Chapter 2: Onondaga Lake Management Plan Status Report

Figure 2-1. Sunset on Onondaga Lake. (Source: 2002 OLP Photo Contest, photo by Paul Sanford)

Introduction

In December 1993, the Onondaga Lake Management Conference (OLMC) released the Onondaga Lake Management Plan (OLMP). The plan outlines the major environmental problems facing the lake and makes recommendations for its restoration. The Water Resources Development Act tasked the Onondaga Lake Partnership (OLP) with developing and implementing water quality improvement projects for the lake and surrounding watershed. As stated in Chapter 1, the OLMC identified eight major strategic areas: Municipal Sewer Discharge, Combined Sewer Overflows (CSOs), Industrial National Priorities List (NPL) site and sub-sites, Industrial non-NPL sites, Hydrogeologic Investigations, Habitat and Fisheries, Inner Harbor and Shoreline Use, and Non-Point Source Pollution. Using these strategic areas, the OLP set major cleanup goals in its effort to restore the lake, its tributaries and the watershed. Over the past eight years, more than 40 restoration projects have been completed, and there are over 20 active projects being implemented.

This report presents the eight strategic areas by a general description of the pollution problems, the recommendations made by the OLMP, the strategies utilized for remediation, progress made, and the need for future remediation efforts. Additional requirements for Onondaga County's Metropolitan Syracuse Wastewater Treatment Plant (METRO) sewer discharge and combined sewer overflows are outlined in the 1997 Amended Consent Judgment (ACJ). Remediation requirements for properties owned or affected by Honeywell International, General Motors, Niagara Mohawk/National Grid, and the town of Salina are discussed in the Records of Decision and various Consent Orders pertaining to those sites. These items are discussed within their corresponding strategic area. Since the requirements for correction of water quality problems related to Municipal Sewer Discharge and Combined Sewer Overflows are both impacted by the ACJ, these two strategic areas are combined for clarity purposes. Similarly, NPL and non-NPL industrial sites are discussed together in one section concerning industrial pollution; all of the sites in both strategic areas are subject to consent orders that identify potentially responsible parties and outline the requirements to which those parties must adhere.

Strategic Areas 1&2: Municipal Sewer Discharge and Combined Sewer Overflows

History

METRO services the wastewater treatment needs of the city of Syracuse and several surrounding communities. Built in the 1960s, the plant was upgraded in 1979 and again in 1981 to provide more complete removal of pollutants. Following these upgrades, Onondaga Lake continued to show excessively high levels of ammonia and phosphorus, resulting in high toxicity, algae blooms, decreased oxygen, and poor water clarity. The 1997 ACJ addressed strategies for handling ammonia, which has been shown to interfere with the reproduction and migration of fish, and phosphorus, which leads to algae growth and oxygen depletion.

In 1988, a lawsuit was filed by Atlantic States Legal Foundation against Onondaga County, alleging that METRO and CSO discharges violated Federal Water Pollution Standards. The State of New York joined as a plaintiff, and the parties endeavored to settle the litigation in 1989 through the METRO consent judgment. In 1997, the prior METRO consent judgment was superseded when the parties reached an agreement on wastewater treatment plant and collection system improvements and a schedule for attaining compliance with the Clean Water Act by 2012. This agreement is known as the ACJ.

Throughout the city of Syracuse, there are sewers that carry both sanitary sewage and stormwater from streets. During dry weather, these sewers

carry all sanitary sewage to METRO; however, during intense rainfalls, the amount of stormwater entering the combined sewer system exceeds the system's capacity, resulting in overflow and discharges of untreated wastewater (stormwater and sanitary sewage) into the tributaries of Onondaga Lake. The frequency with which CSOs actually occur varies from one CSO discharge location to the next, but generally ranges from only a few times per year to as many as 60 times per year.

CSOs are a major contributor of bacteria, floating trash, organic material, solids and grit to the lake and its tributaries. Elevated bacteria concentrations in Onondaga Lake can occur for up to three days following a storm event.

Floating trash and debris is a concern in Onondaga Lake and its tributaries. Floating trash is not only an aesthetic problem, it can also have chemical and biological impacts including interference with the growth of aquatic plants, leaching of pollutants from trash, and hazards to wildlife through ingestion or entanglement. Debris often enters Onondaga Lake and its tributaries through CSOs and storm sewers, but also is blown by wind into the waterways.

Recommendations from the OLMP

The OLMC made the following recommendations concerning METRO and CSOs in 1993:

•• An out-of-lake discharge of wastewater currently treated at METRO is endorsed. At the present time, the most promising discharge alternatives include a diversion of some influent flow to an expanded Baldwinsville-Seneca Knolls treatment facility, and a diversion of the remaining METRO effluent to the Seneca River below the Onondaga Lake Outlet. Effluent limitations for both discharges should be defined through the use of the Onondaga Lake and Seneca River water quality models. The diversion should be implemented as soon as possible.

•• Onondaga County and the city of Syracuse should coordinate any construction activity relating to the renovation of METRO so as to minimize, to the extent possible, any negative impact on lakefront development and the surrounding community.

•• Onondaga County should implement a pilot project to test CSO control technology. The project should consist of the design and construction of two CSO storage and treatment facilities. Onondaga County should seek sources of funding including the Water Resources and Development Act of 1992 to the extent available to support this effort.

•• Using appropriate treatment methods, Onondaga County should provide additional storage and/or treatment facilities to control remaining CSOs. The remediation of the CSOs should be implemented as soon as possible.

•• The city of Syracuse and Onondaga County should work together to design and construct engineering solutions to eliminate floatables and silt in Onondaga Creek over the next several years. The U.S. Army Corps of Engineers should assist consistent with its authority.

•• Onondaga County and the city of Syracuse should coordinate to ensure, to the extent possible, that CSO treatment projects are compatible with plans by the city and the New York State Thruway Authority for development of the Inner Harbor.

Requirements of the ACJ

The purpose of the ACJ was to improve the water quality of Onondaga Lake and to assure the County's compliance with all state and federal water quality regulations. Over 30 projects were scheduled for completion within a 15-year period. The ACJ set time schedules for specific tasks, such as completion of environmental review, beginning of construction, and start of operations. The various projects under the ACJ are divided into three main categories: Improvements to METRO; CSO Construction; Ambient Monitoring Program.

The OLMC passed a resolution in 1998 amending the OLMP to incorporate the ACJ and adopt its objectives as an integral part of the OLMP. There-

fore, it is important to note that as amendments to the ACJ occur, the OLMP is likewise amended.

Improvements to METRO

Since METRO has been identified as the main contributor of phosphorus and ammonia in the lake, the ACJ requires Onondaga County to upgrade the ammonia and phosphorus treatment of the wastewater discharges from the METRO plant. The ACJ calls for a three-phase reduction of ammonia and phosphorus in the effluent.

METRO Phase I

Phase I called for "no net increase" on existing effluent limits for ammonia discharged from METRO through May 1, 2004, and "no net increase" on existing effluent limits for phosphorus discharged from METRO through April 1, 2006.

METRO Phase II

Phase II required that METRO meet a 30-day average interim ammonia effluent limit of 2 milligrams per liter (mg/L) in the summer and 4 mg/L in the winter no later than May 1, 2004. To meet this limit, the County constructed an ammonia reduction facility.

METRO was required to meet a 12-month rolling average interim phosphorus limit of 0.12 mg/L, no later than April 1, 2006.

METRO Phase III

Phase III requires METRO to meet a final 30-day average effluent limit for ammonia of 1.2 mg/L in the summer and 2.4 mg/L in the winter, no later than December 1, 2012.

Under Phase III, Onondaga County is also required to demonstrate by December 31, 2011 that METRO will be able to meet a final effluent limit for phosphorus of 0.02 mg/L, measured as a 12-month rolling average, on or before December 31, 2015. (A 12-month rolling average means that on any given day, the average level over the preceding 12 months cannot have exceeded the limit.) In the event that this capacity cannot be demonstrated, a diversion of flow from METRO to the Seneca River or implementation of other engineering alternative that results in compliance with water quality standards must be completed by December 31, 2015.

CSO Construction

The ACJ required the County to address 66 CSOs (this number was later revised to 70 CSOs) and to construct two Regional Treatment Facilities (RTFs) and multiple Floatables Control Facilities (FCFs). RTFs are designed to receive sewage flows from several CSOs during high flow events and remove floatables, nutrients, and other pollutants either by storage of the overflow volume itself or by passing the discharge through a water treatment unit within the facility. FCFs are structures and/or equipment that remove floating debris (including trash, waste matter, and other objects) from sewer discharges using net bags, screens, or other devices.

Ambient Monitoring Program (AMP)

The ACJ requires Onondaga County to monitor conditions of the lake, its tributaries and the Seneca River to evaluate how improvements to

Figure 2-2. Aerial view of new facility at METRO. (Source: OCDWEP)

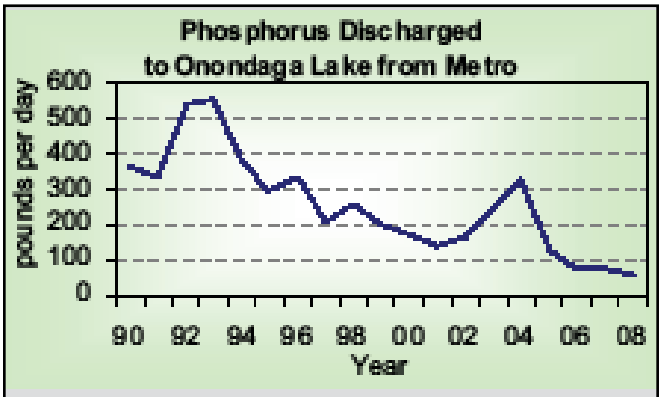

Figure 2-3. Average daily phosphorus discharge from METRO, 1990-2008. (Source: OCDWEP)

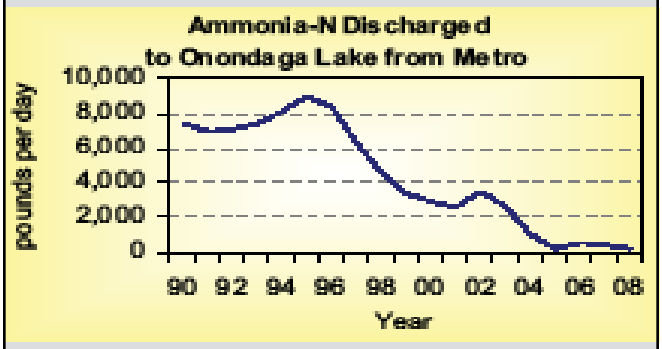

Figure 2-4. Average daily ammonia discharge from METRO, 1990-2008. (Source: OCDWEP)

METRO and the CSOs effect the quality of water in the lake and river. The ACJ specifies the objectives of the program, the types of monitoring to be conducted and defines a schedule for the program.

Amendments to ACJ

An amendment to the ACJ in December 2006 suspended a previously required oxygenation demonstration project for the lake. This decision was based on data from the AMP, which demonstrated that the lake's oxygen levels had significantly improved. The 2006 amendment also included changes allowing for the consolidation of the ammonia and phosphorus removal facilities, use of a skimmer boat in the Inner Harbor rather than a boom in Onondaga Creek, and the design and construction of a CSO abatement plan for Harbor Brook that includes conveyances and regional treatment facilities.

An additional amendment to the ACJ in 2009 authorized the use of green infrastructure in combination with traditional engineering practices (grey infrastructure) to reduce CSO volume during wet weather. Green infrastructure involves the use of existing landscape features, soils, and vegetation to capture or infiltrate stormwater runoff, thereby reducing the volume of flow contributing to CSOs. In recognition of the anticipated volume reduction that will be achieved through the use of green infrastructure, the 2009 ACJ amendment eliminated the requirement for Onondaga County to construct RTFs in Armory Square on Onondaga Creek, as well as on State Fair Boulevard adjacent to Harbor Brook. System-wide, on an average annual basis, CSO volume will be gradually reduced by 95 percent by December 31, 2018.

ACJ Progress and Effects on Lake Water Quality

METRO has improved its capacity to safely, efficiently and effectively treat wastewater over the past two decades. Treatment improvement projects included an odor control upgrade, aeration system upgrade, digital system improvements, increased capacity for chemical storage and feed facilities, digester modifications, and advanced ammonia and phosphorus removal.

As a result of the advanced ammonia removal project, Onondaga County met the final Phase III effluent requirements for ammonia in 2004. The County has also met the requirement to reduce the phosphorus level to 0.12 mg/L, as required in Phase II. Figures 2-3 and 2-4 show the decline in phosphorus and ammonia discharged from METRO in recent years.

The original ACJ outlined a plan to address 66 CSOs. That number was later revised to 70 CSOs. As of February 2008, 12 CSOs were eliminated, 11 were addressed to accommodate peak discharge of a one-year storm, and 4 CSOs were addressed through FCFs. Improvements to the Kirkpatrick Street Pumping Station and an upgrade to the Erie Boulevard Storage System have been completed along with the construction of four FCFs. The

FCFs are located at Franklin Street, Maltbie Street, Harbor Brook and Teall Brook at the Inner Harbor. The FCFs intercept millions of tons of debris from discharging into Onondaga Creek, Harbor Brook and Ley Creek. Construction work at the Midland Regional Storage and Treatment Facility was completed in June 2008 to address 3 CSOs.

As described above, the projects that have been undertaken so far have had a positive impact on the health of the lake and its tributaries. Data indicates that ammonia and phosphorus concentrations in the lake have declined as a direct result of the METRO treatment plant improvements. The higher oxygen levels documented in the lake in recent years suggest the lake is providing a healthier habitat for aquatic life. The AMP has shown that the lake supports an abundant fish community with an increasing number of species. Aquatic plants are increasing, and the lake is starting to resemble other lakes of similar size with respect to plant abundance, number of fish species and summertime water clarity (Onondaga County Department of Water Environment Protection (OCDWEP) 2007b).

While there has been significant progress improving the health of the lake and its tributaries, there are no public swimming beaches. New York State Department of Health (NYSDOH) current requirements include a four-foot water clarity standard for bathing beaches, as well as criteria for bacteria concentrations. Results from the AMP show that these standards are not achieved at all times (OCDWEP 2007b). The percent of measurements in compliance with standards varies by monitoring location, but ranged from 50 to 75 percent for the year 2006, with conditions generally improving from the southern part of the lake to the north end. In 2008, bacteria measurements were in compliance in all locations except the extreme southern end of the lake, where they exceeded standards 14 percent of the time (OCDWEP 2009). Wet weather tends to negatively impact both criteria.

Figure 2-5. Skimmer vessel used to remove debris in the Inner Harbor. (Source: OCDWEP)

Future Restoration Efforts

Onondaga County continues to work toward the goals set forth in the ACJ. Currently, METRO has reached a phosphorus effluent limit of 0.12 mg/L. The County plans to coordinate its efforts to attain the Phase III phosphorus requirement with NYSDEC's update of the Onondaga Lake Total Maximum Daily Load (TMDL), which is planned for 2011. The Phase III requirement must be achieved by 2015.

The Combined Sewer Overflow program continues to progress. Currently, of the 70 CSOs identified, 35 remain to be addressed. The County is working with parties to the ACJ to advance pilot projects that will further develop the best application of green infrastructure to meet CSO volume reduction requirements. Part of Onondaga County's green infrastructure program involves public education to improve implementation and maintenance of green infrastructure on private property in the affected drainage areas. The 2009 amendment to the ACJ calls for the construction of a 3.2 million gallon storage facility in place of a full-scale RTF at Armory Square, and a 3.7 million gallon storage facility on State Fair Boulevard, along with replacement of the Harbor Brook Interceptor. These facilities, along with green infrastructure projects, will be constructed in place of the much larger RTFs that were originally proposed. As an additional requirement of the

2009 amendment, CSO 044 must be connected via a new conveyance pipe to the existing Midland RTF, which was constructed in 2008.

As progress continues on the ACJ projects, water quality monitoring in the lake will continue. Four progress indicators will be used: suitability for water contact recreation, visual attractiveness, support of a balanced community of plants and animals and compliance with water quality standards. A list of the ACJ projects and their status as of December 2009 is found in Appendix E.

Strategic Areas 3&4: Industrial Pollution (National Priorities List Site and Other Adjacent Areas of Concern)

History

The Onondaga Lake shoreline has been the site of industrial and chemical manufacturing activities for over 125 years. From 1882 through 1986, Allied-Signal (formerly, Solvay Process Company and currently, Honeywell International Inc.) discharged a host of wastes, including mercury, salt wastes, ammonia, benzene, and chlorinated benzenes. From 1947 through 1979, Allied-Signal operated chlor-alkali plants utilizing mercury electrodes in the production of chlorine. According to the OLMP, during this same time period, Allied-Signal discharged mercury into Geddes Brook, Nine Mile Creek, and Onondaga Lake. In 1994, the United States Environmental Protection Agency (EPA) named Onondaga Lake to the National Priorities List (NPL), under the Superfund law.

The Onondaga Lake NPL site is made up of eight sub-sites (Figure 2-6), including the bottom of the lake itself and seven locations nearby that have been linked to the pollution of the lake. The sub-sites are known as Onondaga Lake Bottom, Semet Residue Ponds, Willis Avenue, Linden Chemical and Plastics (LCP) Bridge Street, Wastebed B/Harbor Brook, Inland Fisher Guide (IFG) Facility, Ley Creek PCB Dredgings and Salina Town Landfill.

The Onondaga Lake NPL site is being addressed in two stages. These include initial actions that can be undertaken without significant prior investigation, and long-term remedies described in the cleanup plan, which are based on extensive study and design[1]. Honeywell International is implementing the investigations and cleanup of the Onondaga Lake Bottom, Semet Residue Ponds, Willis Avenue, LCP Bridge Street and Wastebed B/Harbor Brook sub-sites. General Motors is implementing studies for the IFG Facility and operations, maintenance and monitoring at the Ley Creek PCB Dredgings sub-site. The town of Salina is implementing the remediation of the Salina Town Landfill sub-site.

The NYSDEC continues to investigate other industrial facilities in the area to assess their impacts on the surrounding environment, including Onondaga Lake.

OLMP Recommendations

In 1993, the OLMC recommended ten action items relating to Industrial Pollution. Those recommendations are as follows:

•• New York State should, through the judicial consent decree, oversee the completion by Allied of the remedial investigation studies of mercury and other Allied-related pollutants. Thereafter, upon completion of the feasibility study, the State should select an appropriate remedial technology. The process leading to a remediation of mercury and other Allied-related toxic pollutants should be pursued as a priority.

1. The initial cleanup activities are known as Interim Remedial Measures (IRM). An IRM is a discrete set of cleanup actions for both emergency and non-emergency situations that can be conducted without extensive investigation and evaluation. An IRM is designed to be a permanent part of the final remedy (NYSDEC 2008a). The long-term remedies described in the full cleanup plan are based on individual Records of Decision (ROD) issued by the NYSDEC and EPA.

Figure 2-6. Onondaga Lake Industrial Pollution Site Map, showing eight NPL sub-sites and four non-NPL sites. (Source: NYSDEC)

•• New York State should implement through its remedial program an investigation and remediation of the LCP Chemicals site. This should include the evaluation and implementation of interim remedial measures as appropriate.

•• New York State should, through its Administrative Consent Orders with Allied Signal, oversee: a) the implementation of an interim remedial program to remove, treat, or dispose free product chlorinated benzenes[2] from the Willis Avenue site, and b) the completion of studies of the sources and extent of contamination associated with the Willis Avenue site. These studies are scheduled for completion in late 1994. The State will evaluate and select appropriate remedial options thereafter.

•• New York State should, through its consent order with Allied-Signal, oversee an investigation and remedial program of the Semet Tar Bed deposits. The initial investigation is scheduled for completion in 1993. The State will evaluate and select appropriate remedial options thereafter. This should include the evaluation and implementation of interim remedial measures as appropriate.

•• New York State should, through its consent order with Allied-Signal, oversee implementation of physical closure of the Solvay waste beds where determined necessary and appropriate. This may include grading, soil cover, installation of positive surface drainage and bulkheading.

2. Free product chlorinated benzenes are chemical products of manufacturing at the Willis Avenue site that contaminated groundwater in the vicinity.

•• Onondaga County should require Allied-Signal to cease discharge of waste bed drainage to METRO within one year. Through its SPDES permit process, NYSDEC should determine the conditions for issuance of a permit for the drainage to be redirected, treated and released appropriately.

•• New York State should carry out the RI/FS[3] and NRD[4] assessment processes to define further remedial needs and methods, and collect monetary damages for lake sediments, groundwater, lower Ninemile Creek, the Tar Beds site, the Willis Avenue site, and other Allied impacts.

•• New York State should prioritize and implement through responsible parties remediation of any other sites that are determined to pose a threat to the lake ecosystem and usage.

•• New York State should, through the appropriate responsible parties, implement a comprehensive investigation and appropriate remediation of Oil City petroleum product contamination. This should address contamination on-site, as well as any contamination moving off-site, if applicable. As the first step, NYSDEC should finalize and implement a consent order with appropriate parties to fully evaluate subsurface conditions at the site.

•• New York State should pursue a program to selectively remove near-shore deposits that due to their physical characteristics may impede construction of the proposed New York State boat launch site on the lake's west shore.

3. A Remedial Investigation/Feasibility Study (RI/FS) can begin once the presence of hazardous contamination is confirmed at a site. The State, or a responsible party under State oversight, performs a detailed examination of the site to determine the nature and extent of contamination, and then evaluates possible remedies through a process that includes public involvement.

4. Liability for Natural Resource Damages (NRD) is provided by Federal statutes, whereby State and Federal officials may seek compensation from responsible parties for the injury to, loss of, loss of the use of, or destruction of natural resources, including land, biota, air, surface and ground waters.

National Priorities List Sub-Sites

Onondaga Lake Bottom

Allied-Signal and other industries in the area contributed to the contamination of the lake water and sediment. Mercury contamination is found throughout the lake; the entire lake exhibits varying degrees of mercury contamination within the sediment layer at its bottom. Other contaminants present in the lake sediments include benzene, toluene, xylenes, ethylbenzene, chlorinated benzenes and polychlorinated biphenyls (PCBs)[5].

In early 2006, NYSDEC, New York State Office of the Attorney General (NYSOAG) and Honeywell International reached an agreement in the form of a Consent Decree requiring the company to conduct a cleanup of contaminated sediments in Onondaga Lake in accordance with the government-issued cleanup plan.

The cleanup plan for the Onondaga Lake Bottom sub-site includes dredging an estimated 2.65 million cubic yards of contaminated sediments, isolation capping of an estimated 425 acres in the littoral zone[6], thin layer capping of an estimated 154 acres, monitored natural recovery, wetland and habitat restoration, and long-term maintenance and monitoring.

A workplan detailing the remedial design was issued in March 2009.

Status of Projects

Honeywell International is currently collecting

5. PCBs are human-made, organic chemicals that were used in hundreds of industrial and commercial applications, such as electrical and hydraulic equipment, oil-based paints, plastics and rubber products. The manufacturing of PCBs was banned in 1979.

6. The cleanup plan for the Onondaga Lake Bottom sub-site defines the littoral zone as the area of the lake where water depths range from 0 to 9 meters (approximately 30 feet).

additional data to further support design detail specifications for the Onondaga Lake cleanup activities. These data will be used to refine dredging locations and design the sediment consolidation area planned in Waste Bed 13.

In-lake monitoring was conducted from 2004 through 2007 to help assess the possibility of controlling methylmercury production through nitrate addition to the deep water areas of the lake during the summer stratified periods. In June 2007, a workplan to continue this assessment was approved by NYSDEC. Field trials of nitrate application were successfully completed in 2009.

Future Activities

Lake bottom dredging is expected to begin in 2012. A workplan detailing the remedial design activities has been developed and was issued in March 2009. A plan to monitor the lake before, during and after cleanup activities is also being developed.

Initial design documents submitted to NYSDEC in March 2009 included information regarding sediment consolidation area (SCA) construction, dredging, water treatment operations, sediment capping, and deep lake bottom remediation.

Semet Residue Ponds

Allied-Signal disposed 20 million gallons of acidic, tar-like wastes on approximately 40 acres of land in the village of Solvay. Located approximately 400 feet south of Onondaga Lake, the sub-site includes five man-made ponds used from 1917 to 1970 as depositories for waste material, and two small areas that were built to contain leakage from the ponds. The Semet Residue Ponds cover approximately 11 acres and have an estimated depth of 5 to 6 feet. Monitoring-well data indicate that there is a plume of contaminated groundwater originating at the sub-site and migrating toward Onondaga Lake. The primary contaminants of concern are benzene, toluene, ethylbenzene, xylene and naphthalene.

In March 2002, NYSDEC and EPA issued a cleanup plan for the sub-site (NYSDEC and EPA 2002). The selected remedy includes the excavation and on-site processing of the Semet Pond residue into benzene, light oil, and a soft tar product. The remedy also includes groundwater collection and on-site treatment.

Following the finalization of the cleanup plan in 2002, Honeywell International presented information suggesting that the cleanup plan would no longer be feasible due to changes in market conditions. A modification of the remedy, which would allow for the residue to be converted to a material used in energy recovery, was being evaluated by Honeywell pursuant to a Consent Order negotiated by NYSDEC and Honeywell International, Inc. However, field activities conducted in 2009 and 2010 to determine the thickness of the residue in the Semet Residue Ponds indicate that the volume of material in the ponds is considerably less than previously estimated. As a result, other alternatives to address the pond material are being considered.

Status of Projects

Studies have been undertaken to identify and investigate seeps in and around the berms that enclose the Semet Ponds, and to evaluate the potential for human exposure to the residue as a result of the seeps. Engineering details are also being generated to ensure the structural integrity of the berms. This information is being developed in support of the revised cleanup plan.

An addendum to the remedial design work plan was submitted in September 2007. The addendum called for additional characterization of sediment and surface water in the upper reaches of Tributary 5A, and additional exploration and inspection of outfalls and culverts along the tributary.

Design and construction of the Semet groundwater collection trench system adjacent to Onondaga Lake have been completed. Design of the Semet groundwater collection trench adjacent to and under Tributary 5A (a tributary to Onondaga Lake

that flows south from Semet Pond then turning north to the lake) is nearly completed.

Future Activities

Removal of contaminated sediment in Tributary 5A and construction of the groundwater collection trench adjacent to and under Tributary 5A will take place in 2010.

Willis Avenue

Located on Willis Avenue in the town of Geddes, this sub-site is situated at a former chemical manufacturing plant that has been demolished. The plant specialized in chlor-alkali production of caustic soda and chlorine. The plant was also used to manufacture benzene and chlorinated benzenes. Currently, both groundwater and surface runoff transport contaminants to the lake via the East Flume.

Status of Projects

Honeywell International completed installation of an underground barrier wall downgradient of the Semet Ponds in 2007 and installed the Willis Avenue section of the barrier wall (Figure 2-7). The barrier wall allows for collection of contaminated groundwater, which is pumped under I-690 to the Willis Avenue groundwater treatment plant. The treated water is then sent to METRO for additional treatment before being discharged to Onondaga Lake. Construction of the groundwater treatment plant was completed in February 2006.

Figure 2-7. Barrier wall installation. (Source: NYSDEC)

Future Activities

Honeywell International is conducting investigatory work, and a list of cleanup alternatives will be available for public comment in 2011.

LCP Bridge Street

From 1953 to 1988, the 20-acre LCP Bridge Street sub-site was used for various industrial activities. The chlor-alkali facility produced caustic soda and liquid chlorine using the mercury cell process. Hydrogen gas, which was generated as a by-product at the facility, was used to manufacture hydrogen peroxide between 1955 and 1969. In 1979, the facility was sold to LCP Chemicals and continued to operate until 1988. Mercury and xylene from former chemical production has contaminated groundwater, surface water, soil and sediment. In September 2000, NYSDEC issued a cleanup plan for the sub-site.

The cleanup plan included mercury removal from soil on the property, excavation of contaminated sediments in the surrounding area, installation of an on-site groundwater collection system and the construction of an underground cut-off wall to prevent any future movement of contaminants from the site.

Status of Projects

In 2005, Honeywell International completed the installation of an underground cut-off wall, sewer abandonment work and soil washing remedial activities. Soil washing removed a total of approximately 14,000 pounds of elemental mercury from soils at the site.

Remedial activities completed in 2006 included the installation of groundwater collection system wells, piezometers, the groundwater collection facility and sediment excavation in wetlands and the West Flume.

In 2007, wetland and stream restoration activities and groundwater collection began. Honeywell International coordinated with wetlands and habitat specialists to design a wetlands and landscape plan to reestablish native species and wildlife. Over 12,000 trees and plants were introduced in an effort to restore wetlands and habitat in the lake watershed near the site (Figure 2-8). All remedial activities called for in the design, with the exception of the construction of the final cap, were completed in 2007.

Figure 2-8. Completed wetland restoration project at the LCP Bridge Street site. (Source: NYSDEC)

Future Activities

Ongoing operation, maintenance and monitoring began in 2008. Monitoring of wetlands, groundwater and the West Flume, and operation and maintenance of the groundwater collection system and temporary cap are being conducted.

The final cap will be installed after the Ninemile Creek/Geddes Brook remedy has been completed (see Other Adjacent Areas of Concern later in this section). Soil and sediment removed from the Geddes Brook/Ninemile Creek site will be placed in the containment facility at the LCP Bridge Street site and/or at the SCA to be constructed at Wastebed 13.

Wastebed B/Harbor Brook

Wastebed B forms the western bank of Harbor Brook downstream of the I-690 crossing and is a source of contaminants to Harbor Brook and Onondaga Lake. The lakeshore area was the disposal site of Solvay waste from 1908 through 1926 and was designated as Wastebed B. The East Flume, located on Wastebed B, was historically one of the major discharge locations for mercury and other waste materials to the lake. The area located south of the lakeshore area, known as Penn-Can, has been used for the production and storage of asphalt products since 1919. A host of hazardous materials, including benzene, toluene, xylene, naphthalene and mercury were disposed of by Allied-Signal resulting in sediment, soil and groundwater contamination.

Status of Projects

In 2003, Honeywell International entered into an agreement with NYSDEC to implement cleanup actions on the Wastebed B/Harbor Brook sub-site. The goal was to isolate, collect and treat contaminants from groundwater before they entered Onondaga Lake using a barrier wall and collection and treatment system. Investigatory work to define the nature and extent of contamination was compiled into a report by Honeywell International and has been reviewed by NYSDEC. Construction of the western portion of the barrier wall, to extend from the East Flume to Harbor Brook, is underway.

Honeywell International is conducting a sediment removal project within the East Flume. Work that began in 2006 includes lowering the water level in the East Flume and visually inspecting catch basins along I-690. As of this writing, no sediment has been removed. Once removed, sediment will be temporarily placed at Wastebed B pending a final decision on its ultimate disposal.

Future projects

NYSDEC and EPA's recommended cleanup plans

for the lower Harbor Brook portion of the site and the area outboard (on the water side) of the barrier wall will be presented in 2010. A cleanup plan to address other areas of the site will be issued in 2011 or 2012.

Inland Fisher Guide Facility

From 1952 through 1993, the Inland Fisher Guide (IFG) facility operated as an automotive chrome plating facility and later, as a manufacturer of plastic automotive components. PCBs, chlorinated solvents and metals from the former General Motors auto parts plant contaminated groundwater, soils and Ley Creek sediments and floodplain soils. A number of cleanup activities to remove or contain contaminants were performed between 2000 and 2004. These included capping an on-site landfill, diverting storm water to an on-site treatment plant and removing 30,000 cubic yards of PCB-contaminated soil.

Status of Projects

In 2006, in accordance with a NYSDEC approved vapor intrusion investigation work plan, air samples were collected and tested. Results indicated elevated levels of solvents in both indoor and sub-surface air samples, leading to General Motors' efforts to plug preferential pathways for soil vapors through floors. General Motors submitted a Vapor Intrusion Evaluation Report to NYSDEC in early 2008. Additional monitoring and remedial measures to address vapor intrusion are anticipated.

Field work was performed in 2008 to collect fish tissue samples for PCB analysis in support of a baseline environmental risk assessment (BERA) and human health risk assessment (HHRA).

Future Activities

Upon receipt and approval of the Supplemental Remedial Investigation Report, HHRA and BERA, an analysis of various remedial alternatives to address the remaining sub-site contamination will be submitted to NYSDEC. NYSDEC plans to issue a final cleanup plan for addressing the remaining concerns at the sub-site in 2012.

Ley Creek PCB Dredgings

General Motors placed PCB-contaminated sediment along the banks of Ley Creek during the 1970s. In 1997 the NYSDEC approved a cleanup plan that included excavation and disposal of PCB-contaminated dredge material/soils at a permitted hazardous waste landfill, consolidation and covering of the remaining PCB-contaminated materials, removal of previously deposited dredged materials from the first 25 feet of the floodway to restore the area to an appropriate elevation, re-vegetating soil outside of the floodway, vegetating drainage swales, installation of a chain-link fence around the area of the vegetative cover to limit access, and implementation of deed restrictions to preclude activities that could potentially expose contaminated materials.

Status of Projects

Excavation of the PCB-contaminated dredged material/soil was conducted between 1999 and 2000. Approximately 3,750 cubic yards of material was transported to an off-site facility. Approximately 920 cubic yards of material located on the north bank of Ley Creek was excavated and consolidated on-site.

A vegetative cover was installed over the consolidated dredged material. 1.5 acres of wetlands were created to replace wetlands that were eliminated during remedial construction.

Implementation of deed restrictions to preclude activities that could potentially expose contaminated materials and to ensure that the integrity of the cover is maintained were put in place in early 2008. The Ley Creek PCB dredgings sub-site was

re-classified in 2008[7]; it is no longer considered an immediate threat to public health, and is properly closed, but requires continued management.

Future Activities

The cleanup plan has been fully implemented. The NYSDEC considers the site to be properly closed. Ongoing maintenance is required.

Salina Town Landfill

The Salina Town Landfill is approximately 55 acres and is located in an industrial area in the town of Salina. In addition to accepting municipal solid waste, the landfill also accepted hazardous wastes including paint sludge, paint thinner, PCB-contaminated materials and contaminated sediment dredged from Ley Creek. The landfill was closed in 1975 as mandated by NYSDEC.

In September 1981, the town covered the landfill with a clay soil and hydroseeded to establish a vegetative cover. Numerous investigations were performed on the landfill to determine whether the landfill was a threat to human health and the environment. In 1997, the landfill was designated a sub-site to the Onondaga Lake Superfund Site because it was determined that contamination from the landfill migrated to Ley Creek, which flows into Onondaga Lake.

In 1997, the town of Salina began investigatory work to evaluate the nature and extent of contamination. A resulting report identified alternative actions for addressing issues at the landfill site. The final cleanup plan was issued by the NYSDEC and EPA in 2007.

The cleanup plan includes excavation and consolidation of contaminated sediments, construction of groundwater/leachate collection trenches north and south of Ley Creek and an on-site treatment plant, construction of caps over the landfill areas north and south of the creek, drainage controls and fencing, installation of an on-site 150,000-gallon storage tank to hold excess water from storm events, institutional controls to prohibit residential use of the property and long-term monitoring and maintenance.

Status of Projects

Remedial design of the leachate collection system is underway, and Onondaga County has agreed to accept treated leachate from the Salina Town Landfill.

Future Activities

Completion of the remedial design and commencement of the proposed work are both expected to occur in 2010. After that time, a suitable new use for the site will be determined.

Other Adjacent Areas of Concern

Geddes Brook/Ninemile Creek

The Geddes Brook/Ninemile Creek system has been impacted by mercury from the LCP Bridge Street NPL sub-site. Analysis of surface water, sediment and floodplain soils indicates that the West Flume, which leads from the LCP plant to Geddes Brook, has been the main channel of mercury contamination in the Ninemile Creek watershed. Other contaminants, such as arsenic, lead, hexachlorobenzene, phenol and PCBs have also been detected in the sediments and floodplain soils.

Status of Projects

Studies are underway to evaluate alternatives for the long-term cleanup of channel and floodplain sediments for Geddes Brook/Ninemile Creek as mandated by the NYSDEC. Cleanup plans for two portions of the Geddes Brook/Ninemile Creek

7. The site was reclassified in 2008 from a Class 2 to a Class 4 New York State inactive hazardous waste site. NYSDEC defines Class 2 as a significant threat to the public health or environment and action is required. Class 4 inactive hazardous waste site is a site that has been properly closed and requires management.

Figure 2-9. Ninemile Creek. (Source: Central New York Regional Planning & Development Board)

system were issued by NYSDEC and EPA in April and October 2009.

Future Activities

Design activities to implement the cleanup plans for Geddes Brook and Ninemile Creek are underway. It is anticipated that construction will commence in late 2010 at the Geddes Brook portion of the site.

Niagara Mohawk-Hiawatha Boulevard

The Niagara Mohawk-Hiawatha Boulevard manufactured gas plant (MGP) area of concern is approximately 20 acres in size and located on West Hiawatha Boulevard, bordered by Onondaga Lake and Onondaga Creek. The MGP operated from 1925 to 1958. Wastes associated with the MGP production are heavy metals, coal tar, phenols, oil sludge and cyanides. National Grid, which merged with Niagara Mohawk, is the party responsible for remediation efforts.

Current Status and Future Activities

Monitoring of the site continues to determine appropriate remedial actions. Contaminated soils were identified and removed during construction of the METRO expansion. A cleanup plan for this site is expected to be available for public comment in 2010.

Wastebeds 1 - 8

Located on approximately 315 acres of the former Geddes Marsh on the southwest side of Onondaga Lake, Wastebeds 1 - 8 were used to dispose Solvay Process waste and other industrial waste from the early 1900's through 1944. The disposal of the waste at Wastebeds 1 - 8 ceased after a containment dike failed in 1944. The presence of contaminants, including benzene and toluene, has been documented.

Current Status and Future Activities

Investigatory work to define the nature and extent of contamination is nearly complete. Honeywell International will use this information to propose a remediation plan for this site which, when available, will be subject to public comment.

Oil City

The area at the southern end of Onondaga Lake formerly known as "Oil City" consists of approximately 750 acres formerly occupied by various industrial operations, including over 80 bulk petroleum tanks that contributed to contamination of groundwater by solvents and petroleum products (Mobil Oil Company vs. Syracuse Industrial Development Agency 1990; Lakefront Development Corporation 2000). This contamination made its way through the underlying soils surrounding the southern part of Onondaga Lake. Much progress has been made on remediation of this area, including cleanup of approximately 200 acres and construction of the Carousel Center Mall in the late 1980s and early 1990s. All of the tanks have been removed, and the former owners of the property have relocated their facilities to other

areas. More information on the reclamation and redevelopment of the Oil City area can be found in Strategic Area 7: Inner Harbor and Shoreline Use.

Strategic Area 5: Hydrogeologic Investigations

History

Located approximately 18 miles south of Syracuse, the Tully Valley has unique hydrogeologic features called mudboils (Figure 2-10). Mudboils have contributed significant amounts of sediment to Onondaga Creek. Mudboils are artesian-pressured geologic features that discharge turbid (cloudy), fresh to saline water at the land surface, and eventually into the creek. Historically, fine-grained sand settled to the creek bottom while the finer-grained silt and clay remained in suspension making the creek turbid, sometimes all the way to the Inner Harbor. During high flow events, the sandy sediment became re-suspended and eventually was deposited at the Inner Harbor of Onondaga Lake.

Sedimentation is of particular concern because it reduces habitat for aquatic insects, plants and fish. Historically, Onondaga Creek has contributed more than 50 percent of the annual tributary sediment load to the lake.

Figure 2-10. Tully Valley mudboil. (Source: USGS)

OLMP Recommendations

In 1993, the OLMC recommended four action items for the Tully Valley mudboils:

•• The OLMC, in cooperation with the United States Geological Survey (USGS), United States Department of Agriculture (USDA), United States Army Corps of Engineers (USACE), NYSDEC, NYSOAG and other agencies and experts, should assess and report on the feasibility of implementing a short list of cost-effective remedial solutions in order to reduce sediment and chloride discharges to Onondaga Lake and Onondaga Creek. The solutions may include implementation and monitoring of pilot projects such as placement of sub-surface depressurization wells, rerouting a portion of Onondaga Creek, and/or installation of impoundment structures to allow settling of the fine sediments.

•• The NYSDEC, through the Administrative Consent Order with Allied-Signal, should continue oversight of the plugging of solution mining wells to promote stabilization of the brine field area.

•• The USGS, in cooperation with NYSDEC, NYSOAG and other agencies, should continue hydrogeologic investigations and research to define the characteristics and impacts of the Tully Valley mudboils.

•• New York State (NYS) should pursue those parties responsible for the initiation and/or exacerbation of the mudboils in the Tully Valley. NYS should also require both appropriate remediation and compensation for damages from those responsible parties.

Remediation Strategies for OLMP Recommendations

In the fall of 1991, the OLMC created the Mudboil Working Group (representing local, state and federal agencies) to develop a plan to identify the cause of mudboil activity and formulate ways to reduce or eliminate mudboil discharges (Kappel and McPherson 1998). USGS, NYSDEC and researchers from Syracuse University began the first long-term study of mudboil activity with funding from EPA. The goals of the plan were to:

•• Define the mechanism and extent of mudboil development.

•• Drill test wells to define the glacial stratigraphy (layering of glacial materials) and delineate groundwater flow paths within the valley.

•• Monitor the flow and sediment concentrations of mudboil discharges to calculate the amount of water and sediment discharged to Onondaga Creek.

•• Identify remedial actions to reduce those discharges.

•• Monitor the results of those actions.

During the 1990s, artesian pressure within the underlying aquifer was identified as a force behind mudboil flow. It was learned that the flow from the mudboils changes seasonally in response to changes in artesian pressure. In the spring, when groundwater recharge is higher, the mudboils are more active. Artesian pressure in the aquifer declines during the summer as recharge to the aquifer declines (Kappel, Sherwood, and Johnston 1996; Kappel 2009).

The Mudboil Working Group supported the recommendations made in the OLMP, including diverting flow from a tributary that feeds the main mudboil depression area (MDA), installing depressurizing wells at several locations, and constructing a dam and sediment-settling impoundment to detain mudboil sediment.

Diversion of Tributary Flow

Remediation work along the Tully Valley mudboil area began in 1992. In June of that year, a project to divert surface water inflow to the MDA reduced sediment loading to Onondaga Creek by half – from nearly 30 tons/day to about 15 tons/day.

Depressurizing Well Installation

Depressurizing wells (Figure 2-11) were first installed in 1992 near the Otisco Road bridge. It was believed that depressurizing wells drilled to the base of the freshwater aquifer would reduce artesian pressure in the upper aquifer and slow nearby mudboil activity. Several wells were installed with 10-foot-long well screens to allow artesian-pressured water to flow out of the well while holding the fine-grained sand and silt in place. Additional depressurizing wells were installed in the summer of 1996 in the aquifer surrounding the MDA and along Onondaga Creek (Kappel and McPherson 1998).

Figure 2-11. Depressurizing well at Tully Valley. (Source: USGS)

Impoundment Dam

In July 1993, a temporary impoundment dam was constructed at the outlet of the MDA to reduce the average daily load of sediment discharging to Onondaga Creek. The impounded area covered several mudboils and allowed most of the sediment to settle out before flowing to Onondaga Creek. In 1996, a permanent impoundment dam was constructed in order to continue the capture of sediment discharged from mudboils within the MDA.

Remediation Results

The results of tributary diversion, depressurizing well installation, and the impoundment dam were positive. Flow diversions reduced sediment loading, and the impoundment dam and depressurizing wells slowed mudboil activity in the MDA. Because of the impoundment, the average daily load of sediment discharged from the MDA to Onondaga Creek was reduced from 15 tons/day in 1992 to 1.5 tons/day during 1993 and 1994. The

installation of depressurizing wells resulted in reduction of the artesian pressure in the mudboil aquifer, further reducing mudboil activity.

Stream flow and sediment concentration are currently being monitored at the MDA. The measurements include flow (15-minute increments), total hourly precipitation, weekly sediment concentrations, estimated sediment load discharged to Onondaga Creek, quarterly depressurizing well volume and water quality measurements and quarterly groundwater level measurements. These measurements document current conditions at the MDA, and the effectiveness of the remedial activities implemented. In the long-term, the data will provide a measure of how the mudboils react to variable and seasonal weather activity. As of this writing, sediment loading from the mudboils remains at less than 1 ton/day, a 95 percent reduction from the early 1990s.

Figure 2-12. Aerial photo of mudboils and impoundment dam alongside Onondaga Creek. (Source: USGS)

Brine Mining at Tully Valley

The salt and brine mining industry has thrived in NYS for over 125 years. The Solvay Process Company started solution-mining halite (salt) in the Tully Valley brine field in 1888. Solvay Process Company drilled 167 wells into the halite bed approximately 1,200 feet below land surface. Water was injected to create saturated brine, which was then transported by pipeline to the company's Solvay plant where it was used to make soda ash, and later, for the production of chlorinated chemicals. Solvay's successors, Allied-Chemical and Allied-Signal, continued their operations until Allied-Signal ceased their Syracuse operations in 1986.

During the preparation of the OLMP, it was believed that the solution mining activity in Tully Valley was the primary cause of mudboil activity. The OLMP recommended that NYS pursue parties found responsible for the initiation or exacerbation of the mudboils and require remediation and compensation. Studies to date have not developed sufficient data for NYS to pursue parties that may be responsible for initiation or exacerbation of the mudboils, although that may change in the future.

Allied-Signal was required to plug the solution-mining wells in the Tully Valley brine field area. Over a two-and-a-half year timeframe, Allied located and filled 160 brine wells with cement grout. The project was completed in 1994.

Future Remediation Efforts

The remedial activities implemented to date have been successful in reducing sediment discharge to Onondaga Creek. Maintaining water clarity requires continuous attention. Periodic maintenance activities, such as dredging of sediment-filled containment areas and repairing flow-measuring and flow-diversion structures, are necessary activities due to periods of high flow and excessive sediment accumulation. Depressurization wells also require constant maintenance to assure continued well discharge and diminished mudboil activity.

With funding provided by EPA, the OLP has undertaken two pilot projects to study how to lessen the water entering the mudboil aquifer, thus reducing mudboil activity even further. The OLP is researching the potential impact of reducing the volume of surface runoff entering the groundwater system up-gradient of the mudboil area. USGS plans to expand the aforementioned study to target

the brine fields associated with Allied-Signal's solution mining activities and two alluvial fans at Rattlesnake and Rainbow Creeks (Kappel 2009).

Scientists are also turning their attention to increased sediment loading of Onondaga Creek resulting from ongoing landslide activity. On April 27, 1993, a large landslide occurred at the base of Bare Mountain in the town of LaFayette, approximately 12 miles south of Syracuse and 2 miles north of the mudboils. The landslide destroyed three homes and covered 1,500 feet of Tully Farms Road with more than 15 feet of mud (Figure 2-13). Studies conducted by federal and state environmental agencies and several universities indicate that several landslides have occurred at the base of Bare Mountain, dating as far back as 10,000 years ago. Possible causes of these landslides include increased water content of near-surface soils resulting from greater than normal precipitation and snow melt, instability of the lower hillside, and artesian pressure changes below ground (Pair, Kappel, and Walker 2000). Other landslides have occurred since 1993. USGS estimates that landslide activity may now contribute as much, if not more, sediment to the creek as do the mudboils. The OLP will continue to study landslide activity in Tully Valley and its tributary valleys to determine the scope and nature of landslide activity and associated sediment loading to Onondaga Creek.

Figure 2-13. April 27, 1993 landslide at Bare Mountain. Dotted line is Tully Farms Road. (Source: USGS)

Strategic Area 6: Fish and Wildlife Habitat and Fisheries Management

History of Contamination

A host of contaminants have adversely impacted Onondaga Lake and its surrounding habitat in the past. Elevated amounts of phosphorus, ammonia, mercury, sediment, salinity, and other contaminants have diminished the water quality of the lake (see Table 2-1).

Phosphorus

Historically, METRO released significant amounts of phosphorus into the lake. High levels of phosphorus contribute to excessive algae growth. When the algae eventually die, they settle to the bottom of the lake and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms cannot exist in water with low dissolved oxygen levels.

Ammonia

In the past, the concentrations of ammonia in Onondaga Lake have exceeded environmental standards. Although the elevated ammonia levels in Onondaga Lake were never toxic enough to cause a fish kill, chronic exposure can reduce fish spawning and restrict migration patterns. Ammonia is supplied to the lake from METRO.

Mercury

Excessive mercury levels in the lake have inhibited aquatic life. Mercury contamination measured in fish flesh led to a 1970 ban on all fishing within the lake. Catch and release fishing was reinstated in 1986, but consumption advisories remain in place.

Sediment

Non-point source erosion and the Tully Valley mudboils and landslides have increased sedimentation in Onondaga Creek, which is currently the primary source of sediment to the lake. Further non-point source sediment inputs from other

tributaries add to the problem. The increased sediment loading of the lake reduces water clarity and habitat for aquatic insects, plants and fish spawning.

Contaminant	Sources	Effects
Phosphorus	Municipal wastewater discharge, non-point source runoff (e.g. fertilizer)	Excessive algal blooms, decreased water clarity, depletion of oxygen that is necessary for fish and other aquatic organisms to survive
Ammonia	Municipal wastewater discharge and industrial wastebeds	Toxic to fish; disruptive to survival behaviors
Mercury	Industrial activities along lake	Measured in fish flesh and is toxic to humans and wildlife
Sediment	Tully Valley mudboils and landslides	Reduces aquatic habitat, fish spawning sites, sunlight penetration and plant growth
Salinity	Salt mining activities, soda ash production, salt springs	Reduces and/or eliminates suitable habitats

Table 2-1. Major Pollutants of Onondaga Lake.

Salinity

Elevated levels of salts, particularly sodium chloride and calcium chloride, occur in Onondaga Lake as a result of former soda ash production activities along the west shore of the lake. Salt springs in the Tully Valley area also contribute to the elevated salinity. High salinity levels alter the stratification process of the lake, and contribute to the formation of anoxic zones. As a result, fish and other aquatic organisms cannot inhabit these zones due to a lack of dissolved oxygen in the water.

Other contaminants

A large portion of the lake and its near-shore area are covered with calcium carbonate stones called oncolites. Oncolites are a product of the Solvay Process conducted at the Allied-Signal soda ash facility. Oncolites inhibit the growth of rooted aquatic plants, which limits the variety and population of animal species found within the lake.

Other contaminants originate from non-point sources. These include pesticides, motor oil, metals, septic leachate, and several other pollutants that are harmful to fish and wildlife.

As a result of the contamination, fish populations decreased and the fishery that once flourished within the lake declined. Migratory salmon and non-migratory ciscoes (also known as Onondaga Lake whitefish), both coldwater fish, are mentioned in anecdotal accounts from the 1800s and early 1900s. The historical presence of coldwater

Figure 2-14. Smallmouth bass caught in Onondaga Lake. (Source: OCDWEP)

fish (particularly salmon) remains subject to debate, but neither the Atlantic salmon, whitefish, nor any other coldwater fish currently reside in the lake year-round.

During the early 1990s, the OLMC convened a working group of fisheries scientists and managers to examine the various alternatives available to enhance the lake's fishery. The following three options were evaluated:

1. Enhanced warmwater resident fishery

2. Resident coldwater fishery

3. Resident warmwater/transient coldwater fishery

The group chose the third option as an interim program goal. This option states that there is potential for a transient coldwater fishery, where the fish migrate between the lake and the Seneca River. The OLMC concluded that if the lake water quality was enhanced to meet the set water quality standards to support warmwater fish populations, the establishment of a transient Atlantic salmon fishery in the lake and lower reaches of the main tributaries would also be feasible[8].

Recommendations from OLMP

•• The establishment of a suitable year-round habitat for a sustainable warmwater fishery in the lake and the migration of coldwater fish into the lake's tributaries by the achievement of sufficient water quality, vegetative cover, access, food supply and other habitat requirements.

•• The achievement of a suitable year-round habitat for a sustainable consumptive warm and coldwater fishery in the lake and its tributaries.

•• Making specific reaches of Ninemile Creek and Onondaga Creek suitable for spawning, migration and residence of indigenous fish species.

•• NYSDEC should develop a Fisheries Management Plan specific to Onondaga Lake to address and work toward achieving the above recommendations on the fishery.

•• Continue to completion the on-going study to evaluate methods of littoral zone rehabilitation. The results of the study should be considered in determining remediation options for the lake.

•• Undertake an artificial in-lake oxygenation pilot project to evaluate the potential role of in-lake oxygenation on lake restoration, and its effect on the release of nutrients and metals from the bottom sediment.

•• Undertake experimental stocking of Ninemile Creek with Atlantic salmon smolts to assess remediation needs to allow future Atlantic salmon migratory runs.

•• As long as fish continue to exceed Food and Drug Administration (FDA) levels for mercury, the advisory against eating fish should be maintained. If the levels of these contaminants fall below these FDA guidelines, it is recommended that careful review be undertaken of all contaminants likely to be of concern in the Onondaga Lake system prior to lifting the consumption advisory.

Figure 2-15. A Great Blue Heron. (Source: 2002 OLP Photo Contest, photo by Paul Garvey)

8. The presence of Atlantic salmon, which is a coldwater species, is not always linked to the water quality standards for warm water fish. However, in this case a consensus was reached among scientists and managers that achievement of the water quality standards for warm water fish would be a sufficient condition to support a transient Atlantic salmon fishery. This conclusion was based on results of NYSDEC stocking efforts and research studies.

•• Development of a comprehensive biological monitoring program to demonstrate trends and to identify sources and causes of ecosystem-wide problems. Biological monitoring should be coordinated with other activities such as water quality studies, mercury studies and fishery investigations.

•• NYSDEC should undertake an annual fish-monitoring program of Onondaga Lake, associated tributaries and the lake outlet to identify all appropriate and likely contaminants that may be present in the lake system.

•• Implementation of a Natural History Information and Education Program to educate and inform the public on fish and wildlife species in and around the lake.

•• Development and implementation of a plan to hydrologically connect selected wetland areas to Onondaga Lake.

•• NYSDEC should identify environmentally sensitive areas and significant wildlife habitat around the lake's shoreline. Incompatible development in these areas should be discouraged.

Strategies and Progress

Fisheries

The improvements at METRO and the control of CSOs have successfully reduced ammonia and phosphorus levels in the lake, thus providing a healthier habitat for a sustainable year-round warmwater fishery. The improved water quality in the lake has promoted spawning, migration and residence of native fish species in portions of Ninemile Creek and Onondaga Creek. Aquatic plant growth has also increased. Results from the biological component of the Ambient Monitoring Program (AMP) show dramatic increases in the areal coverage of aquatic plants throughout the littoral zone. The number of species of rooted aquatic plants has increased from five in 1991 to seventeen in 2005. The increasing aquatic plant growth is helping to stabilize the lake bottom and encourage fish habitat (OCDWEP 2007a).

Habitat conditions are improving to allow establishment of a sustainable warmwater fishery in the lake and migration of fish into the tributaries. As of 2007, studies have identified 64 fish species in the lake, up from 9 to 12 species found in the lake during the 1970s, and have acknowledged that the lake supports a "very productive" warmwater fishery with abundant numbers of largemouth and smallmouth bass. The lake also supports cool water species, such as walleye and yellow perch. Brown trout, a coldwater species, have been caught during colder periods of the year, suggesting that the migration of coldwater fish into the lake's tributaries has been successful (OCDWEP 2007a).

Progress is being made toward achievement of a consumptive warmwater fishery in the lake. Fish species and populations are increasing in the lake. The NYSDOH continues to re-assess the advisories it has issued on fish consumption, which are related to potentially harmful chemical levels. After more than 10 years of catch-and-release fishing, the NYSDOH issued a change in the fish advisory for Onondaga Lake in 1999, stating that anglers were to eat no walleye from the lake and no more than one meal per month of all other species. The advisory was updated in 2007, adding that largemouth and smallmouth bass were not to be eaten due to mercury contamination. Women of childbearing age, infants and children under the age of 15 are advised not to eat any fish from the lake (NYSDOH 2007).

An annual fish monitoring program to identify contaminants of concern presently exists only for the lake. Onondaga County, through the AMP, collects largemouth and smallmouth bass annually for mercury testing from the lake. The program has generally shown the persistence of elevated mercury concentrations in these fish species. A fish monitoring program does not currently exist for the outlet or the tributaries.

Researchers at SUNY ESF began experimental stocking of Ninemile Creek with Atlantic salmon in 1991 and continued in 1995 through 2002. The results of the experimental stocking were positive,

as the salmon survived the winter in the creek and were visible in the spring. It was evident to the researchers that the salmon thrived in the creek, and while they have been seen in the lake, the lake is often too warm to support the salmon fishery.

In 2002, OCDWEP began to record the species of fish caught in the lake through the Angler's Diary Program. In an effort to monitor the fishery, OCDWEP requested that anglers fishing in the lake, Seneca River, or Oneida River carefully record the time spent fishing, numbers and species caught, fish kept, and the area fished, in order to monitor the progress of the fishery.

As a true testament to the aquatic improvement, Onondaga Lake hosted the Bassmasters Memorial Bass Fishing Tournament July 26-29, 2007. Over 50 of the country's top anglers gathered in Central New York to participate in the tournament. One fisherman was quoted as saying, "they told us this lake was polluted. They were right, it's polluted with fish," (Lucky Craft 2008).

Habitat Improvement Projects

In 2000 and 2001, the OLP supported the construction of two major habitat restoration projects. As a way to reduce the shifting and resuspension of bottom sediments in the shallow water caused by waves on the lake, a jetty was constructed in the northwest corner of the lake. By reducing the shifting of bottom sediments, the jetty, known as a permanent habitat module, promotes aquatic vegetation growth and provides spawning habitat for fish. The OLP also funded the design and construction of two wetlands connection projects as recommended in the OLMP. The purpose of the wetlands connection was to hydrologically connect selected wetlands to Onondaga Lake in an effort to restore habitat. Maintenance of the wetlands connection projects has been minimal and there is silt blockage at both sites at this time.

The OLP sponsored the Onondaga Creek Conceptual Revitalization Plan (OCCRP) project with funds from the EPA. The goal of the OCCRP project is to develop a community-based revitalization plan for the Onondaga Creek watershed by providing a guide for future development, water quality and habitat improvements that can enhance social and economic conditions along the creek. The Onondaga Creek Working Group, charged with developing the conceptual revitalization plan, is comprised of a diverse group of volunteers who live or work in the watershed. The revitalization plan will include suggestions for specific habitat improvements in the Onondaga Creek watershed.

Figure 2-16. One example of a jetty at Onondaga Lake. (Source: OLP)

Natural History Education

The Syracuse University Living Schoolbook created a CD titled, *The Natural History of Onondaga Lake* in 1999. The CD was created with the assistance of middle school students and distributed to Syracuse area schools. It included educational information regarding the different types of fish and wildlife species in and around the lake. A kiosk display was also created using this information and was displayed at St. Marie among the Iroquois and later at the Salt Museum.

Future Efforts for Habitat & Fisheries

As part of the Onondaga Lake Bottom cleanup plan discussed on page 2-8, Honeywell International is developing a habitat restoration plan that will identify and consider the presence of

environmentally sensitive areas affected by remedial actions. The plan will address the design and implementation of activities that will enhance water quality while providing habitat and a sufficient food supply for wildlife. Although Onondaga County's AMP has a biological monitoring component, Honeywell International will also conduct long-term biological monitoring as part of the Onondaga Lake Bottom cleanup plan.

The permanent habitat module and wetland hydrological connection project constructed in 2000 and 2001 have not been maintained since the early 2000s. Silt blockage in the wetlands continues to increase; in order to sustain these habitat restoration projects, ongoing maintenance is necessary.

As recommended in the OLMP, NYSDEC plans to develop a fisheries management plan specific to Onondaga Lake. The plan will outline management activities necessary to maintain and enhance the lake's fishery.

Strategic Area 7: Inner Harbor and Shoreline Use

Inner Harbor Issues

The city of Syracuse is divided into 26 neighborhoods. Syracuse's Lakefront neighborhood consists of a diverse mix of residential, commercial and industrial land uses.

Like other areas of Syracuse, the Lakefront neighborhood was once the site of significant industrial development. The areas of Franklin Square, Stadium Market Center, Carousel Center, Harbor East, Harbor West, and the Inner Harbor are all part of the Lakefront neighborhood. The area of the Lakefront known as Franklin Square was the former location of automobile and parts production facilities. When the factories closed in the 1980s, they left behind a number of vacant buildings and empty lots near the Inner Harbor. A 750-acre area in the Lakefront neighborhood known as Oil City housed over 80 petroleum storage tanks and distribution terminals owned by various oil companies. Contamination from the tanks at Oil City leached into the soils surrounding Onondaga Lake.

The many decades of industrial activities have contributed significant contamination to the lake's shoreline, while sedimentation and pollution have adversely affected the water quality of the lake's Inner Harbor. Many of the industrial contamination sites along the lake have been remediated, while others are currently undergoing remediation as part of the long term cleanup plan involving Honeywell International (see Strategic Areas 3 and 4: Industrial Pollution).

Figure 2-17. Public event at the Syracuse Inner Harbor. (Source: City of Syracuse)

Recommendations

The OLMC made the following recommendations in 1993 for the Inner Harbor and shoreline:

- NYSDEC, Onondaga County, and the city of Syracuse should work to expand and improve access to the lake for fishing and boating as the fishery and public demand warrant. Facilities should provide access for boating and shoreline anglers and may include boat access sites and public fishing piers. All facilities should be handicapped accessible and located in consideration of all residents.

- NYSDEC should continue to pursue the development and construction of a fishing access site on the west shore of the lake.

•• USACE should design and prepare plans to dredge the Inner Harbor during 1993/1994. The planning process will determine the appropriate party to dredge the Inner Harbor; and the dredging should be conducted before 1996.

•• Local governments should seek public and private funds for the design and construction of projects which may include, but not be limited to: an outdoor performing arts facility, a year-round skating rink, a public art park, a lake education and research center, bike paths and pedestrian walkways.

•• Local governments should coordinate any construction activity relating to the development of wastewater treatment facilities so as to minimize to the extent possible any negative impacts on lakefront development and the surrounding community.

•• The city, the county and other local governments should work with the NY State Department of Economic Development and NY State Canal Corporation to design and circulate tourism focused promotional publications to promote the lake and the Inner Harbor.

•• Re-use of Allied waste beds, where appropriate, for public use purposes including the possibility of parks, golf courses, etc. Remedial efforts undertaken by responsible parties should be developed and implemented in consideration of future possible public usage.

•• Local governments should continue to improve public access to the lake by completing the lake-wide trail system and expanding the East Shore marina.

•• No land use should be permitted which would be deleterious to the lake's water quality.

Strategies for OLMP Recommendations and Current Status

Inner Harbor

Remediation and redevelopment of the Lakefront neighborhood began in the early 1990s. Oil company operations were relocated from the area known as Oil City to a new location in the town of Van Buren. The last of the oil tanks were removed from Oil City in 2001 (Lakefront Development Corporation 2000). The property owner removed contaminated soils from Oil City and prepared the land for redevelopment. Currently, much of the property is undeveloped with the notable exception of a large commercial shopping mall located on the southeast lake shore.

Redevelopment of the vacant factory buildings at Franklin Square began in the 1990s. These large, open-floored, brick buildings have been transformed into residential apartments, luxury condominiums, senior citizen apartments, commercial offices, and small businesses, including restaurants and cafes. Landscaping, ornamental lighting and tree-lined streets have converted this formerly underutilized and unattractive industrial site into a charming, mixed-use neighborhood.

The Onondaga Creekwalk is an attractive trail connecting the Franklin Square area to the Inner Harbor (see Appendix A for a map of the area). Extending north toward the lake from the Inner Harbor, the Creekwalk is a paved, ¾-mile path. The Creekwalk offers the community opportunities for recreation, including in-line skating, bicycling and fishing along the shoreline. It is envisioned that the Onondaga Creekwalk will eventually be extended to the Downtown Syracuse area and the planned Loop-the-Lake Trail. The Creekwalk will also connect to the Erie Canalway Trail. When completed, the Erie Canalway Trail will link canal communities from Albany to Buffalo along the New York State Canal System.

The 42-acre Inner Harbor is owned by the New York State Canal Corporation, but is maintained by the city of Syracuse's Lakefront Development Corporation (LDC). The LDC was established in 1996 by the city of Syracuse and the Metropolitan Development Association to facilitate the redevelopment of the Syracuse Lakefront. The LDC began renovations to the Inner Harbor in 1999. The New York State Canal Corporation dredged approximately 60,000 cubic yards of sediment and other materials from the Inner Harbor in 1999.

The renovation of the Inner Harbor was a three-

phase process. The first phase involved repairing the bulkhead canal wall in the harbor, which was completed in 1999. The second phase included the installation of landscaping, light poles and a promenade in 2001. An historic freight house was moved from its original south pier location to a new harbor site along Solar Street. The third phase involved the construction of 700 feet of floating docks, the north pier, gazebo and water and electrical amenities. A 1,500-seat amphitheater was completed as part of phase three in 2002 (Duffett 2005).

The Inner Harbor is available to the public for events and private parties. The Inner Harbor Block Party, a weekly, Thursday night event held at the Inner Harbor during the summer features local bands and a fun, after work atmosphere. An annual Independence Day Fireworks Celebration is held at the Inner Harbor by the city of Syracuse each year, drawing several thousands of people.

Shoreline

Onondaga Lake Park is the most visited park in Onondaga County. With over five miles of shoreline, over 1.3 million visitors picnic, fish, recreate and relax at the park each year.

The park has picnic facilities for rent, playgrounds for children, a dog park and a skate park.

Figure 2-18. Onondaga Lake Park. (Source: Central New York Regional Planning & Development Board)

Rowboats and kayaks are available for rent at the park and an 87-slip marina within the park is often fully occupied during the peak summer months.

Effect of Water Quality on Recreational Activities

Rain and snowmelt affects water quality by carrying stormwater runoff into nearby surface waters. Such runoff often contains unwanted materials, such as sediment, nutrients and bacteria. Bacteria carried in runoff comes from a variety of sources including waste from wildlife, pets, agriculture sources, and, in the case of Onondaga Lake, combined sewer overflows (CSOs) which can contain both sanitary sewage and stormwater.

Bacteria levels in portions of Onondaga Lake typically increase after significant storm events, primarily in the southern end of the lake where most tributaries receiving CSOs are located. Bacteria levels in the northern end of the lake (in the Willow Bay area), while less impacted by rainfall events, may increase for a few days after significant storm events. These occasional high bacteria levels are among the factors why swimming in the lake is not encouraged. Swimming from shore is also prohibited because of legal requirements that restrict swimming to a designated bathing beach. Onondaga Lake does not have a designated bathing beach.

There are no regulations pertaining to boaters using the lake for recreational purposes. While the water quality in the northern part of Onondaga Lake is likely suitable for recreational activities in most areas most of the time, there are other factors (including elevated bacteria levels) that lead the Health Department to recommend that the lake not be used for swimming.

(Onondaga County Parks Department, Onondaga Lake Special Event Water Quality Protocol 2009)

The park has over seven miles of paved, shoreline trails specifically designated for walking/running and biking/skating. A Loop-the-Lake Trail is planned to extend the entire 12-mile perimeter of the lake. Currently, half of the Loop-the-Lake Trail, a five-mile section along the east shore and northwest section of the west shore, is complete. Portions of the trail that will extend from the west shore of the lake from Ninemile Creek to the NYS Fairgrounds have been designed and are currently undergoing environmental review.

Onondaga Lake Park is the site of two museums;

the Salt Museum, which displays original equipment used for salt mining in Syracuse, and Sainte Marie among the Iroquois, which provides an historic look at the 17th century culture of the Iroquois and the French.

Future Lakefront Developments

The Syracuse Lakefront Area Master Plan, adopted in 1999 by the LDC Board of Directors, Syracuse Planning Commission and Syracuse Common Council, offers a redevelopment vision for the Syracuse Lakefront. Future development of the Syracuse Lakefront will be in accordance with the city of Syracuse Zoning Regulations (Parts B-IX and C-IX), which were developed to codify the concept presented in the Lakefront Area Master Plan.

Onondaga County Parks received a $225,000 grant from the New York State Canal Corporation in 2006 to upgrade the existing 87-slip marina located on the eastern shore of Onondaga Lake at Onondaga Lake Park (see Appendix A for location). The project involves adding a section to the marina that will accommodate up to 14 additional boats and modernizing existing facilities. The Dock Enhancement Program will increase marina capacity and promote local and regional recreation and tourism. Similarly, to improve boating access opportunities, NYSDEC is conducting investigatory work in support of developing plans for a boat launch on the west shore of the lake.

Figure 2-19. Onondaga Lake Park Marina. (Source: Onondaga County)

Strategic Area 8: Non-Point Source Pollution

History

As point sources of pollution such as the METRO discharge and CSOs are reduced, there is a growing need to reduce non-point sources of pollution within the lake and the watershed. Non-point source (NPS) pollution comes from diffuse sources and is transported by stormwater runoff and wind. Common non-point sources are associated with land use activities such as agriculture, forestry, urbanization and construction. Typical agricultural sources of NPS pollution existing in the Onondaga Lake watershed include soil erosion and over-grazed pastures, unstabilized barnyards and manure runoff. Sediment from eroded streambanks and roadbanks, nutrients and chemicals from man-made fertilizers and pesticides contaminate waterways when they are washed into creeks and streams. Urban forms of NPS pollution include litter and debris from streets that are carried by stormwater, fertilizer and pesticides, construction site runoff and petroleum products.

Recommendations from OLMP

•• Completion of a NPS Management Strategy to address the impacts of NPS pollution on the lake watershed based on available geographic, demographic, hydrologic and water quality data.

•• Onondaga County's Water Quality Strategy should include a NPS Management Strategy incorporating urban, suburban and rural control problems. The Water Quality Strategy should be under the direction of the Onondaga County Water Quality Coordinating Committee and would continually evaluate and update watershed protection implementation programs.

•• Portions of the Onondaga Lake watershed should be identified and prioritized for implementation of best management practices (BMPs)[9] to control NPS pollution.

•• Define a "Zone of Primary Ground Water Management Concern" in order to further evaluate and manage ground water pollution impacts to the lake and its tributaries.

•• New York State, Onondaga County, local governments and other appropriate government agencies should initiate a NPS public education program to raise public awareness and promote practices at the individual household level to reduce NPS pollutant inputs to the watershed.

Additionally, the OLMP suggested other NPS control options, including streambank fencing programs to limit livestock access to valuable streams, re-establishment of streambank vegetation, litter control and cleanup, and educational campaigns for pollution prevention. It was recommended that the Onondaga County Soil and Water Conservation District (OCSWCD) assist the agricultural community in establishing BMPs to reduce soil and nutrient inputs from the Onondaga Lake watershed. The OLMP recommended that USDA, Cornell Cooperative Extension of Onondaga County (CCE) and the OCSWCD coordinate to provide technical assistance to farmers for erosion control and nutrient and pest management.

Strategies for OLMP Recommendations and Status of Remediation

Onondaga Lake NPS Information and Education Program

Beginning in the early 1990s, efforts were made to reduce pollution from non-point sources in the Onondaga Lake watershed. OCSWCD developed and implemented a NPS Information and Education Program. In June 1994, the OCSWCD submitted the final report, Onondaga Lake Non-Point Source Information and Education Program and Best Management Practice Implementation Demonstration to the OLMC, summarizing the attitudes of the community (farmers and non-farmers) and outlining the levels of knowledge about NPS pollution (OCSWCD 1994). As part of this project, OCSWCD provided educational materials to the public regarding NPS pollution. These fact sheets covered topics relating to farmers (animal waste management, pesticide management, erosion control) and homeowners (household cleaners

Figure 2-20. Pre-BMP barnyard at a farm in Onondaga County. Soil erosion and surface runoff of nutrients from barnyard can pollute streams. (Source: OCSWCD)

Figure 2-21. Post-BMP barnyard with concrete pad to reduce erosion and enhance animal waste management. (Source: OCSWCD)

9. A BMP, as applied here, is a method, measure or practice determined to be the most practical and effective in preventing or reducing the impact of pollutants.

management, battery disposal, oil and automobile product disposal, paint thinners and other solvent management). The OCSWCD and CCE also conducted a series of NPS workshops for public officials and educators regarding erosion control and stream preservation.

Roadbank/Streambank Stabilization

In 2000, OCSWCD, in coordination with the USACE, identified roadbanks and streambanks of concern in the watershed and began an implementation project to stabilize these areas. As of February 2007, various construction techniques were used to stabilize 25 stream reaches (over 3,755 linear feet) in the Onondaga Creek subwatershed. These efforts have enhanced habitat and reduced erosion. Shrub willow trees have been planted to help stabilize the soil and provide shade for the stream (OLP 2007).

Agricultural Best Management Practices

A well-maintained farm can protect water quality, but when agricultural runoff is a concern, Agricultural Environmental Management (AEM) plans should be implemented. An AEM plan identifies critical areas of concern specific to the individual farm and BMPs are designed to resolve the NPS pollution issues (NYS Soil and Water Conservation Committee 2007). AEM plans are developed through a tiered process (see Table 2-2).

The AEM program is a voluntary, incentive-based program that benefits the watershed environment by reducing pollutants entering surface and groundwater resources. In 2001, OCSWCD began the AEM program in the Onondaga Lake watershed. As of 2009, 67 farms in the Onondaga Lake watershed had been identified for an AEM plan, 51 had completed the initial surveying and inventory stages (Tiers I-II), 21 had developed and implemented conservation plans (Tiers III-IV), and 18 farms had been evaluated under Tier V. Maintenance of the plan by the farmer is key to ensuring the continued protection of the environment.

Tier I	Inventory current activities, future plans and potential environmental concerns.
Tier II	Document current land stewardship; assess and prioritize areas of concern.
Tier III	Develop conservation plans addressing concerns and opportunities tailored to farm goals.
Tier IV	Implement plans utilizing financial, educational and technical assistance.
Tier V	Evaluate results to ensure the protection of the environment and farm viability.

Table 2-2. Tiers of the Agricultural Environmental Management program. (Source: OCSWCD.)

The BMPs implemented through the OCSWCD's AEM program have included construction of concrete barnyards to prevent nutrient runoff and provide improved surface for manure cleanup (Figures 2-20 and 2-21), streambank fencing to prevent animals from entering streambeds, and rotational grazing systems to avoid vegetation damage and soil erosion by cattle.

As part of the NPS Environmental Benefit Project, BMPs were implemented on three farms in the Onondaga Lake watershed. The three farms, which varied in size and type of production, were considered to be representative of the overall farming industry in the watershed. A variety of BMP solutions were developed and implemented to address the specific concerns each farm had relative to their particular situation and needs. These solutions serve as demonstration projects, providing examples of BMP effectiveness.

Urban Best Management Practices

Urban BMPs incorporate stormwater detention, storage or infiltration structures and treatment

devices to remove pollutants. While there are numerous urban BMP technologies available, it is imperative to identify those that will benefit the specific area of concern.

Onondaga County, the city of Syracuse and numerous organizations within the area have contributed to educating the public about urban BMPs. Public Service Announcements encouraging people to help reduce NPS pollution related to the urban environment were developed in the early 2000s. Press releases identifying ways to properly dispose of trash and debris were developed and distributed to the public by the city of Syracuse. Onondaga County purchased a litter vacuum truck for the city of Syracuse with a grant from the OLP and produced educational materials associated with proper litter disposal. As a way to capture the floating debris in the Inner Harbor, the County purchased a skimmer vessel that removes the floating trash from the water. Finally, the OLP previously sponsored annual cleanups of Onondaga Creek, in which local volunteers removed trash from the streambanks.

In addition to the agricultural BMPs implemented under the Environmental Benefit Project, two urban BMPs were constructed and implemented. A stormwater vortex unit, designed to capture and hold solids (grit and sand), floatables, oil and grease and nutrients during runoff events was constructed on East Seneca Turnpike in Syracuse. Captured solids were eventually removed from the unit for disposal. The stormwater vortex unit resulted in relatively low nutrient reduction, but successfully captured solids and floatables.

A vegetative filter strip[10] was also constructed in a parking lot at the Burnet Park Zoo (see Appendix A for location) through the Environmental Benefit Project. The vegetative strip was designed to remove pollutants in stormwater runoff through filtration, deposition, infiltration and absorption. The strip consists of a mix of ground cover plants and larger, woody species. The vegetation was allowed to become established for one year before sampling began in June 2001. The results showed that the vegetative strip was effective at removing solids and absorbed much of the runoff from the parking lot (Moffa and Associates 2002).

Groundwater Management

A "Zone of Primary Groundwater Management Concern" has not been defined. The remedial activities undertaken by Honeywell International along the lakeshore will manage groundwater concern as required in the cleanup plan. See Strategic Areas 3 & 4: Industrial Pollution for further information.

Stormwater Management

Stormwater is water from rain or melting snow that does not soak into the ground, but runs into waterways. It flows from rooftops, over paved areas and bare soil, and through sloped lawns. Flowing stormwater collects and transports soil, animal waste, pesticides, fertilizers, oil and grease, debris and other potential pollutants.

Beginning in the early 1990s, the EPA developed a nationwide stormwater program focused on medium to large municipal separate storm sewer systems (MS4s). In 1999, the EPA expanded the regulation to cover certain smaller MS4s. The regulatory program, which aims to reduce urban nonpoint source pollution in stormwater runoff, requires the development and implementation of a stormwater management program. Stormwater management programs must contain appropriate management practices in the areas of public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction site stormwater runoff control and municipal pollution prevention and good housekeeping (NYSDEC 2008c). Several municipalities in the Onondaga Lake watershed are subject to the stormwater regulations.

10. Vegetative filter strips are areas of land with vegetative cover that are designed to accept runoff as overland sheet flow from upstream development.

Water Quality Strategy

The Onondaga County Water Quality Strategy, developed by the Onondaga County Environmental Health Council, identifies specific goals for major watersheds in Onondaga County. The goals include implementation of BMPs, AEM, streambank stabilization projects and the assessment of point and non-point source impacts on bodies of water. The strategy is periodically updated and is used to prioritize water quality needs.

Future Remediation Efforts

The OLMP recommended the completion of a NPS Management Strategy. While a NPS Management Strategy has not been completed, the OLP has focused attention on developing a model to identify specific areas within the watershed on which to focus NPS management efforts for maximum efficiency. Through the OLP, the USACE and Onondaga County funded the development of a watershed specific model for Onondaga Lake called the Surface Water Watershed Model, which is based on a computer program known as Hydrologic Simulation Program - Fortran (HSPF). The model simulates flow to and in the major tributaries of the lake in order to project sediment, phosphorus and nitrogen loads to the lake (Coon and Reddy 2008). This model will be used to predict what effect certain projects might have on water quality in the lake. The OLP plans to use the Surface Water Watershed Model to identify areas of significant interest to focus future NPS management efforts.

The OCSWCD plans to continue providing AEM planning services to interested farmers in the Onondaga Lake watershed. The AEM program helps reduce pollution in the watershed and helps to maintain clean and healthy farms that provide the County and watershed an additional economic/tourist benefit.

Educating the public on the importance of urban BMPs is a priority for Onondaga County, the city of Syracuse, and the OLP. Past events such as Onondaga Lake Day, an annual event held at Onondaga Lake Park and hosted by the OLP, have offered activities for the public to learn about the history of the lake and surrounding area and opportunities for positive interaction with the lake. The OLP intends to continue to sponsor public education events and promote BMPs at events in the future.