipitation gauges.
South Eastern Michigan Council of Governments (SEMCOG)		Aerial photography	Southeastern Michigan Council of Governments' (SEMCOG) 36-year aerial photography collection consists of seven surveys (the first in 1966 and then every five years since 1970) totaling over 16,300 frames. Each survey covers the Southeast Michigan region consisting of Livingston, Macomb, Monroe, Oakland, St. Clair, Wayne and Washtenaw counties.
State Government			
Michigan Department of Environmental Quality	Water Division	Fish Contaminant Monitoring Program	The principal objectives of Michigan's Fish Contaminant Monitoring Program are to evaluate the need for sport fish consumption advisories and commercial fishing regulations; identify spatial and temporal trends, and; evaluate whether existing programs are effectively eliminating or reducing chemical contamination.
Michigan Department of Environmental Quality	Water Division	Water Chemistry Monitoring Project	The purpose of the Water Chemistry Monitoring Project (WCMP) is to assess temporal and spatial trends in surface water contaminant levels; assess the current status and condition of individual waters of the state and determine whether Michigan Water Quality Standards are being met; provide data to support water quality protection programs and evaluate their effectiveness; and detect new and emerging water quality problems.
Michigan Department of Environmental Quality		Stream Bioassessment Program	This program samples every major watershed in the state on a rotating schedule of 5 yrs. Monitoring includes fish, benthic invertebrate community structure, nuisance aquatic plants, algae, slimes, and assessment of physical habitat.
Michigan Department of Environmental Quality		Beach Monitoring Database	Database of county collected beach monitoring information. Open to the public at http://www.deq.state.mi.us/beach/ . This site contains information about Michigan public beaches and recreational-use waterways. Here you will find information about beach closings, monitoring efforts and <i>E. coli</i> test results. Information on this site is entered and maintained by local health department offices.
Michigan Department of Natural Resources		Lake Sturgeon Assessment in Lake St. Clair and St. Clair River	Determine population parameters, spawning locations, movements of lake sturgeon in the St. Clair System.
Michigan Department of Natural Resources		Assessment of the Fish Community of Lake St. Clair	The objectives of this study are to measure the abundance of yellow perch, juvenile game fish, and various forage species in Lake St. Clair; to monitor abundance of adult game fish species; to document the abundance and distribution of aquatic plants in Lake St. Clair with sidescan sonar and hydroacoustic technology, and; to monitor trends in sport fish catch rates for the Lake St. Clair fishery.
Michigan Department of Natural Resources	Fisheries Division - Management	Fish Surveys	This program surveys fish populations in lakes and streams in the Lake St. Clair watershed. Surveys evaluate population abundance, species diversity, and fisheries management programs.
Michigan Natural Features Inventory		Michigan Natural Features Inventory (MNFI)	Michigan Natural Features Inventory maintains a continuously updated information base, the only comprehensive, single source of data on Michigan's endangered, threatened, or special concern plant and animal species, natural communities, and other natural features.
Local Government			
City of Center Line		Center Line Illicit Discharge Elimination Program	Sixty-one samples along 19 miles of sewer tributary have been sampled. Follow up sampling and dye testing will be performed if problems are detected in the initial samples.
City of Center Line		Center Line Storm Sewer Overflow/Wet Weather Monitoring	The city storm sewer is monitored during wet weather events for high <i>E. coli</i> levels.
Macomb County	Department of Planning and Economic Development	Mapping Database of Macomb County Outfall Locations	For each of the 27 communities in Macomb County three preliminary Geographic Information System (GIS) data layers are being created to help communities with Phase II permit requirements. Data layers include US census urban boundaries, MDEQ approved sub-watershed and drain basins, and outfall

Organization	Department	Title	Description
			locations and ownership.
Macomb County	Health Department	Macomb County Bathing Beach and Surface Water Quality Program	The Macomb County Health Department conducts a water quality monitoring program each year from mid April through late September. Water samples are analyzed for E. Coli bacteria, which, in high numbers, indicate that surface water contamination by sewage or other wastewater has occurred and that harmful bacteria may be present.
Macomb County	Health Department	Surface Water Sampling Program	This project focuses on monitoring of surface water quality through systematic sampling of county watersheds.
Macomb County	Health Department	Macomb County Health Department Illicit Discharge Elimination Program	This project focuses on the elimination of improper connections to the storm sewer system, as well as, the elimination of illegal dumping into storm sewers. In addition, the project focuses on minimizing the amount of seepage into the storm water system from the sanitary sewer system and from septic systems.
Macomb County	Health Department	Lake St. Clair Water Quality Assessment	The objectives of this project include establishment of a surface water and sediment quality database; evaluation of impact of climatological variables and sewer overflows on surface water quality; and collection of sediment chemistry data at previously identified locations of concern.
Macomb County	Public Works	Bear Creek Clean Water Initiative	The goal of the project is to identify and eliminate sources of E. coli contamination in Bear Creek. The first step is to track down the sources of E. coli entering the watercourse through systematic sampling and testing of the Bear Creek and drains tributary to it. Wet weather, dry weather, and sediments were sampled.
Macomb County	Public Works	Macomb County Public Works Illicit Discharge Elimination Program	This project conducts initial investigations of outfalls for E.coli temperature, surfactants, and ammonia as part of the Phase II permit process.
Oakland County	Drain Commissioner's Office	Oakland County Illicit Discharge Elimination Program	The project focuses on the elimination of improper connections to the storm sewer system, as well as the elimination of illegal dumping into storm sewers. In addition, the project focuses on minimizing the amount of seepage into the storm water system from the sanitary sewer system and from septic systems.
Oakland County	Drain Commissioner's Office	Chapter 20 Drains in Oakland County	The purpose of this program is to map the drains in Oakland County defined in Chapter 20 of the Drain Code.
Oakland County	Drain Commissioner's Office	Twelve Town Combined Sewer Overflow (CSO) Basin/George W. Kuhn (GWK) Project monitoring	The George W. Kuhn drain site in southeast Oakland County is surveyed for F. Coli and E. Coli after wet weather events to determine if all systems within the twelve town basin are functioning properly.
Oakland County	Health Division	Oakland County Beach Monitoring Program	Water at each of the beaches in Oakland County is tested on a weekly basis June through August, measuring for an indicator bacteria, Escherichia coli (E. Coli).
Oakland County	Health Division	Drinking Water Supply Program, Well Protection and Education Code	The purpose of this program is to allow for the issuance of permits for new well construction and inspection of private wells, as well as educate the citizens of Oakland County who utilize ground water for drinking.
Oakland County	Planning and Economic Development Services	Geographic Information System (GIS) Data Inventory	The program monitors a variety of land-based information through Geographic Information Systems (GIS) including land use, impervious surface, community master plans, significant potential natural areas, and wetlands and water features.
Oakland County	Planning And Economic Development Services	Environmental Stewardship Community Inventory	The purpose of this program is to inventory local community master plans and ordinances relative to standards for water resources and natural areas protection.
Saint Clair County	Drain Office	Saint Clair County Drain Office Illicit Discharge Elimination Program	This project focuses on the elimination of improper connections to the storm sewer system, as well as, the elimination of illegal dumping into storm sewers in Anchor Bay and Pine River watersheds by testing all county drains. This project will move to other watersheds as funding permits.
Saint Clair County	Health Department	Bathing Beach and monitoring program	This program seeks to provide information on water quality, provide education programs to community on water quality, establish an information database on water quality, and preserve water quality.

St. Clair River and Lake St. Clair Comprehensive Management Plan, June 2004
Chapter 8- Monitoring

Organization	Department	Title	Description
Saint Clair County	Health Department	St. Clair County Monitoring Sites Other Than Beaches	Gather data for background information and to help determine possible causes of beach closings.
Saint Clair County	Health Department	Saint Clair County Health Department Illicit Discharge Elimination Program	This project focuses on the elimination of improper connections to the storm sewer system, as well as, the elimination of illegal dumping into storm sewers in Anchor Bay and Pine River watersheds by testing drainage areas along natural waterways and roadside ditches.
Wayne County	Health Department	Wayne County Bathing Beach Water Quality Program	During the summer months the Wayne County Environmental Health Division monitors bacteria, E. coli, at the natural bathing beaches in Wayne County to protect the health of the bathers.
Non-governmental Organization			
Clinton River Watershed Council		Stream Leaders Program	Stream Leaders is CRWC's school-based water quality monitoring program. Currently there are two dozen schools in the program monitoring at approximately 40 sites twice a year (May and October). Data is collected on the following parameters: chemical (pH, phosphates, nitrates, temperature, turbidity, DO, BOD, and fecal coliform), physical (in-stream and riparian habitat conditions), and biological (macroinvertebrates). The data are compiled into a Water Quality Index and CRWC publishes an annual "scorecard" on the overall water quality for each of the seven major subwatersheds of the Clinton River (Upper Clinton, Paint Creek, Stony Creek, Clinton Main, North Branch, Red Run, and Clinton River East).
Clinton River Watershed Council		Adopt-A-Stream	Adopt-A-Stream is the umbrella program for CRWC's volunteer stewardship activities. Monitoring includes physical (in-stream and riparian habitat conditions) and biological (macroinvertebrates) parameters. Other activities include riparian landowner stewardship such as streambank stabilization, native landscaping, and river clean-ups. Currently only several individuals and groups are involved in the monitoring portion of this program, but CRWC has developed a plan to expand this program in the next two years to include monitoring teams in each of the seven major subwatersheds of the Clinton River.
Clinton River Watershed Council, Michigan Department of Natural Resources, Trout Unlimited		Clinton River Coldwater Conservation Project	This is a joint effort between CRWC, MDNR, and four chapters of Trout Unlimited to assess fish habitat and identify enhancement opportunities in the Clinton River. The project's first phase is focusing on Galloway Creek in Auburn Hills and the mainstem of the Clinton River from Galloway Creek to the Oakland-Macomb county line. Volunteer teams are collecting data on temperature, flow, in-stream and riparian habitat conditions, and macroinvertebrate communities, using methods approved by MDNR. This will be the most comprehensive inventory of this stretch of the river that has ever been undertaken.
Mill Creek Action Alliance		Mill Creek Volunteering Project	Every spring and fall, volunteers collect benthic macroinvertebrates and other water quality data from nine sites along Mill Creek. The goal of the project is to collect and compare data from dredged and non-dredged sites and to document the impact dredging has had on water quality .
The Nature Conservancy		Interactions between freshwater mussels and zebra mussels in the Upper Clinton River	To determine if chronic low levels of zebra mussel infestation on native mussels has a long-term impact on freshwater mussel populations in a small river habitat that supports two globally rare mussels.
Wildlife Habitat Council		Nest Monitoring Program (NMP)	Employees and community volunteers monitor nest boxes to document the nesting cycle and number of fledglings, in order to measure reproductive success. Data includes numbers of nest boxes, eggs and fledglings.

Organization	Department	Title	Description
University/Education			
Lake Shore Public Schools	Science Department	Great Lakes Education Program	Annually, sixth grade students test the water at Lake St. Clair. One goal is to meet the state objectives of involving students in testing.
Michigan State University Extension	St. Clair County	Adopt-A-Stream	This is a grassroots program focused on macroinvertebrate and chemical testing in the streams of St. Clair County. Activities include streambank clean-ups, streambank surveys, monitor stream insects and gauge water quality, execute streambank enhancement projects to help control erosion and stabilize streambanks.
Oakland University	Chemistry	Interim monitoring program	Educational tool that is also used to support environmental groups or specific targeted issues (e.g., forensic studies)
University of Michigan	Ocean Engineering Laboratory	Lake St. Clair Weather Buoy	An over-water data buoy was deployed to collect and report data in Lake St. Clair. The buoy supplied wind and water data to aid in the development of a system to predict beach closures and to guide county health officials in water sampling strategies.