Chapter 3: Onondaga Lake Watershed Action Strategies

Figure 3-1. Onondaga Lake on an autumn day. (Source: OLP)

Introduction

This chapter outlines the remaining actions to be taken, and information gaps to be filled, in order to fully accomplish the goals of the Onondaga Lake Partnership (OLP) for the rehabilitation of Onondaga Lake. The OLP's cleanup goals are summarized and organized according to the eight Strategic Areas. Some of the original goals have been refined by the OLP to reflect new information about the Onondaga Lake ecosystem, advances in remediation technology, and changes in regulatory requirements. The OLP members identified and developed action strategies to fulfill the stated goals, with supporting action items and/or recommendations for their attainment. *Action Items* are required to be implemented by the identified parties as a result of legal decisions or enforcement actions. *Recommendations* are intended as suggested approaches for implementing the action strategies. The OLP may reassess and modify its approach if necessary due to changing needs.

The detailed action items and recommendations allow for more accurate assessment of funding needs for each action strategy. Estimates of the required cost along with identified or potential available funding sources are listed and discussed where possible. A timeline for completing each strategy is also provided to the extent possible, based on regulatory requirements and/or public interest. In many cases, the action strategies identified will require continuous and ongoing effort.

Entities responsible for implementation of action items and recommendations are also identified, and their role in the process is defined where appropriate. The extent to which it is possible to designate the role of a given organization relative to a particular item varies. In some cases, the parties involved are specifically identified by a legal decision, consent agreement, or regulatory enforcement action; these instances are noted accordingly. In other cases, however, entities involved in implementation are identified based on past or current involvement. These entities are noted to assist the OLP in identifying partners that may have the capacity to undertake particular projects. In these instances, it may be suitable for other parties, not specifically identified, to assume a role in accomplishment of a given recommendation, depending on capabilities, funding, and future approval by the OLP.

As described in Section 573 of the Water Resources Development Act of 1999, completion of the activities for which OLP is directly designated in this document must occur not later than August 17, 2014 (sometimes referred to as the OLP termination date).

Strategic Area 1: Municipal Sewer Discharge

The OLP has stated the following goals for addressing municipal sewer discharge:

Goal 1. Maintain a 30-day average ammonia effluent limit of 1.2 mg/L in summer and 2.4 mg/L in winter from METRO as mandated by the ACJ[1].

Since 2004, the Syracuse Metropolitan Area Wastewater Treatment Plant (METRO) has consistently met this goal and anticipates continuing to achieve these levels of ammonia removal by utilizing the present technology. However, Onondaga County will continue to monitor its discharge in accordance with the ACJ and its State Pollutant Discharge Elimination System (SPDES) permit to document compliance with effluent limits, and to address any exceedances of those limits or changes in data that suggest the facility is at risk of incurring exceedances.

1. *Atlantic States Legal Foundation, State of New York and John P. Cahill, as Commissioner of the New York State Department of Environmental Conservation v. The Onondaga County Department of Drainage and Sanitation and Onondaga County, New York*. 88-CV-0066.

Goal 2. By December 31, 2015, meet a final effluent limit of 0.02 mg/L as a 12-month rolling average for phosphorus from METRO, as mandated by the ACJ.

Accomplishment of this objective will be subject to the final Total Maximum Daily Load (TMDL) allocation tentatively scheduled to be established by the New York State Department of Environmental Conservation (NYSDEC) in 2011. Onondaga County has completed a phosphorus removal pilot project to assist in determining the feasibility of meeting the effluent limit specified by the ACJ and alternative technologies to achieve it.

Goal 3. Limit algal growth, lower toxicity, increase oxygen levels, and improve water clarity within the lake by lowering ammonia and phosphorus levels in accordance with the ACJ.

Promising new data on ammonia and phosphorus levels have been generated over the course of the last several years, indicating that the improvements to METRO, along with other remediation activities, have been quite effective at achieving this goal. Phosphorus levels in the lake during the 2008 recreation season were, on average, the lowest measured during that time of year since the inception of the Ambient Monitoring Program (AMP) in 1998 (0.015 mg/L). Reduction in phosphorus is one of the factors that has led to improved clarity and a decrease in algal blooms over the past decade.[2] This effect may be enhanced if additional improvement in conditions continues. Average annual ammonia-N concentrations in the lake have remained below 0.2 parts per million since 2004, and meet NYSDEC standards for protection of aquatic life (OCDWEP 2009). Data have shown a decline in the number of summer days with major algal blooms in the lake, corresponding with the reduction in phosphorus and ammonia. Strategic Area 6, Action Strategy 2 describes how the ability of the lake to support aquatic life may be evaluated to help determine phosphorus reduction criteria.

Dissolved oxygen concentrations reach their lowest levels in the lake's upper waters during October. The October oxygen concentrations have been in compliance with NYSDEC Ambient Water Quality standards since 1998 and minimum October levels have continuously increased since 2004 (OCDWEP 2009).

To assist in attaining and sustaining the above goals, the following action strategies are recommended. These strategies are in addition to work described in Chapter 2 that has been completed.

Action Strategy 1. Continue an Ambient Monitoring Program (AMP) to assess the effectiveness of improvements to METRO in meeting the stated goals based upon four progress indicators identified in the ACJ: suitability for water contact recreation, visual attractiveness, support of a balanced community of plants and animals, and compliance with applicable water quality standards.

Presently, the Onondaga County Department of Water Environment Protection (OCDWEP) is the entity responsible for the AMP, and will continue to be as long as so specified by the ACJ. The AMP currently includes monitoring stations within the lake and its tributaries to identify sources of pollutants entering the lake, as well as interactions between the lake and the Seneca River. If long-term, sustained improvement occurs, the AMP may be scaled back and the parties involved may change, pending the amendment and/or termination of the ACJ.

Ultimately, the objectives set by New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (EPA) are to improve the above

2. Zebra mussels, which have become abundant in Onondaga Lake in recent years, are also believed to play a role in increasing water clarity in the lake.

progress indicators to levels capable of supporting the uses designated by water quality standards for the northern and southern parts of the lake. These include non-contact recreation (i.e. fishing and boating) (Class C) for the southern portion and contact recreation (Class B) for the northern part of the lake.[3] (See "Effect of Water Quality on Recreational Activities," page 36, which offers cautionary notes that apply to activities such as swimming, waterskiing, and kayaking.) A discussion of the water quality characteristics that affect suitability of the lake for swimming can be found on page 16 in Chapter 2.

Action Item:

1. Continue the Ambient Monitoring Program and adjust it as necessary on an annual basis in accordance with needs and available funds.

Monitoring data provide valuable information on environmental conditions, trends and data gaps. The AMP is presently designed with the primary purpose of documenting compliance with the ACJ. Modifications to the AMP can be made annually based on results and needed areas of evaluation, and any potential amendments to the ACJ will also impact the data that needs to be collected. The approximate annual cost of the program is $1.3 million. This figure is not expected to change substantially in coming years while the ACJ remains in effect, but costs will reflect program needs relative to ACJ compliance. Annual cost may change substantially after the ACJ is terminated.

Action Strategy 2. Complete studies and models necessary to determine what improvements to METRO may be necessary to achieve the goals specified in the ACJ, and identify technologies to accomplish these improvements.

Action Items:

1. Complete modeling efforts to develop the Phosphorus TMDL for the Onondaga Lake watershed.

On behalf of the OLP, Onondaga County has contracted with Anchor QEA, an environmental engineering firm, to complete the relevant modeling work. Assistance is being provided by a peer review committee currently coordinated by the Onondaga Environmental Institute (OEI). The work is funded by the EPA and U.S. Army Corps of Engineers (USACE).

The modeling effort in progress is the Onondaga Lake Water Quality Model (OLWQM), which is intended to provide a critical link between the Surface Water Watershed Model being developed by United States Geological Survey (USGS) and the existing Three Rivers Water Quality Model (TRWQM) completed by Anchor QEA on behalf of Onondaga County. The OLWQM is being developed in three phases: (1) development of the modeling work plan (complete), (2) development, calibration and initial application of the integrated lake/river model (complete), and (3) model validation, integration with the watershed model, and application (expected to be complete in 2010).

The initial estimated expenditure approved by the OLP for the modeling effort was just over $1.3 million. This funding was later supplemented with an additional $490,000 for further work including Phase 3 of the modeling effort, and to allow Peer Review of the entire model. A bioavailability study and assessment of the effect of plunging inflows from tributaries are also required by the ACJ and will necessitate additional funds of approximately $400,000. These studies must be completed no later than December 31, 2010.

3. Classifications of water bodies are based on the most suitable usage designated for a given body of water or portion thereof. The designations are promulgated in Water Quality Regulations: Surface Water and Groundwater Classifications and Standards, 6NYCRR Parts 700-706, effective August 4, 1999, NYSDEC, Albany, New York.

2. Re-evaluate the Stage III Phosphorus reduction criteria.

Under the terms of the ACJ, Onondaga County is required to demonstrate its ability to attain the phosphorus effluent limit of 0.02 mg/L by December 31, 2011. The County is also required, by August 31, 2011, to complete an analysis of its current facilities at METRO to determine if any improvement in phosphorus treatment is possible. The ACJ also requires feasibility analyses of the potential capacity of METRO to meet the effluent limit through additional engineering technologies, as well as through flow diversion to the Seneca River. In the event that the County is unable to demonstrate the ability to comply with this effluent limit, a flow diversion from METRO to the Seneca River (bypassing Onondaga Lake) must be completed by December 31, 2015.

Figure 3-2. The frequency and severity of algal blooms such as this one in Onondaga Lake have declined significantly in recent years, due in part to major improvements in METRO's phosphorus removal processes. (Source: Central New York Regional Planning & Development Board)

The solution for meeting the phosphorus effluent limits must not contribute to violation of water quality standards in the Seneca River. Before the NYSDEC can determine whether the flow diversion to the Seneca River is needed or appropriate, the allowable waste load that can be released to Onondaga Lake (known as a TMDL) must be calculated. The TMDL will determine the maximum daily quantity of phosphorus allowed to enter the lake from METRO and all other sources. The results of the Advanced Phosphorus Removal Pilot Project report, completed June 28, 2007, may also be used to determine the technologies to be considered to achieve the final effluent limit. The phosphorus allocation for METRO, and its ability to meet this allocation, will help determine whether METRO's discharge should be diverted to the Seneca River.

AMP data for the summer of 2008 demonstrated unprecedented improvement in lake water quality relative to phosphorus levels. Throughout the 2008 summer recreation season, total phosphorus maintained an average level of 0.015 mg/L at Onondaga Lake South Station, the monitoring site closest to the METRO outfall. These data will be evaluated in conjunction with subsequent data to determine future actions and limits.

Action Strategy 3. In accordance with the 1993 OLMP, coordinate any construction activities that may occur relating to the potential renovation of METRO so as to minimize, to the extent possible, any negative impact on lakefront development and the surrounding community.

Recommendation:

1. If necessary, assess alternatives to METRO expansion activities to limit to the extent practical any additional impacts to lakefront access.

Because of METRO's proximity to a potentially important redevelopment area, it will be beneficial to ensure close coordination between Onondaga County and city of Syracuse so that any expansion of METRO or the conveyance and treatment systems (if determined to be necessary) do not interfere with the city's plans to develop the Inner Harbor or Lakefront areas. This process should also include coordination with the New York State

Canal Corporation (NYSCC), which is presently involved in decisions regarding development in the Inner Harbor. More details on recommendations for the Inner Harbor are found under Strategic Area 7 in this chapter.

Strategic Area 2: Combined Sewer Overflows

Consistent with EPA policy, the ACJ states the following goal to address combined sewer overflows:

Goal 1. In accordance with the ACJ, by December 31, 2018, eliminate or capture for treatment at least 95 percent of the volume of combined sewage collected during precipitation events in the pre-existing system, achieve water quality standards for bacteria in the lake and its tributaries, and eliminate or minimize the occurrence of floatable substances in the lake resulting from Combined Sewer Overflows (CSOs).

The above goal is to be accomplished by addressing a total of 70 CSOs identified in the ACJ through use of green infrastructure, sewer separation, Regional Treatment Facilities (RTFs), Floatables Control Facilities (FCFs), or other practices as applicable so as to attain water quality standards within the lake. In order to achieve this, the action strategies identified below must be undertaken in addition to the completed work described in Chapter 2. Onondaga County is designated by the ACJ as the party responsible for completing the work described below in connection with CSO abatement, but will do so in coordination with the NYSDEC, EPA, the New York State Office of the Attorney General (NYSOAG), and the city of Syracuse.

Action Strategy 1. Implement the use of green infrastructure in combination with downsized engineered facilities to achieve the CSO volume reduction benchmarks specified by the ACJ.

In 2007, the parties to the ACJ (Onondaga County, NYSDEC, and Atlantic States Legal Foundation (ASLF)) indicated an intention to assess the possible use of green infrastructure[4] to address CSOs as the impetus for a possible modification to the ACJ. *Green infrastructure* is a term used to describe utilization of naturally occurring or human-made features, such as vegetated areas, to infiltrate stormwater or store it for gradual release. These actions can lower the volume of stormwater entering the city sewers, reducing CSOs and the associated discharge of untreated wastewater to Onondaga Lake and its tributaries. The parties to the ACJ are not convinced that sole reliance on conveyances, sewer separation, RTFs and FCFs (practices known as *gray infrastructure*) is the best approach to addressing CSOs in the Clinton Street, Midland, and Harbor Brook areas.

The parties to the ACJ presented a proposed fourth amendment to the ACJ in September 2009. The amendment, signed and approved on November 16, 2009, incorporates the use of green infrastructure into the CSO abatement program. A combination of gray and green infrastructure will be used to reduce the volume of flow ultimately released into combined sewers during precipitation events. An increased volume of stormwater will be captured onsite or close to the source, for reuse, plant uptake, or attenuation through infiltration into the soil, thereby reducing the stormwater volume entering CSOs.

4. The concept of green infrastructure includes many practices that have been shown to reduce runoff volume by capturing and retaining precipitation onsite, returning it directly to the atmosphere through evapotranspiration, or allowing it to infiltrate through the soil to the groundwater table. The use of green infrastructure has been shown to provide a number of ancillary benefits, including but not limited to aesthetic improvement, better air quality, mitigation of heat absorbed by urban buildings (resulting in lower energy costs for cooling), increased property values, wildlife habitat, groundwater recharge, and treatment of runoff water to remove pollutants.

Action Items:

1. Develop green infrastructure alternatives, evaluate volume reduction potential based on proposed projects, potential use, and status relative to the ACJ, and implement most feasible and effective options.

A determination will be made pursuant to the ACJ as to what types of green infrastructure practices will lead to the greatest reduction in stormwater runoff volume, and which of those practices can be implemented in the areas that drain to the sewers for which treatment is contemplated. The technologies under consideration include the following:

- Rain gardens (Figure 3-3)
- Rerouting of downspouts ("disconnecting") to grassed areas and rain barrels
- Installing curb cuts to divert stormwater to vegetated areas
- Pervious pavement (Figure 3-4)
- Vegetated roofs
- Tree planting and establishment of vegetation on vacant lots

Figure 3-3. Example of a rain garden, a form of green infrastructure. The white pipe observed between the two shrubs is a downspout from the roof of the adjacent building. (Source: Central New York Regional Planning & Development Board)

Onondaga County will proceed with the implementation of volume control through the utilization of engineering upgrades consisting of gray and green infrastructure according to the following schedule mandated by the ACJ. The percentages shown reflect the proportion of the total volume of combined sewage generated during precipitation events (on a system-wide average annual basis) that must be captured on or before the milestone dates.

Stage	Milestone date	Volume of combined sewage captured on system-wide average annual basis
I	Dec. 31, 2013	89.5%
II	Dec. 31, 2015	91.4%
III	Dec. 31, 2016	93.0%
IV	Dec. 31, 2018	95.0%

Table 3-1. CSO Volume Control Schedule.

2. Based on the amendment to the ACJ allowing the use of green infrastructure to reduce the volume of stormwater contributing to CSOs, assess the amount of volume and flow to be treated by RTFs, and redesign and construct the facilities as mandated by the revised ACJ.

The revised ACJ supersedes the previously proposed requirements for the Clinton Street RTF, Harbor Brook RTFs, and expansion of the treatment volume at the Midland RTF. According to the 2009 revision to the ACJ, Onondaga County must construct a 3.2 million gallon storage facility at State Fair Blvd., and an Interceptor Replacement in the Harbor Brook sewershed; a 3.7 million gallon storage facility at the Clinton Street Trolley Lot, and a modification to the gate chamber structure at the Erie Boulevard Storage System.

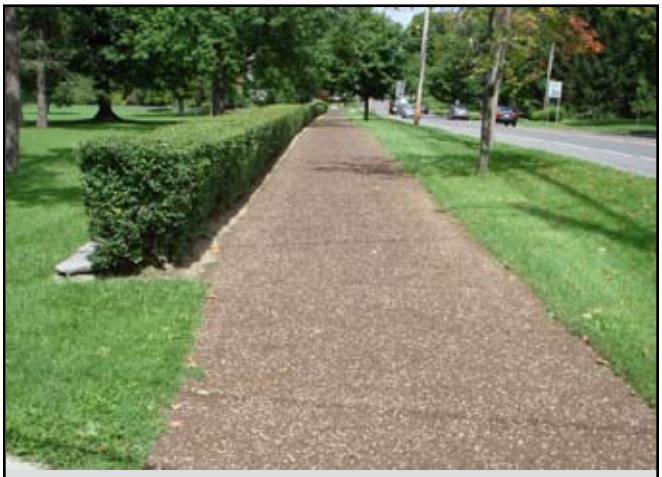

Figure 3-4. Green infrastructure: An example of porous pavement. (Source: Central New York Regional Planning & Development Board)

3. Implement education and outreach programs to encourage public awareness of the purpose and advantages of green infrastructure.

A number of concerns exist with reliance upon green infrastructure to control the quantity of stormwater runoff entering the combined sewer system. Green infrastructure, depending on how it is implemented, may be installed partly or entirely on private property. Because of the need for regular maintenance to ensure proper functioning of green infrastructure practices, significant education efforts would be needed to inform property owners of the proper use and maintenance of the practices. Formal agreements with property owners or their local representatives may also be necessary.

With respect to necessary education and outreach, the potential role of green infrastructure has been a part of the OLP Outreach Committee's programs in the past and will, if relevant and appropriate, continue as a program element in the future. Onondaga County is also developing a green infrastructure public outreach program and has received $375,000 for program implementation from the Onondaga County Legislature.

4. Modify the Ambient Monitoring Program as necessary to adequately assess the effectiveness of gray and green infrastructure projects implemented pursuant to the ACJ.

The 2009 revision to the ACJ requires Onondaga County to implement a modified AMP no later than August 1, 2010, to assess the response of water quality in the lake's tributaries to CSO abatement projects. The County must also propose a plan to monitor both the quality and volume of CSO discharges to ensure that water quality standards and capture requirements are met.

Action Strategy 2. Complete construction of identified sewer separation and conveyance projects to abate designated CSOs as mandated by the ACJ, in cases where these are positively identified as the appropriate abatement approaches.

Sewer separation involves construction of additional sewer line(s) in series with or parallel to the existing combined sewer line(s). At the completion of construction, one set of lines will handle only sanitary sewage, the other only stormwater. In addition to increasing overall system capacity, sewer separation eliminates the direct discharge of untreated sewage to tributaries of Onondaga Lake associated with high precipitation storms and major runoff events. In contrast, the purpose of installing conveyance pipes is to increase the capacity and storage volume available for combined sewage, thus greatly reducing the frequency of overflows. This is accomplished by connection of these conveyances to the existing sewer system and/or an RTF.

Action Items:

1. Assess the appropriateness of sewer separation as means of CSO abatement, and proceed with sewer separation work as specified in the ACJ.

Sewer separation is one of several options for abatement identified by the ACJ. Several sewer separation projects are planned; some of these are proceeding, while others are currently in the design stage. Although alternatives for proposed

sewer separation projects that have not yet been constructed may be considered by the parties to the ACJ, sewer separation may proceed in cases where other alternatives are not feasible.

2. Connect CSO 044 to the Midland RTF.

The ACJ stipulates that no later than December 31, 2011, Onondaga County must address CSO 044 through construction of a conveyance pipeline to the existing Midland RTF (Figure 3-5), which presently has the capacity to attenuate the CSO volume for storm events of the magnitude and frequency specified by the ACJ.

Figure 3-5. Aerial view of the Midland RTF while under construction during 2005. (Source: Onondaga County)

Action Strategy 3. Consistent with the OLMP and ACJ objectives of reducing bacteria inputs to Onondaga Lake, complete all phases of the project titled 'Identification of the Primary Sources of Bacteria Loading in Selected Tributaries of Onondaga Lake' to identify and address point and/or non-point source origins of elevated bacterial concentrations in the Onondaga Creek watershed during dry weather.

In 2006 and 2007, data were presented to the OLP that indicated elevated levels of bacteria in Onondaga Creek during dry weather. While elevated bacteria concentrations are known to exist immediately after major rain events as a result of CSO discharges, elevated bacteria levels observed during dry weather are not as well understood. Therefore, a study is underway to identify point and/or non-point sources of high bacteria counts during low flow conditions. As part of the study, Onondaga Environmental Institute is sampling total coliform and fecal coliform bacteria during dry weather at several sites along Onondaga Creek and Harbor Brook. The sites identified to date generally include discharges of sewage to tributaries that are not a result of CSOs, but elimination of these sources will nonetheless advance the objective of achieving and/or maintaining water quality standards for bacteria in the Class B portion of the lake.

Recommendations:

1. Continue the program to address existing data gaps, with the potential to expand the project scope to other tributaries on the NYSDEC list of impaired waters for which pathogens are a pollutant of concern if significant benefits are anticipated.

Future phases of the program are expected to better define sources and address data gaps, including the role of sediment in contributing to elevated bacterial concentrations during dry weather, possible leakage of intercepting sewers into receiving waters, and investigation of the apparent loss of flow from Harbor Brook into a sewage conveyance line that ultimately flows to the lake. The project may be expanded to encompass a determination of the relative significance of CSOs, storm drains, tributaries and groundwater influx in urban areas, as well as identification of the nature and location of rural bacteria sources, during wet weather. Work may be expanded to all tributaries of Onondaga Lake presently on NYSDEC's list of impaired waters (NYSDEC 2008b) for which pathogens are a pollutant of concern, beginning with Bloody Brook and Ley Creek.

Presently, $145,000 in Onondaga County Environmental Benefit Project (EBP) funds is available to continue the program. An additional $210,000 in EPA grant dollars may also be available to supplement this funding. Additional funding may be necessary to complete the program if the scope is expanded.

2. Take action to address identified pollution sources.

To date, one source of dry-weather bacteria has been identified and repaired, with reduced bacteria levels documented in Onondaga Creek after repair. Additional suspected point and non-point sources have been identified. The amount of funding needed for the OLP to address remaining pollution sources will be dependent on the number and nature of sources identified.

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

The OLP has established the following goal for the Strategic Area of Industrial Pollution (National Priorities List Site):

Goal 1. Conduct cleanup of eight areas (sub-sites) of the Onondaga Lake National Priorities List (NPL) site to meet health standards and reduce impacts upon the Onondaga Lake fishery, in accordance with cleanup plans approved by NYSDEC (and EPA, as applicable) for each of the respective sub-sites.

The OLP has established the following goal relative to cleanup of industrial pollution at other adjacent areas of concern that contribute industrial pollution to Onondaga Lake:

Goal 2. Conduct a cleanup of Other Adjacent Areas of Concern associated with the contamination of Onondaga Lake to meet health standards and reduce impacts upon the Onondaga Lake fishery, in accordance with cleanup plans issued for each of the respective sites.

The action strategies and recommendations that follow have been established to accomplish these goals. A map showing the locations of sites and sub-sites can be found on Page 18 (Figure 2-6). All sites and sub-sites are subject to oversight by NYSDEC, with support by EPA.

Action Strategy 1. Complete cleanup activities related to the Onondaga Lake Bottom NPL sub-site.

Cleanup of the Onondaga Lake Bottom sub-site, which is integral to the future ecological health of the lake, will be coordinated with upland cleanup activities. This approach will ensure that significant active sources of contaminants in the lake's watershed have been addressed. All cleanup activities for the Lake Bottom sub-site must be conducted in accordance with the cleanup plan issued by NYSDEC and the EPA in 2005 (NYSDEC and EPA 2005). As designated under the terms of a Consent Decree dated 2006[5], Honeywell International is completing the cleanup of the Onondaga Lake Bottom sub-site, with oversight by NYSDEC. The estimated cost for cleanup of the sub-site, as stated in the 2005 cleanup plan, is $451 million.

Action Items:

1. Implement the approved work plan for the design of the cleanup of the Onondaga Lake Bottom sub-site with the opportunity for input from

5. *State of New York and Denise M. Sheehan as Trustee of Natural Resources v. Honeywell International, Inc.* 89-CV-00815. October 11, 2006.

Citizen Participation working groups and other public involvement efforts.

Following the issuance of the cleanup plan, NYSDEC and Honeywell International formed several technical work groups to expedite the design process and adapt the design to new information that becomes available. The technical work groups are focused on the various design aspects of the project. The Work Plan for design and construction was finalized in March 2009 (Parsons 2009b).

NYSDEC is involving and informing the public throughout the course of the design and construction process in accordance with the March 2009 Citizen Participation Plan (NYSDEC 2009). Public involvement is occurring through information meetings, stakeholder outreach, roundtable discussions with NYSDEC and Honeywell International representatives, and formal Citizen Participation working groups. The Citizen Participation working groups will continue to meet throughout the cleanup efforts, providing a forum to inform, receive input, and discuss the lake bottom remediation and citizen participation programs.

2. Complete a comprehensive plan for habitat restoration of disturbed areas, including partial shoreline restoration.

The 2006 Consent Decree requires Honeywell International to restore all areas subject to dredging and capping activities following their completion. The draft Habitat Restoration Plan was released for public information in 2009 (Parsons 2009a) and will be completed in 2010. This plan will address issues such as thickness and composition of the lake bottom habitat layer, mitigation of lake surface area, and wetland mitigation.

3. Finalize design documents for the sediment consolidation area (SCA).

The SCA, which will be constructed on Wastebed 13, will be the disposal area for most materials dredged from the lake bottom. Required components include a cap, liner, and wastewater collection and treatment system. Design of the SCA is anticipated to be complete in 2010 and construction is to begin in 2011.

4. Design and construct water treatment facilities.

The design of water treatment measures, including selection of technologies for treatment and the development of an operation and maintenance plan for the water treatment plant, is expected to be completed by 2010. Construction of the water treatment facility must be completed by 2012. Once constructed, the water treatment facility will treat water removed from the SCA and stormwater runoff.

5. Complete a design and performance monitoring plan for dredging operations.

The design for dredging operations, which will specify the methods for dredging and the locations of lake bottom dredging activities, is anticipated to be completed in 2011. Dredging operations will focus on areas containing high concentrations of mercury and other contaminants. The performance monitoring plan for the dredging operations is due to be completed in 2012. The purpose of the performance monitoring plan is to ensure that dredging operations are conducted with due care and in conformance with all applicable environmental requirements, to minimize the risk of pollutant release to the lake. Dredging operations are scheduled to begin in May 2012, and conclude in 2016.

6. Complete a design for capping of lake bottom sediments by the end of 2011.

Two methods of capping will be used; isolation capping and thin-layer capping. Isolation capping is used to completely isolate the underlying material from the surrounding environment. Thin-layer capping is used over less polluted sediments where natural recovery may be possible through

processes such as sediment accumulation on top of the cap.

7. Complete assessments to select a treatment technology to control the formation of methylmercury.

The concept of nitrate addition to deep-water areas of the lake during the summer months is being studied by Honeywell International to determine its effectiveness in controlling methylmercury production. Field trials of nitrate application took place during 2009; the trials were successful, and a pilot project is scheduled to be undertaken during 2010. A report on the pilot project results is planned to be completed in 2011.

8. Complete construction and implementation work related to all aspects of the Work Plan and design outlined above by 2017.

Full implementation of the Onondaga Lake Bottom remediation is anticipated to take about five years. The closure and covering of the sediment consolidation area, which is the final stage in the construction process, is anticipated to occur in 2017.

Action Strategy 2. Complete implementation of the cleanup plan for the Semet Residue Ponds sub-site.

Per a 2004 administrative consent order signed with NYSDEC, Honeywell International is responsible for completing cleanup at the Semet Residue Ponds sub-site (Figure 3-6), with oversight by NYSDEC. The estimated present-worth cost of the final remedy for the site, as per the 2002 cleanup plan (Record of Decision) was $46 to $56 million. However, since the previously selected remedy is being revised, the final estimated cost will change.

Action Items:

1. Complete and release a modified cleanup plan.

The NYSDEC and EPA are currently modifying the cleanup plan issued in 2002. It is anticipated that the new plan will be released in 2010.

2. Complete additional work, including barrier wall installation and groundwater collection.

The purpose of the barrier wall and groundwater collection system located along the west shoreline of Onondaga Lake, is to prevent contaminated groundwater related to the Semet Ponds and former Willis Avenue facility from entering Onondaga Lake. The groundwater from the collection system is conveyed to the Willis Avenue groundwater treatment plant. Construction of the barrier wall and groundwater collection system has been completed. In addition, a shallow collection trench will be installed to prevent discharge of groundwater to Tributary 5A, a small stream that conveys flow from the area adjacent to Semet Ponds to the southwestern portion of Onondaga Lake. The design of this system is nearly complete and construction of the system will occur in 2010.

Figure 3-6. An aerial view of the Semet Ponds sub-site. (Source: NYSDEC)

Action Strategy 3. Implement a cleanup plan for the Willis Avenue sub-site.

Upon issuance of a cleanup plan by the NYSDEC, Honeywell will be requested to enter into a legal agreement to implement cleanup actvities at the

Willis Avenue sub-site, with oversight by the NYSDEC.

Figure 3-7. The groundwater collection and treatment system is an Interim Remedial Measure that is associated with the Willis Avenue sub-site. The system removes contaminants such as mercury and organic compounds from groundwater. (Source: Central New York Regional Planning & Development Board)

Action Items:

1. Complete ongoing Interim Remedial Measures.

The barrier wall at the Willis Avenue sub-site, completed in 2009, will prevent contaminated groundwater from migrating into Onondaga Lake. Habitat lost as a result of construction will be replaced by creating aquatic habitat at a nearby location.

2. Complete analysis of cleanup alternatives and develop final cleanup plan by 2012.

The source of benzene contamination in deep groundwater at the sub-site will be investigated. If determined to originate from the Willis Avenue operations, remediation of this contamination will be part of the cleanup plan. Remaining site remediation activities will be completed in accordance with a cleanup plan approved by NYSDEC, scheduled to be issued in 2012.

Action Strategy 4. Implement cleanup plan for the LCP/Bridge Street sub-site.

Honeywell International is nearing completion of the cleanup of the Linden Chemical and Plastics (LCP)/Bridge Street sub-site, with oversight by NYSDEC, pursuant to a 2002 consent order, at a cost of about $14 million. Installation of a groundwater collection system, excavation of sediment in the wetlands and West Flume, installation of a temporary cap over contaminated material, and restoration of habitat have all been completed.

Action Items:

1. Construct final cap in accordance with the approved cleanup plan.

Installation of the final cap is dependent upon completion of remedial work at the Geddes Brook/Ninemile Creek Site, which is described in more detail in Action Strategy 9 of this section. Due to the site's proximity to the Ninemile Creek and Geddes Brook work area, and the fact that the mercury contamination in the floodplains originated from the Bridge Street facility, the LCP Bridge Street site is a convenient and appropriate location for permanent disposal of the excavated or dredged material.

2. Continue the Operation, Monitoring, and Maintenance Program for site resources.

Wetland and stream restoration activities took place at the LCP/Bridge Street site in 2007. The ecological restoration activities consisted of plantings and controlled hydrologic regimes that will require significant monitoring and maintenance to aid in their long-term effectiveness. Monitoring of the wetlands and West Flume will continue for a five-year period.

3. Implement the Operation, Monitoring, and Maintenance (OM&M) Program for the groundwater collection system and cap.

Adherence to the designated OM&M program will ensure that the groundwater collection system and cap function as intended.

Action Strategy 5. Implement cleanup plan for Wastebed B/ Harbor Brook sub-site.

Upon entering into a consent order with NYSDEC, Honeywell International will be responsible for cleanup of the Wastebed B/ Harbor Brook sub-site, with oversight by NYSDEC.

Action Items:

1. Complete analysis of cleanup alternatives and development of final cleanup plan.

A revised Remedial Investigation (RI) Report and draft Feasibility Study (FS) Report are scheduled to be submitted by 2010. NYSDEC and EPA will issue, and Honeywell will implement, the final cleanup plan for the site including commencement of any necessary habitat restoration work by 2012.

2. Complete installation of barrier wall and groundwater collection system.

The Wastebed B/Harbor Brook barrier wall and groundwater collection system project is underway. Construction of the western portion of the wall commenced in 2009. Construction of the eastern wall and upper Harbor Brook sections are anticipated to begin in 2010. It is expected that the construction will be completed in 2012.

Action Strategy 6. Implement cleanup plan for the Salina Town Landfill sub-site.

In accordance with a State Assistance Contract and a consent order with NYSDEC, the town of Salina has agreed to perform cleanup of the Salina Town Landfill sub-site, with financial assistance and oversight by NYSDEC. The total estimated cost of the Salina Town Landfill site cleanup is $23.5 million, according to the NYSDEC cleanup plan (NYSDEC and EPA 2007).

Action Items:

1. Design and construct a leachate and groundwater collection trench system.

The leachate and groundwater collection system will remove contaminated groundwater from the landfill. Design of the system will be completed in 2010, and construction of the system will commence in the same year. This system will be accompanied by the design and construction of an onsite groundwater and leachate pre-treatment plant. Pre-treated leachate and groundwater will be routed to the Metropolitan Syracuse Wastewater Treatment Plant (METRO).

2. Implement remaining site cleanup activities.

Remaining remediation activities include excavation and consolidation of contaminated sediments, capping of landfill areas north and south of Ley Creek, construction of drainage controls and fencing, and construction of a 150,000 gallon storage tank for excess stormwater. These actions are due to be completed in 2011. Long-term monitoring and maintenance of the site will also commence at this time.

3. Implement institutional controls to prohibit residential use and other incompatible uses in accordance with the cleanup plan, and determine the best allowable use of the property.

Required actions to establish the ultimate use of the landfill site are due to be completed by 2012.

Action Strategy 7. Implement cleanup plan for the General Motors (GM) Inland Fisher Guide (IFG) Facility sub-site.

Upon entering into consent order with NYSDEC, GM will be responsible for cleanup of the IFG site, with oversight by NYSDEC.

Action Item:

1. Implement the cleanup plan for sediment and groundwater contamination, to be issued by

NYSDEC by 2012.

The remaining site impacts are to sediment and groundwater, which are contaminated with polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs) from solvents, and metals. Effects of the groundwater contamination on adjacent wetlands are being evaluated.

Action Strategy 8. Ensure continued effectiveness of completed cleanup activities at the Ley Creek PCB Dredgings sub-site.

In accordance with a 1997 cleanup plan (NYSDEC 1997), and under the terms of a 1999 consent order signed with NYSDEC, GM is responsible for continued maintenance of the Ley Creek contaminated sediment disposal sub-site. Oversight by NYSDEC will continue. Cleanup activities have been fully implemented at the site for a cost of approximately $6.7 million.

Action Item:

1. Continue maintenance and monitoring program at the site, and complete five-year review of the site activities by January 2012.

Ongoing activities include maintenance accompanied by environmental monitoring at the site to ensure that the remedies continue to remain effective.

Action Strategy 9. Develop and implement a plan for the cleanup of the Geddes Brook/Ninemile Creek floodplain soils and sediments.

The Geddes Brook/Ninemile Creek site is considered an extension of the Onondaga Lake Bottom NPL sub-site. Upon entering into a legal agreement with the NYSDEC, Honeywell International will implement the cleanup of the Geddes Brook and Ninemile Creek floodplain sediments, with oversight by NYSDEC. Sediments within the floodplains of Geddes Brook and Ninemile Creek are contaminated with mercury and other toxic substances; these streams have been the major pathway of mercury contamination to Onondaga Lake. It is critical that the source and avenue of pollution be removed in order to prevent possible recontamination of the remediated lake bottom (as discussed under Strategic Area 3).

Action Items:

1. Complete the cleanup plan and remedial design, and implement cleanup activities.

A cleanup plan for the first phase of work (lower Geddes Brook and the "upstream" portion of Ninemile Creek) was finalized by NYSDEC in April 2009 (NYSDEC and EPA 2009a). This phase includes the lowermost segment of Geddes Brook and the "upstream" portion of Ninemile Creek, which is the section adjacent to Wastebeds 9 and 10. The document details plans for excavation, consolidation and capping of contaminated sediments from the stream channel and floodplain. The cleanup plan includes dredging and excavation of 59,000 cubic yards of material with a total remediation area of 14.7 acres, and capping of some of the area. The channel and floodplain will be completely remediated under this option. Dredged sediment will be deposited and capped at the nearby LCP/Bridge Street sub-site or at the sediment consolidation area being constructed on Wastebed 13 as part of the remediation of Onondaga Lake. This cleanup is estimated to require a capital cost expenditure of $18.9 million, with an average annual maintenance cost of $105,000. Total construction time required for implementation would be approximately two years; construction will commence in 2010.

The final cleanup plan for the second phase of work (the "downstream" portion of Ninemile Creek) was issued by NYSDEC in October 2009 (NYSDEC and EPA 2009b). The second phase includes the reach of Ninemile Creek downstream of Route 690. Under the proposed cleanup plan, 58,000 cubic yards of contaminated sediment will be removed from an area of approximately 15

acres, and replaced by clean materials. Sediment disposal would occur at either the LCP Bridge Street containment area or Wastebed 13. Stream beds and banks, wetlands, and habitat will be restored following the sediment removal, including placement of appropriate substrates and wetland and upland vegetation. The approximate cost of the cleanup for the second phase is $16.5 million. Upon entering into a judicial consent order with the NYSDEC, Honeywell International will commence design of both phases of cleanup.

2. Complete interim cleanup work required by the 2002 consent order.

Full removal of contaminated channel sediment and contaminated floodplain soil to the clean clay layer beneath Lower Geddes Brook will be conducted under a 2002 NYSDEC consent order. This project will involve a realignment of the Geddes Brook channel and restoration of the channel and wetland, and will be performed prior to the Ninemile Creek cleanup.

Action Strategy 10. Develop a plan for the cleanup of the Niagara Mohawk Manufactured Gas Plant Site.

Upon entering into a consent order with NYSDEC, National Grid will be responsible for completing cleanup activities at the Niagara Mohawk Hiawatha Boulevard manufactured gas plant site, with oversight by NYSDEC.

Action Item:

1. Develop and implement a cleanup plan and remedial design.

A cleanup plan will be developed by the NYSDEC for the site in 2010. The plan will address heavy metals, cyanides, and coal and petroleum by-products remaining beneath the site as a result of past energy generation activities. It is anticipated that implementation of the plan will be completed in 2011. Groundwater monitoring will continue on a regular schedule following completion of this effort.

Action Strategy 11. Develop and implement a plan for the cleanup of the Waste Beds 1-8 Site, and implement a groundwater control plan.

Upon entering into a consent order with NYSDEC, Honeywell International will be responsible for completing the cleanup of this site, with oversight by NYSDEC.

Action Items:

1. Develop and implement a cleanup plan.

A cleanup plan will be developed by NYSDEC for the site by 2011.

2. Design and construct a groundwater control system.

This item includes assessment of alternatives, and the design and construction of a groundwater collection and treatment system to prevent contaminated groundwater from reaching Onondaga Lake. A design plan for the groundwater control system is expected to be released in March 2010.

Figure 3-8. A view of the Solvay waste beds on the west shore of Onondaga Lake. (Source: Onondaga Environmental Institute)

3. Design and construct shoreline stabilization practices.

The highly erodible material of the wastebeds has been steadily washing into Onondaga Lake, carrying with it various contaminants. An appropriate shoreline stabilization system, which may partly consist of establishment of vegetation adapted to saline environments, will hold waste material in place, thus preventing further degradation of the lake environment.

Strategic Area 5: Hydrogeologic Investigations.

The OLP established the following goal concerning mudboil activity and other geologic phenomena in the Tully Valley:

Goal 1. Improve water quality in Onondaga Lake by maximizing reduction of sediment loading to Onondaga Creek from geologic phenomena in the Tully Valley, including mudboils and landslide activity.

Without mitigation of various sediment loading sources, including mudboils, deposition of sediment at the mouth of the creek in the Syracuse Inner Harbor has historically been heavy enough to warrant repeated dredging about every six years (additional discussion of this issue can be found under Strategic Area 7). Sediment accumulation in the Inner Harbor has impeded recreational activities such as boating, and has also negatively impacted the aesthetics of the area by creating turbid or "muddy" conditions in the Inner Harbor waters. Sedimentation also negatively impacts habitat for aquatic insects, plants and fish. Therefore, control of mudboil and landslide activity has important implications for water quality in the Inner Harbor and lake. The following action strategies and recommendations have been developed to mitigate these geologic phenomena.

Action Strategy 1. Determine and implement the best course of action relative to the Tully Valley mudboils, dependent on availability of funding sources.

Sources of federal funding for maintenance of the existing mudboil remedies, including the diversion of flow from the mudboil area, depressurizing wells, and sediment containment area, are rapidly diminishing and are not guaranteed after the current funding is expended. Required maintenance includes ensuring continuous functioning of depressurizing wells, periodic dredging of the sediment-filled containment areas, and repair of flow-measuring and flow diversion structures. These practices, when properly maintained, hold the level of sediment entering Onondaga Creek from the mudboils to approximately 0.5 to 1.0 ton per day on average (USGS 1999). Figure 3-9 shows the decline in sediment discharge from the mudboils that occurred as a result of management activities, which began in the early 1990s. Without these forms of mitigation, sediment discharge would be expected to return to its pre-existing range of 15 to 30 tons per day (OLP 2008).

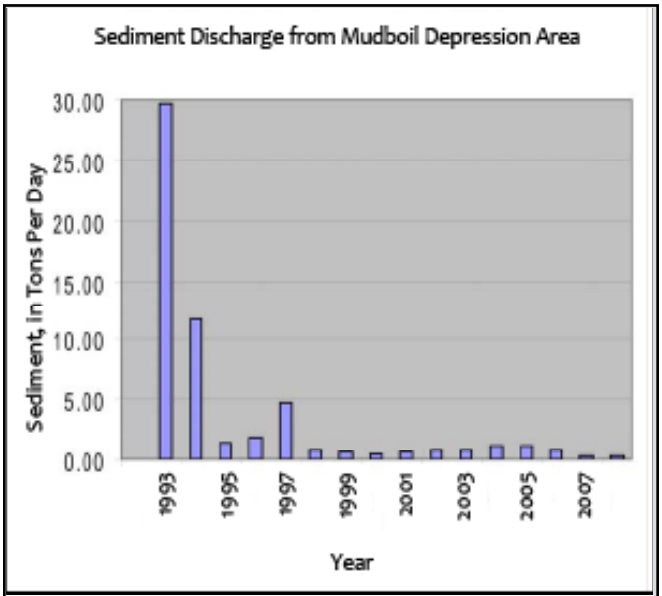

Figure 3-9. Decline in sediment discharge from the mudboil depression area (MDA) since the beginning of management activities in the early 1990s. (Source: USGS)

Recommendation:

1. Seek necessary funding from applicable sources to accomplish the selected course of action for mitigation of the Tully Valley mudboils.

In a September 2008 white paper titled "Tully Valley Mudboils: Long-term Management Needs", three long-term options for addressing the mudboils were presented by the OLP Executive Committee (OLP 2008). These alternatives are as follows:

•• Option 1. Discontinue all remedial activities. All monitoring equipment and the mudboil area dam would be removed, depressurizing wells would be grouted shut, and upper watershed flow may possibly be returned to its original drainage pattern. The approximate cost of mudboil closure activities would be $150,000; funds in the amount of $20,000 to $30,000 currently maintained in escrow could be used to partially cover this cost.

•• Option 2. Continue ongoing control actions (status quo). This option assumes the present level of discharge monitoring conducted by USGS (regular monitoring of mudboil outflows, well discharges, water quality and rainfall; weekly sediment sampling; annual reports; maintenance of remedial practices and development of remedial technologies; and monitoring of the Rattlesnake and Rainbow Creek landslides). The annual program cost for these services is estimated to be $210,000, and is subject to increase pending unexpected occurrences and changes in hydrogeologic conditions that may warrant emergency actions. Operations and maintenance would continue as needed. Mudboil impacts would continue at the present level of about 0.5 to 1 ton per day.

•• Option 3. Enhanced mudboil stewardship. While continuing existing operation of maintenance as discussed under Option 2 above, this option also includes expansion of the existing program to control mudboil discharges at their source. The influx of up-gradient surface runoff through the groundwater system, which ultimately emerges as discharge from the mudboils, would be studied. The goal would be to reduce daily sediment discharges, leaving only seasonal (spring and fall) discharges, with the potential of eventually lessening the need for maintenance of other controls in the long-term. In addition to the continued annual cost of $210,000 as discussed above, this option would also require an initial one-time cost estimated at $620,000. The anticipated reduction in annual maintenance costs is expected to pay back some or all of the additional start up cost if this option is selected. Because pilot projects qualify for research dollars for which current maintenance activities are not eligible, funding prospects may be better to support Option 3 as compared to Option 2.

A fourth option not discussed in the September 2008 white paper involves scaling back the mudboil monitoring and control maintenance program currently being carried out by the OLP. The Onondaga County Soil and Water Conservation District (OCSWCD), which has assisted in the current remedial activities at the mudboils, would be responsible for oversight of the mudboil area. The existing control practices at the mudboils would generally be maintained. Through maintenance and repair efforts, OCSWCD would respond to significant changes in geologic activity that, if left unchecked, could lead to renewed sediment loading to Onondaga Creek. This alternative may be explored as an interim measure while awaiting funding in an amount capable of supporting a larger program. It is estimated that a scaled back program, including only the basic maintenance functions, could be implemented by OCSWCD at a cost of $50,000 per year to cover program administration and provide an escrow reserve for repair projects. Neither monitoring nor reporting would be included under this option. An identified source of funding would be required in order to complete this work.

Action Strategy 2. Evaluate the outcome of pilot studies to lower groundwater artesian pressure at upgradient source areas, and conduct additional studies as necessary to fully evaluate source control

as an alternative solution for mudboil management.

Pilot studies are being conducted that seek to reduce mudboil activity at the source rather than attempting to control the mudboils where they emerge. Preliminary data suggest that the control of surface water inflow to the mudboil aquifer will reduce mudboil activity.

Figure 3-10. Pilot study activity at the mudboils. The photo shows Big Sink outlet, excavated to a depth of about 15 feet to maintain the water level in Big Sink at summer low levels. The work reduces seasonal fluctuations in the influx to Big Sink that are believed to contribute to mudboil activity. (Source: USGS)

Recommendations:

1. Assess pilot study results to determine whether or not they demonstrate a reduction in mudboil activity that can be attributed to diversion of surface water from entering the aquifer.

A pilot study was undertaken by USGS in the east brine field in a subsidence area known as the Big Sink, which experiences a water level fluctuation of 15 vertical feet per year. A channel was excavated along one side of the sinkhole to maintain the water at summer levels, preventing increased ground water infiltration due to snowmelt and spring runoff that can lead to increased mudboil activity (Figure 3-10). The volume of water in the outflow channel at Big Sink was monitored simultaneously with artesian pressure in mudboils to the north. The cost of this pilot study was approximately $25,000.

An additional pilot study was undertaken by USGS at the west brine field. A layer of clay was added to another major subsidence area to block flow from entering underground solution areas, forcing runoff water to remain in the surface water channel and flow to Onondaga Creek, reducing its contribution to mudboil activity down-gradient to the north. The cost of this pilot study was approximately $16,000.

Results of the above pilot studies will be evaluated after several years of data collection. At that time, it will be determined whether source control (Option 3) represents the best option for long-term control of mudboil activity, and if funding can be secured to fully implement an effective source control program.

2. Complete additional studies as necessary in support of development of source control methods to manage mudboil activity.

Source control of the mudboils may be the most practical long-term solution to the problem, given the difficulties encountered in securing perpetual funding to continue current control activities. Depending on the outcome of current and proposed studies, funding should be sought for permanent source control programs. Future studies expanding on the initial pilots are being considered in order to refine source control methods and establish the approach as a permanent solution.

If deemed effective, similar work might next be attempted on a much larger scale at the alluvial fans of Rainbow Creek and Rattlesnake Gulf, as these two areas are also sources of surface water that infiltrate to the mudboil aquifer. A total of $166,000 in federal funds from EPA has been approved to date to study enhanced remediation options. However, far greater long-term costs

would be associated with full implementation of large-scale source control efforts.

Action Strategy 3. Complete studies to determine the contribution of sediment to Onondaga Creek and Lake from landslides in the Tully Valley, and determine if there are any remedial actions that could be taken to minimize damage to the water resource.

Two reports are being prepared outlining the contributing sediment load from the landslides to Onondaga Creek. However, no permanent remedy has been identified to stop landslide activity in the two tributary valleys (Rainbow Creek and Rattlesnake Gulf) due to difficult access and the steep, unstable nature of the slopes (Kappel 2009). The most critical course of action now is to continue regular maintenance of bridges, roadways, and culverts, excavating sediment within the limits allowed by NYSDEC to reduce the discharge of sediment that ultimately reaches Onondaga Creek.

Recommendation:

1. Provide financial and technical support for state, county, and town highway and transportation departments to ensure that regular maintenance of roadways in landslide-prone areas remains a priority.

Tully Farms Road, which is owned by Onondaga County, requires routine maintenance and removal of eroded sediment from roadside ditches and drainage systems by the Onondaga County Department of Transportation. Eroded sediment originates from ongoing geologic activity on the slope of Dutch Hill, including spring emergence and continued slope instability. Sediment also is generated by ongoing geologic activity on the south slope of Rainbow Creek west of I-81, consisting of spring discharge and continued slope instability. The removal of sediment and handling of drainage issues along Tully Farms Road is addressed through annual maintenance work comparable in cost and effort to that of neighboring roads.

The point at which New York State Route 11A crosses Rainbow Creek is subject to significant maintenance work requiring the commitment of equipment (i.e. an excavator or bulldozer) by New York State Department of Transportation for as much as one month per year. This work is necessary to prevent clogging of the culvert that carries Rainbow Creek beneath Route 11A.

Action Strategy 4. Continue education and outreach programs to foster awareness of the impact of the natural and anthropogenic sources of sedimentation (mudboils, landslides) on water quality in Onondaga Lake and its watershed.

Recommendation:

1. Obtain funding to continue and expand the existing USGS public outreach program.

Continued education and outreach are needed to raise public awareness of the impacts of mudboils and landslide activity on water quality in Onondaga Creek and ultimately, Onondaga Lake. On behalf of the OLP, USGS has taken the lead role in providing this outreach through talks at universities, schools, and to the general public. In addition to the distribution of fact sheets and other informational publications, occasional tours of the mudboils and landslides are conducted by USGS. Presently, no funding is available for USGS to conduct this work; an annual budget of $20,000 would support activities similar to what has been done in the past.

Strategic Area 6: Fish and Wildlife Habitat and Fisheries Management

The OLP has established three goals relative to fisheries and aquatic habitat in Onondaga Lake. Achieving these goals will require a coordinated and cooperative effort among entities such as NYSDEC, Honeywell International, Onondaga County, and other resource managers and scientists

in the community. It is likely that management decisions will change in response to new information and improved understanding of the lake's ecosystem.

Goal 1. Maintain a healthy and diverse native fish community in Onondaga Lake, able to support a resident coolwater fishery and a transient coldwater fishery, by restoring and/or sustaining necessary lake and tributary habitats.

Management of Onondaga Lake must be based on sound ecological principles for multiple purposes and users. Future management decisions must consider the lake's consumptive and recreational fishery and what is ecologically desirable for the native aquatic community.

This goal has been partly achieved. A recovering coolwater fishery exists in Onondaga Lake that includes several game species. Species such as lake sturgeon are returning to the lake, and fish populations are increasing.

The 1993 OLMP presented a long-term objective of maximizing, to the degree attainable, the coldwater fishery in Onondaga Lake by providing suitable year-round habitat. However, it has been recognized that numerous factors play a role in determining the extent to which a coldwater fishery can be sustained in the lake.

Barriers to fish migration between the lake and other bodies of water are one factor to be addressed in consideration of establishing a resident coldwater fishery. Dams and habitat degradation are present both in tributaries to the lake and in downstream rivers that link Onondaga Lake to other regional lakes and to Lake Ontario.

The morphology of the lake is also a key factor that affects coldwater fish support. Onondaga Lake, like many lakes of comparable size in temperate climates, experiences seasonal layering, or stratification, in which temperatures and dissolved oxygen conditions differ markedly between the epilimnion (upper layer) and hypolimnion (lower layer) of water in the lake. During summer, only the hypolimnion contains temperatures suitable for coldwater fish. However, anoxic conditions occur in the hypolimnion during the summer months, and these conditions cannot be tolerated by fish and many other forms of aquatic life.

Dissolved oxygen levels in the lake are affected by many factors, one of which is phosphorus loading. Current lake models under development will be used to predict the effect of phosphorus on oxygen demand. Oxygen demand is also affected by the introduction of organic matter to the lake. Stratification, while primarily caused by temperature differences, is exacerbated by the elevated salinity of the lake, which increases the density differences between the layers of water and the resulting seasonal oxygen deficits.

At the present time, it appears that Onondaga Lake can support a transient coldwater fishery. Coldwater fishes have recently been documented in the lake during all seasons except summer. Although nearby Otisco Lake is significantly impacted by human activity, its present condition can be used as a benchmark for short-term recovery potential in Onondaga Lake. Otisco Lake, which is similar to Onondaga Lake in size, depth, latitude, orientation, and depth to surface area ratios, lacks historic record of coldwater fishes. Historic and current conditions in Otisco Lake suggest that in Onondaga Lake, summer oxygen levels in the hypolimnion are unlikely to reach a level capable of supporting resident coldwater fishes within the timeframe in which current management decisions must be made. There is evidence that at least one coldwater fish species (cisco or whitefish) once thrived in Onondaga Lake, but historic documentation of native fish fauna in Onondaga Lake is incomplete. A transient coldwater fishery continues to be the most feasible short-term management framework for Onondaga Lake.

Goal 2. Reduce and/or mitigate the effects of wave erosion, past oncolite

formation, sediment contamination, and other environmental issues in order to restore habitat throughout the lake and its surrounding area.

Formation of oncolites in the shoreline sediment of Onondaga Lake may be diminishing. Many areas occupied by oncolites have been colonized by zebra mussels or aquatic macrophytes. Remediation of these areas, including removal and/or capping of contaminated sediments as required, will improve substrate suitability for fish and desirable macrophytes. Initially, progress toward achieving this goal will be driven by habitat restoration performed by Honeywell International under NYSDEC oversight, as part of the Onondaga Lake remediation described in Strategic Area 3.

Goal 3. Complete restoration activities necessary to make Ninemile Creek, Onondaga Creek, and other tributaries suitable for spawning and rearing of native fishes.

Common sources of aquatic habitat degradation such as sewage, excess sediment, and contaminants continue to negatively impact salmonid production in Onondaga Lake tributaries (Coghlan & Ringler 2005). Physical habitat characteristics are generally favorable and temperature regimes have improved to within the range of tolerance for salmonids and other fishes. Through further control and reduction of pollutant sources, spawning and rearing of salmonids and other fishes in Onondaga Lake tributaries may again be possible. Restoration activities are being investigated on a number of fronts to restore native coldwater fish to the tributaries of Onondaga Lake.

The following action strategies are being pursued in an effort to accomplish the above goals.

Action Strategy 1. Complete a habitat restoration plan for Onondaga Lake that identifies sensitive aquatic habitats affected by remedial actions and associated habitat improvements for lake fisheries.

This action item is being initially pursued through a cooperative effort by NYSDEC, EPA, and Honeywell International in association with the cleanup of the Onondaga Lake NPL site pursuant to the 2006 Consent Decree. Thus far, cooperating entities have developed lists of representative species for fish, mammals, birds, amphibians, reptiles, and plants that are anticipated to use the remediated aquatic and upland habitats. These lists provide a basis for addressing substrate and habitat needs for all organisms expected to benefit from remediation.

Recommendation:

1. Identify specific habitat improvements that will support utilization of the lake and its shoreline by target species.

Habitat improvements selected for implementation will likely support a range of species similar to the target species. The Onondaga Lake habitat restoration plan may provide the framework for an analogous plan extending to the entire watershed. As this effort is part of the remediation program for the Onondaga Lake Bottom NPL sub-site, associated costs are included in the estimated total for the activities discussed in Strategic Area 3&4, Industrial Pollution: National Priorities List (NPL) Site and Other Adjacent Areas of Concern. A draft plan outlining remedial design elements for habitat restoration was released for public comment in December 2009 (Parsons 2009a).

Action Strategy 2. Identify and implement habitat improvements (water quality, vegetative cover, substrate, access, food supply, and other habitat requirements) that are necessary to improve the existing transient coldwater fishery in Onondaga Lake.

The continued existence of a transient coldwater fishery in Onondaga Lake is heavily dependent on the capacity of major tributaries to the lake, as well as the outlet of Onondaga Lake and the Seneca River, to support coldwater fishes during the summer months, when conditions in the lake itself are not favorable. Fishes that are able to reside year-round in the tributaries, the outlet and the Seneca River in both the juvenile and adult life cycle stages will generally utilize the lake during the spring, fall, and winter months.

Figure 3-11. Although channelized, the lower portion of Onondaga Creek contains several wooded reaches with the potential to provide spawning and rearing habitat for native fishes. (Source: Central New York Regional Planning & Development Board)

Recommendations:

1. Continue to pursue water quality improvements to increase the probability of utilization of physical habitat in lower Onondaga Creek by coldwater fishes.

Water quality improvements, such as those to be achieved by addressing CSOs and remediation of industrial pollution, must succeed in order for coldwater fishes to fully take advantage of favorable habitat elements in the lower reaches of Onondaga Creek. Habitat in the lower reaches of Onondaga Creek is believed to be sufficient to support juvenile Atlantic salmon populations (Coghlan & Ringler 2005). Cover and substrate are within the range demonstrated to be suitable in other streams inhabited by coldwater fish. The headwaters already offer suitable conditions for growth and survival, although flood control dams at Dorwin Avenue and on the Onondaga Nation Territory (refer to map in Appendix A) limit upstream fish movement to these areas. Water quality conditions presently limit the ability of lower Onondaga Creek to support native salmonids (Coghlan & Ringler 2005).

2. Complete improvements to habitat structure and composition in lower Ninemile Creek and Geddes Brook.

Improvements to habitat characteristics must occur in the lower reaches of Ninemile Creek and Geddes Brook in order for these tributaries to support coldwater fishes. Restoration efforts that are planned in association with remediation of the Onondaga Lake Bottom NPL sub-site will increase the likelihood that these areas will be able to support residency by adult and juvenile coldwater and coolwater fish. These improvements include replacing the dredged sediment in Ninemile Creek and Geddes Brook with coarser material and establishing some riffle zones, although the lack of gradient in these streams may remain a hindrance to achieving suitable velocity-depth regimes.

3. Consider and assess the appropriate and achievable aquatic life objective for Onondaga Lake through studies used for the development of the phosphorus TMDL, with due consideration of

the numerous factors that affect the type of fish community the lake can ultimately sustain.

Modeling in support of the phosphorus TMDL is one tool that can be used to provide additional insight into the potential recovery of dissolved oxygen levels. However, these results must be interpreted in the context of biological, geological, and climatological factors (including those noted in the discussion of *Goals* earlier) to develop a realistic assessment of the type of aquatic community the lake can ultimately support. The OLP should evaluate available sources of information in assessing the aquatic life endpoints that may be achieved through implementation of the TMDL and other efforts, and consider the level of management intervention that would be necessary or desirable to achieve that endpoint.

Action Strategy 3. Identify and implement habitat improvements necessary to improve the existing coolwater fishery in the lake, and ultimately maintain year-round habitat necessary to sustain a consumptive warmwater and coolwater fishery in Onondaga Lake.

Development of a fisheries management plan or strategy for Onondaga Lake by NYSDEC is one of the means by which this action item may be achieved. Such a plan or strategy, if developed, would identify habitat characteristics necessary to promote a healthy aquatic community. The plan would include focus on three species, Northern pike, walleye, and lake sturgeon, for which reproducing populations are desired and considered attainable.

Habitat and water quality improvements are not expected to produce major changes to the overall type of fish community supported by the lake. It is anticipated that the lake will continue to contain large proportions of sunfish, largemouth bass, and smallmouth bass (OCDWEP 2003), although pollution-sensitive species may recolonize the lake. Alewives and gizzard shad are also expected to remain dominant in terms of both total numbers and biomass within the lake's open water areas. Aquatic habitat improvements may enhance reproduction and survival of resident fishes, increasing population sizes. While efforts will be made to encourage use of the lake and tributaries by native species, it is recognized that some species historically present in Onondaga Lake (e.g. American eel) have declined as a result of regional factors and may not return to the lake until these factors have been addressed. Habitat improvements benefitting these species will allow for success in Onondaga Lake should they recover at the regional scale.

Unanticipated changes at broader scales, such as the introduction and spread of exotic species and diseases, can have major impacts on the Onondaga Lake ecosystem. Attempts to exert control over these biological factors are beyond the scope of OLP activities.

Recommendations:

1. Identify and implement habitat enhancements to benefit Northern pike.

A lack of spawning and rearing habitat currently limits the use of Onondaga Lake by Northern pike. NYSDEC is considering spawning habitat enhancement options associated with littoral vegetation, which may be coordinated with Honeywell International's remediation efforts described in the habitat restoration plan (Action Strategy 1).

2. Construct rearing habitat for walleye.

Non-native alewife predation on walleye fry currently limits the walleye population in Onondaga Lake. NYSDEC is examining the feasibility of constructing a walleye rearing pond near the lake. Fry would be reared to fingerling size and then released into the lake or one of its tributaries.

Figure 3-12. A walleye collected from Onondaga Lake as part of the Onondaga County fish monitoring program. (Source: OCDWEP)

3. Complete necessary steps to establish Onondaga Lake as a priority habitat for lake sturgeon.

Presently, NYSDEC believes that both Ninemile and Onondaga Creeks are large enough to provide spawning and juvenile rearing habitat for lake sturgeon. Once a statewide lake sturgeon hatchery program is reinstated, the objective is to have Onondaga Lake listed as a priority water body for the establishment of a lake sturgeon population. The chemical and physical conditions of Onondaga Lake's epilimnion appear sufficient to support lake sturgeon throughout the year. Furthermore, research at Oneida Lake indicates that sub-adult and adult sturgeon extensively utilize zebra mussels, which are presently abundant in Onondaga Lake, as a primary food source. A sustainable coolwater fishery requires a healthy macrophyte community, suitable reproductive habitats and substrate, and an adequate forage base. Successful habitat restoration by Honeywell International, in coordination with NYSDEC and other regulatory agencies, is critical for fish survival, growth, and reproduction (see Action Strategy 1).

Action Strategy 4. Continue to implement a biological monitoring program to document trends and identify sources of ecosystem-wide problems within the Onondaga Lake watershed.

Recommendation:

1. Continue current biological monitoring program to fulfill ACJ requirements, and tailor long-term biological monitoring program to meet ecological data needs.

Onondaga County continues to implement an annual biological monitoring program. The Ambient Monitoring Program (AMP) evaluates aquatic communities through an extensive series of sampling and studies. This program will continue at its current scope as long as the ACJ remains in effect, with protocol flexibility as information needs change. The biological component of the AMP (including the annual fisheries program and zebra mussel monitoring program) costs approximately $105,000 to $110,000, with an estimated additional $40,000 every five years for monitoring of macroinvertebrate populations in the lake. These figures are based on estimates from the most recent program information available. Cost varies significantly from year to year depending on the need to repair or replace various support equipment, sampling gear, and computer software and hardware. Costs for macrophyte surveys are discussed separately with Action Strategy 5 below.

The OLP may also develop a long-term biological monitoring program if necessary after the time period mandated by the ACJ.

Action Strategy 5. Document effects of restoration/remediation actions on desirable macrophytes and pursue additional enhancement actions as necessary.

Certain rooted and floating macrophytes are desirable to support a variety of fish and invertebrate habitat functions. Macrophytes provide spawning and nursery habitat for several desirable fishes; however, excessive plant density reduces habitat quality for fish and invertebrates (OCDWEP

2003). The ACJ sets 40 to 60 percent macrophyte cover within the littoral zone as the most favorable level, since this is the degree of cover considered optimal for reproduction of largemouth bass, a desirable warmwater fish.

Conversely, some macroalgae and aquatic nuisance species degrade aquatic habitat. One goal of the ACJ is to limit occurrence and impacts of filamentous algae. Undesirable algae control is being addressed through improvements to Metro, CSO abatement, and non-point source pollution control. Management for native macrophytes will be attempted only to the extent that they can be separated from non-native species. Because a mixture of different species is typical, the combined community must be assessed.

Recommendation:

1. Continue annual assessments of macrophyte cover in order to direct efforts toward maintaining optimum levels.

Annual comparisons of macrophyte cover, through aerial photography and/or ground-level observation, are needed to assess the degree of macrophyte cover throughout the lake. These studies are presently completed by Onondaga County as part of its Ambient Monitoring Program to assist in identifying parts of the lake that contain too much vegetative cover, as well as areas where cover consists primarily of non-native invasive species. Approximate cost of the annual flight survey is $22,000. The County also undertakes a more detailed macrophyte survey every five years that involves the sampling of submerged vegetation in the littoral (near-shore) zone; this study should also be continued to fully characterize the composition of the macrophyte community. The cost of this survey is about $32,000 every five years. Estimates for both macrophyte survey programs are based on the most recent program information available, and may vary depending on the need to repair or replace various support equipment, sampling gear, and computer software and hardware.

Areas where macrophyte growth is limited due to lack of suitable substrate are being evaluated in association with Honeywell's restoration activities, which will address these substrate limitations.

Action Strategy 6. Implement species-specific fish monitoring programs for the outlet and tributaries of the lake as necessary to obtain needed information about fish movement and reproductive patterns.

Recommendation:

1. Evaluate the need for programs to monitor fish populations in the outlet and tributaries of Onondaga Lake as part of Fisheries Management planning efforts.

The OLP has identified the potential need for a program to monitor fish populations in the outlet and tributaries of Onondaga Lake. Such a program would initially focus on spawning and rearing in Onondaga Creek, Ninemile Creek, and Onondaga Lake Outlet. If developed, the program would be targeted toward monitoring seasonal migration patterns of species of interest to determine where breeding and/or spawning are occurring. The completion of a Fisheries Management Plan or similar document must occur before a monitoring program for the outlet and tributaries is initiated, since the Plan would specify what species and areas are targeted, and provide the context for evaluation of improvement efforts.

Action Strategy 7. Continue to evaluate fish consumption advisories, with the ultimate goal of removal of consumption advisories by the New York State Department of

Health (NYSDOH).

Recommendation:

1. Reassess fish contaminant levels and advisories following completion of industrial pollution cleanup efforts.

In order for the NYSDOH species-specific fish advisories for Onondaga Lake to be lifted, NYSDOH would have to make such a determination, based on:

- an evaluation of fish contamination data indicating that fish contaminant levels are sufficiently low to justify advisory removal; and
- other factors (see section below on NYSDOH Criteria for Setting Fish Consumption Advisories).

As discussed in Section 2.6, NYSDOH has in effect extensive specific advisories on eating sport fish from Onondaga Lake (see section below, "NYSDOH Criteria for Setting Fish Consumption Advisories" for important factors for fish advisory determination.) To remove these specific advisories, data would have to show significant declines in concentrations of mercury in all fish species and sizes in Onondaga Lake, as well as declines in PCBs and dioxin in some species of Onondaga Lake fish. After remediation is completed, extensive monitoring of contaminant levels and their accumulation in fish will be necessary before any consideration of relaxing or lifting the advisories.

Even if the specific advisories are removed, the statewide general advisory to eat no more than one meal per week of all fish presumably will still apply (as it does for all New York State fresh waters). NYSDOH issues this advice because:

- Some chemicals are commonly found in New York State fish (e.g. mercury and PCBs),
- Fish from all waters have not been tested, and
- Fish may contain unidentified contaminants.

NYSDOH Criteria for Setting Fish Consumption Advisories

NYSDOH uses considerable Judgment and weighs many factors when setting fish advisories. The balance between the benefits and risks of eating fish with mercury and other fish contaminants may be different for at risk populations (women of childbearing age, infants and young children) versus the general population. NYSDOH takes these differences into account during the fish advisory setting process. The following are some important features of the NYSDOH advisories and advisory-setting process:

1. NYSDOH issues a general advisory to eat no more than one meal per week of fish from all New York State fresh waters because some chemicals are commonly found in New York State fish (e.g., mercury and PCBs), fish from all waters have not been tested, and fish may contain unidentified contaminants.

2. NYSDOH recommends that infants, children under the age of 15 and women of childbearing age EAT NO fish at all from waters with specific advisories (including Onondaga Lake).

3. When reviewing fish contaminant data to determine fish advisories for a specific water body or region, NYSDOH considers the following:

- Fish contaminant levels, including fish sampling characteristics (e.g., number and type of samples, species, age, length, percent lipid, sample location, etc.) and patterns of contamination;
- Health risks;
- Populations at greater potential risk;
- The FDA marketplace standard;
- Health benefits; and
- Risk communication issues.

(Information provided by NYSDOH)

Action Strategy 8. Restore and maintain wetlands hydrologic connection and habitat module project completed in 2000-2001.

The habitat module project (Figure 3-13) was completed in 2001 with oversight by the Onondaga County Department of Environmental Health. The project included construction of a jetty-like structure near the northwest shoreline of the lake, intended to enhance littoral zone habitat in the area to promote use by waterfowl, wading birds,

raptors and mammals (Onondaga Environmental Institute 2008). One of the purposes of the jetty was to deflect wave action, improving conditions for establishment of aquatic macrophytes by reducing the shifting and re-suspension of bottom sediments in the shallow water. Improved conditions for aquatic plant growth will increase the attractiveness of the habitat for fish spawning. The OLP also funded construction of two culverts under the lake's west shore trail to provide a direct hydrologic connection between the lake and previously isolated wetlands (OLP 2003). The improved connectedness has the potential to enhance the usefulness of the wetlands for reproduction by various species of wildlife.

A long-term maintenance program may be necessary to restore the hydrologic connection and habitat module project constructed along the western shore of Onondaga Lake. Although the structures remain sound, they require maintenance to provide maximum benefit. A long-term mechanism for funding may be needed to fully develop and implement the required maintenance program, with the intent of restoring naturally sustained habitat. The cost of such a program, including removal of sediment and skimming of algae, would likely be modest ($4,000 per year). Funding is also needed to complete sediment sampling to monitor post-construction mercury levels.

Recommendations:

1. Complete immediate maintenance requirements as necessary to restore project function.

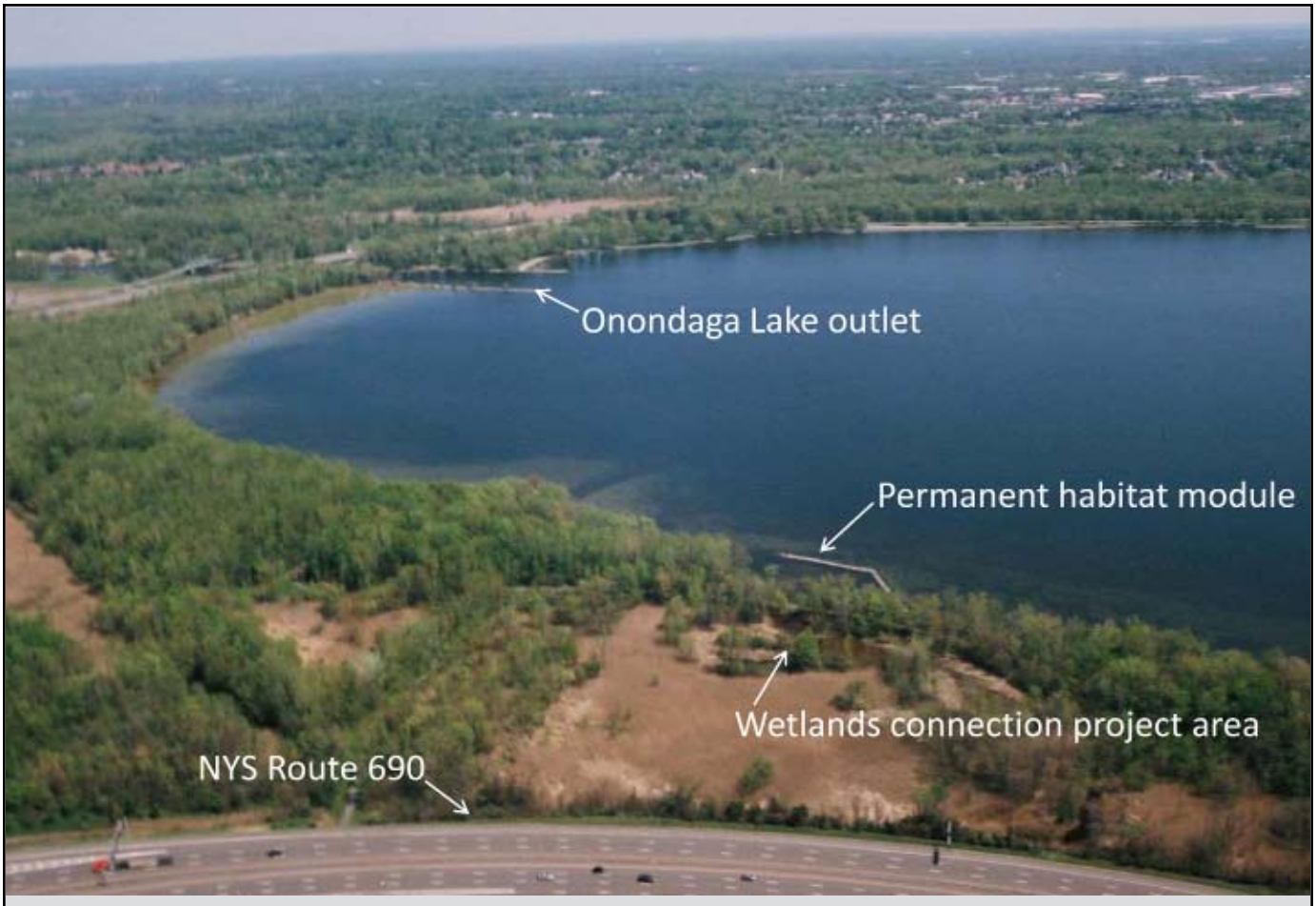

Figure 3-13. Aerial photograph showing the location of the permanent habitat module (jetty-like structure) and wetland connection projects near the northwest end of Onondaga Lake. Two culverts link the wetlands connection area with the lake. (Source: USACE).

To allow water movement, sediment removal is necessary at openings on both sides of the culvert connecting the wetland with the lake. It is estimated that the initial work to accomplish this would cost $3,000. Also, mats of floating algae regularly become trapped behind the jetty. The problem could be addressed by skimming, which if feasible, would be least expensive (about $2,000 per year). The re-establishment of appropriate native wetland and shoreline vegetation also is needed in parts of the project area to enhance its ecological function ($6,000 as a one-time cost expenditure).

2. Review the project proposal and design for expectations regarding the need and responsibility for long-term maintenance, and redesign and reconstruct the project to reduce maintenance needs.

Culvert and jetty maintenance and/or modification is needed to maintain water flow and discourage growth of undesirable algae while promoting development of desirable vegetation. Operational modifications might also include the active use of stoplogs to more closely control water levels. As an alternative to periodic skimming for removal of algal mats, parts of the existing jetty could be removed to create openings, enhancing water flow through the system to prevent the stagnation that leads to algal growth.

As part of the original project, substrate improvement was attempted in areas where oncolites deterred the establishment of desirable vegetation. Geotextile pads covered with rock substrate were installed, but have not functioned as well as intended due to the size and distribution of substrate. Modifications to the restoration effort, expected to result in significant improvements to the quality of vegetation, would require approximately $20,000.

In order to progress with any changes or additional work on the project, the OLP would need to review the project and determine the entity or entities best equipped to undertake these activities.

Action Strategy 9. Support implementation of elements of the Onondaga Creek Conceptual Revitalization Plan (OCCRP) as desired and appropriate.

Recommendation:

1. Provide support and/or assistance with implementation of appropriate and feasible OCCRP recommendations as pilot projects.

The OCCRP was developed through a visioning process enlisting participation of residents of the Onondaga Creek watershed. One of the purposes of the OCCRP is to present the public's vision of a cleaner, more natural Onondaga Creek. The draft OCCRP (Onondaga Environmental Institute 2009), identifies a number of possible habitat restoration projects to help achieve this vision. The OLP will evaluate options presented by the OCCRP, and may support implementation of project concepts that are determined to be desirable, technically feasible, and affordable, pending regulatory and community acceptance. Adopted OCCRP concepts would initially be implemented as pilot or demonstration projects if they meet these criteria.

Action Strategy 10. Implement a natural history information and education program to educate and inform the public on fish and wildlife species in and around the lake.

Recommendation:

1. Utilize a combination of existing and new outreach resources to educate the public about the natural history of Onondaga Lake.

The OLP Outreach Committee will determine the method by which public education concerning the Lake's natural history is accomplished. Various media options have been proposed, such as document CDs, information kiosks, videos, printed materials, and a website. Existing materials, such

as a video produced by the OLP Fisheries Working Group, may also be appropriate. Previous efforts, including printed media such as an insert in the local newspaper and publication of a newsletter, have discussed natural history and aquatic habitat. These efforts, combined with additional distribution of the existing video, would likely cost about $10,000 for each year in which they are implemented.

Action Strategy 11. Encourage communication and coordination between agencies, facility operators, and user groups within the Oswego River Basin to improve and facilitate management of Onondaga Lake in a manner protective of the lake's ecology.

Onondaga Lake discharges north to the Seneca River, which joins the Oneida River to form the Oswego River near Phoenix, New York. Communication amongst local and regional government entities and private industries in the Oswego River basin must be improved to ensure the long-term ecological integrity of Onondaga Lake. Issues such as water level management and detrimental effects of invasive species originate in the Erie Canal/Seneca/Oswego River system, and impact Onondaga Lake management. The OLP will encourage cooperation and information sharing amongst the relevant parties. Through education and outreach, the OLP will work to facilitate effective information exchange and agency coordination.

New York State Canal Corporation and multiple hydropower facility operators within the Oswego River system control water levels and affect Onondaga Lake. The Canal Corporation regulates Erie Canal water levels during the navigation season for commercial and recreational boat traffic. Habitat management, power generation, and navigation often require different water level regimes. Discussion among water users should inform and facilitate water level management decisions and are necessary to reconcile conflicts between uses.

Recommendation:

1. Work with government and local agencies to educate the public about removal of non-native invasive species from watercraft to prevent their proliferation and range expansion.

Non-native invasive species reach Onondaga Lake from the Seneca River (Erie Canal) through the lake outlet, or attached to boat hulls. Education of boat operators on the importance of invasive species removal from their craft (e.g. by proper cleaning of watercraft prior to transport) is critical to limiting the spread of exotics. This can be accomplished by providing information or signage at marinas and points of lake access, or via OLP Outreach Committee efforts and programs. Another means for invasive species to enter non-native waters is via fishing equipment including waders. Anglers should be provided education materials and encouraged to properly clean equipment when going from one waterway to another.

Strategic Area 7: Inner Harbor and Shoreline

The OLP developed the following goals relative to utilization of the Onondaga Lake Inner Harbor and Shoreline areas:

Goal 1. Promote use of the Inner Harbor and its waterfront areas for tourism, recreation, and economic benefit, in order to optimize public appreciation and enjoyment of the natural features of the lake and its environs.

Goal 2. Promote the use of the lake's shoreline areas for public access and recreation.

To assist in attaining the above goals, the following action strategies and recommendations have been developed.

Action Strategy 1. Complete trail construction to establish and/or maintain community connectivity with Onondaga Lake and its tributaries.

Key projects identified to enhance connectedness of the lake with its surrounding communities include the Loop-the-Lake Trail and the Onondaga Creekwalk.

Recommendations:

1. Complete a new section of trail that will continue across Ninemile Creek to provide access from Lakeland and Geddes.

The Onondaga County Department of Parks and Recreation, in cooperation with the Onondaga County Department of Transportation (OCDOT), is undertaking the completion of a new section of the Loop-the-Lake trail, which ultimately is planned to entirely encircle Onondaga Lake. The trail will be extended by approximately two miles to continue across Ninemile Creek via a steel bridge to the top of the hill known as the "Upper Bluff" overlooking Onondaga Lake from the west (see Appendix A for a map of the area). The trail will be located at the top edge of the ridge, as close as possible to the lake. New access will be provided from Lakeland and Geddes (immediately west of Onondaga Lake) via Exit 7 from Route 690. Access to the State Fairgrounds upper parking lots will be possible. At the entrance to the State Fairgrounds atop the hill, a cordoned parking lot will be created for users accessing the trail from this area. The proposed pathway will be 10 feet wide and hard surfaced to allow a variety of uses.

All necessary engineering and design work pertaining to the construction of this phase of the trail has been completed, and funding is in place for its construction. The total cost of the project is approximately $3.5 million. Funds are provided through OCDOT sources and environmental fine money dedicated to completion of an Environmental Benefit Project as a condition of consent order between NYSDEC and parties responsible for pollution of the lake. Presently, construction is planned to commence in 2010, with an 18-month construction period. OCDOT is the lead agency in the construction and funding aspects of this project.

2. Design and complete remaining sections of the Loop-the-Lake Trail.

Two unfinished portions of the Loop-the-Lake trail will remain following the completion of the section described above; these parallel the southwest and southeast shores of the lake. The ultimate objective is to link the section on the east side, which presently ends in Onondaga Lake Park in Liverpool, with the portion on the west side outlined in Recommendation 1. The intent is to link these sections of trail to the Creekwalk near the mouth of Onondaga Creek at the Inner Harbor.

Several logistical challenges are associated with both of these remaining sections. The southwest section from the top of the bluffs to Onondaga Creek will need to cross lands owned by Honeywell International, where remediation activities are planned. Coordination with Honeywell's activities must occur, and the ultimate suitability of the land for a trail following remediation must be ascertained. A set of active railroad tracks also hug the shoreline closely at the southwest corner of the lake, presenting another access challenge.

The southeast section connecting Onondaga Lake Park in Liverpool to Onondaga Creek is equally challenging. Currently, active railroad tracks and Onondaga Lake Parkway (located along the east side of the lake) both exist close to the lake shoreline in this area. Construction of a trail even closer to the shore would be difficult to accomplish. A previous conceptual design involved construction of a causeway built out slightly into the southeast corner of the lake, creating a backwater area that could contain valuable habitat. The objective was to carry the trail around the congested area via the causeway, linking to the shore near Carousel

Center Mall. An alternative option, considered more recently, is to coordinate development of the trail with the reconstruction of Onondaga Lake Parkway, with which it may share the right-of-way.

A dedicated source of funding has not yet been identified for either of these sections of trail. A general estimate is that the total cost for design and construction of both sections would exceed $50 million.

3. Complete the Onondaga Creekwalk and establish connections to the Loop-the-Lake Trail and Erie Canalway Trail.

The city of Syracuse is undertaking the completion of the Onondaga Creekwalk (Figure 3-14). Construction on Phase I of the Onondaga Creekwalk began in November 2009. Phase I will connect Armory Square to the Inner Harbor, paralleling Onondaga Creek for most of the distance and incorporating sections of the existing Creekwalk through the Franklin Square neighborhood and the Inner Harbor. Total costs for Phase I of the Creekwalk are estimated to be in the range of $8 to $10 million. Two additional phases of the Onondaga Creekwalk are planned. Phase II involves the connection of Armory Square to Kirk Park; a feasibility study has been completed for this portion. Phase III, which connects Kirk Park to Dorwin Avenue at the south end of the city, has yet to enter into a feasibility study. (See Appendix A for a map of the area.)

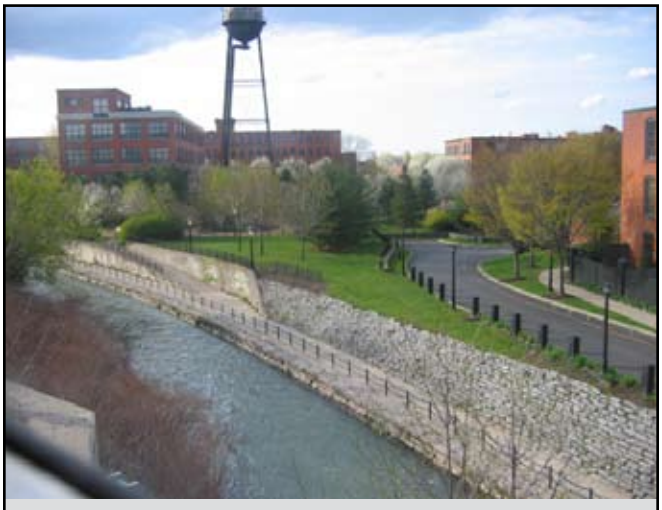

Figure 3-14. Onondaga Creekwalk at Franklin Square (Source: City of Syracuse)

This work will be complemented by planning efforts led by the city of Syracuse for enhancements to the Inner Harbor and creek shoreline areas. A Master Plan to connect communities along Onondaga Creek to the Inner Harbor via the Creekwalk is being funded by a $500,000 Local Waterfront Revitalization Program grant from the New York State Department of State.

Action Strategy 2. 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 could potentially include boat access sites and public fishing piers. All facilities should be accessible to people with disabilities and located in consideration of all residents.

Boat launching and fishing access facilities are desired at multiple locations around the lake, including the east and west shores as well as the Inner Harbor. Currently the Lakefront Development Corporation (LDC) oversees activities in the Inner Harbor area through a lease and canal permits. The OLP supports the development and improvement of such access opportunities at suitable locations.

Recommendations:

1. Complete investigatory work for the development of a boat launch and fishing access site on the west shore of the lake, and implement plans if feasible, pending completion of industrial remediation work.

One possible proposed location on the west shore for a boat launch and fishing access site is at the end of Exit 7 from Interstate 690 on property used formerly by Crucible Steel for disposal of waste slag. The property is now part of the New York

State Department of Transportation right-of-way for Route 690. NYSDEC and EPA are planning environmental investigatory work to determine what cleanup activities may be required at the site. Installation of a boat launch and fishing access at this location would fulfill the OLP's objective to provide such access on the lake's west shore. Other sites are also being evaluated for a possible west shore boat launch and fishing access.

2. Upgrade the existing marina at Onondaga Lake Park.

The existing marina at Onondaga Lake Park is in the process of being upgraded by the Onondaga County Department of Parks and Recreation. Grant money was secured through the Environmental Protection Fund and Canal Greenways. Construction, which began in 2009, is near completion as of this writing. Primary upgrades include removal of permanent docks and replacement with floating docks, and installation of utility improvements including additional water and electric service. Floating docks will also replace some of the permanent pile-and-gangway structures. The upgraded marina will accommodate 96 vessels instead of the current 87. The approximate cost of the marina improvements is $450,000.

Additionally, the waters of the marina have tended to fill in with accumulated sediment from non-point sources. It is hoped that non-point source pollution control efforts by the OLP to reduce sediment loading to the lake will slow the rate of future sedimentation. In the interim, minor dredging and sediment removal are necessary in this area to restore the marina to its full usefulness. For dredging to take place in this area, additional funding would be necessary.

Figure 3-15. Existing docking facilities at the Onondaga Lake Park Marina. (Source: Onondaga County)

Action Strategy 3. Support implementation of the city of Syracuse Lakefront Area 2002 Master Plan (city's Lakefront Development Corporation Zoning Regulations for the Inner Harbor), which allows continued public access to the Inner Harbor and critical shoreline areas, and promotes compatibility of lakefront area development proposals with lake management objectives.

The city of Syracuse's plans for the Inner Harbor and Lakefront areas make the lake and its harbor a key focal point of activity, and encourage public access and enjoyment of these resources.

Recommendations:

1. Ensure that the proposal selected in response to the 2009 Request for Proposals for the Inner Harbor is consistent with approved Lakefront Area zoning regulations as well as public access and lake management objectives.

A Request for Proposals (RFP) for the development of the Inner Harbor was prepared by the New York State Canal Corporation (NYSCC) and released in December 2009. The RFP breaks the Inner Harbor area into three sections, with proposed recreation, commercial and residential uses. Proposals are due in March 2010, and project selection will follow. LDC, the city of Syracuse and NYSCC will be the parties involved in ensuring that the selected proposal is consistent

with established objectives for redevelopment of the Inner Harbor.

Any new development would be required to be in accordance with the Lakefront Area Zoning Regulations (city of Syracuse Zoning Code, Parts B-IX and C-IX). The Syracuse Lakefront Area Master Plan was released as a very basic conceptual document in 2001. In 2004, the city of Syracuse issued a set of zoning regulations for the lakefront area surrounding the Inner Harbor. The regulations were developed based on the Master Plan, codifying it to reflect the desired land uses. Parts of the area were classified as Urban Center, with the remainder characterized as General Urban. The Urban Center District is intended to be a "dense, fully mixed use neighborhood with a vibrant street life and a public realm with many design amenities." In contrast, the General Urban District is described as "A primarily residential mixed use neighborhood in which non-residential uses are present, but small in scale and impact.[6]"

The zoning code also creates a "Tourism Overlay District" that allows the underlying zoning to be superseded when a project proposal is submitted as a Comprehensive Development Plan that furthers the use of the Inner Harbor as a tourism or resort destination. In all areas within the overlay district, public access to Onondaga Creek and the harbor must be maintained.

Action Strategy 4. Determine the feasibility and appropriateness of establishing a "No Discharge Zone" in Onondaga Lake and in immediately connected waters, and coordinate with NYSDEC to implement the selected course of action.

A "No Discharge Zone" (NDZ) is a designated area of navigable waters in which the discharge of sanitary sewage from all vessels is prohibited. Securing an NDZ for Onondaga Lake would ensure that recreational use of the waters continues in a manner consistent with lake rehabilitation efforts.

Recommendation:

1. Complete the required process for NDZ review and designation.

The OLP supports the establishment of an NDZ for Onondaga Lake. The NYSCC has proposed that all canal waters, including Onondaga Lake, receive this designation. In order for a body of water to receive designation as an NDZ, sufficient pump-out stations for onboard sewage must be present at marina and docking facilities. It has yet to be determined if the single pump-out station presently provided at the Onondaga Lake marina is adequate. A program of regular maintenance will be required for all pump-out stations, regardless of number. Additional pump-out stations would improve capacity and further support the designation of an NDZ. NYSDEC is pursuing the NDZ designation.

Action Strategy 5. Evaluate the success of stewardship and management of the Tully Valley Mudboils, as well as non-point source control efforts, in controlling sediment in the Onondaga Creek watershed, and remain cognizant of the potential periodic need for additional dredging of the harbor depending on the effectiveness of these efforts.

Recommendation:

1. Evaluate the success of non-point source sediment control and mudboil management efforts as part of the basis for decisions concerning the frequency of dredging.

Management decisions concerning the Tully Valley Mudboils (described in Strategic Area 5) and non-point source pollution control efforts (Strategic Area 8) will influence how frequently the Inner

6. City of Syracuse Zoning Code, Part B, Section IX, Article 2, 2004

Harbor must be dredged. Without mitigation of the mudboils, accumulation of sediment in the harbor via flow from Onondaga Creek will take place more rapidly; historically the harbor required dredging about once every six years. The harbor was last dredged ten years ago, having experienced a lesser rate of sedimentation since that time.

Dredging results in odor and aesthetic concerns, as well as restrictions to uses such as boating. Active control of the mudboils and non-point source pollution would lessen the need to dredge the harbor, thereby reducing these impacts. Presently, the ability to store dredge spoils is a limiting factor on the quantity of material that could be removed; only one upland disposal area remains for sediment spoils removed from the harbor. The frequency at which dredging is necessary will depend on the availability of adequate funding to keep inputs from the mudboils and non-point source pollution at their present level.

Action Strategy 6. Promote the use of the Inner Harbor and Onondaga Lake shoreline for recreation and tourism through publications or other media as appropriate.

The OLP will continue to coordinate with member agencies, including the city of Syracuse, Onondaga County, and the NYSCC, to promote the use of the Inner Harbor and Onondaga Lake shoreline for recreation and tourism.

Recommendation:

1. Provide information for inclusion in design of tourism-focused promotional publications on the Lake and Inner Harbor, and encourage the continued circulation of these publications.

The LDC and members of the OLP have periodically circulated brochures and articles concerning progress on the redevelopment of the Inner Harbor, and the construction of the Onondaga Creekwalk. The OLP will provide necessary information to ensure that these publications capitalize on the improving conditions within Onondaga Lake watershed and highlight new shoreline access and recreation opportunities.

Strategic Area 8: Non-Point Source Pollution

The OLP established the following goal relative to control of non-point source pollution of surface waters:

Goal 1. To achieve the designated best uses established by the water quality classification for Onondaga Lake, develop and implement a Non-Point Source (NPS) Management Strategy (consistent with the NYSDEC Onondaga Lake TMDL) incorporating appropriate Best Management Practices that address the impacts of NPS pollution and reduce pollutant inputs from rural and urban non-point sources throughout the watershed of the lake.

Recognizing the multifaceted nature of NPS pollution, the OLP considers the following to be important components of the developing NPS Management Strategy:

- Reduction of agricultural NPS inputs through education and technical assistance to farmers within the watershed and implementation of best management practices (BMPs)

- Reduction of urban NPS inputs through outreach to the general public and businesses

- Monitoring of conditions in tributaries to Onondaga Lake to locate and eliminate sources of sediment, bacteria, and other pollutants that can be pinpointed within the tributaries

- Identification and stabilization of sediment sources throughout the watershed, including erosion of stream banks and channels, roadside ditches, and roadway embankments

The NPS Management Strategy also includes consideration of the use of natural features and vegetated areas to promote infiltration of runoff near its source and removal of pollutants through biological processes. The use of these practices, sometimes referred to as green infrastructure, is being implemented by the County as a means to partially replace Regional Treatment Facilities and other traditional engineered practices in CSO abatement. See Strategic Area 2 for more detail.

Several of Onondaga Lake's tributaries are on NYSDEC's 2008 list of impaired waters requiring a TMDL or other strategy. Table 3-2 summarizes existing impairments to tributaries of Onondaga Lake. The table includes only sources and types of impairment that have been documented through monitoring programs recognized by NYSDEC. Other sources, including runoff from agricultural operations, rural roadways, and hydrogeologic phenomena (see Strategic Area 5), are believed to be significant sources of NPS pollution. The OLP supports efforts to remedy the tributary impairments.

Action Strategy 1. Continue implementation of the Agricultural Environmental Management (AEM) program consistent with the Rural NPS Management Plan as funding allows.

The Onondaga County Soil and Water Conservation District (OCSWCD) is the primary agency responsible for implementing the AEM program in Onondaga County. The program is discussed in more detail in Chapter 2. Funding for the AEM program in the Onondaga Lake watershed is provided by EPA through the OLP, and by New York State through the Environmental Protection Fund.

The Rural NPS Management Plan (OCSWCD 1993) made six recommendations to address agricultural concerns on farms in the Onondaga Lake watershed. These recommendations, listed below, will maintain the focus of the AEM program toward projects that accomplish these objectives.

- Source reduction through information and

Water body	Pollutants of concern	Sources of pollutants
Ninemile Creek	Phosphorus, pathogens	Municipal, urban runoff
Geddes Brook	Ammonia	Municipal, urban runoff
Bloody Brook	Pathogens	Municipal, urban runoff
Onondaga Creek	Phosphorus, pathogens, sediment, ammonia, turbidity, habitat impairment, unknown toxicity	Stream bank erosion, CSOs
Harbor Brook	Phosphorus, pathogens, ammonia, habitat impairment	Municipal, urban runoff, CSOs
Ley Creek	Phosphorus, pathogens, ammonia, cyanide, unknown toxicity	Municipal, urban runoff, CSOs
Minor tributaries to Onondaga Lake	Pathogens, phosphorus, ammonia, cyanide	Municipal, urban runoff, CSOs

Table 3-2. Pollutants of concern and their sources in tributaries of Onondaga Lake watershed, according to the NYSDEC 303(d) list of impaired waters (NYSDEC 2008b). See Figure 2-6 for locations of water bodies.

education: Continuously encourage landowners to voluntarily install needed management practices to reduce NPS pollution

•• Nutrient management to reduce surplus phosphorus: Manage the rate of phosphorus application according to plant needs, so that excess phosphorus is not released and ultimately carried to Onondaga Lake

•• Manure management: Implement manure management practices to reduce runoff of nutrients, organic material, bacteria and pathogens from barnyards and agricultural fields

•• Pesticide management: Provide education and technical assistance on pesticide application and management techniques that minimize pollution of surface waters

•• Livestock exclusion: Restrict access to streams by cattle so that nutrients, pathogens and organic matter from manure are not introduced into Onondaga Lake through direct input to its tributaries

•• Watershed-wide NPS pollution control strategy: Merge urban, suburban and rural programs into one comprehensive program so cumulative problems can be properly evaluated

Consistent with planning efforts such as the Rural NPS Management Plan, the AEM program focuses on providing assistance to farms where manure runoff is a major issue and contributor of organic matter, pathogens, and nutrients. Reduction of phosphorus is of particular concern, as it remains a necessary part of meeting future Onondaga Lake TMDL requirements. Currently the OCSWCD is working with over 50 interested farms to plan and implement agricultural BMPs. The AEM program has been successful in addressing manure runoff to reduce nutrient and pathogen loading through installation of BMPs throughout the Onondaga Lake drainage basin, including the Otisco Lake/ Ninemile Creek arm of the watershed.

Because AEM is a voluntary program, success depends on the long-term willingness and commitment of farmers to remain in the program until their particular management plan is fully

Figure 3-16. Pre-BMP barnyard at a farm in Onondaga County. Soil erosion and surface runoff of nutrients from barnyard can pollute streams. (Source: OCSWCD)

Figure 3-17. Post-BMP barnyard with concrete pad to reduce erosion and enhance animal waste management. (Source: OCSWCD)

implemented. Among projects expected to produce significant water quality improvement, higher priority is assigned to those in which participants are willing to implement and maintain the recommended BMPs.

Recommendation:

1. Implement BMPs on farms that have completed the planning process, and evaluate BMP

effectiveness. Continue to progress with AEM on as many farms as possible that have entered the initial resource inventory and planning phases of the program.

AEM involves a series of five steps, known as Tiers, (see page 40), that guide the process from initial identification of natural resource concerns to selection, design, construction, and maintenance of BMPs. The OLP's objective is to install BMPs and evaluate their effectiveness (Tiers IV and V) on farms that have completed the planning phases, while moving forward with resource inventory under Tiers I, II, and III of AEM on as many farms as possible.

In working with the OLP, OCSWCD uses a ranking spreadsheet to track and prioritize farms that have entered the AEM program. OCSWCD's approach will be to complete all five tiers on as many currently enrolled farms as possible before enrolling new ones.

To date, approximately $3,000,000 has been spent on AEM implementation in Onondaga Lake watershed, and it is estimated that a similar amount would be required in order to finish the program on all currently enrolled farms. To continue to operate the program at its current level, OCSWCD relies upon receipt of funding in the amount of approximately $165,000 per year; the amount varies depending on the level of farm participation. To date, this funding has come from EPA, as well as from the Environmental Protection Fund as cost-share dollars through the New York State Department of Agriculture and Markets and Soil and Water Conservation Committee, but the same level of funding is not guaranteed for future years. OCSWCD continues to identify new participants to begin the initial survey process as funding and time allow.

Action Strategy 2. Development of computer models should be completed to identify areas within the Onondaga Lake watershed in which to focus NPS management efforts in support of the development of a NPS Management Strategy for the watershed.

The Onondaga Lake Surface Water Watershed Model (SWWM) was developed by USGS to estimate loading of phosphorus and other nutrients (Coon & Reddy 2008). The computer-based model breaks the watershed into 107 sub-basins (parts of the watershed that drain to a common point, such as a junction between two small tributary streams). Figure 3-18 shows land use within the sub-basins, (delineated by black lines). The model is able to identify pollutant sources at the sub-basin level. 2008 AMP data are presently used as input to the model; this input will be supplemented with new data from 20 USGS water quality sampling sites located throughout the Onondaga Lake watershed. The model needs to be periodically updated with current land use Geographic Information Systems (GIS) data, because land use changes can influence actual pollutant loading.

The Ambient Monitoring Program carried out by Onondaga County in conjunction with USGS includes the monitoring of several sites within tributaries of Onondaga Lake. While not all of the parameters monitored as part of the County's program justify intensive modeling efforts, data from the program may continue to be entered into the model and used as a means of tracking origins of NPS pollution and identifying "hot spots".

Recommendations:

1. Calibrate the existing Onondaga Lake SWWM with data from the Surface Water Ambient Monitoring Program (SWAMP), and develop and implement a series of model scenarios appropriate for use in the SWWM to provide a framework for interpreting current watershed conditions.

On behalf of the OLP, USGS is calibrating the Onondaga Lake SWWM to ensure the reliability of results and to provide a context in which to interpret them. The model is run using a computer program known as Hydrologic Simulation Program Fortran (HSPF). The cost of this phase of

the program, presently in progress, is $178,000.

2. Use the calibrated Onondaga Lake SWWM to evaluate loading of various water quality parameters and identify sites for implementation of Best Management Practices.

Once the calibration and sample scenario work required for the model has been completed, the OLP will be able to put the model to use to identify and address sub-basins containing significant sources of NPS pollution. The SWWM will highlight the sub-watersheds most likely to yield high pollutant loads. Further investigation of these sub-watersheds will be pursued on a case-by-case basis, including field assessment of possible pollutant sources.

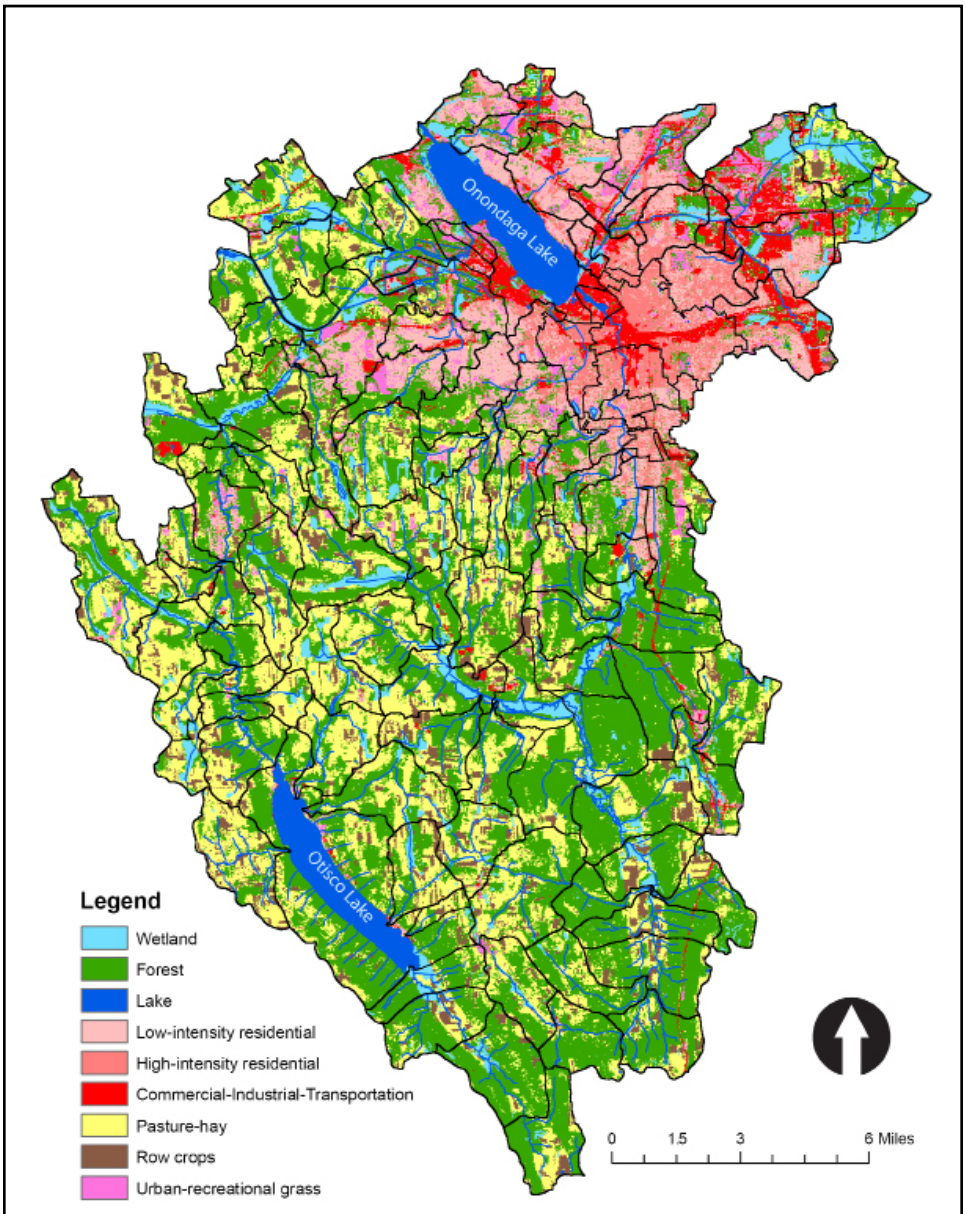

Figure 3-18. USGS figure showing land use classifications and sub-basin delineations from the Surface Water Watershed Model (HSPF) study, illustrating typical inputs to the model. Blue lines represent streams. (Source: USGS)

The NPS Management Strategy envisioned by the OLP is intended to rely only partly on the outcome of the model. The model is only one of the several tools discussed in this document that the OLP may use for targeting and prioritizing BMP implementation opportunities.

Action Strategy 3. Continue education and outreach programs to foster awareness and behavior change relative to the impact of individual actions on water quality in Onondaga Lake and its watershed, and pursue funding to undertake additional education programs.

NPS pollution originates from numerous small-scale sources. Watershed residents can contribute to either the problem or the solution through their actions. An effective public education program is the best means of raising awareness of the role individual actions play in NPS pollution. Education

efforts that target individuals and commercial entities, including the land development and earth-moving industries and other operations that have the potential to generate NPS pollution, are a critical component of these efforts.

While much progress has been made in informing the public about the various pollution problems present in Onondaga Lake and its tributaries, the OLP recognizes that a constant awareness must be maintained in the public consciousness over the long-term. The OLP is therefore committed to continuing to support education and outreach efforts. Many methods and media are available to raise awareness of NPS pollution issues. The OLP Outreach Committee conducts various public education activities, several of which focus on NPS pollution, with funding provided through the EPA.

Figure 3-19. Runoff from construction sites with poor erosion control carries sediment and nutrients into municipal drainage systems and to Onondaga Lake. This is a major cause of non-point source pollution. Efforts to educate the construction industry about these impacts continue. (Source: Central New York Regional Planning & Development Board)

Recommendation:

1. Obtain additional funding for the OLP Outreach Committee to continue and expand ongoing urban NPS public education efforts in the Onondaga Lake watershed through the authorized duration of the OLP (currently August 2014).

In order to continue educating the public about the impact of NPS pollution on Onondaga Lake, the OLP must secure future funding and develop a detailed outreach program with expanded focus on NPS pollution control. In the past, the OLP has received funding from the EPA to implement education and outreach efforts relative to NPS pollution control. Although $194,377 is available from the EPA through 2012 to maintain public education programs, additional funding will be necessary to deliver a program focused on NPS pollution control. Consequently, the OLP may develop a new program proposal focused on urban NPS public education efforts in the Onondaga Lake watershed. USACE has been identified as a potential source of funding.

Action Strategy 4. Continue roadbank stabilization and hydroseeding programs in coordination with local, county, and state transportation departments.

With funding provided by the NYSDEC, the OCSWCD purchased a hydroseeder and provides seeding and mulching services to NYSDOT, OCDOT, and individual municipalities within Onondaga County to reduce erosion along ditches and road embankments. In addition to controlling sediment, erosion control also prevents the transport of sediment-bound phosphorus to tributaries of Onondaga Lake. Since rural areas in Onondaga County frequently contain elevated phosphorus levels in agricultural soils with a history of nutrient application, the program appears to be an effective means of controlling phosphorus loading. The hydroseeding program is currently funded through 2010 by a grant from the NYSDEC that pays for

50 percent of the cost. The remaining 50 percent must be covered by local match dollars. OCSWCD intends to seek additional funding to continue the program beyond this timeframe.

Recommendation:

1. Identify funding to continue the existing hydro-seeding program.

The cost per acre for operation of the hydroseeder at the standard application rate is about $1300; generally 25 to 30 acres are stabilized on an annual basis for a cost of $32,000 to $39,000. OCSWCD will continue to make its existing hydroseeding services available to municipalities through grant monies, if available. Other funding options include the use of a shared funding agreement paid for by participating municipalities, or implementation of a fee-for-service based program.

Action Strategy 5. Continue streambank stabilization program for sites identified through the USACE funding program.

In 2000, the OCSWCD completed an inventory of streambank and roadbank erosion in Onondaga Creek watershed, identifying and prioritizing current erosion and sedimentation problems. This inventory was used by USACE to complete engineering plans and specifications for 38 reaches along Onondaga Creek in 2003. Construction of 23 streambank stabilization projects, spanning a total of 3,755 linear feet, was funded by USACE and Onondaga County through a Rural Best Management Practices grant in 2004, 2006 and 2007. OCSWCD worked with the landowners affected by these projects, and managed the construction contracts. Program funds totaling approximately 1 million dollars were exhausted before all identified problems could be addressed. Stabilization of the remaining 15 sites, which were considered lower in priority, was not feasible during the time the project was funded due to access restrictions and other practical matters.

Recommendations:

1. Update and prioritize the 2000 inventory of streambank and roadbank erosion sites.

Additional funding is needed in order to build upon previous streambank and roadbank erosion inventory and repair work undertaken by USACE and OCSWCD. A new inventory of roadbanks and streambanks is needed, since additional sites may now exist, and minor erosion problems may have become more severe than they were previously. The cost of the inventory would be dependent on its scope and the criteria evaluated, but it is estimated to be up to $10,000 to complete work throughout the entire Onondaga Creek sub-basin. Modeling efforts may help determine the sediment load contribution from various subwatersheds, in order to prioritize the stream reaches and areas inventoried.

2. Develop and implement remediation plans on priority sites.

Additional funding would be needed to complete actual design and construction work on the identified priority sites, with the amount driven by the scope of the problems documented. Prioritization of projects would consider modeling results, in addition to the degree of property loss, damage to infrastructure, severity of erosion, and threat of flooding suffered. Once potential projects have been selected, acquisition of easements from private land owners is typically a necessary part of the process in order to allow access for construction. Periodic maintenance may also be required for streambank stabilization projects, particularly where vegetation establishment is involved.

Action Strategy 6. Integrate the MS4 Stormwater program into the OLP's overall strategy to address non-point problems throughout Onondaga Lake Watershed, with a watershed-level focus on the six Minimum Control Measures, to control

urban stormwater runoff of phosphorus and other pollutants.

Under a federal mandate from the Clean Water Act, a number of urbanized municipalities and other government entities in the Onondaga Lake watershed are required to comply with State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) (NYSDEC 2008c). The permit requires these regulated MS4s to control stormwater runoff by implementing a management program that incorporates the following six categories of activities, which are referred to as Minimum Control Measures:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Stormwater Management
- Pollution Prevention and Good Housekeeping in Municipal Operations

In addition to general stipulations of the permit that apply to all MS4s, regulated entities within the Onondaga Lake watershed are subject to heightened requirements specific to addressing the pollutant phosphorus. These requirements presently include the following:

- Education and outreach efforts must be conducted specific to phosphorus
- Development projects requiring construction permits must implement enhanced phosphorus removal criteria in designs for stormwater treatment
- A stormwater retrofit program, requiring municipalities to upgrade existing stormwater management practices and drainage systems for improved phosphorus removal, must be implemented through stakeholder-driven watershed planning efforts to reduce loading of the pollutant phosphorus to Onondaga Lake
- Municipalities are required to develop a turf management program controlling the use of phosphorus in fertilizer applications, and encouraging planting of native vegetation

Because the MS4 Stormwater General Permit is periodically updated and modified by NYSDEC in compliance with EPA mandates, the above requirements will be subject to change.

Recommendation:

1. Consider proposed MS4 compliance projects in determining allocation of funding to the extent that they support lake rehabilitation objectives.

Proposed projects and initiatives that address MS4 stormwater issues within the Onondaga Lake watershed should be eligible for consideration for federal funding if they contribute to the OLP's goals and objectives. Although the MS4 Stormwater program had not been initiated at the time the original OLMP was approved, urban NPS pollution has since been recognized as an important contributor to the impairment of Onondaga Lake. Urban stormwater runoff is also one of the sources of phosphorus that will receive a specific allocation relative to the lake's TMDL.