Chapter 3:

Environmental Health of the Watershed

Key Topics:

1) Point source discharges
2) Nonpoint source pollution
3) Findings and recommendations

Our Goal:

- Pollution does not threaten public health and the health of the watershed.

Many contaminants have the potential to threaten the quality of aquatic life and human health in the Lake St. Clair watershed. These contaminants come from a variety of past and present agricultural, industrial, private, and municipal activities, and include both point and nonpoint sources of pollution. Point source contamination is pollution that comes from an easily identifiable source, such as outfall pipes from industrial or municipal wastewater treatment plants. Nonpoint source contamination is pollution that comes from indistinguishable or hidden sources, such as failing septic systems, leaking underground storage tanks, runoff from lawns and agricultural fields, parking lots and roadways, or atmospheric deposition. This chapter describes the major sources of point and nonpoint source pollution in the watershed and reviews some of the existing programs that address them.

Background

The impact of large industrial and municipal discharges in the watershed is well studied and for the most part well regulated. The combined impact of many smaller, less-regulated sources has been known for many years but is only now coming into focus within federal, state and local programs. For years, these smaller sources were not considered as high a priority as larger sources. However, as the entire system becomes better understood, it was recognized that control of these sources is important in order to control water quality degradation.

Did you know…

Point source contamination is pollution that comes from an easily identifiable source, such as an outfall pipe from a wastewater treatment plant

Nonpoint source contamination is pollution that comes from undistinguishable or hidden sources, such as leaking underground septic or storage tanks, runoff from lawns and agricultural fields, runoff from parking lots and roadways, or atmospheric deposition.

In Ontario, federal, provincial and local agencies have studied and documented pollution from nonpoint, or diffuse, sources for many years. Based on the findings from these studies and the impact of nonpoint source pollution, there have been a number of government programs aimed at reducing pollution from diffuse sources.

In1988, a binational report known as the Upper Great Lakes Connecting Channels Study (UGLCCS) documented the environment quality of Lake St. Clair and identified most of the pollution sources. The UGLCCS report stated that “no exceedences of water quality based guidelines were found in Lake St. Clair and overall, the water quality in the lake was not a concern.” Canadian contaminant loadings, excluding inputs from the St. Clair River, were found to be predominately associated with tributaries discharging into the lake. Other studies for Canadian tributaries have supported these findings.

The UGLCCS report recognized the St. Clair River as the source of the largest volume of water to Lake St. Clair, and the source of significant contaminant loadings. The UGLCCS report indicated that the contaminant loadings from tributaries and degraded tributary water quality were also of concern. The Sydenham and Thames rivers were recognized as the major sources of phosphorus and nitrate/nitrite loading to the lake on the Canadian side, while considerable input of phosphorus and nitrate on the U.S. side originates in the Clinton River watershed.

The St. Clair River RAP Stage 1 Report provides information on the relative loadings from point and nonpoint sources along the river and upstream loadings from Lake Huron. The St. Clair River RAP Stage 2 Recommended Plan, published in 1995, identified high priority point sources in both Canada and the United States. In addition, the plan reported concern regarding nonpoint sources of contaminants, including urban runoff, rural storm runoff, waste sites, malfunctioning septic systems, domestic sources not connected to municipal treatment facilities, and household hazardous waste. The plan also identified contaminated sediments in three priority zones along the Canadian side of the upper St. Clair River.

The contaminants of concern in the system can be broadly grouped into three categories: conventional pollutants, metals, and organic pollutants. Table 3-1 provides a summary of contaminants found in the St. Clair River that exceeded regulatory agency guidelines used to evaluate environmental quality, based on information collected during the mid-1980s or earlier.

Table 3-1: Contaminants that Exceeded Regulatory Guidelines in the St. Clair River

Metals	Conventional Pollutants	Organic Pollutants
Cadmium (w, s)	Oil and grease (s)	Octachlorostyrene (b, w)
Copper (w, s)	Total Kjeldahl nitrogen (s)	Hexachlorobenzene (w, s)
Chromium (s)	Total phosphorus (w, s)	Hexachlorobutadiene (w)
Iron (w, s)	Chloride (w)	Tetrachloroethylene (w)
Lead (w, s)	Bacteria (w)	Carbon tetrachloride (w)
Manganese (s)		Dieldrin (w)
Mercury (b, w, s)		PCBs (b, w, s)
Nickel (s)		PAHs (s)
Zinc (w, s) Arsenic (s)		

*found in biota (b), water (w), and/or sediment (s) (mid-1980s)
Source: St. Clair River Stage 1 RAP Report

Since the RAP Stage 1 report was issued in 1991, there have been update reports issued in 1993 and 1998. These reports document the actions taken to directly address the RAP issues and reduce contaminant levels. Information on the progress of the St. Clair River RAP can be obtained from a number of web sites, including the Friends of the St. Clair at www.friendsofstclair.ca.

The report issued in 1998 (Stage 1 1997 Update) provided a comparison of current contaminant levels to the yardstick values established by the St. Clair RAP. The report was careful to note that the comparison may provide a skewed impression of overall AOC ambient conditions since the RAP studies focus on the most environmentally degraded segments of the river. The yardsticks are a set of guidelines established utilizing information from Ontario, Michigan, Canadian and U.S. governments and the

International Joint Commission. They serve as benchmarks to evaluate future remedial measures in the St. Clair River.

Point Source Discharges

Point source discharge generally refers to the wastewater or "effluent" that is released through a man-made pipe or sewer, although the term can also be applied to ditches, swales, and other sources that discharge effluent. These discharges are regulated under permits obtained by industries and municipalities.

Point source discharges to the St. Clair River, Lake St. Clair, and tributaries come from municipal and industrial sites, including wastewater treatment plants, thermal electric generating stations, and industrial facilities. Figure 3-1 shows the location of industrial and municipal discharges directly to the St. Clair River.

Figure 3-1: Location of municipalities and major point source discharges in the St. Clair River AOC
Source: Stage 1 St. Clair River RAP (1991)

Industrial Point Source Discharges

While some residual contamination from historic practices continues to cause environmental challenges, industries that discharge now contribute fewer pollutants to the St. Clair waterways than they have in the past.

According to the Michigan Department of Environmental Quality (MDEQ), industrial permittees on the U.S. side are in compliance with the discharge permits issued to them under the Federal Clean Water Act and the Michigan Natural Resources and Environmental Protection Act. The MDEQ has reported that there are minor exceedances of permit conditions at facilities within the watershed but that none of these exceedances are formally actionable under the enforcement guidance used by the department. Field personnel for the MDEQ contact the facilities when minor exceedances occur to determine the cause and assure that corrective actions have been taken so that similar problems will not occur in the future. From a regulatory standpoint, current discharges should have minimal impact on the waterways, and shouldn't be a contributory factor relative to violating water quality standards. There are, however, remnants from historic practices that affect the system. In addition, these standards have not yet been addressed using the TMDL approach and may have to be adjusted when the other watershed influences are considered.

Crude oil refinement began at Oil Springs and Petrolia, Ontario, in the 1860s where several small refineries used large black iron pots and condensers to boil crude oil and recover valuable liquids. These refineries and petrochemical facilities expanded significantly between the 1940s and 1970s. Unfortunately, these refineries were also the sources of many historic environmental problems that, together with other pollution problems, caused the International Joint Commission (IJC) to identify the St. Clair River as a "Problem Area" in 1973. In 1981, "Problem Areas" were renamed "Areas of Concern" (AOC) to reflect a shift to a broader approach aimed at using environmental quality data for water, sediment and biota to evaluate the areas in a uniform manner.

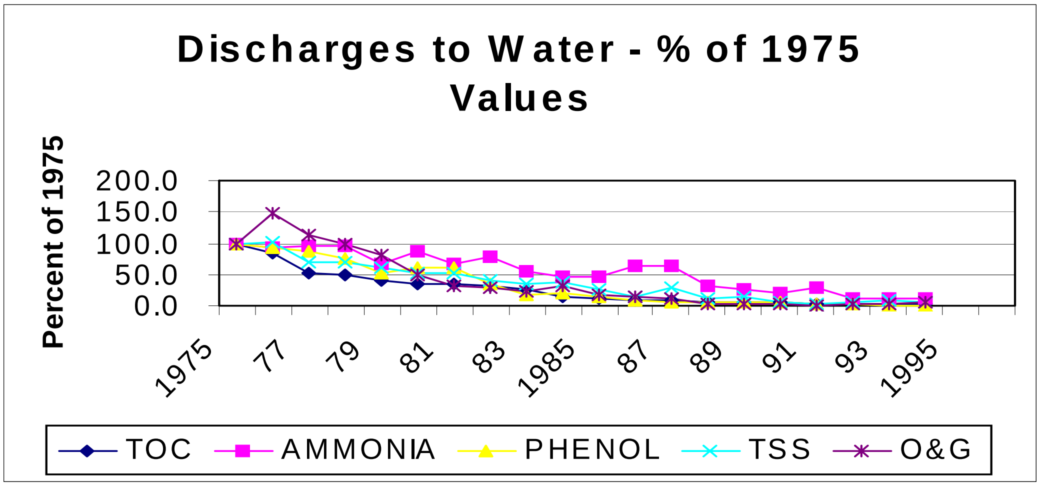
For more information...

Information on current pollution prevention projects at major U.S. and Canadian facilities on the St. Clair River can be found at:

- www.friendsofstclair.ca or
- http://www.on.ec.gc.ca/glimr/raps/connecting/st-clair/stclair-map.html

Today, various provincial and federal laws, including the Ontario Water Resources Act (OWRA) and the provincial Clean Water Regulations regulate discharges from chemical manufacturing and petrochemical processing industries. The 1996 State of Canada's Environment (SOE) Report shows that contaminant discharges declined from 1975 to 1994 (see Figure 3-2).

Figure 3-2: Annual loadings to the St. Clair River, 1975-1994, as a percentage of 1975 loadings



(TOC – Total organic carbon, TSS – Total suspended solids, O&G – Oil & grease)
Source: The State of Canada's Environment 1996

The 2001 Environmental Compliance Report, issued by the Ontario Ministry of the Environment (OMOE) indicates that seven of the industrial facilities discharging to the St. Clair River were in noncompliance with a Clean Water Regulation. Exceeding any effluent discharge requirement for a single incident during the year results in the plant being reported as noncompliant or nonconformant. A Provincial Officer's Order was issued to one plant and a Director's/Control Order was being prepared for another. The remaining plants either had voluntary abatement programs in place or did not require further action because events were isolated incidents.

In addition to provincial regulations and Certificate of Approval requirements, the federal Petroleum Refinery Liquid Effluent Regulations under the Fisheries Act apply to one of the four local refineries, and guidelines apply to the other three refineries. In the 2002/03 inspection year, all four refineries were inspected by Environment Canada and all four were found to comply with their respective regulations or guidelines.

Municipal Point Source Discharges

United States: Municipal governments on the U.S. side of the lake and river have been required to obtain permits for discharging effluent from their wastewater treatment plants for decades. As time went by, they were also required to obtain permits for other discharges, including backwash for drinking water treatment plants and combined sewer overflows (CSOs). Other discharges, including sanitary sewer overflows (SSOs) were illegal yet continued for many years.

Stormwater has long been recognized as a significant pollutant source, but, until the 1990s was not clearly a municipal responsibility. This changed when the U.S. Environmental Protection Agency (U.S. EPA) amended the 1972 Clean Water Act to include municipal stormwater as a point source pollutant. This amendment made urban municipalities responsible for pollution leaving any of their facilities, including discharge pipes, regardless of the source of the pollution.

Canada: Municipal facilities, including stormwater, in Ontario are regulated under Certificates of Approval (COAs) under OWRA.

The following sections detail municipal discharge responsibilities and their potential link with environmental degradation.

Municipal Wastewater Treatment Plants

Did you know…
Potential contaminants from municipal wastewater treatment plants and water pollution control plants are typically called "conventional pollutants" and include suspended solids, total phosphorus, and Biochemical Oxygen Demand (BOD). If left untreated, conventional pollutants affect the ecosystem by overwhelming the waterway's capacity to naturally absorb the pollutants.

Potential contaminants from municipal wastewater treatment plants and water pollution control plants (WWTP and WPCPs) are typically called "conventional pollutants" and include suspended solids, total phosphorus, and Biochemical Oxygen Demand (BOD). Because municipal wastewater also includes treated industrial waste and household chemicals, WWTP/WPCPs may also discharge low levels of metals and organic pollutants.

Excessive levels of conventional pollutants affect the ecosystem by overwhelming the waterway's capacity to naturally assimilate the pollutants. High BOD levels may consume available oxygen in the water and lead to fish kills. High suspended solids levels can kill fish and degrade aesthetics. Some metals and toxic organics can bind to sediment and work their way up the food chain, causing harm to game fish, game birds, and humans. Excess phosphorus causes nuisance aquatic plant growths, potentially leading to fish kills and negatively affecting recreational boating and swimming. All of these problems can lead to degradation of a water body.

Even when in compliance with regulated guidelines, these sources can be problematic due to seasonal variations in stream flow, land use changes and other factors. In addition, these standards have not yet been addressed using the TMDL approach and may have to be adjusted when the other watershed influences are considered. These facilities may
contribute a substantial load into the St. Clair waterways because they discharge a large volume of treated wastewater on a constant basis. Large volumes of low pollution concentrations have the potential to significantly impact the ecosystem when discharged over long periods.

United States: All municipal wastewater treatment plants on the U.S. side of the St. Clair River and Lake St. Clair are secondary or tertiary facilities (see sidebar for more information on the different types of wastewater treatment plant facilities). These facilities are in compliance with their discharge permit requirements although many are on specified compliance schedules to correct problems with their local sanitary sewers. The MDEQ has reported that there are minor exceedances of permit conditions at facilities within the watershed but that none of these exceedances are formally actionable under the enforcement guidance used by the department. When minor exceedances occur, MDEQ staff contact the facilities to determine the cause and assure that corrective actions have been taken.

Several communities, including Centerline, Fraser, Marysville, and Port Huron, are involved in programs that are under MDEQ oversight to correct CSO and/or SSO problems within their sewage collection systems. Although there are bacterial inputs in several areas within the Lake St. Clair watershed attributable to CSOs and SSOs, the most significant impact from these sources on the U.S. side of the watershed is from the communities within the Clinton River watershed area. The river and the tributary areas within the watershed, particularly those in the downstream urban areas, consistently violate the bacterial water quality standards.

Canada: Six municipal sewage treatment facilities in Ontario discharge directly into the St. Clair River. All facilities provide secondary or tertiary treatment. The Point Edward plant was upgraded to secondary treatment in 1992, and the Sarnia plant was upgraded in 2001. In addition to the standard effluent parameters – BOD, suspended solids, and phosphorus – Point Edward and Sarnia plants must meet requirements for total ammonia nitrogen and *Escherichia coli.*

Over thirty municipal water pollution control plants (WPCPs) are located along the tributaries entering Lake St. Clair on the Ontario side. Another two municipal wastewater treatment plants discharge directly into the lake. All of these municipal wastewater treatment plants provide secondary or tertiary sewage treatment.

Did you know…

Wastewater treatment uses microbes to decompose organic matter in sewage. If too much untreated sewage or other organic matter is added to a lake or stream, dissolved oxygen levels will drop too low to support sensitive species of fish and other aquatic life. Treatment systems may use the following processes:

- *Primary treatment* physically removes large solids using grates, screens, and settling tanks.
- *Secondary treatment* promotes growth of bacteria and other microbes that break down the organic wastes.
- *Tertiary treatment* is used only where it is needed to protect the receiving waters from excess nutrients. In tertiary treatment, the concentrations of phosphorus or nitrogen are reduced through biological or chemical processes.

The 2001 OMOE Environmental Compliance Report indicated noncompliance by one municipal plant discharging into the St. Clair River, one municipal plant discharging into Lake St. Clair, and 14 WPCPs discharging into the tributaries. Another four were in nonconformance with policy or guidelines. Exceeding any effluent discharge requirement for a single incident during the year results in the plant being reported as noncompliant or nonconformant. The report states that all problems had been assessed by the OMOE and that two plants had voluntary abatement programs underway, one plant was under investigation, and the others did not require further action.

Sewer Overflows

Combined Sewer Overflows (CSOs)

Many of the sewer systems in the watershed are "combined" meaning that they carry both sanitary wastes and storm water when it rains. When the combined volume of sanitary wastes and storm water exceed the carrying capacity of the sewers, they are designed to overflow. These combined sewer overflows can carry untreated wastes to nearby waters through an opening or pump that transports excess wastewater directly to the river or lake. Both the combined sewer overflow structure and the discharge from the structure are referred to as "CSOs."

United States: The MDEQ and the U.S. EPA have initiated compliance and enforcement actions against these point sources throughout the watershed under the Clean Water Act and the Michigan Natural Resources and Environmental Protection Act. These programs have enabled significant corrective actions to treat or correct CSOs, primarily through construction of separated sewer systems and construction or enhancement of retention treatment basins (RTBs). Much still remains to be done but the problems and solutions are understood.

Canada: The St. Clair RAP identified four Canadian CSOs, all in the City of Sarnia. The city has constructed a storage tank in 1997 to collect the overflows from two of four CSOs during storm events and reroute the sewage to the WPCP after the storm. Sarnia has commenced a master stormwater management retrofit plan that will extend over 2003/04 and 2004/05. The plan will include consideration of treatment options for the remaining two CSOs (Cromwell and Exmouth Streets). More information on programs to address CSOs can be found in Chapter 5.

Sanitary Sewer Overflows (SSOs)

If sanitary sewers are watertight and properly designed, all of the sewage that enters the sewer is transported to the WWTP/WPCP. Unfortunately there are many pathways for stormwater to also enter the sanitary sewer system and overload the capacity of a WWTP/WPCP. When this occurs, raw sewage may be released into rivers, streams, streets, properties, or even back up into people's homes. To prevent this, the sanitary pipe is "relieved" into a storm drain or a river in the same manner that a combined sewer is relieved. Sewage that leaves the sanitary sewer is not treated and, thus, carries bacteria that can threaten human health, conventional pollutants that stress fish and wildlife, material that impairs water aesthetics, and industrial wastewater that might be present in the system.

Even though SSOs are illegal and constitute a serious environmental problem, neither the numbers of communities that have overflow problems nor the frequency and duration of these overflows are well known. In Michigan, the MDEQ have been working for the past 20 years with municipalities to identify and correct SSO discharges. More information on programs to address SSOs can be found in Chapter 5.

Nonpoint Source Pollution

Nonpoint source pollution entering Lake St. Clair or the St. Clair River stems from multiple points of origin, including man-made and natural mechanisms. Below is a review of the major nonpoint sources of pollution in the watershed.

Agriculture

Cattle in stream
(Photo courtesy ECT)

Agriculture is a significant source of a large number of pollutants. Livestock sites, such as dairy, beef, swine, and poultry, plus intense cultivation of grain crops, such as corn and soybeans, can cause water quality problems, including excessive nutrients, excessive particulates from soil erosion, and contaminated runoff due to fertilizers, pesticides, and herbicides. Additionally there is some concern that agriculture may be a source of hormones and endocrine mimics that could impact fish, wildlife, and source water intakes.

Agriculture utilizes much of the land in the Ontario portion of the Lake St. Clair and St. Clair River watershed as well as a significant portion of the tributary land in St. Clair County, Michigan.

United States: Agricultural impacts in the U.S. portion of the watershed tend to be localized and generally result from:

- cattle having unlimited access to the tributary areas within the watershed, resulting in bank erosion and increased bacteria levels; and
- lack vegetated buffer strips to isolate tilled acreage or grazing areas from waterways resulting in stream bank erosion and the entrance of more sediment and higher levels of agricultural chemicals and nutrients.

The Michigan Department of Environmental Quality (MDEQ) initiated a partnership with the Michigan Department of Agriculture (MDA), Michigan agricultural associations and farmers to promote voluntary pollution prevention in agriculture. Key partnership goals focus on preventing agricultural pollution through increased efficiency while maintaining and improving on-farm profitability.

In 1998, both MDEQ and MDA endorsed the state's Agricultural Pollution Prevention Strategy and Implementation Plan that set forth pollution prevention efforts in Michigan.

The Michigan Agricultural Environmental Assurance Program (MAEAP) was created in 2000, from a recommendation of the Michigan Agricultural Pollution Prevention Strategy. The mission of the MAEAP is to develop and promote a recognized, voluntary, proactive environmental assurance program, targeted to the agricultural industry, which ensures that producers are engaging in cost-effective pollution prevention practices and are in compliance with environmental regulations.

Voluntary programs have done much to educate the agriculture industry on how to minimize their impact on water quality, but more oversight and enforcement is required in areas where water quality consistently fails to meet standards.

Did you know…
Each year, 27 manure spills, on average, are reported to OME. Spills and other discharges due to manure mismanagement degrade water quality and impact fish and fish habitat.

Canada: OMOE's Clean up Rural Beaches (CURB) program studies have found that livestock and soil erosion can have significant impacts on local watercourses. The study conducted by the Upper Thames River Conservation Authority (UTRCA), for example, reported that:

- Controlling livestock access to streams and drains was the most cost-effect remedial measure to reduce bacterial contamination;
- Treating milk house wastewater appeared to be the most cost-effective method to control phosphorus; and
- Preventing soil erosion would eliminate the highest single contributor of phosphorus to the watercourses.

The St. Clair Region Conservation Authority's CURB studies identified improperly stored or mishandled manure as the second largest pollution contributor after faulty septic systems. Manure can contaminate streams and waterways through the spread of manure on fields, runoff from manure storage, and by allowing cattle to access streams where their waste can be directly deposited into the water.

Implementation programs to address non-point source water quality problems and improve local water quality followed the CURB studies. A Healthy Futures for Ontario (HFOA), recently finished offered technical and financial assistance to rural landowners that are implementing rural water quality projects designs to correct and protect rural water quality. The Great Lakes Sustainability Fund encourage the use of Best Management Practices to improve local water quality and improve habitat. The new Ontario Nutrient Management Act is expected to enhance water quality by improving the use and handling of manure and other fertilizers and requiring buffers adjacent to watercourses.

The 2001 Sydenham River Recovery Plan lists five general threats to aquatic species at risk in the Sydenham River. These are sediments, nutrients, toxic contaminants, thermal, and invasive species. With the exception of invasive species, agriculture was identified as one of the significant causes for each threat. Agriculture now covers 85 percent of the land in the Sydenham River watershed that, prior to European settlement, was 30 percent swamp and 70 percent forest. Agriculture was also considered to be a significant source of nutrients – phosphorus and nitrogen. Since much of the phosphorus was bound to sediment, it probably originated from farmland.

Each year 27 manure spills, on average, are reported to the Ontario Ministry of the Environment Spills Action Centre (SAC). Spills and other discharges due to manure mismanagement degrade water quality and impact fish and fish habitat through oxygen depletion, toxic levels of ammonia, and nutrient enrichment leading to excessive plant growth and further disruption of the oxygen regime. Thus, nutrient management and best management practices for manure handling and spreading are critical to maintaining a healthy waterway.

Waste Disposal Sites

Waste disposal sites can potentially contaminate the environment through surface runoff or seepage into groundwater. Modern waste handling facilities are designed, constructed and regulated to prevent pollutants from leaving the site. Such measures include spill containment and stormwater control facilities designed to keep pollutants from entering groundwater or surface water. Historic dumping sites and abandoned landfills, however, were not designed to prevent pollutants from leaving the site. Thus these sources, although presently not quantified, could be a significant source of contamination to the watershed.

Humans, Wildlife, Waterfowl, and Domestic Pets

Excessive fecal bacteria levels in waterways can pose a threat to human health and cause beach closures and suspend recreational activities, which impact the local economy. Multiple beach closings on both sides of the border indicate that a problem exists. However, the specific cause or causes of the problem remain elusive, and the extent that humans, wildlife, waterfowl, and domestic pets contribute to the problem remains unmeasured and unknown. However, it is widely recognized that the system's ability to filter nonpoint source influences has been impaired due to removal of natural buffers, wetlands, as well as increase in runoff as lands are made more impervious due to development.

Tests for fecal bacteria involve testing for *Escherichia coli* (*E. coli*), which is a species of bacteria found in the large intestines of humans and other animals. The presence of *E. coli* often indicates the presence of other, potentially more harmful, organisms as well.

In the past, tests for *E. coli* have not been foolproof, as test results were complicated or misleading in waterways that had large variations in the *E. coli* readings and where an obvious source could not be detected. Fortunately, testing procedures have improved, and Bacterial Source Tracking (BST) can now be used to determine the sources of fecal bacteria – human, livestock, domestic pets, or wildlife.

More information on *E. coli* contamination and beach closures can be found in Chapter 5.

Fertilizers

Fertilizers can contain nitrogen and phosphorous, both of which are nutrients that promote plant growth. While proper field application produces healthy crops, lack of buffers, over-fertilization and misapplication can contribute to water quality problems in lakes and streams.

Did you know…
Fertilizers can contain nitrogen, a gaseous element, and phosphorous, a solid nonmetallic element. In excess, nitrogen and phosphorus cause excessive algae and aquatic plant growth, which, in turn, causes large variations in the amount of dissolved oxygen in the aquatic habitat, which can be detrimental to aquatic life.

Nitrogen and phosphorus can cause excessive algae and aquatic plant growth, which, in turn, causes large variations in the amount of dissolved oxygen in the aquatic habitat. Dissolved oxygen is the amount of oxygen that is available in the water for plants and animals. During periods of sunlight, plants photosynthesize and give off oxygen, thereby, raising dissolved oxygen levels. During periods when sunlight is not available – during night or when snow and ice cover is present – plants respire, thus consuming oxygen and depleting the amount of dissolved oxygen. Large variations in dissolved oxygen can be detrimental to aquatic life, as most fish and other aquatic animals die when dissolved oxygen levels approach zero or when they fall below acceptable standards for prolonged periods.

While excessive fertilization can originate on agricultural land and golf courses, urban homeowners typically apply many times the amount of fertilizer needed to support their lawns or gardens. They often believe, "if some is good, more is better." Unfortunately, the fertilizer not needed to support plant growth runs off the property, flows into sewer systems, and accelerates plant growth downstream. Public education programs are necessary in order to educate homeowners about the effects of over fertilization as well as alternatives to traditional fertilizers.

Pesticides

Pesticides, including insecticides, algicides, fungicides and herbicides are designed to kill "pest" insects and "weed" plants. Pesticides are also a large environmental concern because they are sometimes over applied and, by means of runoff, end up in our water bodies. Even when applied according to U.S. EPA guidelines, pesticides can end up in runoff.

While some pesticides used in the past left environmental legacies that will require expensive cleanups, modern pesticides are more environmentally friendly. However, selection, storage, and application must still be done appropriately to protect our water resources. Product education is particularly important among homeowners who are often poorly educated about the risks of mishandling these materials.

The U.S. Geological Survey recently investigated the distribution of pesticides in the Lake Erie-Lake St. Clair watershed as part of its National Water Quality Assessment Program (NAWQA). Concentrations in streams were in the top 25 percent of streams in the nation and many public water supplies must treat water to reduce herbicide concentrations. The pesticides detected most frequently were among those applied in the greatest quantities to agricultural and mixed land use areas. Atrazine, acetochlor, cyanizine, metolachlor, and simazine were detected in 50 to 100 percent of samples.

Erosion and Sedimentation

Erosion is a process through which wind and water dislodge and displace soil particles. While erosion occurs naturally, it is accelerated by human activities.

Sedimentation is a process through which water transports dislodged soil particles and deposits them somewhere else on land or in streams, rivers, lakes, or wetlands.

Turbidity is a condition associated with erosion and sedimentation in which eroded soil particles are suspended in the water, making it cloudy or unclear.

Due to gravity and physics, sediment will usually settle in the areas where the current is slower. These areas generally tend to be where the water is deeper, where tributaries enter the lake, and in areas where the shape of the shoreline results in slower water flow. These areas also tend to be critical for fish habitat and spawning. Sediment also fills in voids created by woody debris, rocks, and gravel, and buries food for aquatic animals. Sediment in these areas destroys habitat and cover for young fish and other aquatic species, leaving them vulnerable to predators and creating the potential loss of a valuable food source.

Deposited sediments affect stream shape or morphology, making waterways wider, shallower, and thus prone to temperature changes. Erosion and sedimentation can also increase flooding, damage water supplies, degrade recreational areas, and increase turbidity.

Suspended particles cause fish and other aquatic plants and animals to starve or suffocate by adhering to gills, lodging in feeding or breathing organs, and making the water turbid which disrupts natural prey-predator relationships and limits light . Erosion and sedimentation also increase the amount of pollutants in waterways, especially heavy metals, fertilizers, and pesticides, because these pollutants adhere to soil and are transported along with the detached soil.

The northern regions of the Clinton River watershed are under significant pressure from urban development. As land use changes from agricultural to urban, the hydrology, hydraulic, and sediment regimes are altered. The impacts can be seen throughout the watershed in the form of increased stream bank and streambed erosion. The U.S. Army Corps of Engineers is currently developing a sediment transport model for a portion of the Clinton River watershed that can be used to predict the amount of surface runoff and sediment that is being delivered to the river. The Macomb County Office of Public Works is also conducting a study on how land use changes over time have affected the geomorphology of the Clinton River. These models could be applied to a number of current planning efforts in the watershed, including Phase II stormwater permits, TMDLs for sediments, spill response and water quality modeling.

Contaminated Groundwater

Although groundwater input to Lake St. Clair and the St. Clair River is relatively small (approximately 24 cubic feet per second), it still could be a route through which highly concentrated contaminants reach the waterways. In its 2000 NAWQA report on water quality in the Lake Erie-Lake St. Clair drainages, the U.S. Geological Survey reported a significant change in groundwater quality linked to residential development near Detroit. Groundwater recharged before 1953 (before suburbanization) has concentrations of chemicals that are typical for natural water. Groundwater recharged after 1953, in contrast, has a significantly higher concentration of chemicals derived from human activities. Major human influences on groundwater quality include septic systems, roads and lawns in residential areas, and herbicides and fertilizer in agricultural areas.

Contaminated Sediments

Did you know…
Contaminated sediments from historic industrial activities are a likely source of many toxic pollutants measured in fish within Lake St. Clair and the St. Clair River.

Contaminated sediments from historic industrial activities are the source of many toxic pollutants measured in fish within Lake St. Clair and the St. Clair River. As described in chapters 4 and 5, the various chemical contaminants found in lake and river sediment pose a threat to biological aquatic communities and to humans who consume fish from the area.

Field studies done in 1994 and 1995 for the St. Clair River RAP show three small zones of highly impacted sediment in the upper St. Clair River near the Canadian shore. Based on these findings, a 1998 report concluded that 160,000 cubic feet (4,500 cubic meters) of highly contaminated sediments in the most upstream zone warranted remediation. These sediments are hazardous to benthic, or bottom dwelling, organisms due to elevated concentrations of mercury, cadmium, lead, hexachlorobenzene (HCB), hexachlorobutadiene (HCBD), octachlorostyrene (OCS), and other chlorinated compounds.

In 2002, Dow Chemical Canada Inc., which assumed responsibility for a portion of the contaminated sediments, conducted a successful pilot project to dredge and remove part of the contaminated sediment. Phase 2 and Phase 3 efforts will remove the majority of the contaminants. Remediation of the highly contaminated sediment is an important step toward removing the river as an AOC and remains the focus of the St. Clair River RAP program.

The U.S. Environmental Protection Agency Region 5 has recently completed a $6 million PCB-contaminated sediment cleanup of the St. Clair Shores, Michigan, Ten Mile Drain storm sewer system. Unexpectedly high levels of PCBs were discovered during routine sediment sampling in preparation for dredging in the area. The yearlong project involved the excavation and disposal of more than 23,000 tons of contaminated sediment from the storm sewer system and outlets that form two canals that flow behind homes in the area.

Historical point source discharges and ongoing nonpoint sources are responsible for sediment contamination in the main stem of the Clinton River. Metals, polychlorinated biphenyls (PCBs), pesticides and other organics have been documented over several decades in a number of locations along the Clinton River from Pontiac to the mouths of both the river and the spillway.

Tributaries

Rivers and streams that drain into Lake St. Clair and the St. Clair River impact those waterways because they have problems similar to those discussed throughout this chapter, including substantial amounts of conventional pollutants, metals, and organic compounds.

Examples of tributary problems within the watershed include:

- The Clinton River, which is an Area of Concern (AOC) and has a flow that is 50 percent wastewater;
- The Thames River at Komoka, where phosphorous and fecal coliform concentrations exceeded provincial water quality guidelines and showed a trend of increasing concentrations from 1971 to 1998;

- Essex County tributaries where the Essex Region Conservation Authority confirmed serious bacterial contamination from faulty septic systems and nitrates from faulty septic systems and agricultural runoff;
- Soil erosion as a significant source of phosphorus loading.

Spills

U.S. Coast Guard Spill Response
(Photo courtesy USCG)

Spills can involve industrial, municipal, commercial and agricultural sources. Historically, spills have had a large impact on the water quality and sediment of Lake St. Clair and the St. Clair River. Spills can also negatively impact fish and wildlife. The risk of chemical and fuel spills is of particular concern during spring and fall migration when large numbers of birds are traditionally using offshore areas and fish are spawning. Should a spill occur during these periods there is a strong potential for a direct impact on migratory birds and on critical migratory and breeding habitat.

The number and size of spills or releases has reduced dramatically over the last several years due to measures implemented by both U.S. and Canadian industries. Between 1990 and 2001, spills on the U.S. side have decreased from 28 to 18 annually. Canadian records indicate an even greater reduction, from between 70 and 135 spills annually between 1986 and 1989, to between seven and 12 spills between 1998 and 2002. On-going monitoring must continue to assure that the number of spills and the quantity of materials spilled continues to decline.

Airborne Deposition

Did you know...
Air deposition is the largest current source of mercury. Sediments contain the largest mass of mercury in the Great Lakes.

Much of the mercury currently entering the waters of the region settles from the air or is deposited in precipitation. Mercury enters the atmosphere through the release of geologically bound mercury by both natural processes and human activities, such as waste incinerators, coal-fired power plants, base metal smelting plants, as well as others. In addition, the global reservoir of atmospheric mercury makes long-range transportation of mercury a concern. Sediments in this watershed contain some of the highest concentrations of mercury in the Great Lakes.

Airborne deposition directly to the St. Clair River represents a minor source because of the small surface area relative to its very large flow. However, inputs to Lake Huron and its drainage basin, as well as airborne deposition directly to Lake St. Clair, can be significant due to their large surface area. Atmospheric contamination directly to Lake Huron flows into the St. Clair River and through to Lake St. Clair.

Municipal Stormwater

Stormwater can be classified as either a point source or a nonpoint source depending how the storm water gets to a stream. If there is a discrete pipe or ditch that carries the stormwater, it is generally considered to be a point source and is regulated through the National Pollutant Discharge Elimination System (NPDES) permit program. If it flows over the ground or is more diffuse as it enters a stream, then it is considered to be a nonpoint source and is controlled under that MDEQ program area.

Did you know...
Stormwater runoff is a natural event that occurs when the rate of rainfall exceeds the ability of the ground to absorb the rainfall. Impervious surfaces, such as rooftops, driveways, sidewalks, roadways, and parking lots, do not absorb water and, consequently, alter hydrologic characteristics. These surfaces collect and direct the runoff to the nearest ditch, drain, stream, lake, or wetland more quickly, producing greater runoff volumes with higher and more frequent floods.

Stormwater runoff is a natural event that occurs when the rate of rainfall exceeds the ability of the ground to absorb the rainfall. In undeveloped areas, most rainwater, as well as springtime snowmelt, soaks into the ground, recharges aquifers, and slowly makes its way to nearby river systems. Unfortunately, increased development in many areas of the watershed has altered natural drainage patterns, particularly in Macomb County and the southern portion of St. Clair County. Ontario's portion of the watershed has less urban area but there is an extensive network of municipal drains to improve drainage for agricultural land.

For many years, it has been recognized that excessive stormwater runoff is a significant source of water quality degradation, yet municipalities have argued that they had little or no control over what their contributors discharged into the drainage system. In addition, municipal stormwater discharges have largely been given a lower priority as a pollutant source while regulatory agencies worked on controlling point source discharges. This focus is changing as governments on both sides of the border implement new stormwater control programs.

Even so, very rapid unplanned, low-density urban sprawl continues to cause water quality problems in areas that do not have the infrastructure or services to accommodate the new growth. Impervious surfaces, such as rooftops, driveways, sidewalks, roadways, and parking lots, do not absorb water and, consequently, alter hydrologic characteristics. Thus, the impervious surfaces collect and direct the runoff to the nearest ditch, drain, stream, lake, or wetland more quickly. These actions produce greater runoff volumes which can result in flashiness, or higher and more frequent floods of short duration.

Left unchecked, increased water volume and flow from the construction of impervious surfaces can cause serious damage to the physical and biological integrity of streams. Potential problems include:

- Water quality degradation due to increased amounts of contamination
- More floods
- Runoff that reaches a stream up to 50 percent faster
- Wider stream channels and streambank erosion
- Reduced aquatic habitat
- Loss of aquatic biodiversity

Increased water temperatures.

Stormwater runoff, which carries bacteria and nutrients as well as other contaminants, has been identified as the single greatest source of water quality degradation to the Clinton River watershed. Rapid urban development and the subsequent loss of habitat, which compound the problem of stormwater runoff, has been identified as the second greatest threat to water quality in the watershed. Oakland County leads the state in new construction, and Macomb County is experiencing rapid urbanization as well. Wetlands and other wildlife habitat have been all but eliminated from the downstream portion of the basin, and natural drainage has been drastically altered throughout the watershed.

Michigan has been delegated authority from the federal government to implement the Phase II stormwater program under the NPDES permit program. Under this program, communities are required to develop permits or plans to reduce pollutants being discharged through stormwater. More information about this program can be found in Chapter 6.

United States: Regulatory agencies throughout the watershed have identified runoff as a major source of pollutants entering Lake St. Clair and the St. Clair River. For example, stormwater runoff, which carries bacteria and nutrients as well as other contaminants, has been identified as the single greatest source of water quality degradation to the Clinton River.

While major capital investments have been made to control sewage collection and treatment systems in the watershed, investments to control stormwater pollutant loadings have not been made at the same level. Until controlled, excessive stormwater will continue to cause increased flood frequency, volume, and velocity as well as impairments to aquatic habitat and riparian properties.

While studies provide statistics about general problems associated with stormwater events, current data is not available regarding the quantity of stormwater being discharged to the watershed from municipal and industrial sources. This information will be addressed through subwatershed planning in connection with Phase II stormwater permits.

Canada: For several years, the Province of Ontario has required municipalities to address stormwater as part of the planning and development process. A combination of lot level, conveyance, and end-of-pipe stormwater management practices are usually required to meet the multiple objectives of stormwater management: maintaining the hydrologic cycle, protection of water quality, and preventing increased erosion and flooding. In 2003, an updated Storm Water Management Planning and Design Manual was released by the Ontario Ministry of the Environment. The manual serves as a baseline reference document for review of stormwater management applications for approval under section 53 of the Ontario Water Resources Act.

Illicit Discharges

Illicit discharges can be divided into three major categories:
1) Illicit connections, a pipe intended for a sanitary sewer that is connected instead to a storm drain;
2) Failing on-site sewage disposal systems, which result in discharge of semi-treated or untreated sewage to a watercourse; and
3) Spilling, dumping, or mishandling of materials in a manner that allows those materials to drain to a watercourse.

Many illicit connections are difficult to isolate because they discharge intermittently. However, if left uncorrected, these intermittent discharges can, cumulatively, contribute a significant pollutant load. More information on programs to address illicit discharges can be found in Chapter 5.

Failing On-site Sewage Disposals Systems

Failing on-site sewage disposal systems (OSDSs) can be classified as either a point source or a nonpoint source. The effluent from a failed disposal system can seep through the ground or flow across the ground, which would classify it as a nonpoint source type of pollution. A failed system can also be connected directly by pipe to a stream or storm sewer, which would classify it as a point source discharge.

OSDSs, commonly know as septic systems, are wastewater treatment systems that use septic tanks and drain fields to dispose of sewage below the surface of the ground. OSDSs occur in areas where municipal sanitary sewers systems do not exist. In these areas, the most cost-effective means to safely treat and dispose of sanitary sewage from homes and businesses are on-site soil absorption systems. If properly located, constructed, used, and maintained, these systems can provide reliable service over many years. Unfortunately, the heavy clay soil present in much of the watershed represents a particular concern for the proper design and construction of septic systems, and many systems fail within a relatively short period of time. Additional factors, such as increased water usage where piped municipal water is available, can contribute to septic system failure.

Did you know...
The most desirable long-term solution for on-site sewage disposal system failure is to construct sewers that will transport the domestic wastewater to waste water treatment plants or water pollution control plants.

The discharge of poorly treated sewage from faulty septic systems can be a significant source of bacterial and nutrient pollution in local watercourses. To put the issue in perspective, the average residence uses 200 to 500 gallons of water daily, meaning that each failing system could contribute thousands of gallons of polluted wastewater to the watershed each year. This, along with estimates that system failure rates may be as high as 25 percent in some areas on the U.S. side, underscores the importance of local programs to ensure the proper installation and use of on-site systems.

United States: These issues, coupled with new regulatory programs, has lead Macomb County to institute initiatives to actively detect failing systems through proactive on-site inspection programs, expanded water quality monitoring, and field surveys. Oakland County is in the process of adopting similar programs, and although St. Clair County does not currently have an ordinance for on-site inspection, health officials there are conducting field-level surveys to determine potential failure sites. These types of programs are a required component of the Phase II stormwater permitting program.

The most desirable long-term solution for OSDS failure is to construct sewers that will transport the domestic wastewater to WWTP/WPCPs. However, this may be too expensive for rural areas and is not always the most feasible option.

Public education is one of the best ways to help residents minimize pollution from septic systems while also saving money. Programs should remind the public that:

- All septic systems will eventually fail
- Repair and replacement are expensive
- Failed systems can go undetected for years
- Failed systems can adversely impact public health and the environment
- Proper use, inspection, and maintenance are necessary.

Canada: It is estimated that less than 15 percent of the population living in the Canadian portion of Lake St. Clair and the St. Clair River watershed have individual septic systems. As part of its Provincial Rural Beaches Strategy Program in the late1980s and early 1990s, OMOE funded several Clean Up Rural Beaches (CURB) studies for portions of the local watercourses. CURB studies conducted by local conservation authorities showed that:

- Twenty-seven to 49 percent of the bacterial contamination in the upper Thames River could be attributed to failing septic systems or gray water – water from sinks, showers, and washing machines – that bypassed the septic system.
- Seventy-five percent of the bacterial contamination in the Essex Region was attributable to faulty septic systems, and half of the systems did not work properly.

- Sixty-five percent of the bacterial pollution in Bear Creek, a tributary of the Sydenham River, was from faulty septic systems.

Implementation programs to repair problems and improve local water quality followed the CURB studies. Today, the Healthy Futures Program offers technical and financial assistance to correct problems and protect rural water quality.

Canadian municipalities also conducted Pollution Prevention Studies in the 1990s as part of a provincial program to assess and document problems and to replace individual systems with municipal sanitary sewers where needed and practical. These studies documented that up to 100 percent of septic systems surveyed along the St. Clair River in St. Clair Township (formerly Moore and Sombra Townships) were discharging sewage directly into the river. To correct this problem, sanitary sewers were constructed to collect sewage and direct it to existing municipal wastewater treatment facilities.

In Ontario, many municipal official plans direct growth to urban settlement areas with full municipal services, reducing the potential that new developments will have similar problems. More information on programs to address failing OSDSs can be found in Chapter 5.

Findings and Recommendations

The U.S. recommendations regarding Lake St. Clair are presented as part of this management plan. Canadian recommendations for Lake St. Clair will be developed following public review of and input into the management plan. In addition, the St. Clair River has a set of binational goals and objectives that were established as part of the binational St. Clair River RAP (see www.friendsofstclair.ca).

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.

United States: Industrial and municipal point sources are well regulated and are no longer the greatest threat to the St. Clair River and Lake St. Clair ecosystem. Adequate funding for state and federal agencies with enforcement authorities is crucial to ensure the long-term effectiveness of regulatory programs for point source dischargers.

Municipal stormwater remains a large pollutant source that has been traditionally unregulated. Programs initiated in the United States are designed to remedy this shortcoming; however, funding will be critical to ensure consistent and effective long-term enforcement and implementation.

Wastewater treatment in rural and developing areas remains a challenge. On-site sewage disposal systems remain poorly monitored and regulated, resulting in large numbers of reported failures. A program for timely inspection of systems is necessary. Failure to properly operate small package plants and/or sewage lagoons remains a concern of public health officials, particularly in developing areas.

Combined sewer overflows (CSOs) are being addressed. Much has been completed and additional mitigation efforts are scheduled. For the most part, untreated CSOs are being eliminated.

Sanitary sewer overflows (SSOs) continue to be discovered as communities gain a better understanding of their infrastructure. Each SSO represents a serious health hazard. Programs to identify and eliminate SSOs must continue.

Illicit discharges are difficult to identify. Illicit Discharge Elimination Programs in Michigan must be continued and strengthened.

Nonpoint sources pr remain a challenge – as they have been for thirty years – due to difficulties in identifying the scope and sources of the problem, and developing and enforcing solutions to address it. Efforts to manage natural resources on a watershed basis are a crucial first step.

The Total Maximum Daily Load (TMDL) program in the United States gets to the heart of the problems associated with balancing load reductions from point and nonpoint sources. When a lake or stream does not meet Water Quality Standards (WQS), the MDEQ does a study to determine the amount of loading that can be put into that lake or stream and still meet WQS. This allowable load is allocated to point and nonpoint discharges with a margin of safety to account for technical uncertainties in the process and difficulties in implementing effective nonpoint source reductions. Once these loadings are established, the TMDL is implemented through NPDES permits and nonpoint source reduction programs.

Streams and lakes in Michigan that need to have a TMDL developed are listed on the 303(d) List. The 2002 Michigan 303(d) List contains 21 lakes and streams within the Lake St. Clair/St. Clair River watershed, which need to have a TMDL developed. These TMDLs are scheduled for development between 2004 and 2011. The TMDLs will cover portions of the Black, Clinton, Pine, Salt, and St. Clair rivers, several tributary streams associated with these rivers, many of the beach areas within the watershed, Bear Creek, and Red Run Drain. Contaminants that resulted on placing these areas on the 303(d) list include bacteria, polychlorinated biphenyls (PCBs), mercury, poor habitat, nutrient enrichment, low dissolved oxygen, and fish kills. The complete 2002 list and TMDL procedures are available at http://www.michigan.gov/deq.

Agriculture is a source for a large number of pollutants in the Michigan portion of the watershed. Voluntary programs have been an effective tool to educate the agriculture community on water quality impacts and mitigation strategies. However, more monitoring and enforcement is needed in some areas.

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

Contaminant Sources and Contaminated Sediments

3-1. Develop and implement a Contaminant Management Strategy that focuses on pollution prevention and restoration of polluted areas.

3-2. Implement U.S. obligations under the Great Lakes Binational Toxics Strategy

3-3. Prioritize contaminants of concern

3-4. Identify all sources and quantify all loads of point source and nonpoint source contaminants

3-5. Investigate the extent of contaminated sediments, evaluate the degree of contamination and the risk it poses, and implement the best remedial option(s) to reduce the risk posed by the sediment to a safe level

3-6. Develop, fund and distribute practical and economically feasible pollution prevention programs for municipalities, industries, and other relevant parties

3-7 Continue and accelerate research and monitoring on the distribution, fate, and effects of mercury, PCBs and other contaminants

3-8. Define impacts of new generation pesticides, pharmaceuticals, endocrine disrupters, and other chemicals

3-9. Identify, quantify and prioritize atmospheric sources of contaminants and implement regulatory programs and pollution prevent strategies to assure that the sources are reduced or eliminated

3-10. Support the development and implementation of Total Maximum Daily Loads (TMDLs) throughout the watershed.

Pollution Prevention Practices and Education

3-11. Encourage the use of agricultural Best Management Practices, as needed

3-12. Distribute to local government and other stakeholders information-education materials highlighting homeowner impacts on water quality and actions that can be taken to prevent or minimize those impacts