

# Willow Island Hydroelectric Plant - FERC Project No. 6902-WV

## Project Background and New Construction since 2017

The Willow Island Hydroelectric Plant commenced operations in 2016. Since submittal of the original application to LIHI in 2017, conditions at the site have remained relatively static. A new warehouse was erected on site in 2020.

## Mussel Monitoring Summary

The mussel-monitoring plan for the Willow Island Project was approved by FERC in 2010. AMP has contracted with EA Engineering, Science, and Technology Inc. and Lewis Environmental Consultants to perform:

- Pre-construction surveys,
- 2007 and 2008 mussel relocations at Willow Island,
- 2010 baseline monitoring,
- 2012 and 2014 construction phase surveys, and
- 2016 and 2018/2019 operational phase monitoring surveys.

Statistical analyses performed on 2018/2019 and prior survey data for the Willow Island Hydroelectric Project indicate that the mussel community downstream from the Project has remained generally comparable to previous years of monitoring.

For the quantitative total abundance, all survey years were statistically similar on both the Ohio and West Virginia shorelines. For the semi-quantitative total abundance on both shorelines, mean densities in the 2012 through 2018/2019 surveys were statistically similar but all were significantly higher than that of the 2010 baseline survey. The mean number of juveniles per sample for each study type in the 2018/2019 survey is statistically similar to all previous study years except the 2014 survey. Among the most common species collected in the 2018/2019 semi-quantitative and quantitative surveys, only one species (Pink Heelsplitter) exhibited a significant decrease from a previous survey year, however there was no significant decrease in the species from the 2010 baseline survey year. Results from the 2018/2019 mussel surveys did not vary beyond the range of values previously observed.

In regard to statistical analysis of mean grain size, the pebble count data exhibited significantly different (larger) grain size on the West Virginia shoreline compared to the Ohio shoreline in 2018/2019 as it had in nearly all previous survey years. However, 2018/2019 mean grain size was significantly different (larger) than the 2010 baseline survey along both the Ohio and West Virginia shorelines. Based on the mussel survey results, the size range and substrate composition available did not appear to have a negative effect on the downstream mussel community.

While some observed spatial or temporal differences are evident among survey years, these appear to be attributable to natural variability in density within the mussel community and/or a result of sustained high Ohio River flows observed in recent years in the vicinity of the Project. Analysis of the 2018/2019 survey data, alone or in comparison to previously collected data, provided no discernable or consistent trends that suggest the Willow Island Hydroelectric Project has adversely affected the downstream mussel community. Rather, the fact that 2018/2019 substrate and mussel survey results are within the previously observed range of values suggests that other factors such as inter-annual variability, method bias, and/or prevailing high flow conditions are more likely contributing to the observed differences.

## Willow Island Hydroelectric Plant - FERC Project No. 6902-WV

The 2020 Willow Island Mussel Survey was completed on July 31<sup>st</sup> and AMP's consultant, EA Engineering, submitted a draft mussel monitoring report to consulting agencies on September 25<sup>th</sup>. Comments were received from USFWS on October 23<sup>rd</sup> which were subsequently addressed by AMP and included in the November 12<sup>th</sup> final submittal to FERC. Per AMP's approved mussel monitoring plan, 2020 was the final year of mussel monitoring at the Project. Following submittal of the 2020 mussel monitoring report to FERC, AMP submitted a compendium report on April 29<sup>th</sup>, 2021 documenting completion of requirements under Article 412 of the Projects license. As of June 9<sup>th</sup>, no comments have been received from FERC or the consulting agencies on the compendium report.

### Water Quality Report Summary

Dissolved oxygen (DO) is monitored at the Willow Island Hydro Plant per Article 402 of the projects FERC license. DO data is sampled on the upstream and downstream sides of the hydro plant between May 1<sup>st</sup> and October 31<sup>st</sup> of each year. Samples are recorded automatically every 15 minutes during the period. The raw data obtained from the WQ Data Live website is downloaded and processed to generate the annual report by averaging the raw data into daily data for the monitoring period. A summary of DO monitoring from 2016-2020 can be found below:

**2016** – DO measurements met or exceeded license requirements over the 2016 monitoring period. On 8/6/2016, an upstream probe briefly dropped below the 24 hour average requirement, however, it was determined that the probe was defective. Upon replacement, the new probe provided readings well within specified DO parameters.

**2017** – DO measurements met or exceeded license requirements over the 2017 monitoring period. Upstream probe failure and data communication failures led to intermittent data loss, however, daily averages were available for all days in the monitoring period. The missing data did not appear to have a significant impact as the days with missing data were consistent with surrounding daily averages. Throughout the monitoring period, the 24 hour and instantaneous DO readings were all within acceptable range and the 24-hour average downstream DO concentrations were consistently above 5 mg/L.

**2018** – DO measurements met or exceeded license requirements over the 2018 monitoring period. There was a probe failure on the downstream DO probe that caused some low/inaccurate readings. The probe was promptly replaced and the downstream DO returned to acceptable ranges. As a precaution both probes were replaced with upgraded models towards the end of the 2018 DO monitoring period. Outside of the issues experienced with the downstream DO probe, the DO during the 2018 monitoring period was within acceptable ranges and consistently above 5 mg/L over a 24-hour average.

**2019** – DO measurements met or exceeded license requirements over the 2019 monitoring period. Daily 24-hour averages were within acceptable limits for the duration of the monitoring period on the downstream DO probe. There was a roughly six-hour period of time when the upstream 24-hour average DO was below 5 mg/L on 9/22/2019. Although this was noted in the DO report submitted to FERC and consulting agencies, the Dissolved Oxygen monitoring plan prepared in accordance with Article 402 of the license specifies that the 5 mg/L 24-hour average limit applies only to downstream DO data.

## Willow Island Hydroelectric Plant - FERC Project No. 6902-WV

**2020** –DO measurements met or exceeded license requirements over the 2020 monitoring period. Following submittal of a draft report to consulting agencies on November 30, the 2020 DO report was submitted to FERC on December 31, 2020. No comments have been received on the report to date.

Following year five (2020) of annual DO monitoring at Willow Island, a comprehensive DO report was required for FERC submittal by 12/31/2020. Because this date fell on the same deadline as the annual report, AMP requested an extension of time to complete the five-year report. FERC granted an extension on December 18<sup>th</sup> that extended the deadline for report completion to March 31, 2021. The purpose of the report was to analyze the available monitoring data from 2016-2020 at the project and determine whether new trends in the DO concentrations had become apparent since the commencement of operations at Willow Island. EA Engineering was contracted to complete the report on AMP's behalf and the final report concluded that the project is not negatively impacting downstream DO concentrations on the Ohio River. AMP submitted the final comprehensive report to FERC and consulting agencies on Mar. 31, 2021. No comments have been received on the comprehensive DO report to date.

### Fish Entrainment Studies

The Clean Water Act Section 401 Water Quality Certification issued by the State of West Virginia for the Willow Island Hydroelectric Project includes a condition to determine the effects of the project operation on fishery resources by assessing impingement and turbine entrainment. To meet the requirements of this condition, AMP contracted Alden Research Laboratory, Inc. to conduct a turbine entrainment and survival analysis, as well as to assess the potential for impingement on the intake trash racks. Estimates of total project survival for all fish passing downstream at the dam were also calculated. The desktop study methods that were used for the analysis produced estimates of the number of fish (by species and size group) entrained through and killed by the turbines each month and annually. Total project survival was also estimated with desktop modeling techniques to determine the survival rate of all fish passing downstream at the dam (i.e., through the spill gates and turbines).

It was determined that impingement will not occur for any of the species evaluated due to the large trash rack bar spacing of 8.25 inches. Few (if any) fish in the vicinity of the project will reach a size that would physically exclude them from passing through the turbine intake trash racks and any fish of such size would have burst swimming capabilities greater than the maximum approach velocities calculated for the project (about 5 ft/s).

Gizzard Shad comprised most of the entrainment of smaller fish (<250 mm in length), accounting for 90.3% of the annual total. Freshwater Drum, Sauger, and Walleye collectively accounted for about 68% of total annual entrainment for the larger size group (>250 mm).

Excluding American Eel, turbine survival estimates of resident species ranged from 79.6% for 750-mm fish up to 100.0% for 25-mm fish. Fish less than 250 mm had an average survival of 98.0% and fish with lengths between 250 and 750 mm had an average survival of 86.8%. The turbine survival analysis for American Eel indicated survival rates for adults (average length of 750 mm) could be as high as 100%, which is in the range of field study estimates (about 90 to 100%) reported for turbines similar the units at Willow Island units. These high turbine survival estimates for all species at Willow Island are due to the small number of blades, low rotational speed, and large diameter of the two units, all of which contribute to low blade strike probabilities, even for larger fish.

## Willow Island Hydroelectric Plant - FERC Project No. 6902-WV

Across all river flows, total project survival (i.e., percentage of fish passing downstream of Willow Island through all available routes, except the lock system) was estimated to be 98.0% for non-diadromous fish less than 250 mm and 89.4% for fish greater than 250 mm in length. When adjusted for size group composition (97% for fish less than 250 mm and 3% for fish greater than 250mm), combined total project survival across all river flows was estimated to be 97.6% for all fish passing downstream at the project. Total project survival for American Eel was estimated to be 97.5% across all river flows.

The high turbine and total project survival rates for fish passing downstream at Willow Island indicate that any potential impacts of turbine entrainment on the fish community in the vicinity of the project are negligible and inconsequential. Gizzard Shad and the other species (e.g., Channel Catfish, Bluegill, Emerald Shiner, and Sauger) that had high entrainment estimates are relatively resilient and fecund species whose populations are not expected to be negatively affected by the operation of the Willow Island Project. The high downstream passage survival rates and low entrainment mortality estimates support this conclusion.

AMP has worked with WVDNR throughout the study and submitted several iterations of reports during that time. WVDNR provided comments on 7/3/2019, 6/1/2020 and 11/18/2020 which were subsequently considered and incorporated into the final report per the agency's request.

For clarification, you can find the timeline of reports listed below and WVDNR's comments summarized:

- 1.) Initial Willow Island Fish Entrainment Desktop Report prepared by EA Engineering and submitted to WVDNR on 6/3/2019
  - a. WVDNR requested a new report be conducted due to the lack of estimated entrainment and mortality for Willow Island
- 2.) 1<sup>st</sup> Alden Labs prepared Fish Entrainment Report submitted to WVDNR on 5/14/2020
  - a. On 6/1/2020 WVDNR requested certain fish species be included for further analysis and that winter data estimates be included. The report did not include the data initially due to lack of information at similar projects. To remedy this, Alden Labs needed to adjust the scope of the study to include non-representative facilities with less comparable design, operating parameters, and fish populations.
- 3.) 2<sup>nd</sup> Alden Labs Willow Island Fish Entrainment Report (Rev. 1) submitted to WVDNR on 8/13/2020
  - a. Fish entrainment was extrapolated from the smaller facilities to match the generating flow capacity of Willow Island which resulted in large increases for estimated entrainment and mortality at Willow Island. In particular, estimated entrainment of gizzard shad was skewed high following the data extrapolation. WVDNR and AMP agreed to take another look at the data and determine a better avenue for gizzard shad entrainment estimates at the project.
- 4.) 3<sup>rd</sup> (and final) Alden Labs Willow Island Fish Entrainment Report (Rev. 2) submitted to WVDNR on 10/27/2020
  - a. This report included a Gizzard shad addendum which attempted to correct Gizzard Shad entrainment estimates by discounting projected entrainment due to cold shock. WVDNR provided their own Gizzard Shad estimates based on rotenone surveys conducted at the Willow Island Locks.