**Biological Fact Sheet - Cooling Water Intake Structure**

**Bureau of Habitat, Steam Electric Unit**

**Name of Facility:** Lake Source Cooling Plant  
**Owner/Operator:** Cornell University  
**SPDES #:** NY-0244741  
**Location:** Tompkins County, New York  
City of Ithaca  
Cayuga Lake

1. **Description of Facility**  
The Cornell Lake-source Cooling System (LCS) began operation in 2000. The system is designed to withdraw up to 46 million gallons per day of water from Cayuga Lake at a depth 250 to cool campus buildings. Lake water at that depth is approximately 40 degrees F year round. The cold water pumped from the lake bottom is passed through a heat exchanger, located on shore, which absorbs some of the heat in water used to cool the Cornell Campus and Ithaca High School.

The intake is an octagonal structure made up of 2.0 mm wedge wire screen panels, resting 10 feet above the lake bottom. Each screen panel is 8 feet high by 4 feet wide. The intake has a solid cap so that water is withdrawn from the horizontal plane only. The design intake velocity is 0.50 feet per second (fps) with 50% of the area of the slots plugged (velocity = 0.25 fps when clean). A 63 inch diameter HDPE pipe extends from the structure along the lake bottom for a distance of approximately 2 miles, connecting to the onshore heat exchange facility. Cleaning of the screen panels is done manually, but this has seldom been necessary.

2. **Ecological Resource**  
Cayuga Lake is located in the Oswego River drainage basin. The lake, of glacial origin, is oriented on a northwest-southeast axis and is 39 miles long, and averages 1.7 miles in width. Maximum lake width is 4 miles and maximum depth is 435 feet. The total surface area of the lake is 67 square miles and the total lake volume is 331 billion cubic feet. The lake bottom is steep sided along its east and west shorelines, with the north and south ends being relatively shallow (NYSEG 1975).

Cayuga Lake is considered to be oligotrophic, and has clear well oxygenated water at all depths. The lake is well noted for fine trout and salmon fishing. In the open water of the central lake basin, cold water species such as lake trout, rainbow trout, brown trout, chinook salmon, cisco and whitefish are found. Sculpin and burbot inhabit the deep bottom waters. The littoral region, located along the north and south ends and in a narrow zone along the lake’s east and west shores, supports a warm water fishery. Northern pike, chain pickerel, largemouth bass and brown bullhead are important sport fish of the littoral zone. Other important warm and/or cool water species include smallmouth bass, yellow perch and panfish such as rockbass. Alewife, a major forage species in the lake, migrates to these inshore areas to spawn during June and July (NYSEG 1975).
A freshwater crustacean, a mysid shrimp (*Mysis relicta*), is found throughout Lake Cayuga in the deep cold regions (i.e., hypolimnion). Though found near the lake bottom during the day, the species does migrate vertically at night. This species is considered to be an important component of the Lake Cayuga ecosystem and was studied extensively prior to the operation of the LCS. Studies demonstrated that the mysids were found throughout the hypolimnetic region of the lake and were not endemic to the southern lake area were the LCS is operated.

Cayuga Lake in the area of the cooling water outfall is designated a class A water. The best usage of Class A waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival (NYSDEC 2008a). The south basin of Cayuga Lake is currently on the Federal Clean Water Act Section 303(d) list of Impaired Waters due to excessive levels of phosphorous, silt/sediment and pathogens, originating from both municipal and non-point sources of pollution.

The cooling water intake was constructed with 2.0 mm wedge wire screen panels in order to eliminate the impingement/entainment of adult and older juvenile fish. This technology exceeds the impingement performance goals of CP-52 thereby meeting the BTA requirements for impingement mortality. Although fish eggs and many larvae can pass through a 2.0 mm slot, it was thought that at that depth they would either not be found or present in such low numbers as to not be of concern. A low intensity light was also installed to keep freshwater mysids (*Mysis relicta*) away from the intake. However, studies have not shown this deterrent system to be effective, and it is no longer in use. In addition, light sources have been shown to attract fish so it was possible that the use of a light deterrent system for the mysids could increase the entrainment of fish eggs and larvae through the LCS.

Biological monitoring for the entrainment of ichthyoplankton (fish eggs and larvae) and mysids occurred from 2000-2005. Based on the results of this study it was estimated that, on average, 35,769 eggs were entrained each year (range: 0 – 134,675). The only species to be identified were alewife with more than 90% of the eggs unidentifiable. In addition, an average of 2,648 fish larvae were estimated to be entrained each year (range: 0 – 4,660). The entrained larvae were made up of yellow perch (36.2%), rainbow smelt (24.5%), alewife (19.8%), and slimy sculpin (14.2%). It was also estimated that several million mysids were entrained annually.

### 3. Alternatives Evaluated
Feasible technologies such as wedge wire intake screens and behavioral deterrent systems were evaluated at this facility during the State Environmental Quality Review (SEQR) process. If the results of the *Entrainment Characterization Study* demonstrate that the current design, capacity, and location of the CWIS does not meet the entrainment performance goal of CP-52, the current permit requires the submission of a Design Construction Technology Review to assess all feasible technologies and/or operational
measures to minimize adverse environmental impact from operation of the Cornell lake Source Cooling intake.

4. Discussion of Best Technology Available
According to 6NYCRR Part 704.5 - Intake structures and Section 316(b) of the federal Clean Water Act, the location, design, construction, and capacity of cooling water intake structures must reflect the “best technology available” (BTA) for minimizing adverse environmental impact. The identification of BTA is a technology driven determination, however, the final decision may also consider cost. For existing facilities with cooling water intake structures, the Department expects that the performance goals of Commissioner Policy #52 will be achieved from the implementation of these permit conditions.

5. Determination of Best Technology Available
After evaluating all of the available alternatives, the Department will determine the technology or combination of technologies and/or operational measures which are BTA for minimizing adverse environmental impacts from the cooling water intake structure(s). This decision may take into consideration those technologies reasonably borne by the facility and determined to be more cost effective in meeting the requirements of 6 NYCRR §704.5, §316(b) CWA, and the performance goals of Commissioner Policy #52.

6. Monitoring Requirements
This permit requires an assessment of ichthyoplankton entrainment and sampling of ichthyoplankton in the near-shore zone in 2014. If additional technology or operational measures are determined to be required, a verification monitoring study will be required to confirm that the reduction in entrainment required by this permit will be achieved.

7. Legal Requirements
The requirements for the cooling water intake structure in this State Pollutant Discharge Elimination System permit are consistent with the policies and requirements embodied in the New York State Environmental Conservation Law, in particular - Sec.1-0101.1.; 1-0101.2.; 1-0101.3.b., c.; 1-0303.19.; 3-0301.1.b., c., i., s. and t.; 11-0107.1; 11-0303.; 11-0535.2; 11-1301.; 11-1321.1.; 17-0105.17.; 17-0303.2., 4.g.; 17-0701.2., and the rules thereunder, specifically 6NYCRR Part 704.5 Section 316(b) CWA, and the performance goals of Commissioner Policy #52.

8. Summary of Proposed Permit Changes

<table>
<thead>
<tr>
<th>Deletions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Biomonitoring Special Conditions Sections I and II</td>
</tr>
<tr>
<td>Delete and replace with updated conditions and requirements contained in new Biological Monitoring Requirement (BMR) Nos. 1-10 and Cayuga Lake Water Quality Model Plan</td>
</tr>
</tbody>
</table>
### Additions

<table>
<thead>
<tr>
<th>BMR No.</th>
<th>Description</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1.</td>
<td>Entrainment Characterization Study</td>
<td>Assess the entrainment abundance of fish eggs and larvae.</td>
</tr>
<tr>
<td>No. 2.</td>
<td>Design Construction Technology Review</td>
<td>Analyze feasible technologies and operational measures to minimize adverse environmental impact.</td>
</tr>
<tr>
<td>No. 3.</td>
<td>Proposed Suite of Technologies and Operational Measures</td>
<td>Applicant to submit proposal to minimize entrainment and meet requirements of 6 NYCRR Part 704.5 and CP-52.</td>
</tr>
<tr>
<td>No. 4.</td>
<td>Technology Installation &amp; Operation Plan</td>
<td>Submit approvable plan to install and operate technologies approved to meet requirements of 6 NYCRR Part 704.5 and CP-52.</td>
</tr>
<tr>
<td>No. 5.</td>
<td>Verification Monitoring Plan</td>
<td>Submit approvable plan designed to confirm reductions in entrainment required by permit are being achieved.</td>
</tr>
<tr>
<td>No. 6.</td>
<td>Verification Monitoring Plan Report</td>
<td>Submit an approvable report demonstrating compliance with 6 NYCRR Part 704.5 and Section 316(b) of the CWA.</td>
</tr>
<tr>
<td>No. 7.</td>
<td>Additional Reporting Requirement</td>
<td>Maintain pertinent records for minimum 10 year period.</td>
</tr>
<tr>
<td>No. 8.</td>
<td>Status reports</td>
<td>Submit status reports at EDP + 2.5 years showing compliance with Biological Requirements 1-6 of permit.</td>
</tr>
<tr>
<td>No. 9.</td>
<td>Cumulative Reductions Report</td>
<td>Submit a report by EDP + 4.5 years showing cumulative reduction in entrainment over past 4 years and measures that may further reduce fish mortality at Cornell LSC intake.</td>
</tr>
<tr>
<td>No. 10.</td>
<td>General Requirement</td>
<td>Requirement to obtain Department approval for any changes made to the location, design or capacity of the cooling water intake.</td>
</tr>
</tbody>
</table>

### 9. References


Document prepared by Michael Calaban and last revised on 11 October 2012.