SELECTED FINDINGS

LAKE ST. CLAIR REGIONAL MONITORING PROJECT

June 2007
Macomb County Health Department

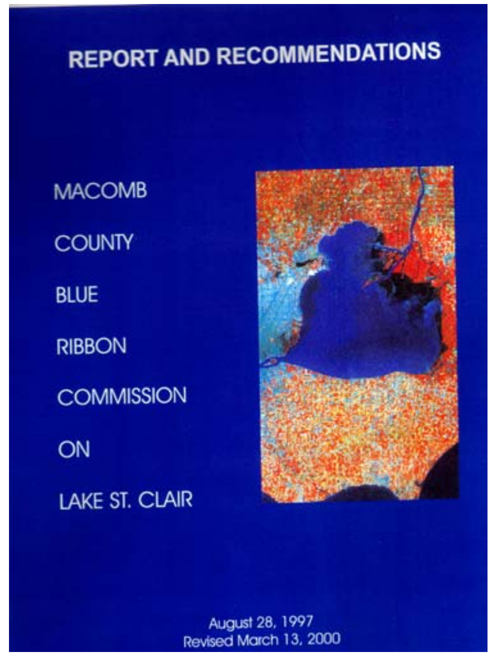
Lake St. Clair Regional Monitoring Project
funded by the Michigan Department of Environmental Quality
Lake St. Clair Assessment Program
funded by the Macomb County Board of Commissioners
In-Kind Contributions by Participating Agencies

This booklet provides a brief narrative of selected project findings in key areas:

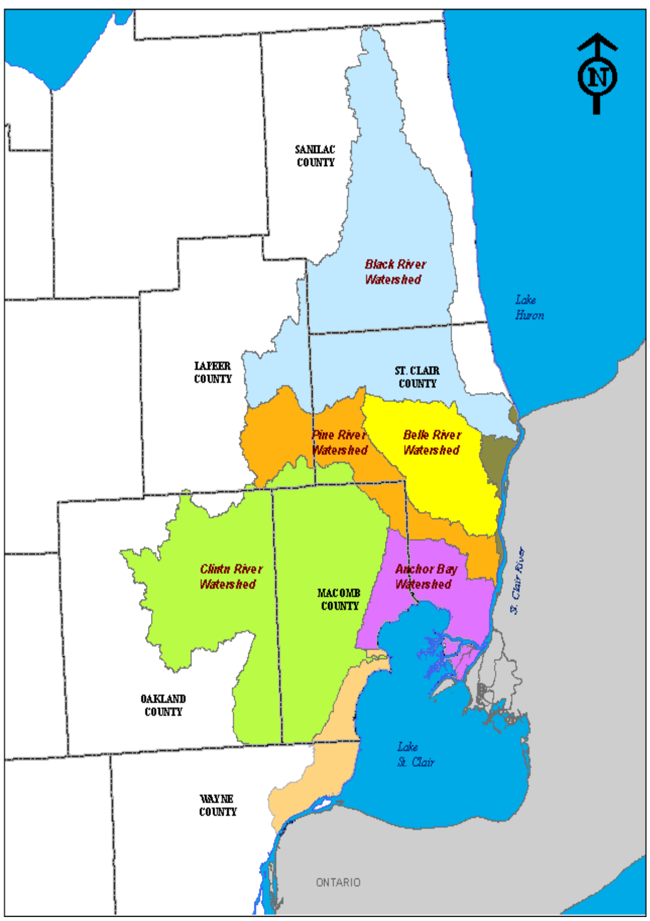
E. coli
Nutrients
Chloride
Wet weather impacts on water quality
Tributaries and Lake St. Clair

Summary conclusions are also highlighted. This booklet should be considered a brief snapshot of what has been learned. Comprehensive reports will be completed in early Fall 2007. Several project reports are currently on the website (www.lakestclairdata.net) and others will be added as they are finalized. Project data, which can be accessed in a variety of ways and other information are also available on the website.

The origins of the Lake St. Clair Regional Monitoring Program (LSCRMP) lie in the long-established Beach Monitoring Program operated by Macomb County Health Department (MCHD). The summer of 1994 brought excessively high *Escherichia coli* (*E. coli)* levels to Lake St. Clair's four bathing beaches, forcing MCHD to close the beaches for a total of 147 days. Besides denying recreation to citizens and causing economic hardship to businesses, this unprecedented occurrence generated great concern in both the academic science and public health communities.



Project Area



John Hertel, then Chairman of the Macomb County Board of Commissioners, appointed a 32-member Blue Ribbon Commission on Lake St. Clair to determine the causes and cures for the problem. The 1997 report from that Commission included this recommendation: "The Macomb County Health Department should enhance and maintain ongoing water quality monitoring programs, and identify sources of contamination within the county."

In 1999 a draft concept paper, created through the efforts of the Macomb County Water Quality Board, was circulated in Lansing. By 2002 the ideas in that paper had evolved to the point of readiness for implementation. The 2003 Michigan Department of Environmental Quality (MDEQ) budget contained a $2.5 million appropriation to MCHD for a comprehensive water quality monitoring program for Lake St. Clair (LSC). The Lake St. Clair Regional Monitoring Project (LSCRMP) began on August 1, 2003.

Sampling was done during 2004 and 2005, for a total of nineteen "dry weather events" and fourteen "wet weather events." Continuous water quality monitoring was conducted at thirteen fixed stations, continuous and manual stream flow measurements at twenty-three locations and rainfall measurements at five locations. With inclusion of data from MCHD's ongoing LSC Assessment, the LSCRMP database contains 25,000 pieces of data for over 90 different sites, including several inland lakes in Oakland County, near-shore and off-shore locations in LSC, the St. Clair River and the watersheds of LSC's important tributaries: the Clinton, Belle, Pine, and Black Rivers. Both water and sediment samples were analyzed for more than 80 parameters, including *E. coli*, nutrients, metals, PCB's, pesticides, physical measures of water quality, and many others.

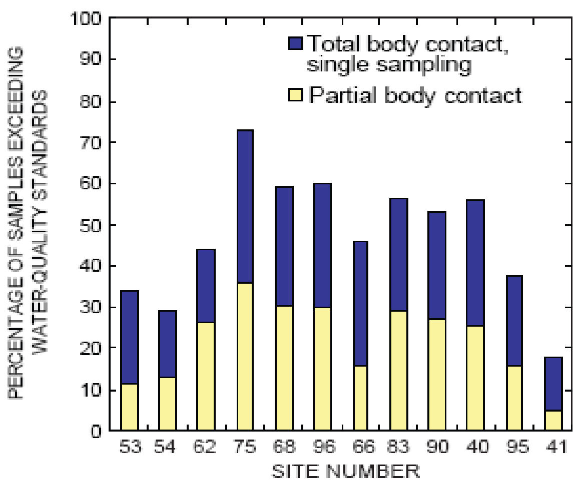
The resulting data were placed at a dedicated, publicly-accessible website, containing not only the project database but also a variety of maps, links to other water quality information, various project reports, and more. Several of these reports were informed by a comprehensive historical review of previously acquired data. The content of the LSCRMP website will be preserved into successor websites also assuring public access.

Like the rivers and watersheds it studied, the LSCRMP operated across boundaries, including geographical boundaries (Macomb, St. Clair, Oakland, and Wayne Counties were all partners), level-of-governance boundaries (local governments, the Michigan DEQ, and the United States Geological Survey (USGS) all played intersecting parts) and public-private boundaries (several prominent environmental consulting firms were involved in both the sampling and data aspects of the project). Much added value was generated because the project reached across these traditional but arbitrary lines to assemble all needed resources.

The LSCRMP confirmed (or proved false) many long-held assumptions, produced much new and valuable knowledge, and clearly demonstrated that its costs were money well spent. The information gained to date, and the information which wise future policy-making will require, justify in the strongest possible way the funding, development, and maintenance of a permanent regional surface water monitoring system.

Nearly half of 18,000 water quality samples analyzed for *E. coli* exceeded Michigan's water quality standard for full-body contact. These samples were collected at 61 locations in Macomb County during 2000 – 2005. *E. coli* are bacteria that indicate a fecal source from animals or humans. The LSCRMP provided a means for a rigorous analysis of the historical *E. coli* data from Macomb County's Lake St. Clair Assessment Project. Sampling locations along the Clinton River often did not meet Michigan standards (Figure 1). For example, concentrations from site no. 75 were greater than total and partial contact standards as frequently as 73 and 36 percent of the time, respectively (Figure 1).

Figure 1: Exceedances of Michigan Water Quality Standards - Clinton River



SITE #	LOCATION
53	Dequindre Road
54	Auburn Road
62	Kleino Road
75	Garfield Road
68	Moravian Road Bridge
96	Shadyside Park
66	Amvet Drive – Crocker Avenue
83	Mt. Clemens YMCA
90	4081 Riverview
40	North River Road – I-94
95	South River Road – Clinton River
41	South River Road – Clinton River & Lake St. Clair

Twelve of the seventeen stream segments and lake areas designated by MDEQ and reported to the U. S. Environmental Protection Agency (USEPA), as impaired in the Michigan part of the Lake St. Clair drainage basin are listed due to high levels of the fecal indicator bacteria, *E. coli*.

The negative influence of Red Run's water quality on the Clinton River is evident from the *E. coli* concentrations in the Clinton River upstream and downstream of its confluence with Red Run. Median *E. coli* concentrations below the confluence of Red Run and the Clinton River are two to three times higher than median concentrations above the confluence. On the Red Run, 86 percent of the samples exceeded Michigan's full-body contact standard.

Not all water bodies in the LSCRMP study area are the same with respect to *E. coli* concentrations. There are significant differences. For instance, samples during the recreational water season (May through September) from Milk River exceeded Michigan's standard for partial body contact only nine percent of the time from 2000 to 2005, whereas samples from Bear Creek exceeded this standard 100 percent of the time. Also, surprisingly, higher fecal coliform levels were found in the Middle Branch in Macomb Township than in the Red Run in Sterling Heights. Two of the three highest wet weather concentrations were at the Middle Branch and Red Run sampling locations. Another unexpected finding was that Paint Creek had much higher *E. coli* levels than Stony Creek; probably because the latter has benefits of dilution and natural attenuation from the immediate upstream Stony Creek Lake.

Although the Clinton River is a significant source of *E. coli* to Lake St. Clair, concentrations near the mouth of the Clinton River are often lower than at upstream sampling locations. The slower velocities near the mouth of the river probably cause pollutants to deposit on the river bottom during most weather conditions (of course, very large rain events will move some of these pollutants into the lake).

For perspective, it is important to know that some Clinton River locations sampled by the Project had quite consistently low *E. coli* concentrations, particularly in dry weather (Table 1). It is also encouraging that through 2005 MCHD continued to document statistically significant decreases in *E. coli* concentrations at the mouths of the Clinton River and of the Clinton River Spillway.

Table 1: Consistently low *E. coli* concentrations

SAMPLING LOCATION[1]	
DRY WEATHER FEWEST EXCEEDANCES	
Stony Creek at Mt. Vernon Street in Washington Twp.	0 of 16
Clinton River Spillway Outlet	0 of 16
Clinton River Mouth	1 of 16
Clinton River Main at Auburn Road in Auburn Hills	1 of 16
Clinton North Branch at M-59 in Macomb Township	2 of 16
Clinton River Main at M-59 in Waterford	3 of 16
WET WEATHER[2] FEWEST EXCEEDANCES	
Clinton River Spillway Outlet	4 of 10

1 Locations with the fewest exceedances of Total Body Contact Standards (300 cfu/100mL)

2 Geomean of four samples per storm event

Contamination due to fecal bacteria was far less common in the Black, Belle and Pine Rivers than in the Clinton River. This was not necessarily the case for some of the watercourses that provide direct drainage to the St. Clair River and Lake St. Clair. In dry conditions *E. coli* levels in the Swan and Beaubien Creeks met full-body contact standards almost all of the time; whereas levels in the Salt River and in Bunce Creek did not meet those standards most of the time.

The LSCRMP provided the first comprehensive assessment of *E. coli* levels in the region and the Project's data include the results from the first ever collection of intensive wet weather samples at thirteen locations. The data allow much better understanding of the exceedances of *E. coli* standards and help identify several stream reaches with suspected point or nonpoint pollutant sources. The Project's results also augment MCHD's long term and robust *E. coli* database.

Acquiring and assessing water quality of Lake St. Clair and its tributaries on a systematic and sustained basis, through a strategic network of permanent monitoring locations, is critical to environmental quality. It is essential to understanding changes over time, providing water quality information to entities responsible for storm water management and to public health agencies for their risk assessments, as well as to regulatory agencies and to officials whose duties include establishment of policies for protection and enhancement of water quality.

Nutrients (nitrogen and phosphorus) can greatly affect the water quality of streams and lakes. They are essential for growth of algae and other aquatic plants. Since 1994 excessive aquatic plant growth has been a problem in Lake St. Clair and inland lakes. Algae, specifically mats of *Cladophora*, are an increasing problem.

Algal Bloom: Lake St. Clair-Mouth of the Clinton River 2004

Long-term data from the mid-1970s to the mid-1990s indicate nutrient levels on the Pine, Black and Belle rivers neither increased nor decreased. In the Clinton River at Mt. Clemens nutrient levels decreased significantly. However, concentrations of total nitrogen still exceeded USEPA water quality criteria. About 75 percent of samples from the Clinton River Basin had concentrations of total nitrate that exceeded the USEPA nitrogen criteria. In contrast, most other streams in the LSCRMP study area were generally below the USEPA nitrogen criteria; the Pine River and St. Clair River rarely exceeded USEPA nitrogen criteria.

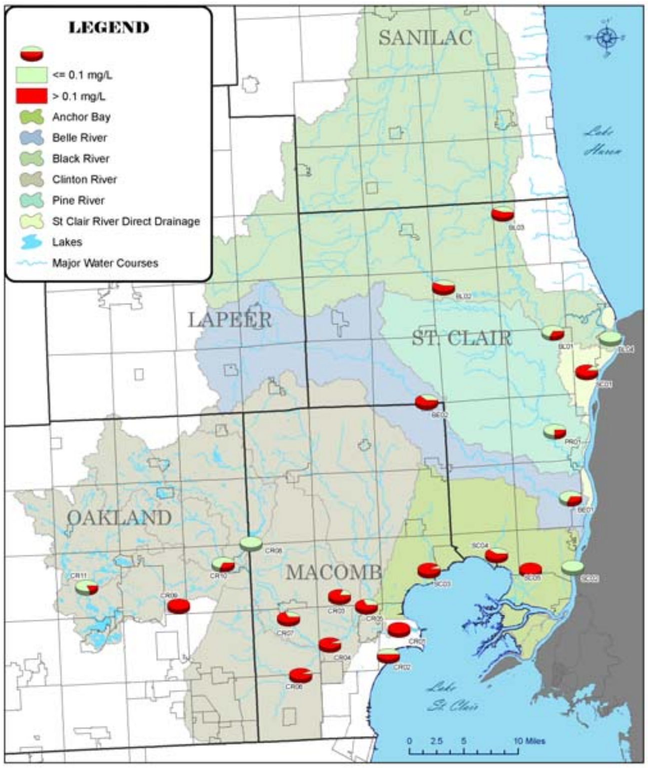
On the other hand, phosphorus concentrations in all streams within the LSCRMP study area exceeded the USEPA criteria. More than 93 percent of phosphorus samples in the Belle, Black, Pine and minor[1] river basins, and 84 percent of samples in the Clinton River Basin were above this standard. Phosphorus concentrations are of particular concern because of their link to very high rates of aquatic plant growth and because their death and decay reduce oxygen needed by fish.

More recent Project data indicated high nutrient concentrations in the Clinton River with upstream monitoring stations exhibiting lower phosphorus and nitrogen concentrations than downstream stations. Fertilizers and illicit connections to storm sewers are the likely sources of these nutrients. Elevated levels of ortho-phosphate (which is associated with fertilizers) were found in the Clinton River watershed downstream of Auburn Hills.

Point sources may be contributing to the nutrient levels found in portions of the Clinton River. The Clinton River in and upstream of Auburn Hills and the Red Run Drain had the highest concentrations of nutrients (nitrate-N and total phosphorus) in the Project area. In addition, these two waterways were the only ones with higher dry weather phosphorus values than wet weather values (Figure 2). These monitoring sites are located just downstream of two major point sources. Outside of the Clinton River watershed, the Salt River has the highest nutrient concentrations in the Project area.

[1] For data analysis purposes, results were aggregated from 45 sampling locations along 21 smaller rivers, creeks and drains. Two of these streams discharge to the St. Clair River, one just downstream from Pt. Huron and one at Marine City, fourteen discharge to Anchor Bay and five discharge to Lake St. Clair in St. Clair Shores north from the Milk River.

Figure 2: Comparison to critical value: total phosphorus – dry conditions



Project estimates from use of USEPA PLOAD (PLOAD) model indicate that total-nitrogen loads from the Black, Belle and Pine River basins are approximately 495,599 lb/yr., 156,561 lb/yr., and 121,212 lb/yr. respectively and total-phosphorus loads are 80,777 lb/yr., 25,493 lb/yr., and 19,655 lb/yr. respectively. Nutrient loadings were initiated for the first time for the Belle, Black and Pine River watersheds. In addition, estimated loadings of total phosphorus and total nitrogen in each sub-basin of these watersheds provides an opportunity to assess comparatively high nutrient loads in each sub-basin and to consider the possible need for best nutrient management practices.

Despite long term decreasing nutrient trends, these contaminants still exceed acceptable concentrations. Periodic excessive algal growth in Lake St. Clair testifies to this problem. Throughout the Project area preventive actions are necessary; with monitoring targeted strategically to assess both current trends and areas that need focused community and citizen actions.

Undesirably high chloride discharges and chloride-contaminated runoff can be prevented. Chloride is naturally occurring in Michigan waters and has not traditionally been thought of as a contaminant. Besides being naturally occurring, however, chloride is also used extensively in Michigan for deicing road pavements in winter and to soften water. Variation in chloride concentrations, therefore, can be instructive regarding impacts of human activities.

LSCRMP's chloride monitoring results from 2004-2005 were compared with a number of Michigan Rivers studied by MDEQ. The two rivers with the highest chloride concentrations were the Belle River as thirteenth out of thirteen and the Clinton River as twelfth. This is consistent with findings within the Project area as higher chloride concentrations were found in more densely developed areas. Five Clinton River locations sampled during summer months by MCHD, concurrent with LSCRMP monitoring, found no surprisingly high chloride concentrations, although two of the twenty results exceeded the EPA's recommended 860 mg/L Criteria Maximum Concentration (CMC), with Bear Creek levels of 1100 mg/L in 2004 and 900 mg/L in 2005. During these and previous years virtually all higher chloride concentrations were detected during dry weather conditions.

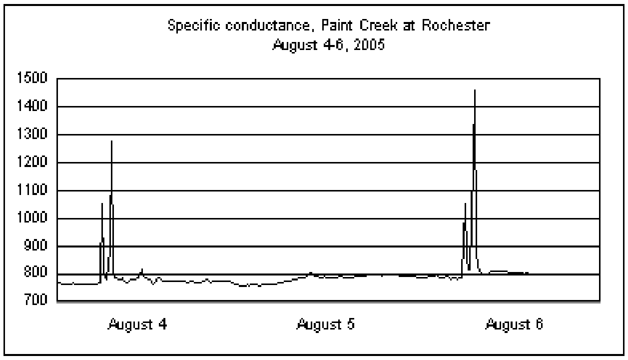
Spatially, chloride concentrations are quite variable. The St. Clair River, with a long-term median value of only 6.0 mg/L has the lowest concentrations in the LSCRMP study area. Concentrations in other streams are higher, with long-term medians for the Black and Pine Rivers at about 40 mg/L and those for the Belle and Clinton Rivers just over 70 mg/L. Long-term median concentrations for minor[1] tributaries are 86 mg/L. The highest concentrations measured were on the Belle River in the 1970s and were greater than 3000 mg/L.

As in many other areas of Michigan, chloride concentrations are increasing in streams throughout the Lake St. Clair basin. In Oakland County, for instance, chloride concentrations in streams have more than doubled in the last 30 years. In the Clinton River at Mt Clemens, chloride concentrations increased from a median of 60 mg/L in the mid-1970s to a median of 120 mg/L in the mid-1990s.

The Project's continuous monitoring resulted in two notable findings. First, during winter months water quality changes can be *very large.* For instance, in the Clinton River in Fraser, chloride concentrations exceeded 1500 mg/L many times during the winter of 2004-05. Significantly, since many agencies do not routinely sample stream water quality in Michigan during winter months they may not detect some of the poorest water quality of the year. There were numerous recent winter exceedances of the CMC for chloride.

Second, continuous monitoring detected extreme changes in water quality that can take place *very rapidly*, i.e., more rapidly than is detectable by manual sampling methods. For instance, at Paint Creek, specific conductance increased dramatically in a matter of minutes at regular intervals during the project, most likely due to a possible discharge upstream of the gage (Figure 3).

Figure 3: Indications of Upstream Illicit Discharges

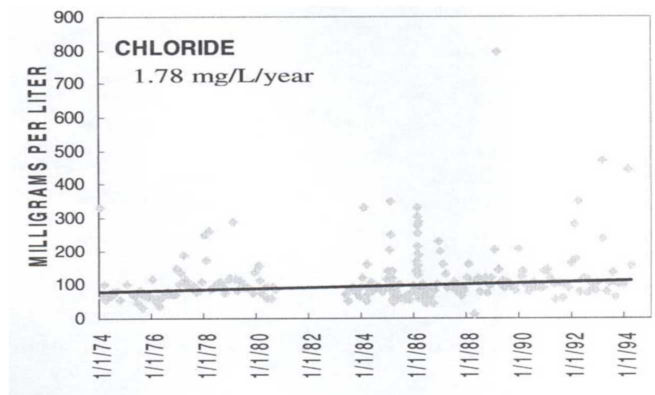


Even inland lakes are a concern. From 1967 to 2005, chloride concentrations in Lakeville Lake, Lake Orion, Lake Angelus, and Sylvan Lake in Oakland County all increased. The smallest increase was by a factor of three; the largest by a factor of seven, from 20 to 141 mg/L. Analysis of chloride levels in Oakland County during baseflow suggest that chloride is increasing in the ground water that flows into streams. Since many lakes are fed by ground water, increases in chloride in inland lakes may be due to chloride in ground water.

Long-term increases in chloride are indicative of increased human influence on stream water quality. Major anthropogenic sources of chloride in the study area are agricultural and urban runoff, municipal and industrial wastewater discharges, illicit discharges, animal wastes, septic tank effluent and fertilizers. Chloride concentrations are probably related to the greater number of paved roads in urban areas with chloride applications to road pavements for winter control of ice and snow (Figure 4).

"High concentrations of salt in surface water may cause certain heavy metals to leach out of water. These substances can potentially harm fish and other aquatic life. The potential for pollution is particularly acute in non-flowing surface water, such as ponds and lakes." [2]

Figure 4: Chloride Trends at Clinton River in Mt. Clemens, Michigan



Clearly, watercourses in the Project area have had, and continue to receive, undesirably high chloride discharges and runoff from anthropogenic, and thus preventable sources. Will continuing chloride additions to LSC contribute to overall lake deterioration? Subsequent investigations, more focused on chloride and its impacts on the Lake, need to be pursued.

[2] Best Management Practices for Environmental Issues Related to Highway and Street Maintenance. National Cooperative Highway Research Program, National Research Board: National Academy Press, Washington, D.C. 1999

Measuring the impact of wet weather on the water quality of the tributaries and subsequently on Lake St. Clair itself has been a signal aspect of the Project. Dramatic water quality differences resulted from storm events in the Project area. Overall, the Clinton River sampling locations in Auburn Hills, Red Run in Sterling Heights, and Middle Branch Clinton River near Waldenburg had the poorest water quality during storm events. These portions of the Clinton River were in relatively poor condition during dry weather as well.

Storm events do not consistently increase or decrease concentrations of measured parameters. At most sites sampled, both urban and rural, *E. coli*, aluminum, total phosphorus, TSS, BOD, and COD concentrations *increased* significantly during storm water runoff events, suggesting that storm water was transporting these pollutants to waterways. At most sites, dissolved oxygen, nitrate-N, and chloride generally *decreased* during storm events suggesting that storm water diluted concentrations of these pollutants.

Suspended solids concentrations are *extremely high* in Paint Creek during storm events, the ratio of wet to dry TSS being 130:1. This suggests excessive erosion of upland soils or of the creek banks and bed. Suspended solids were one to three times higher during wet conditions for *larger* streams the Black, Belle, Clinton River outlets and the St. Clair River and eight to 43 times higher for *smaller* streams other than Paint Creek (Table 2).

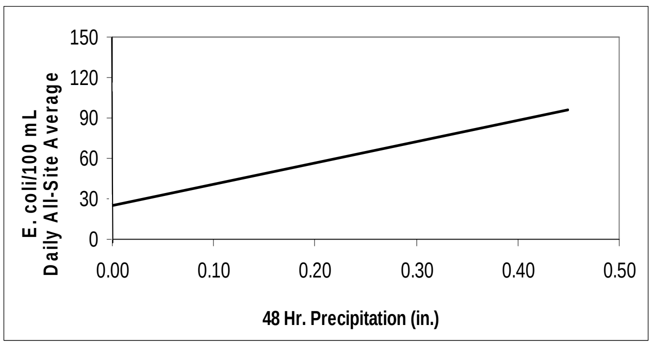
Table 2: Ratios of Wet Weather to Dry Weather levels of *E. coli* & TSS Results

SAMPLING LOCATION	E. COLI WET:DRY	TSS WET:DRY
Belle River Outlet	5:1	4:1
Black River at Jeddo Road	7:1	7:1
Pine River Outlet	12:1	8:1
Clinton River Outlet	5:1	1.3:1
Clinton River Spillway Outlet	7:1	4:1
Red Run Drain at 14 Mile Road in Sterling Heights	17:1	20:1
Clinton River Main branch at Garfield Road in Clinton Township	12:1	10:1
Clinton River Main at Auburn Road in Auburn Hills	38:1	43:1
Clinton River Main at Riverland Road in Sterling Heights	15:1	22:1
Clinton River Main at Garfield Road in Clinton Township	7:1	20:1
Clinton River Middle at 21 Mile Road in Macomb Township	13:1	8:1
Paint Creek at Mt. Vernon Street in Rochester	17:1	130:1
St. Clair River in Algonac	10:1	3:1

E. coli levels were significantly higher in wet conditions especially in the Clinton River Watershed, indicating the likelihood of significant wet weather sources at some sampling locations. This suggests the impact of combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), failing septic systems, re-suspended sediment, storm water runoff contaminated with pollutants from illicit discharges and animal feces. Ratios of wet weather to dry weather *E. coli* results from streams monitored during the Project illustrate the magnitude of the influence of wet weather sources. Ratios of wet to dry *E. coli* concentrations were from five to 38 times higher during storms compared to base flow conditions (Table 2).

MCHD data from 1998 to 2005 demonstrate a correlation between mean *E. coli* concentrations at 23 Lake St. Clair near-shore sampling locations and precipitation during the prior 48 hours. This suggests, and notices of public beach closures attest to, the adverse effects of wet weather discharges to Lake St. Clair (Figure 5).

Figure 5: *E. coli* Daily Averages: Lake St. Clair



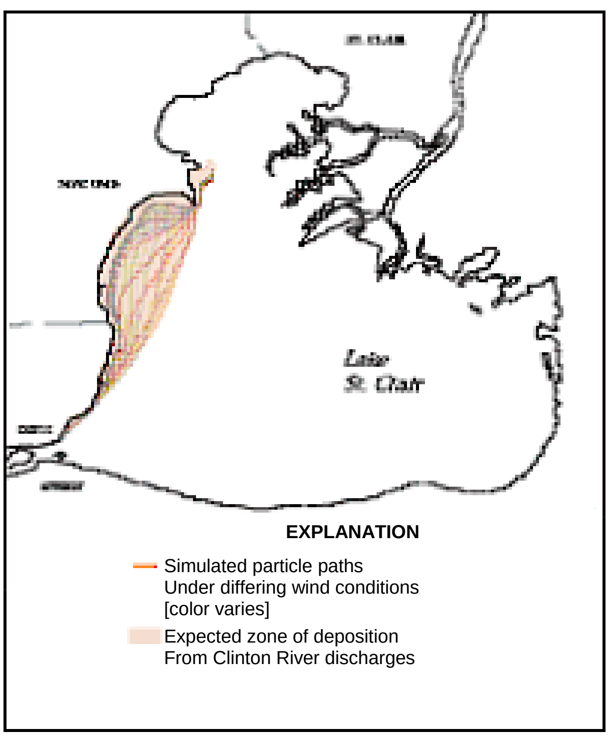
During the monitoring period the Project area received 22 percent less precipitation than normal. This reduced rainfall generally came from smaller storms, rather than fewer storms. This indicates that the results reported here may not fully convey wet weather impacts found during a typical year.

The Clinton, Black, Belle and Pine Rivers did not meet full-body contact standards due to *E. coli* contamination during wet weather conditions. Phosphorus concentrations were generally twice as high, and nitrate and dissolved oxygen concentrations generally decreased.

The Project's findings help understand the severity of storm-induced impacts on the Lake, the high ratios of wet to dry pollutant concentrations, and the increased flows during storms. The MCHD has demonstrated a correlation between precipitation and higher *E. coli* levels in Lake St. Clair. These findings warrant greater recognition of storm water impacts on the Lake, which can focus remedial actions and targeted long term monitoring.

The water quality of Lake St Clair is affected by the St. Clair River, the Clinton River, lake flow dynamics and wind conditions. The St. Clair River dominates flow into Lake St. Clair, averaging ten times more flow than the Clinton River and other U.S. tributary streams. Furthermore, it is mostly Lake Huron water, so it is of much better quality than the Clinton River, although both rivers are Areas of Concern. Most of the flow of St. Clair River is distributed into the U.S. part of Lake St. Clair, with the largest amount being from the North Channel into Anchor Bay. While the Clinton River flow is much smaller, it still significantly affects some areas of the lake. Within Lake St. Clair, wind greatly influences flow directions (Figure 6).

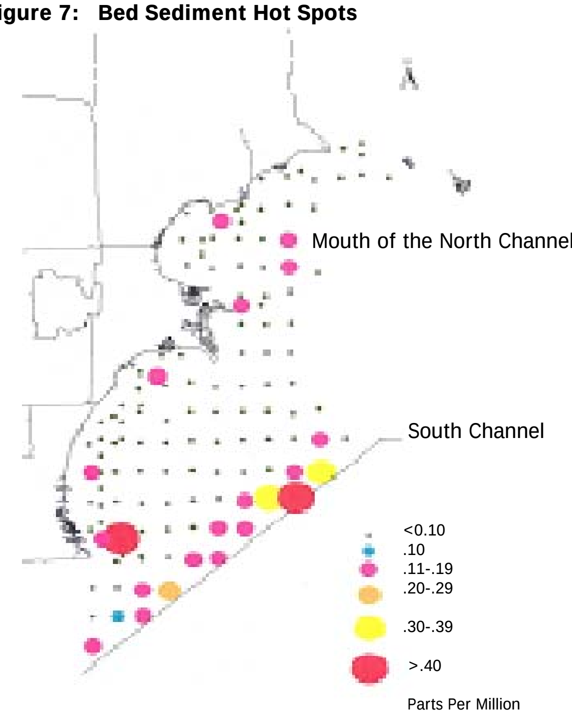
Figure 6: Expected Zone of Deposition



The effects of the Clinton River on Lake St. Clair water quality are mostly evidenced south of the mouth of the Clinton River and within three miles or less of the Michigan shoreline, primarily in L'Anse Creuse Bay. Extensive use of a computer flow model before and during the LSCRMP clearly shows the areas affected by the Clinton River. When winds have an easterly component, water from the Clinton River may stay very near the shoreline, effectively oscillating back and forth in L'Anse Creuse Bay (Figure 6).

Legacy contamination of sediments by heavy metals and organic compounds within the Lake St. Clair basin has been well documented. Analysis of the distribution of these contaminants further highlights the distinction between near-shore and offshore water quality. Mercury concentrations are highest near-shore and decrease lakeward from the Michigan shoreline. Contaminated sediment from the Clinton River likely stays near the Michigan shoreline. Contaminated sediment data and flow modeling indicate that higher metal concentrations in the central and eastern parts of Lake St. Clair do not originate from the Clinton River (Figure 7).

Figure 7: Bed Sediment Hot Spots



During the LSCRMP, samples were collected from a single site on the St. Clair River, near Algonac. Although a single site is not indicative of water quality across the entire river, the water quality at this site was still noteworthy. Following rainfall events, significant increases in *E. coli*, nutrients, and biological oxygen demand (BOD) occurred at this site. These increases suggest a large and highly concentrated source of contamination that should be investigated.

Despite legacy contamination in many places, generally the St. Clair River has fairly good water quality. Continuing to improve and protect the quality of the St. Clair River is critical to protecting Lake St. Clair, because the river provides significant dilution throughout the central part of the lake.

Lake St. Clair near-shore water quality problems became particularly evident in 1994. Shortly thereafter Macomb County initiated several water quality initiatives, including its Lake St. Clair Assessment Project. Subsequent sampling and monitoring have provided extensive water quality data to establish policies, to provide advice to citizens, and to support planning and design of the Lake St. Clair Regional Monitoring Project. The Assessment Project has also been a major source of *E. coli* and other data for analyses and interpretation.

Until recently, data have not been adequate to determine trends in the water quality of Lake St. Clair. However, in examining data collected between 1998 and 2005, MCHD has reported significantly decreasing *E. coli* and other contaminant trends. Another hopeful trend is that water quality near the mouth of the Clinton River has shown declines of nitrogen species and phosphorus from the mid-1970s to the mid-1990s.

If we want to know whether or not these desirable trends are continuing, then we must continue to monitor. The results of that monitoring will be critical to understanding the future water quality of Lake St. Clair.

CONCLUSIONS

• **Watershed management works – the water quality in the St. air/Clinton Rivers continue to improve (after years of neglect).**

Counties and municipalities have spent millions of dollars and progress can be easured.

Environmental advocates, teachers, and children continue to perform acts of ndness to our water resources.

Problems still exist and we all must step up to the task.

Targeted efforts within the study area will allow very cost effective eans of improving water quality – rather than spreading the environmental sources across the entire study area, projects should focus on the specific oblems identified in the study.

Identify, prioritize, implement.

The "one size fits all" approach doesn't work – Spend limited resources where ey do the most good.

As counties and communities zero in on our worst areas, the rest of us must otect our best areas.

Monitoring is important – measuring progress is key to keeping all atershed stakeholders focused on continuing improvement.

You can't improve what you can't measure.

Enforcement relies on timely, accurate water quality information.

Citizens respond best when they understand the scope of the problem.

Rapid access to the data is critical to timely responses to water quality erturbations. No one responds to "old news" and if they did, the problem is early always "washed away."

Old information is old news – who really cares.

We can do better – we must do better.

Monitoring is an excellent investment and the foundation of the entire ivironmental regulation/enforcement infrastructure – The EPA/MDEQ is very iportant but they can't do their job effectively without information.

Thirty years ago the federal and state governments maintained active monitoring ograms.

By and large, these are no longer funded.

This, however, does not mean that they are no longer needed.

We must find a way to install, operate, and maintain long term monitoring if we int to protect our water resources

Funding for long term monitoring is the single best investment for ater quality improvement in southeast Michigan.

If we find the way to set up comprehensive monitoring stations and provide the formation in a timely manner to the public, they will demand that our water is clean d that the government at whatever level protects this valuable resource

PROJECT REPORTS

Inland Lake Sediment Sampling and Analysis, ECT, 2005

Water Sampling and Analysis, ECT, 2006

Data Management and Dissemination, ECT, 2006

Data Coordination and Quality Control, TetraTech EMI, 2006

Selected Findings Booklet: Lake St. Clair Regional Monitoring Project – MCHD, 2007

Lake St. Clair Regional Monitoring Project: Final Report, MCHD, Pending, 2007

Inland Lake water quality summary report, U.S.G.S., 2005

Estimation of nonpoint-source loads of total nitrogen, total phosphorous, and total suspended solids, in the Black, Belle, and Pine River basins, Michigan by use of the PLOAD Model, U.S.G.S*.,* 2006

Areal distribution, concentration of contaminants of concern in surficial streambed and lakebed sediments, Lake St. Clair and tributaries, Michigan, 1990-2003, U.S.G.S., 2006

Bacteria and Emerging Contaminants in the St. Clair River/Lake St. Clair Basin, Michigan, U.S.G.S., 2007

Cooperative water-resources monitoring in the St. Clair River/Lake St. Clair Basin, Michigan, U.S.G.S., 2007

Stream-water quality during storm-runoff events and low-flow periods in the St. Clair River/Lake St. Clair Basin, Michigan, U.S.G.S., Pending, 2007

Nutrients, sediment, and chemical pollutant loadings in the St Clair River/Lake St. Clair Basin, Michigan, U.S.G.S., Pending, 2007

Water quality of the St. Clair River, Lake St. Clair and their United States Tributaries, 1946-2005, U.S.G.S., Pending: 2007

Supplemental Reports:

Annual USGS reports containing Project streamflow and water quality data:

- Water resources data, Michigan water year 2004, U.S.G.S, 2004-2005
- Water resources data, Michigan water year 2005, U.S.G.S., 2006

Lake St. Clair Water Quality Assessment Project, MCHD, 2004 & 2005

FOR MORE INFORMATION:

www.lakestclairdata.net

www.macombcountymi.gov/publichealth

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