1. INTRODUCTION

Honeywell International Inc. (formerly AlliedSignal, Inc.; referred to herein as Honeywell), is conducting a remedial investigation and feasibility study (RI/FS) for Onondaga Lake, which is located near Syracuse, New York (site definition is discussed in Section 1.2 of this RI). The RI/FS is being conducted under the direction of the State of New York and pursuant to the terms of a Consent Decree (Index #89-CV-815) entered into with the State of New York dated January 9, 1992, and associated stipulations (Consent Decree). Onondaga Lake was placed on the USEPA National Priorities List (NPL) (CERCLIS ID number NYD986913580) on December 16, 1994. This NPL listing means that the lake is among the nation's highest priorities for remedial evaluation and response under the federal Superfund law for sites where there has been a release of hazardous substances, pollutants, or contaminants. Honeywell submitted a draft RI report in May 1998. Upon review and comment by the US Environmental Protection Agency (USEPA), the New York State Department of Environmental Conservation (NYSDEC), and the New York State Department of Health (NYSDOH), the NYSDEC and the New York State Department of Law (NYSDOL) disapproved this draft document and provided comments to Honeywell in August 1999.

After completing additional sampling in 1999 and 2000, Honeywell submitted a revised RI report in April 2001 (Exponent, 2001c). This revised report was similarly disapproved by NYSDEC and NYSDOL in July 2001. Thereafter, pursuant to the Consent Decree, NYSDEC/TAMS Consultants, Inc. (TAMS) prepared this rewrite of Honeywell's revised RI report, with the assistance of NYSDOH and USEPA. This rewrite has been completed in accordance with USEPA guidance for conducting RIs and FSs. Honeywell's revised baseline ecological risk assessment (BERA) and human health risk assessment (HHRA) have also been rewritten (TAMS, 2002a,b), based on NYSDEC's rejection of Honeywell's versions (Exponent, 2001a,b). Honeywell will submit a draft FS report in 2003 for agency review, based on the findings of this RI and associated risk assessments.

1.1 Purpose and Organization

The purpose of this RI report is to present the results of the various studies conducted as part of the RI, including investigations to identify and determine the distribution of chemical parameters of interest (CPOIs) in water, sediment, soil, and biological tissue; mathematical modeling studies; and human health and ecological risk assessments. The CPOIs for the RI, which are further defined in Section 1.6, are those elements or compounds that were selected as contaminants of potential concern (COPCs), contaminants of concern (COCs), or stressors of concern (SOCs) in the BERA and HHRA (TAMS, 2002a,b). The CPOIs include a long list of contaminants considered hazardous, such as mercury, chlorinated benzenes, and polychlorinated biphenyls (PCBs). In addition, the CPOIs include potentially less hazardous stressors, such as calcium and chloride. The CPOIs were identified based on an evaluation of the comprehensive chemical analysis of samples collected within the "site" (defined in Section 1.2). The list of CPOIs includes Honeywell-related chemical parameters, as well as chemical parameters found at the site that may not be Honeywell-related. Pursuant to the Consent Decree and the approved Onondaga Lake RI/FS Work Plan (PTI, 1991c), the principal objectives of the RI were to:

- Define the areal extent of contamination with respect to Honeywell-related substances for the Onondaga Lake system and related areas and identify and quantify other substances of potential concern.

- Identify and quantify sources of Honeywell-related substances to the Onondaga Lake system.

- Characterize the distribution of Honeywell-related substances and other substances in the Onondaga Lake system under past, present, and future conditions.

- Estimate the potential human health risks posed by mercury and other substances.

- Determine the ecological significance of mercury, calcite ($CaCO_3$) deposits, and other substances in the Onondaga Lake system.

This RI report is structured in accordance with USEPA's guidance for reporting on site investigations under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). This chapter provides a site description and history, regulatory history, summary of the previous investigations, and a summary of the CPOIs for the site. The remainder of this report consists of nine chapters, as follows:

- Chapter 2, Field and Laboratory Investigations, provides a summary of the investigations performed as part of the RI.

- Chapter 3, Physical Characteristics of the Site, provides an overview of the site's physical characteristics based on both data collected as part of the RI and data from other sources.

- Chapter 4, Sources and Potential Sources of Chemical Parameters of Interest to Onondaga Lake, describes the potential sources of CPOIs at the site based on historical and recent information.

- Chapter 5, Nature and Extent of Contamination, describes the potential sources and measured distribution of CPOIs at the site, based on data collected during the RI.

- Chapter 6, Transport and Fate of Chemical Parameters of Interest, describes the transport and fate of mercury, calcite, and the other CPOIs at the site.

- Chapter 7, Human Health Risk Assessment, provides a summary of the HHRA. The complete HHRA report is presented under separate cover (TAMS, 2002b).

- Chapter 8, Baseline Ecological Risk Assessment, provides a summary of the BERA. The complete BERA report is presented under separate cover (TAMS, 2002a).

- Chapter 9, Conclusions, summarizes the major findings of the RI, as well as potential remedial action objectives.

- Chapter 10, References, presents references for all documents and personal communications cited in the main body of the report.

Onondaga Lake has been the subject of numerous investigations, both as part of this RI and as part of other programs (see Section 1.5). The investigations conducted as part of this RI were performed by Honeywell, unless otherwise indicated. Data reports on these investigations (with the exception of those conducted in 1999, 2000, 2001, and 2002) have been published as separate reports and are part of the public record for the site. Data obtained by Honeywell/Exponent for the 1999 and 2000 investigations and data collected by NYSDEC/TAMS in 2001 and 2002 are included in this RI report.

NYSDEC/TAMS obtained information regarding site history, including historical sources of contamination, in this RI report and the accompanying BERA and HHRA (TAMS, 2002a,b), from, among other sources, reports and materials prepared by Honeywell and its consultants. While the accuracy of the information provided by Honeywell and its consultants is accepted for purposes of the several reports, it must be noted that pursuant to paragraph 68 of the Consent Decree, discovery in the underlying litigation has been stayed. Consequently, the information furnished by Honeywell and its consultants, as well as information provided by third-party sources, has not been verified through the formal discovery process. The State reserves the right, consistent with and without limitation to its rights under paragraphs 33 and 34 of the Consent Decree and under state and federal law, to correct or amend any information in the RI and risk assessment reports if: (a) discovery is conducted, and (b) that discovery reveals information supporting such correction or amendment.

1.2 Site Description and Definition

Onondaga Lake is located adjacent to the city of Syracuse in Onondaga County, in central New York State (latitude 43°06′54″; longitude 76°14′34″) (Figure 1-1). The area around Onondaga Lake is the most urbanized area in central New York. In 2000, Onondaga County (population 458,336) was the tenth most populous county in the state (US Census Bureau, 2002). Syracuse (population 146,435) is located at the southern end of the lake, and numerous towns, villages, and major roadways surround the lake (Figure 1-2).

For consistency with the terminology in the Consent Decree, the site includes Onondaga Lake, its outlet, and tributaries that may have been directly affected by Honeywell operations. Among the tributaries directly affected by Honeywell are Ninemile Creek and its tributaries, Geddes Brook and the West Flume; Tributary 5A; the East Flume; and Harbor Brook (Figure 1-3). To the extent that any of the tributaries have

released and continue to release CPOIs to the lake, this RI addresses these contaminants. Honeywell has entered into consent orders to perform separate, comprehensive RI/FSs for each of the tributaries known to have been affected by Honeywell. Tributaries were evaluated by measuring sediment and water quality conditions at the mouths of the tributaries, and were also considered by evaluating their loadings of contaminants to the lake.

The site, with respect to this report and the related HHRA and BERA reports, is geographically defined as the lake, the mouths of the various lake tributaries, the lake outlet, and two lake-connected wetlands (Wetlands SYW-6 and SYW-12) (Figures 1-3 and 1-4). Lake-connected Wetlands SYW-10 and SYW-19 are being addressed under the Geddes Brook/Ninemile Creek RI/FS and the Wastebed B/Harbor Brook RI/FS, respectively. The dredge spoils area north of Ninemile Creek will be evaluated as a separate site with its own investigation. However, data obtained from these two wetlands and the dredge spoils area during the Onondaga Lake RI are presented in this RI report and associated risk assessments. The various tributaries that were investigated as part of this site, whether at the point they enter or exit Onondaga Lake, are shown on Figure 1-3 and include the lake outlet, Sawmill Creek, Bloody Brook, Ley Creek, Onondaga Creek, Harbor Brook, the East Flume, Tributary 5A, and Ninemile Creek. It should be noted that the risk assessments evaluated all contaminants found in the various media within Onondaga Lake, irrespective of the source of that contamination.

The Consent Decree, discussed earlier in this chapter, requires that an RI/FS be conducted which addresses "...contamination and the threat of further contamination of the Onondaga Lake System,[1] including the threat of further contamination [of the lake] posed by the ORAs[2], resulting from Honeywell's waste substances and the degradation products of such substances. The RI shall also identify and quantify other hazardous substances and contaminants that may be present in the OLS. To the extent necessary to accurately determine the impact on the OLS of Allied's waste substances, the RI shall evaluate other hazardous substances and contaminants."

Various "Other Relevant Areas" (ORAs), such as the Honeywell Willis Avenue site, are being investigated and evaluated independently of this Onondaga Lake RI/FS and are discussed in Chapter 4, Sources and Potential Sources of Chemical Parameters of Interest to Onondaga Lake. In addition to Honeywell's ORAs, Chapter 4 addresses other (i.e., non-Honeywell related) sources or potential sources of contamination to Onondaga Lake.

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[1] Onondaga Lake System (OLS), defined as "...the waters, beds and associated biota of Onondaga Lake, such tributaries of Onondaga Lake or portions thereof as may have been contaminated by Allied's [Honeywell] waste substances, including Geddes Brook and Ninemile Creek, and the outlet of Onondaga Lake known as the 'Lake Outlet.'"

[2] Other Relevant Areas, defined as "...the Waste Beds, the Semet Tar Beds, the Willis Avenue Site and such other areas, as identified in the RI/FS Workplan or identified by information generated during the course of the RI/FS, from which there is a release or threat of release of Allied's waste substances into the Onondaga Lake System."

1.3 History of the Site and Surrounding Area

This section summarizes the history of industrial activities and municipal wastewater issues related to Onondaga Lake. Figure 1-5 presents significant events in the history of Onondaga Lake. Unless otherwise noted, the information below is based on Honeywell's Onondaga Lake RI/FS Site History Report (PTI, 1992d).

1.3.1 General Industrial and Commercial Development

The salt springs near Onondaga Lake, first described by settlers in 1786, supported a major salt recovery industry that thrived during the nineteenth century and fostered the development of an extensive infrastructure in the region, including railroads and the Erie Canal system. Over time, this infrastructure supported the establishment of a number of additional industries near Onondaga Lake, including Honeywell's soda ash, benzene, toluene, xylenes, chlorinated benzenes, chlor-alkali, and hydrogen peroxide manufacturing facilities; petroleum-product storage facilities; a fertilizer production plant; a steel foundry; a manufacturing plant for vehicle accessories; a pottery and china manufacturing plant; and industries including pharmaceuticals, air conditioning, general appliances, and electronics manufacturing. In addition to industry, an evolving municipal wastewater management system, which has influenced the lake, has existed from the 1800s to the present.

The Onondaga Lake area experienced further residential and economic growth during the twentieth century. Paralleling the rise of development in the area, the population of Onondaga County rose from approximately 160,000 in 1900 to 458,336 in 2000 (US Census Bureau, 2002). Much of the population is, and has historically been, located in the Syracuse metropolitan area, which is located on the southeastern end of Onondaga Lake.

The industrial nature of this area, as well as the infrastructure and other development, influenced the site and contributed to its current condition. Honeywell facilities and disposal areas near the lake (Figure 1-3), in addition to other industrial facilities, are discussed below.

1.3.2 Honeywell Facilities and Disposal Areas near Onondaga Lake

Honeywell's predecessor companies operated manufacturing facilities in Solvay, New York, from 1881 to 1986 (see Chapter 4). The predecessor companies were:

- Allied Chemical and Dye Corp., which was incorporated on December 17, 1920 and included the following companies: General Chemical, Barrett Co., National Aniline and Chemical Co., Solvay Process Co., and the Semet Solvay Co.

- Allied Chemical and Dye Corp., which was renamed as Allied Chemical Corp. on April 28, 1958.

- Allied Chemical Corp., which was renamed as Allied Corporation on April 27, 1981.

- Allied Corporation, which merged into AlliedSignal, Inc. on September 18, 1985.

The availability of natural deposits of salt and limestone was the primary reason for locating the facilities in Solvay. The Solvay Process Company, founded in 1881, used the ammonia soda (Solvay) process to produce soda ash, a product used in a variety of applications, including the manufacture of neutralization agents, detergent, industrial chemicals, and glass. Honeywell subsequently expanded its operation to three locations – the Main Plant, the Willis Avenue plant, and the Bridge Street plant (see Figures 1-3 and 1-4) – which are collectively described in this report as the Syracuse Works. Figure 1-6 presents periods of production and production milestones for major product lines at the Syracuse Works.

The Syracuse Works had three major product lines, as follows:

- **Soda Ash** – The soda ash product line produced primarily light and dense soda ash (Na_2CO_3) and a variety of related products, including sodium bicarbonate ($NaHCO_3$, or baking soda), sodium nitrite ($NaNO_2$), ammonium bicarbonate (NH_4HCO_3), ammonium chloride (NH_4Cl), calcium chloride ($CaCl_2$), sodium sesquicarbonate ($Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$, or "snowflake"), and caustic soda (NaOH).

- **Chlor-Alkali** – The chlor-alkali product line produced primarily liquid chlorine, caustic soda (NaOH), and caustic potash (KOH). In addition, potassium carbonate (K_2CO_3) and potassium bicarbonate ($KHCO_3$) were produced by carbonating caustic potash. Hydrogen gas was produced as a byproduct of the chlor-alkali process and was used in the manufacture of hydrogen peroxide (H_2O_2) and as a fuel in the power section of the Main Plant.

- **Benzene, Toluene, Xylenes, and Chlorinated Benzenes** – The benzene, toluene, and xylenes product line produced benzene, toluene, and xylenes, heavy hydrocarbons (tars), and naphthalene. The chlorinated benzenes product line produced chlorobenzene, liquid and crystal paradichlorobenzene, liquid and emulsified orthodichlorobenzene, and trichlorobenzenes. Hydrochloric or muriatic acid (HCl) was a marketed byproduct of the chlorinated benzene product line and was also used to lower the pH of feed brine in the chlor-alkali processes.

The Main Plant at the Syracuse Works manufactured soda ash and related products from 1884 to 1986 and benzene, toluene, xylenes, and naphthalene from 1917 to 1970. The Willis Avenue plant manufactured chlorinated benzenes and chlor-alkali products from 1918 to 1977. Chlor-alkali production by the diaphragm cell process was in operation at the Willis Avenue plant from 1918 until 1977. The mercury cell process was used at the Willis Avenue plant for chlor-alkali production from approximately 1947 (or

possibly earlier) until 1977. Starting in 1953 (or possibly earlier), the Bridge Street plant produced chlor-alkali products, as well as hydrogen peroxide, using the mercury cell electrolytic process. The plant was sold to Linden Chemicals and Plastics (LCP) of New York in 1979. LCP continued to operate the plant until 1988.

In addition to the three major product lines, Honeywell facilities at the Main Plant produced coke and producer gas (a mixture of carbon monoxide, nitrogen, hydrogen, methane, carbon dioxide, and oxygen) for a limited time and generated electricity and steam for use in the manufacturing processes. Several products (i.e., nitric and picric acids; salicylic acid and methylsalicylate; benzyl chloride, benzoic acid, benzaldehyde, and phthalic anhydride; phenol; and hydrogen peroxide) were manufactured for only short periods of time as either startup operations that were later relocated or as part of pilot plant or developmental laboratory activity.

In addition, in 1919 the Barrett Division of the Semet-Solvay Chemical Company began a paving-material production facility, which was operated by AlliedSignal and its subsidiaries until 1983, when it was sold to the Penn-Can Corporation. The Penn-Can property is being investigated as part of the Wastebed B/Harbor Brook site (see Chapter 4, Figure 4-3).

The wastewater from the Bridge Street plant was discharged to the West Flume, a tributary to Geddes Brook, which in turn is a tributary of Ninemile Creek. Geddes Brook and Ninemile Creek are being investigated and evaluated as a separate site. The wastewater from the Main Plant and the Willis Avenue plant was initially discharged directly to Onondaga Lake, but as the waste material built up in front of the discharge point the waste stream was directed through the dredged channel that eventually became known as the East Flume. This is discussed further in Chapter 4, Section 4.5.1. The East Flume is being investigated and evaluated as part of the Wastebed B/Harbor Brook RI/FS being conducted by Honeywell.

Details on the raw materials, manufacturing processes, and waste materials associated with each of these products and activities are presented in Honeywell's Site History Report (PTI, 1992d) and follow-up correspondence to NYSDEC (W. Shepard, 1996, pers. comm.). Waste management is also discussed by PTI (1992b) and Blasland & Bouck (1989). Honeywell operated under a variety of National Pollutant Discharge Elimination System (NPDES) and State Pollutant Discharge Elimination System (SPDES) permits, which are detailed in Table 1-1.

An important feature of waste management at the Syracuse Works was the use of wastebeds located in Solvay (Solvay Wastebeds). The historical locations of the Solvay Wastebeds are shown in Figure 1-7. In brief, the wastebeds were utilized as follows:

- Wastebeds A through M were used to dispose of wastes from the manufacture of soda ash via the Solvay Process prior to the 1920s.

- Wastebeds 1 through 8 were used to dispose of wastes from the manufacture of soda ash via the Solvay Process from the 1920s to 1944. Wastebeds 1 through 8 were subsequently transferred to New York State and Onondaga County.

- Other uses were as a landfill for slag and wastewater treatment sludges from the Crucible Materials Corporation (Wastebed 5) and for Metropolitan Syracuse Sewage Treatment Plant (Metro) sewage sludge disposal (Wastebeds B, 5, and 12 through 15), sites for construction of parking lots for the New York State Fair (Wastebeds 5, 7, and 8), and construction of Interstate 690 (I-690) (Wastebeds 7 through 8).

- From 1944 to 1986, wastes from the soda ash and related operations were disposed in Wastebeds 9 through 11 and 12 through 15, as described by Blasland & Bouck (1989) and Blasland, Bouck & Lee (BBL, 1997).

Wastebeds 1 through 8 are to be investigated as part of a separate preliminary site assessment (PSA). Wastebeds 9 through 15 are currently being evaluated by NYSDEC's Solid Waste Program. These and additional wastebeds are discussed in more detail in Chapter 4, Section 4.3.

The Semet Residue Ponds were disposal lagoons for organic wastes from the Benzol Plant, which was part of the Main Plant. The lagoons were excavated out of the already existing Solvay Wastebed A, and filled with the tarry residue. It has been estimated by Honeywell (O'Brien & Gere, 1989) that the Semet Residue Ponds contain approximately 80 million gallons of residue.

The Wastebed B/Harbor Brook and Willis Avenue Ballfield sites (Figures 1-3 and 1-4) are two additional Honeywell sites. The Wastebed B/Harbor Brook site consists of three areas, including: 1) the Lakeshore Area, which was designated as Wastebed B, and received Solvay waste and other industrial wastes from approximately 1908 to approximately 1926, along with additional material into the 1950s; 2) the Penn-Can property, which has historically been and is currently used for production and storage of asphalt products; and 3) the CSX Railroad Area, which is located southeast of the Penn-Can property.

Previous environmental investigations conducted along Harbor Brook and its vicinity in 1996 and 1997 indicated that mercury, chlorinated benzenes, polycyclic aromatic hydrocarbon (PAH) compounds, and benzene, toluene, ethylbenzene, and xylenes (BTEX) are present within the sediments in the lower reach of the brook (O'Brien & Gere, 2002a). The Willis Avenue Ballfield site, which is the northwest and central portions of Wastebed C, received Solvay waste between approximately 1908 and 1926 (Blasland & Bouck, 1989). The western portion of the Ballfield site was utilized as a baseball field in the 1960s and 1970s and is suspected to have been used as a landfill for Honeywell wastes and debris in the 1940s (O'Brien & Gere, 2000a). Remedial investigations are currently being performed at these sites.

Based on a review of historic aerial photographs it appears that large amounts of Honeywell industrial wastes were discharged to the lake (e.g., via the East Flume), from at least 1938 until sometime between

1951 and 1959, where they built up into a delta of waste deposits. These combined wastes included the calcite-contaminated Solvay wastes, as well as other contaminants, including mercury, BTEX, chlorinated benzenes, PAHs, diphenylethanes (including 1-phenyl-1-[4-methylphenyl]-ethane [PTE] and 1-phenyl-1-[2,4-dimethylphenyl]-ethane [PXE]), and dioxins/furans. At that time, the waste deposits covered approximately 65 acres of the lake bottom. A further discussion of this in-lake waste disposal is provided in Chapters 4 and 5.

Honeywell, in cooperation with Onondaga County, dredged sediments contaminated with mercury from the delta of Ninemile Creek in Onondaga Lake in the late 1960s. The sediments were disposed of in basins constructed in wetlands along the shoreline of the lake just north of the mouth of Ninemile Creek (Figure 1-3). These dredge spoils are further discussed in Chapter 5.

Information from investigations of these upland Honeywell sites has been incorporated into this RI report with respect to the role of these sites as contaminant sources to Onondaga Lake.

1.3.3 Other Industrial and Municipal Facilities

While this RI emphasizes Honeywell sites and contaminants to the lake, as discussed in Section 1.2 of this chapter, there are other industrial facilities in the Onondaga Lake watershed whose location and activities help to interpret the contaminant distributions described in Chapter 5, based on data collected by Honeywell and NYSDEC for this RI. These other industrial facilities are further discussed in Chapter 4, and a map showing the locations of certain of the other sites is included in that chapter as Figure 4-15.

There are several industrial facilities or sites that are known to be either contributors or potential contributors of contaminants to Ley Creek. These include:

- The General Motors – Former Inland Fisher Guide (GM – IFG) Facility and Ley Creek Deferred Media Site.
- The GM Ley Creek Dredgings Site (which has been remediated).
- The Town of Salina Landfill.
- GM – Old Ley Creek Channel Site.

The lakefront area between Ley Creek and Harbor Brook contains several facilities or former facilities that have potentially contributed contamination to the lake or Onondaga Creek, including:

- The historical operations of the facilities in the Oil City area.
- The former Niagara Mohawk Power Corporation manufactured gas plants (MGPs) located on Hiawatha Boulevard on the south bank of the mouth of

Onondaga Creek (current location of the Metro sewage treatment plant) and farther upstream on Onondaga Creek at Erie Boulevard.

- The American Bag and Metal site on Onondaga Creek.
- Roth Steel, located between Onondaga Creek and Harbor Brook.

Other contributors or potential contributors include:

- The Crucible Materials Corporation plant and the Crucible Lake Pump Station disposal site at Crucible Bay, which potentially contributed to contamination in Tributary 5A and the lake.
- The Electronics Park facility (formally operated by General Electric [GE] and currently operated by Lockheed Martin) potentially contributed to contamination in Bloody Brook.

Remedial programs are being pursued at these sites, as appropriate. Separate PSA and/or RI/FS reports have been completed or are currently being prepared for some of these sites. Further, additional remedial programs may be required at these or other sites in the future.

In the early 1800s, Onondaga Lake was receiving untreated industrial and domestic wastes. Around the turn of the twentieth century, a combined sewer system, a single system that transmits a combination of domestic and industrial flows as well as stormwater originating from various sources, was installed that discharged into tributaries and ultimately the lake.

The first primary sewage treatment facility in the Syracuse area was constructed in 1925 at the southern end of Onondaga Lake. An additional major treatment plant was built in 1940 on Ley Creek. During the 1950s, Onondaga County established a sewer district that encompassed the City of Syracuse and some surrounding suburban areas. A new primary treatment plant, the Onondaga County Metropolitan Syracuse Wastewater Treatment Plant (Metro), was constructed in 1960 with a 50 million gallons per day (mgd) design capacity (Onondaga Lake Management Conference [OLMC], 1993).

The Metro sewage treatment plant, which serves the city of Syracuse and several surrounding towns, is currently permitted (NY-0027081) to discharge an average of 80 mgd through its main outfall to Onondaga Lake. The plant provides tertiary treatment for flows up to 120 mgd. For combined stormwater and industrial/domestic sewage flow up to 220 mgd, the incremental flow above 120 mgd receives primary treatment and seasonal chlorination prior to discharge into the lake through a second outfall.

The sewers contain hydraulic relief structures otherwise known as combined sewer overflows (CSOs), which have historically allowed diluted sewage (due to the mixing of stormwater and sewage) to discharge to several tributaries of Onondaga Lake during high flow events. In 1985, Phase I of a program to abate

CSOs was implemented. The second phase of the CSO abatement program began in 1990. Additional abatement activities associated with the CSOs are underway as discussed below.

In January 1998, an Amended Consent Judgment (ACJ) (88-CV-0066) was executed by NYSDEC, the State Attorney General, Atlantic States Legal Foundation, and Onondaga County. The ACJ evolves from a 1989 Judgment on Consent (88-CV-0066) settling litigation between the State of New York and the county relating to state and federal water pollution control regulations.

The ACJ, which is designed to improve the water quality of Onondaga Lake, specifically includes a listing of over 30 projects to be undertaken by Onondaga County over a 15-year period. Although completion of the entire project is not required until 2012, many of these county projects are scheduled for completion by 2009 (Onondaga County Department of Water Environment Protection [OCDWEP], 2002) .

The projects may be grouped into three categories, including:

- Improvement and upgrading of the county's main sewage treatment plant (Metro).
- Eliminating and/or decreasing the effects of the CSOs on the lake and its tributaries.
- Performance of a lake and tributary monitoring program designed to evaluate the effects of the improvement projects on the water quality of the lake and its tributaries.

1.4 Regulatory History

Table 1-1 summarizes key discharge permits and consent orders related to various Honeywell and Onondaga County facilities and activities around the lake. For Honeywell sites, the RI report for the Semet Residue Ponds (O'Brien & Gere, 1991) was approved by NYSDEC and the LCP Bridge Street facility RI report was completed by NYSDEC/TAMS (1998c). The Record of Decision (ROD) for the Semet Residue Ponds was issued by NYSDEC and USEPA in March 2002. The ROD for Operable Unit 1 (OU-1) of the LCP Bridge Street site was issued by NYSDEC in September 2000. Demolition of the buildings at the LCP Bridge Street site was completed as an interim remedial measure (IRM). Remedial construction activities will commence once the remedial design has been completed. An RI/FS for OU-2 of the LCP Bridge Street site is underway.

The Willis Avenue site RI/FS (including Tributary 5A) is underway. A revised RI report (O'Brien & Gere, 2002e) is under review by NYSDEC. Honeywell performed PSAs, and is currently conducting RI/FSs, for the Wastebed B/Harbor Brook and Willis Avenue Ballfield sites. The East Flume and the lower reach of Harbor Brook are included in the Wastebed B/Harbor Brook site. The first phase of data collection for an RI of Geddes Brook and Ninemile Creek was completed in 1998 (Exponent, 1998b). A second phase of data collection for sediment and floodplain soil took place from February to April 2001, as required by

NYSDEC for inclusion in the revised RI and risk assessment reports and for preparation of an IRM in Geddes Brook/Ninemile Creek (BBL, 2000). The revised Geddes Brook/Ninemile Creek RI report was submitted to NYSDEC in November 2001, rejected by NYSDEC in February 2002, and is currently being rewritten by NYSDEC. Additional floodplain sampling in Ninemile Creek was performed by Honeywell during the fall of 2002. Young-of-year (YOY) fish sampling was performed by NYSDEC/TAMS in Ninemile Creek in October 2002. Honeywell is performing a PSA for the Mathews Avenue Landfill site pursuant to an order on consent and a NYSDEC-approved work plan.

1.5 Summary of Previous Investigations of Onondaga Lake

Onondaga Lake has been the subject of intensive study for many years. Much of the research on the lake, with the exception of recent RIs, has been summarized in a report titled "The State of Onondaga Lake," which was prepared for the Onondaga Lake Management Conference (OLMC) by the Upstate Freshwater Institute (UFI) (UFI, 1994), and in the text *Limnological and Engineering Analysis of a Polluted Urban Lake*, edited by Steve Effler of UFI (Effler, 1996). The report and book summarize studies on the hydrogeologic setting; tributaries and discharges; hydrodynamics and transport; and chemistry, biology, optics, sediments, and mechanistic modeling of water in Onondaga Lake. Several academic studies, government reports (including state and county monitoring results), and reports prepared for private industry are summarized in UFI (1994) and Effler (1996).

The investigations performed as part of this RI (see Chapter 2) focused on CPOIs that may be attributed to Honeywell operations in the area of the site (see Sections 1.3 and 1.6), as well as to other non-Honeywell sources. The RIs for the Semet Residue Ponds, the Willis Avenue site, the LCP Bridge Street site, Wastebed B/Harbor Brook site, the Willis Avenue Ballfield site, and Geddes Brook/Ninemile Creek (discussed above) also consider the impact of Honeywell operations in the area of the site and are referenced in this report. Results from these upland, or upstream, RIs are discussed in this report because these upland sites and associated tributaries serve as sources of CPOIs to Onondaga Lake. Transport of CPOIs from non-Honeywell sites is discussed only in general terms, as it was not the focus of this investigation.

This RI report relies primarily on data acquired by Honeywell and NYSDEC and submitted in data reports described in Table 1-2. Other data sources considered for the RI are included in the table.

1.6 Chemical Parameters of Interest

The CPOIs for the RI are defined as those elements or compounds that were selected as COPCs, COCs, or SOCs in the BERA and HHRA (TAMS, 2002a,b). The COPCs that were selected for evaluation in the HHRA are presented in Table 1-3. The COCs and SOCs that were selected for evaluation in the BERA are presented in Table 1-4 for lake media and Table 1-5 for wildlife receptors. Consistent with USEPA guidance, the methods used to select COPCs, COCs, and SOCs were intended to ensure that no chemicals detected at levels of potential human health or ecological concerns were excluded. Justification for selection of these COPCs, COCs, and SOCs is discussed in detail in the human health and

ecological risk assessments, which are summarized in Chapters 7 and 8, respectively, of this RI report. The complete HHRA and BERA reports are provided under separate cover (TAMS, 2002b,a).

Consistent with USEPA guidance, COPCs for the HHRA were selected by comparing site concentrations to conservative risk-based concentrations (RBCs) derived by USEPA. The COPCs identified in the HHRA are fully inclusive of the list of COPCs identified in the Public Health Assessment for Onondaga Lake (NYSDOH, 1995). For the BERA, COCs/SOCs for specific media, including water, sediment, soil, and fish (Table 1-4), were selected by comparing site concentrations to the minimum (i.e., most conservative) screening criterion when available, or retained based on known discharges by Honeywell. COCs for mammals and birds (Table 1-5) were identified through the calculation of screening hazard quotients (HQs) that compared daily intake rates from ingestion of prey, surface water, and sediment or soil to toxicity reference values (TRVs). The lists of COPCs, COCs, and SOCs derived in the HHRA and BERA are distinct from the list of substances described in the Consent Decree and update the COPC list presented in the Onondaga Lake RI/FS Work Plan (PTI, 1991c).