Biological Fact Sheet - Cooling Water Intake Structure
Bureau of Habitat, Steam Electric Unit

Name of Facility: Greenidge Generating Station
Owner/Operator: Greenidge, LLC.
SPDES #: NY0001325
Location: Yates County, New York
Town of Dresden
Seneca Lake

1. Description of Facility

The Greenidge Generating Station is a 161 megawatt (MW) electric generating station, located on the western shoreline of Seneca Lake. The station formerly consisted of six coal fired boilers and four generators, first constructed in the 1930's. Units 1 and 2 were taken out of service in 1985. Unit 3, which began operation in 1950, was retired in 2009. This cooling water intake structure for Unit 3 still operates service water pumps, boiler water pumps, and ancillary cooling water pumps for a total maximum daily withdrawal of 7.92 MGD. The remaining Unit 4 has an above ground intake pipe, terminating in an intake structure surrounded by louvers approximately 800 feet offshore. No intake screens are used. Debris removal is accomplished by back flushing the unit's condensers. The station's current generating capacity is listed at 107 MW, and cooling water withdrawal for Unit 4 is approximately 131 MGD at design flow.

Cooling water is discharged through a dug canal into the Keuka Lake outlet. The station's SPDES permit requires a summer delta T limit of 26°F, and maximum discharge temperature of 108°F. During winter, the permit limits the delta T to 31°F, and the maximum discharge temperature to 86°F.

On March 18, 2011 the Greenidge Generating Station was taken off line. In 2014, the current owner, Greenidge Generation, LLC, applied to renew the SPDES permit and resume operation of Unit 4.

2. Ecological Resource

Seneca Lake is the second longest Finger Lake, measuring 35.1 miles in length, with an average width of 1.9 miles. Carved by glaciers, the lake basin is steep sided in an east to west direction, and has an average depth of 290 feet with a maximum depth of 651 feet. Seneca is the largest Finger Lake in terms of volume, containing more than 4.2 trillion gallons of water (HDR/LM&S Engineers 2005).

Seneca Lake is best characterized as oligo-mesotrophic, (*i.e.,* having between unproductive and moderately productive levels of nutrients). The clear waters are well oxygenated at all depths throughout the growing season. The portion of the lake within a one mile radius of Keuka Lake outlet is classified as B(T). Waters with a B(T) classification are trout waters and the best usages are for primary and secondary contact recreation and fishing. B(T) waters shall be suitable for fish, shellfish and wildlife propagation and survival.

Fish impingement and entrainment studies were conducted at the station in 1976-77, 1993-94 and 2006-07. Approximately 29,000 fish, mainly alewife, were estimated to be impinged over a one year period during the first study. Approximately 23.3 million fish were entrained, predominantly rainbow smelt larvae. Unfortunately, a number of limitations prevent any valid conclusions to be made from the 1993-94 studies. In the 2006-07 study, an estimated 6,200 juvenile and adult fish, primarily sunfish (*Lepomis* spp.), brown bullhead and banded killifish were entrapped annually. Annual entrainment was estimated to be 425,850 with alewife eggs, white sucker post-yolk-sac larvae, and banded killifish juveniles most abundant. Given that the existing CWIS is not equipped with any screens, all of these fish (from egg to adult) are entrapped in the cooling system and killed.

3. Alternatives Evaluated

A *Design and Construction Technology Plan (DCTP)* was submitted in August 2010 and was subsequently approved by the Department in February 2011. The plan included the analysis of potential alternatives such as closed-cycle cooling, wedge-wire intake screens, fine-mesh modified traveling intake screens, barrier nets, an aquatic filter barrier, behavioral deterrents, variable speed pumps, a velocity cap structure, and fish protective outages. Several alternatives were determined to be potentially feasible, however, only closed-cycle cooling, and a combination of narrow slot-width (less than 1.0 mm) wedge-wire screens and variable speed drives on the cooling water pumps could be expected to minimize both impingement and entrainment.

4. Determination 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 cooling water intake structure lacks any fish protection technology, therefore the facility does not meet either the requirements of 6 NYCRR § 704.5 nor the requirements of the CWA § 316(b) Phase II Rule (40 CFR Parts 122 and 125).

The Department has determined that narrow slot-width wedge-wire screens with a slot-width of 1.0 mm or less and variable speed drives on the cooling water pumps represents BTA for this facility. This determination is based on the following assessment of the site specific cost and benefits of closed-cycle cooling and wedge-wire intake screens. All other technologies assessed reduce impingement mortality (by varying degrees) but have little impact on reducing entrainment, or the cost was much higher than for wedge-wire screens for a similar entrainment reduction benefit (*e.g*, fine mesh Ristroph-type modified traveling screens and fish protective outages).

Closed-cycle cooling provides the greatest reduction in impacts, reducing cooling water use from 93 to 98%. Cooling towers may be feasible technology for Unit 4, however a more detailed site assessment would still be necessary to fully demonstrate this. Based on the Department's review of wedge-wire screen literature, and the fish species and life stages susceptible to entrainment at this facility, by operating narrow slot-width (≤ 1.0 mm) cylindrical wedgewire screens and

variable speed drive pumps, impingement mortality will nearly be eliminated with entrainment reductions likely 85 percent or greater from baseline (EPRI 2003, EPRI 2005, EPRI 2006, EPRI 2007, ASA 2017). Therefore, the Department believes that narrow slot-width wedge-wire screens in combination with the reduced water withdrawal from the use of variable speed drivers on the cooling water pumps will provide reductions in impingement mortality and entrainment equivalent to that achievable with closed-cycle cooling.

Based on projecting the capacity utilization data reported by NYISO from 2006-2010, the annual cost of retrofitting and operating closed-cycle cooling on Unit 4 would be approximately 8.4% of the gross annual revenue prior to when the facility closed. In addition, because of feasibility uncertainties and the additional energy required to operate a hybrid system, Department staff did not select closed-cycle cooling as BTA.

5. Monitoring Requirements

Following approval of the schedule for implementing the alternative(s) selected as BTA, and the methodology for assessing their efficacy, the permittee is required to submit a *Verification Monitoring Plan* for Department review and approval. The plan details the procedures necessary to confirm that the reductions in impingement mortality and entrainment required by this permit are being achieved. The specific requirements of the monitoring plan are set forth in Biological Monitoring Requirement No. 7 of the modified SPDES permit.

6. 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. Additionally, the requirements are consistent with the Clean Water Act, in particular Section 316(b) and exceed those required by 40 CFR Part 125.

7. Summary of Proposed Permit Changes

Permit Condition	Change
Biological Monitoring Requirement No. 1.	Identifies the final BTA selection of narrow slot-width (0.5≥1.0mm) cylindrical wedgewire screens and variable speed drive pumps.
Biological Monitoring Requirement No. 2.	Variable Speed Drive installation schedule requirement.
Biological Monitoring Requirement No. 3.	Required timeline to install Variable Speed Drive Pump capabilities.
Biological Monitoring Condition No. 4	Cylindrical Wedge Wire Screen Pilot Study
Biological Monitoring Requirement No. 5.	Technology Installation and Operation Plan requirement
Biological Monitoring Requirement No. 6 & 7	Verification Monitoring Requirements
Biological Monitoring Requirement No. 8 & 9	Sets performance requirements for entrainment and impingement reduction.
Biological Monitoring Requirement No. 10 & 11	Reporting requirements
Biological Monitoring Requirement No. 12	Modifications to CWIS require Department approval.
Biological Monitoring Requirement No. 13.	Requires submittal of a Contingency Plan to Meet BTA requirements if the wedge wire screen pilot study (Condition no. 4) determiners that wedge wire screens are not a feasible technology at this site.

8. References

ASA Analysis and Communication. 2017. Greenidge Generating Station – Response to NYSDEC Information Request.

ASA Analysis and Communication. 2010. AES Greenidge. Design Construction Technology Review. Prepared for AES Greenidge, LLC. August 2010.

EPRI (2007). Chapter 5: Cylindrical Wedgewire Screens *In* Fish protection at cooling water intake structures: A technical reference manual. Palo Alto, CA, Electric Power Research Institute (EPRI). Report No. 1014934. December 2007. pp. 5-1 to 5-43.

EPRI (2006). Field evaluation of wedgewire screens for protecting early life stages of fish at cooling water intake structures. Palo Alto, CA, Electric Power Research Institute (EPRI). Report No. 1012542. June 2006. 126 pp.

EPRI (2005). Field evaluation of wedgewire screens for protecting early life stages of fish at cooling water intakes. Palo Alto, CA, Electric Power Research Institute (EPRI)**.** 130 pp.

EPRI (2003). Laboratory evaluation of wedgewire screens for protecting early life stages of fish at cooling water intakes.

HDR/LM&S Engineers. 2010. AES Greenidge Station. Impingement and Entrainment Characterization Study. Prepared for AES Greenidge, 29 April 2010.

HDR/LM&S Engineers. 2005. Proposal for Information Collection with Section 316(b) Phase II Requirements of the Clean Water Act for Greenidge Generationg Station. Prepared for AES Greenidge. October 31, 2005.

Document prepared by William C. Nieder and last revised on 17 March 2017.