REVIEW OF APPLICATION FOR CERTIFICATION BY THE LOW IMPACT HYDROPOWER INSTITUTE OF THE BRADDOCK LOCKS AND DAM HYDROELECTRIC PROJECT

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I. INTRODUCTION

This report reviews the certification application submitted by Lock+™ Hydro Friends Fund XLII, LLC (Hydro Friends), Project licensee, for LIHI certification of the 5.25-MW Braddock Locks and Dam Hydropower Project (the Project), located at the United States Army Corps of Engineers' (ACOE) Braddock Locks and Dam. A Major license from the Federal Energy Regulatory Commission (FERC), Project No. 13739, was issued in 2015. The Project is located on the Monongahela River, in the Borough of West Mifflin and the City of Duquesne, Pennsylvania. The Project is expected to initiate operation in the second or third quarter of 2024, as a run-of-release facility. Releases from the dam are controlled by the ACOE[1]. This review was conducted under LIHI's Handbook, 2nd Edition, Revision 2.04: April 1, 2020 as the application was received in 2021.

II. PROJECT'S GEOGRAPHIC LOCATION

The ACOE Braddock Locks and Dam is one of nine navigation structures that comprise the Monongahela River Navigation System, authorized by Congress to provide year-round navigation on the Monongahela River between Pittsburgh, Pennsylvania, and Fairmont, West Virginia. Figure 1 shows the nine dams comprising this navigation system. The proposed Project site was originally named Monongahela Dam 2 and was constructed in 1906. It was demolished and replaced in 2004 and renamed Braddock Locks and Dam. The Braddock Locks and Dam is the most downstream dam on the Monongahela River and is located 11.2 river miles of upstream of the confluence of the Monongahela and Allegheny Rivers which join to form the Ohio River. All of these upstream dams contain downstream fish passage.

- Locks & Dam 3, river mile 23.8, no hydro
- Locks & Dam 4, river mile 41.5, FERC Project No. 13767
- Maxwell, river mile 61.2, FERC Project No. 13766
- Grays Landing, river mile 82.0, FERC Project No. 13763
- Point Marion, river mile 90.8, FERC Project No. 13771
- Morgantown, river mile 102.0, FERC Project No. 13762
- Hildebrand, river mile 108.0, no hydro
- Opekiska, river mile 115.4, FERC Project No. 13753

[1] This schedule is later than originally planned, with delays caused at ACOE due to COVID restrictions and yet unresolved issues at PJM (the regional transmission interconnection organization) which currently has put a full stop on the existing and new projects in the interconnection queue.

Currently the pool behind the Braddock Locks and Dam extends 12.6 miles to Locks and Dam 3. As noted in FERC's Environmental Assessment (EA), the Locks and Dam 3 is scheduled to be removed by the ACOE in the near future.[2] Upon its removal, the new Braddock pool would extend between Braddock Locks and Dam and Locks and Dam 4, located at RM 41.5. The normal elevation of the current Braddock pool is 721.8 feet mean sea level (MSL) while the future elevation will be 723.7 feet.

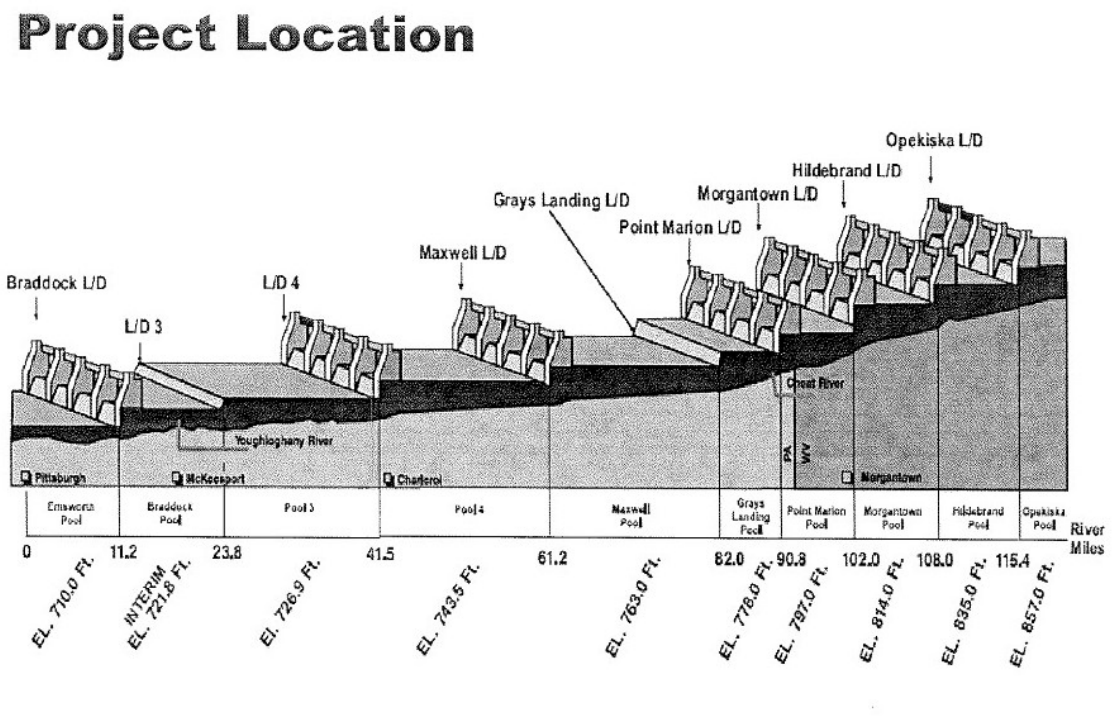


Figure 1 – ACOE Dams on the Monongahela River

Based on follow-up communications with the Applicant (see Appendix A), the two closest downstream dams are on the Ohio River and are:

- ACOE's Emsworth Lock and Dam (FERC P-13757), 17.4 river miles from Braddock. There is fish passage via the large ACOE locks as well as the gates of the dam.
- ACOE Dashields Lock and Dam, 24.5 river miles from Braddock. No hydropower is located here. Fish passage can occur via the large locks.

[2] According to ACOE information, the removal could be complete as early as late 2023 or early 2024. https://www.waterwaysjournal.net/2021/01/29/lower-monongahela-river-project-advances/

III. PROJECT AND IMMEDIATE SITE CHARACTERISTICS

The original dam was built in 1906, reconstructed in 1953, and demolished and replaced in 2004. The 1,007-foot-long locks and dam includes: (1) a 504-foot-long, gated section (four 110-foot-long gated bays); (2) an 84-foot-long fixed crest weir; (3) a land-side lock that is 110 feet wide by 720 feet long, and a river-side lock that is 56 feet wide by 360 feet long, which provide an 8.7-foot vertical lift; (4) a 55-foot-long right abutment; and (5) a 133-foot-long, 52-foot-wide left closure weir, constructed of cellular sheeting and tremie concrete founded on rock at an elevation of 670.0 feet National Geodetic Vertical Datum (NGVD). Elevations of the spillway sill vary from 704.7 feet in gate bays 2 through 4, 714.0 feet at gate bay 1, and 723.7 feet at the fixed weir. The crest of the left closure weir is at 725.0 feet. Figure 2 shows the ACOE Locks and Dam. Gate 1 is also considered the "environmental gate" operated by the ACOE to ensure dissolved oxygen levels are maintained when needed during low flow periods.[3]

Figure 2 – ACOE Braddock Lock and Dam

As currently licensed, the proposed Braddock Project would consist of the following new facilities: (1) a 105-foot-wide, 22-foot-deep, and 40-foot-high steel powerhouse anchored to the ACOE left closure weir (lower right in Figure 2, see also Figure 3); (2) trashracks at the powerhouse intakes, to be constructed approximately 10 feet below the river surface and measuring approximately 30 feet tall and 20 feet wide for each intake, with 6-inch spacing[4]; (3) seven low-head, horizontal modular bulb turbine/generator units, each with an installed capacity of 0.75 MW, for a total capacity of 5.25 MW;[5] (4) an approach channel to the powerhouse; (5) a tailrace channel returning flow to the Monongahela River; (6) a 0.45-mile-long, 23-kilovolt (kV) transmission line constructed between the powerhouse and an existing Union Railroad substation; (7) an

[3] The gate sill configuration is a steep plunge angle which creates turbulence and maximizes entrained bubbles.
[4] These trashrack dimensions differ from that provided in the FERC license, although follow-up communication with Hydro Friends confirmed these were accurate.
[5] The turbine/generator units will be deployed on a large frame on the upstream face of the left weir. The frame will contain all generating and control systems and can be removed during maintenance or high-water events.

approximately 460-square-foot switchyard; (8) a waterway barrier installed upstream of the Project to prevent debris and boats from entering; and (9) appurtenant facilities. As shown on Figure 3, the proposed Project would be constructed on the south (river left) side of the dam, opposite the location of the existing navigational locks and at the upstream face of the existing left closure weir.

The original design is being modified to include four horizontal Kaplan bulb turbines each with a capacity of approximately 1,312 kW but resulting in no change in total installed capacity. Follow-up communication with Hydro Friends indicated that the earliest they expect to file a non-capacity related amendment with FERC would be around September 30, 2022. The LIHI application noted an expected annual generation of 32,263 MWh.

The Project's drainage area is estimated at 7,337 square miles. The FERC Project boundary occupies 1.38 acres of land, 0.28 acre of which is federal land administered by the ACOE and 1.1 acres are owned by Union Railroad Company. The area of water is less than 1.0 acre. The Braddock pool (i.e., the impoundment)'s normal pool elevation is 721.8 feet. The impoundment surface area is 1,190 acres with a gross storage capacity of 18,937 acre-feet.

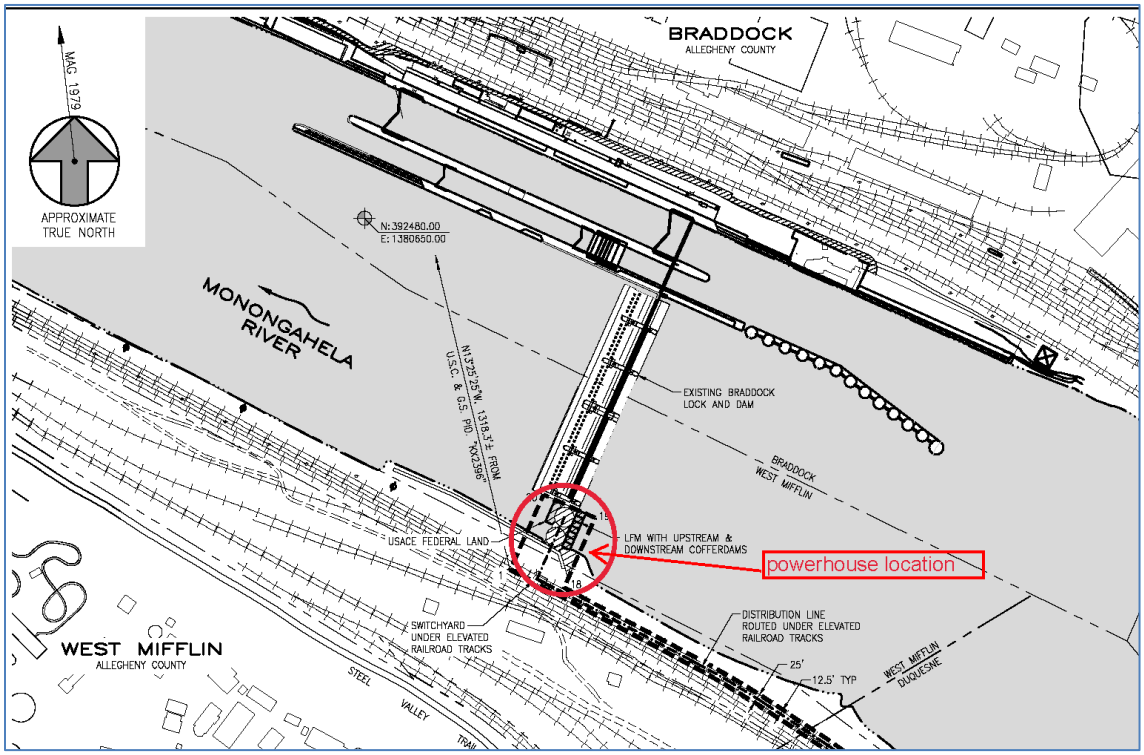


Figure 3 – Planned Location of the Braddock Project

IV. ZONES OF EFFECT AND STANDARDS SELECTED

Two Zones of Effect (ZOEs) were designated by the Applicant: ZOE #1 the Impoundment and ZOE #2 the Downstream Reach, shown on Figure 4. ZOE #1 extends from the dam upstream to the confluence of the Youghiogheny River with the Monongahela River (to river mile 15.6), while ZOE #2 extends downstream to the confluence of Turtle Creek into the Monongahela River (to river mile 9).

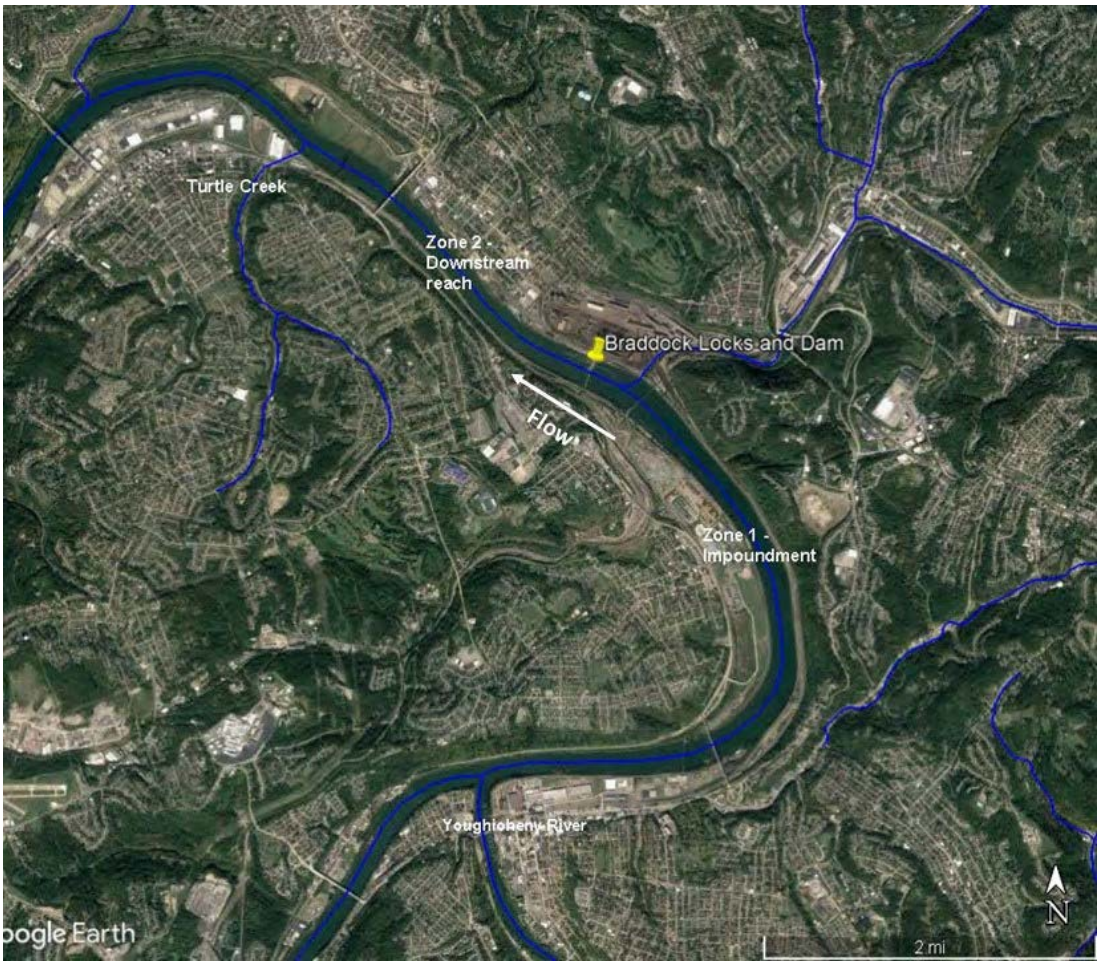


Figure 4 - Zones of Effect

The following Standards were selected by the applicant for both ZOEs. Reviewer suggested changes are noted in **red**.

Criterion		Alternative Standards				
		1	*2*	*3*	*4*	*Plus*
A	Ecological Flow Regimes	X	~~X~~			
B	Water Quality		X			
C	Upstream Fish Passage	X				
D	Downstream Fish Passage	X				
E	Watershed and Shoreline Protection	X	~~X~~			
F	Threatened and Endangered Species Protection		X			
G	Cultural and Historic Resources Protection	X	~~X~~			
H	Recreational Resources		X			

V. REGULATORY AND COMPLIANCE STATUS

An application for a license from the Federal Energy Regulatory Commission (FERC) was submitted on September 17, 2012 and supplemented in November 2013. Only the ACOE filed specific comments and recommendations on the application and the FERC-prepared Environmental Assessment. ACOE's primary concern was on water quality monitoring, although FERC did not accept this recommendation in its entirety. This is discussed further under ***Criterion B – Water Quality***. The U.S. Department of the Interior (Interior) submitted a letter stating they had no comments on the application. Neither Interior or the Secretary of Commerce filed mandatory fish passage prescriptions nor were any 10J recommendations issued.

FERC License

A fifty-year license was issued by FERC on June 4, 2015[6] to construct and operate the Braddock Locks and Dam Hydropower Project. It contained a series of construction related requirements as well as several that are necessary as the Project is being built at the ACOE dam, such as development of an agreement with the ACOE to allow ACOE access and inspection rights. The following summarizes the key requirements of interest to LIHI:

- Article 313. *Regulating (or Operating) Plan.* The licensee must, at least 60 days prior to the start of construction, submit for approval a regulating plan to the ACOE, describing: (a) the designed mode of hydropower operation, (b) reservoir flow diversion and regulation requirements for operation of the ACOE project during construction as established by the ACOE, and (c) integration of the operation of the hydroelectric facility into the ACOE's emergency action plan. In addition, the licensee, prior to start of power plant operation, must enter into an operating Memorandum of Agreement (MOA) with the ACOE describing the detailed operation of the powerhouse acceptable to the ACOE.

[6] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150604-3026&optimized=false

- Article 401. *Run-of-Release Operation*. The licensee must operate the Project in a run-of-release mode, meaning the licensee must not deviate from the flow constraints, including flow releases, established by the Operating Plan required under Article 313.

- Article 402. *Operation Compliance Monitoring Plan*. At least 90 days prior to the start of Project operation, the licensee must file with the Commission, for approval, an operation compliance monitoring plan that describes how the licensee will comply with the operational requirements of the license. This includes details of how operations will be monitored and maintained and a schedule of reporting any deviations from the operational requirements of the license during normal operation and in the event of an emergency.

- Article 403. *Water Quality Monitoring Plan.* Within 180 days of license issuance, the licensee must file with the Commission, for approval, a plan consistent with Water Quality Certification Conditions 6 and 7, to monitor water quality in the Monongahela River upstream and downstream of the Project.

- Article 404. *Steel Valley Trail Rest Area.* Within 180 days of license issuance, the licensee must file, for Commission approval, a plan for the installation and maintenance of a rest area along the Great Allegheny Passage's Steel Valley Trail.

- Article 405. *Protection of Undiscovered Cultural Resources*. This article requires cessation of construction and consultation with the Pennsylvania State Historic Preservation Officer (PA SHPO) if an undiscovered resource is discovered and preparation of a Historic Properties Management Plan (HPMP) if a resource is determined to be eligible for the National Register of Historic Places.

401 Water Quality Certification

The Water Quality Certification (WQC) was issued by the Pennsylvania Department of Environmental Protection (PADEP) on February 17, 2015[7] and contained a number of conditions which were directly adopted into the FERC license. However, Conditions 4, 7 and 8 were modified by FERC by deleting references to an "Operational Compliance Plan" and inserting instead "the operating plan and Memorandum of Agreement required by license Article 313."

ACOE Memorandum of Agreement and Operating Plan

The Project will also be governed under a Memorandum of Agreement (MOA) with the ACOE which describes the detailed operation of the power facilities acceptable to the ACOE. This MOA and the Operating or Regulating Plan which will be established by the ACOE, are required by FERC license Article 313. These have not yet been developed.

Compliance Summary

A review of FERC's eLibrary was conducted going back to January 1, 2012 to understand the licensing activities and issues. As noted above, only water quality issues were identified, which

[7] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150217-5193&optimized=false

are discussed below under that criterion. Extensions of time for construction of the facility have been requested and approved three times, with the most recent extension requiring construction commencement by June 4, 2023, and construction completion by June 4, 2026, approved by FERC in a May 13, 2021 order. As the facility is not yet constructed, compliance review was limited.

VI. PUBLIC COMMENT RECEIVED OR SOLICITED BY LIHI

The deadline for submission of comments on the LIHI certification application was May 29, 2022. No comments were received.

I did not conduct outreach to stakeholders as the Project has not been constructed and no significant issues were identified during licensing. Thus, my review included assessment of the application, FERC records, and follow-up communications with the Applicant, which are contained in Appendix A.

VII. DETAILED CRITERIA REVIEW

A. ECOLOGICAL FLOW REGIME

Goal: The flow regimes in riverine reaches that are affected by the facility support habitat and other conditions suitable for healthy fish and wildlife resources.

Assessment of Criterion Passage

The Applicant selected **Standard A-2 Agency Recommendations** for both ZOEs. However, based on recent review and comment by the LIHI Technical Committee on other similar projects where a hydropower facility is at an ACOE dam, it was determined that **Standard A-1 Not Applicable/De Minimis Effect** is more appropriate as the Project will operate in a run-of-release mode with all flows controlled by ACOE.

The ACOE maintains water level within Braddock pool at an elevation of 721.8 feet, which was included in the FERC EA[8] and final FERC license order. Four gated bays in the dam control water levels and releases; one of which serves as a water quality gate, by which the ACOE releases flow to manage dissolved oxygen levels downstream of the dam during the time of year that it can do so based on ambient temperature. The environmental gate can pass up to 9,440 cubic feet per second (cfs) of flow. A locking flow of 250 cfs is assumed on a constant basis, and any other flow is released through the spillway gates and/or overflow weir. No changes from the current navigation water levels are required as part of the FERC license.

The future Memorandum of Agreement (MOA) and Operating or Regulating Plan will document how the hydropower facility will be operated in conformance with ACOE needs. An Operation Compliance Monitoring Plan will also be developed pursuant to license Article 402 which will include details of how run-of-release operation will be monitored and maintained with a schedule of regulatory agency reporting including any deviations from the operational requirements.

[8] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20140117-3000&optimized=false

Review of the FERC EA indicated that the addition of the proposed turbines within the overflow section of the existing dam would result in higher flows on the western side of the river. Based on the results of a modified application of the Tennant Method[9], Hydro Friends proposed that the ACOE would continue to release a minimum of 20 percent of available flow (1,209 cfs based on the average flow for July) and up to the maximum flow of 9,440 cfs, through the environmental gate, with the balance passing through the proposed turbines or over the weir or other gates[10]. However, in a letter filed November 27, 2013, the ACOE stated that rather than vary the flow, it would maintain a minimum flow of 7,250 cfs through the environmental gate for water quality purposes, and that any diversion of this flow would reduce the functionality of the environmental gate. FERC concluded that changes to the cross-sectional flow pattern and the resulting changes in habitat could cause species assemblages immediately downstream of the turbine outflows to be dominated by species that are better adapted to higher flows. Species that prefer slower pool-type environments may also be displaced. This change in species composition was predicted to be highly localized and would not result in a significant change in the community composition in Emsworth pool or the Braddock tailwater.

Since the Project has license and WQC operational requirements to comply with the MOA, provided the MOA requirements do not deviate significantly from the flow-related assumptions in the EA, I believe the Project can be considered to be in compliance with this criterion at this time. Section VIII – General Conclusions and Reviewer Recommendations denotes my recommended condition regarding submission of the MOA, Operating/Regulating Plan and Operation Compliance Monitoring Plan.

The Project Conditionally Passes Criterion A – Ecological Flow Regimes

B. WATER QUALITY

Goal: Water Quality is protected in waterbodies directly affected by the facility, including downstream reaches, bypassed reaches, and impoundments above dams and diversions.

Assessment of Criterion Passage

The Applicant appropriately selected **Standard B-2 Agency Recommendation** for both ZOEs.

As noted in the EA:

> "Municipal and industrial activities in the Monongahela River Basin have resulted in the introduction of pathogens, organic contaminants from urban runoff and inadequate waste water treatment, inorganic contaminants, and unnaturally low pH levels. Mining has been identified as having the single greatest impact on surface water quality of any single land use in the basin. In the 1960s, the river was occasionally too acidic to support a diverse aquatic community. Since that time, water quality has improved as a result of reductions in industrial discharge, improvements in wastewater treatment, improvements in mine

[9] As noted in the EA, use of the Tenant Method for setting minimum flows through individual crest gates (e.g., the ACOE environmental gate) is not typical.

[10] The average annual flow at the Braddock Locks and Dam is 12,692 cfs. Average monthly flows at the dam range between 4,980 cfs in September to 24,266 cfs in March.

drainage treatment, and low-flow augmentation. Despite improvements, acid- and mineral-laden mine drainage still presents one of the most serious threats to water quality in the Monongahela River Basin."

Waters in the Project vicinity are designated under the state water quality standards as a warm water fishery and are consequently protected for that use, as well as for navigation. Based on the most current listing of impaired waters in the state of Pennsylvania, both ZOEs are under a Category 4a classification, as these waters are impaired for fish consumption due to polychlorinated biphenyls (PCBs). Waters are also listed under Category 5 due to pathogen impairment. Additionally, there are a number of streams that empty into the upstream channel that are listed under various categories. Crooked Run is also listed under Category 5 due to impairment from streambank modifications and destabilization. Thompson Run, which empties into the Monongahela, is listed under Category 4a due to metal impairment as a cause of acid mine drainage. Turtle Creek, is listed under Category 5 due to metal impairment from acid mine drainage. As the hydropower facility has not yet been constructed, these conditions are pre-existing and not attributable to the Project.

Pennsylvania water quality standards applicable to the Braddock Locks and Dam Project waters (Source: 25 Pa. Code § 93.7) are:

Parameter	Objective/Standard
DO	Minimum daily average 5.0 mg/L; minimum 4.0 mg/L
pH	From 6.0 to 9.0 inclusive.
Turbidity	Maximum of 40 Nephelometric Turbidity Units [NTUs] from May 15 through September 15 and 100 NTUs from September 16 to May 14.

State maximum temperature limits vary seasonally and range from a low of 40° Fahrenheit (°F) from January 1 through February 29 to a high of 87° F from July 1 through August 31.

Based on data review by Hydro Friends during licensing, pre-project temperatures exceeded state water quality criteria by up to 6.3 degrees Celsius (°C), but typically exceeded the criteria by less than 2°C. Approximately 18 percent of the water temperature data (1990 to 2011) exceeded state criteria, most frequently in August. DO concentrations (1990 to 2011) were almost always greater than the minimum daily average criteria (5.0 milligrams per liter [mg/L]) with the exception of periods in late August 2002 and late September 2004. Approximately 0.3 percent of pH measurements (1990 to 2011) were outside the state criteria (6.0 to 9.0 standard units [s.u.]). Turbidity levels (1990 to 2002) were typically below 20 Nephelometric Turbidity units (NTUs), only exceeding the state criteria of 40 NTUs on six occasions. Although high turbidity is often associated with high flow events, flow did not appear to substantially influence turbidity.

To further characterize baseline conditions in the proposed Project, Hydro Friends conducted field studies to collect continuous and discrete water quality data upstream and downstream of the dam during summer 2012. Data collected was incorporated into subsequent modeling activities to quantify the changes in DO levels due to the placement of the turbine units. The development of the water quality model was in response to a study request submitted by the Pittsburg District of

the ACOE in response to the September 17, 2012 Final License Application.

As previously noted, during FERC licensing, the ACOE expressed concerns about the effect of the proposed Project operation on water quality, particularly DO concentration, downstream of the Braddock Locks and Dam. The ACOE stated that the proposed shifting of downstream releases from its environmental gate to the proposed powerhouse could result in decreased DO concentrations downstream of the Project, and thus be inconsistent with its antidegradation policy. ACOE recommended continuous water quality monitoring for the entire length of the license to ensure that construction and operation of the Project does not adversely affect water quality of the Monongahela River. The ACOE also noted its concern that water quality effects may be greater following completion of the Lower Mon Project[11], when the higher elevation of the Braddock Pool could result in lower DO concentrations in water passed through the Project's turbines. However, FERC determined the Project would not require monitoring throughout the Project's lifetime. FERC found that monitoring for 5 years would result in a high likelihood of capturing an extremely hot or dry year that could lead to dissolved oxygen stratification above Braddock dam, given the frequency of summer conditions that may cause stratification. FERC noted that the possibility of encountering an even hotter or dryer year outside of the recommended 5-year monitoring period did not alone justify the need for continuous monitoring for the length of the license. However, FERC also noted that as that the ACOE is ultimately responsible for any flows made available to the Braddock Project and it will be operated, (which will be specified in the MOA) ACOE, therefore, could require more extensive monitoring as part of any operating agreement.

In summary, the current Project monitoring requirements based on the WQC and FERC license Article 403 are:

1. Monitoring of summer (i.e., May through October) water temperature and dissolved oxygen (DO) concentration prior to construction;

2. continuous, real-time monitoring of water temperature, DO, and turbidity during Project construction; and

3. continuous, real-time monitoring of summer water temperature and DO for 5 years following Project construction, and for an additional 5 years at such time as the normal elevation of the Braddock pool increases during the term of the license as a result of the ACOE's Lower Monongahela Locks and Dams 2, 3, & 4 Project (Lower Mon Project).

The *Water Quality Monitoring Plan* (WQMP) was submitted on December 3, 2015 and approved by FERC on February 5, 2016. The WQMP was revised and re-approved by FERC on August 7, 2019 because starting in October 2018, the ACOE no longer supported funding for the operation of the Braddock Locks and Dam water quality gage. Thus, the modified WQMP incorporates pre-construction monitoring by the Applicant for temperature and DO in 2020. Pursuant to the WQC Condition 8, during operation, if non-degradation water quality criteria are not met, Hydro Friends would take immediate actions[12] including aeration of the hydropower outfall without nitrogen supersaturation, and/or bypassing flow, until the condition is remedied. The effectiveness of

[11] The Lower Mon Project replaced the nearly 100 year-old fixed-crest dam at Braddock Locks and Dam with a gated dam, and will remove Locks and Dam 3 in Elizabeth, and construct two new larger locks (Charleroi Locks) at Locks and Dam 4 in Charleroi.

[12] Immediate is defined as within 2 hours during non-working hours.

bypassing flow would be immediately apparent, and bypass flow would be increased until the criterion is met. Annual summary water quality monitoring report for the previous year must be filed with FERC (following resource agency review) and must identify any deviations from the state water quality standards and MOA. Should monitoring reveal non-compliance with water quality standards resulting from Project construction or operation, the licensee must file a report with FERC, within 10 days of discovery of the non-compliance, describing the non-compliance and any actions implemented to restore compliance with the standards.

Hydro Friends submitted their pre-construction annual reports for 2020 and 2021. Comments submitted by the US Fish and Wildlife Service (USFWS) and PADEP on the 2020 report identified several report gaps that appear to have been remedied. Water quality data is available from USGS gage No. 03085000 located 300 ft upstream of the dam and No. 03085002 located 300 ft downstream of the dam.

Based on my review of available information, I believe the Project conditionally passes this criterion. Section VIII identifies my recommended condition.

The Project Conditionally Passes Criterion B – Water Quality

C. UPSTREAM FISH PASSAGE

Goal: The facility allows for the safe, timely, and effective upstream passage of migratory fish. This criterion is intended to ensure that migratory species can successfully complete their life cycles and maintain healthy populations in areas affected by the facility.

Assessment of Criterion Passage

The Applicant appropriately selected **C-1 - Not Applicable/De Minimis Effect** for both ZOEs.

Decades of mining, agricultural, commercial, and industrial practices have impacted the aquatic resources in the Monongahela River, with a near loss of fish and invertebrate communities by the mid-20th century. However, substantial water quality improvement over the past several decades has led to improvements in aquatic community composition such that the Monongahela River now supports a diverse array of warm water game- and non-game fish species and macroinvertebrates.

Based on available data, minnow species and gizzard shad dominate the fish community in the Braddock Project vicinity. Other common species include bluegill, channel catfish, common carp, freshwater drum, rock bass, smallmouth bass, spotted bass, and white bass. The smaller non-game fish (e.g., minnows) provide the forage base for predatory fish and play an important role as hosts for glochidial (larval) stages of mussels. Recreational angling opportunities are relatively limited near the Braddock Project due to the highly industrialized nature of the area. However, the tailwaters tend to attract anglers, with smallmouth bass, walleye, and white bass tending to be the preferred species, with bluegill, pumpkinseed, muskellunge, tiger muskellunge, common carp, hybrid striped bass, channel catfish, flathead catfish, freshwater drum, and rock bass as angling alternatives. Sporadic Pennsylvania Fish and Boat Commission (FBC) stocking of select sportfish species has occurred in the Project vicinity. Walleye fry and fingerlings, muskellunge fingerlings,

and tiger muskellunge fingerlings are found in the Braddock pool. Due to PCB contamination, there are consumption advisories for common carp, freshwater drum, and channel catfish in the Braddock Locks and Dam area.

The application notes that two anadromous species that have historically inhabited the Monongahela River are the American paddlefish (Polydon spathula), and the skipjack herring, (Alosa chrysochloris). Skipjack herring were collected in boat electrofish sampling conducted during 2003 and 2010 at the upstream Maxwell and Grays Landing lock chamber and a single paddlefish was collected during 2003 sampling at the Maxwell lock chamber, but neither were found during sampling at the Braddock Locks and Dam. The EA notes that in 1991, FBC initiated a paddlefish stocking program in an attempt to reestablish self-sustaining populations in the Allegheny River and Ohio River. Paddlefish are also being stocked upstream of the Braddock Project in West Virginia as part of a reintroduction/restoration effort. The FBC is currently implementing a paddlefish restoration program through a combination of stocking, research, and working with the ACOE to provide passage of fish through navigational locks. Of the species found in the Project waters, only smallmouth bass and smallmouth redhorse are potamodromous.

No fishway prescriptions or reservations of authority were filed under Section 18 of the Federal Power Act in the FERC license nor were any 10J recommendations or concerns about migratory fisheries issued. The lock chambers pass fish and other aquatic organisms upstream of the dams during scheduled lockages, specifically allowing for fish passage during the spring spawning period. Additionally, during high flow events at the end of the winter and in spring, the dam gates are raised to allow a free-flowing river due to high flows.

Based on my review of available information, I believe that the Project passes this criterion as currently there do not appear to be any requirements or need for upstream passage at the Project.

The Project Passes Criterion C – Upstream Fish Passage

D. DOWNSTREAM FISH PASSAGE AND PROTECTION

Goal: The facility allows for the safe, timely, and effective downstream passage of migratory fish. For riverine (resident) fish, the facility minimizes loss of fish from reservoirs and upstream river reaches affected by Facility operations. Migratory species are able to successfully complete their life cycles and maintain healthy populations in the areas affected by the Facility.

Assessment of Criterion Passage

The Applicant appropriately selected **D-1 - Not Applicable/De Minimis Effect** for both ZOEs due to the lack of diadromous species, other than those that may have been stocked upstream several years ago. The lack of concern for fish passage by the resource agencies during licensing supports this conclusion.

Downstream passage for fish exists via the lock chambers of the dam during scheduled lockages. Due to the six-inch spacing on the bars of the trashracks, larger fish are prevented from entering the penstocks, but the more abundant smaller fish can. A desktop entrainment and survival study

was submitted as part of the Final License Application to FERC. The report concluded the Project will result in some fish mortality due to entrainment and impingement, however, the entrainment potential will vary with river flow, species, season, and fish size/life stage. The majority of entrained fishes will likely be clupeids, sunfish, and young life stages of all species and some young adults incapable of intake avoidance or exclusion by the trashracks. Fish survival rates through modular-bulb turbine units are expected to be relatively high, particularly for small fish that make up the majority entrained (survival rate of 95%). No fishery agency issued comments on the study findings.

Based on my review of available information, I believe that the Project satisfies this criterion.

The Project Passes Criterion D – Downstream Fish Passage and Protection

E. SHORELINE AND WATERSHED PROTECTION

Goal: The Facility has demonstrated that sufficient action has been taken to protect, mitigate and enhance the condition of soils, vegetation and ecosystem functions on shoreline and watershed lands associated with the facility.

Assessment of Criterion Passage

While the Applicant selected **Standard E-2, Agency Recommendation** for both ZOEs because an Erosion Control Plan is required during facility construction, I believe **Standard E-1, Not Applicable/De Minimis Effect** is more appropriate as there are no requirements for a Shoreline Management Plan or similar plan and there are no lands under the direct or indirect ownership or control of the facility owner that have significant ecological value for protecting water quality, aesthetics, or low-impact recreation.

The application states that the FERC Project boundary includes 1.38 acres of land, 0.28 acre of which is federal land administered by the ACOE and 1.1 acres are land owned by Union Railroad Company. Area of water is less than 1.0 acres. In the Project vicinity, there are several brownfield sites where industrial facilities once existed. Brownfields are defined by the United States Environmental Protection Agency (EPA) as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant". Wetland habitat in the Project vicinity is classified by the USFWS as permanently flooded, lower perennial riverine habitat with an unconsolidated bottom. The application notes that given the degree of industrial development along the shoreline (e.g., placement of rip rap, concrete walls), little riparian or bottomland habitat exists in the vicinity of the Project. Thus, it does not appear that lands within the Project boundary or nearby vicinity provide any unique or valuable wildlife habitat.

Based on my review, I believe the Project passes this criterion.

The Project Passes Criterion E – Shoreline and Watershed Protection

F. THREATENED AND ENDANGERED SPECIES PROTECTION

Goal: The Facility does not negatively impact federal or state-listed species.

Assessment of Criterion Passage

The Applicant appropriately selected **Standard F-2 – Finding of No Negative Effect** for both ZOEs.

The following information on protected species was provided in the LIHI application and in the Supplemental Information submitted in response to the preliminary review of the LIHI application which is posted on LIHI's website.[13]

Federally Listed Species

The LIHI application notes that there are five federally endangered mussel species listed by the USFWS as potentially occurring within Allegheny County and the reach of the Monongahela River where the Braddock Project will be constructed: the fanshell (*Cyprogenia stegaria*), snuffbox (*Epioblasma triquetra*), pink mucket (*Lampsilis abrupta*), orange-foot pimpleback (*Plethobasus cooperianus*), and sheepnose (*Plethobasus cyphyus*). However, comprehensive field surveys of the Monongahela River in 2012 did not observe these species in these waters, including the Braddock Project area. Data provided in the license application also noted the possible presence of clubshell (*Pleurobema clava*), also a federally endangered mussel species.

According to the USFWS's Information, Planning and Conservation System (IPaC) website[14] the federally endangered Indiana bat (*Myotis sodalist*) and the threatened northern long-eared bat (*Myotis septentrionalis)* occur within Allegheny County, Pennsylvania.

No federally protected fish species were identified in any filings made by Hydro Friends for the Project.

Given the Project's location and limited area that will be disturbed for construction of the Project, the EA noted that the USFWS had no concerns of impacts on the endangered mussels. The EA also noted that none of the areas to be used for the switchyard, laydown area or single transmission structure had suitable habitat for either endangered bat species.

State Listed Species

The LIHI application noted four state-endangered fish species within Pennsylvania known or have the potential to occur within the Project area (HUC8 Watershed – Lower Monongahela) based on information available in the Pennsylvania Natural Heritage Program species and natural features list. These include the warmouth (*Chaenobryttus gulosus*), Eastern sand darter (*Ammocrypta pellucida*), ghost shiner (*Notropis buchanani*) and lake sturgeon (*Acipenser fulvescens*). Ghost

[13] https://lowimpacthydro.org/wp-content/uploads/2022/03/HGE-Braddock-LIHI-Supplemental-info-17MAR22-with-attachments.pdf
[14] http://ecos.fws.gov/ipac/

shiner were captured in relatively large numbers in electrofishing surveys of the Braddock lock chambers. Supplemental data provided by Hydro Friends also listed the river shiner (*Notropis blennius*) as an endangered species possibly being in the area.

A letter dated September 23, 2011 from the PA Department of Conservation and Natural Resources (DCNR) provided by Hydro Friends noted that "no impact" to the state-listed species is expected. The 2012 license application does note that some of the listed fish may be subject to entrainment given the 6-inch clear spacing of the trashracks. However, as no state resource agency raised concerns during the licensing, it can be assumed they did not have impact concerns.

The DCNR identifies a single Natural Heritage Area (NHA) within the Lower Monongahela HUC8 Watershed (see Attachment 3 of the LIHI application). The Monongahela River at Homestead NHA has been identified as critical habitat for species or natural communities of concern. However, it is not in the immediate vicinity of the Braddock Project.

Based on this review, I believe that the Project satisfies the requirements of this criterion.

The Project Passes Criterion F – Threatened and Endangered Species Protection

G. CULTURAL AND HISTORIC RESOURCE PROTECTION

Goal: The Facility does not inappropriately impact cultural or historic resources that are associated with the Facility's lands and waters, including resources important to local indigenous populations, such as Native Americans.

Assessment of Criterion Passage

The Applicant selected **Standard G-2, Approved Plan**, but the Stage I reviewer and I believe that **Standard G-1, Not Applicable/De Minimis Effect** is more appropriate at this time, primarily due to the anticipated lack of impact to protected resources.

For FERC licensing, Hydro Friends conducted a search of the Pennsylvania Historical and Museum Commission (PHMC)'s Cultural Resources Geographic Information System to identify any known archeological and historic resources within the Project boundary. No known archaeological resources were found in this search. However, one archaeological resource was identified more than 2,900 feet upstream of the Braddock Locks and Dam: the submerged remains of the original Monongahela Navigation Company Lock and Dam No. 2, constructed between 1838-1841. There are a number of known historic resources within approximately 1,500 feet of the Project (e.g., buildings, structures, and districts) which are listed in or eligible for inclusion in the National Register of Historic Places. A table describing these is contained in the LIHI application. A National Historic Landmark district is located within the Project's vicinity: Kennywood Park, a historic amusement park located near the left shoreline of the Monongahela River. It is in the general vicinity of the Project, but is separated by rail lines and infrastructure. Construction and operation of the Project are not anticipated to impact this Landmark.

As noted in the EA, in its letter dated April 17, 2012, the PA SHPO determined that although a

high probability exists that archeological resources are located in the Project area, the proposed Project would have no effects on any archeological sites. The letter also stated that should the scope of the Project be amended to include additional ground-disturbing activity, the SHPO should be contacted immediately, and a Phase I Archaeological Survey may be necessary to locate all potentially significant archaeological resources. In regard to the historic structures, the SHPO determined that the plans and specifications for the proposed Project conform to the Secretary of the Interior's *Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings*. As a result, the SHPO concluded the Project would have no adverse effect upon the National Register-eligible Monongahela River Navigation System.

Under Article 405 of the license, if previously unidentified cultural resources are discovered during the course of constructing, maintaining, or operating Project works or other facilities at the Project, the Hydro Friends must stop all land-clearing and land-disturbing activities in the vicinity of the resource and consult with the PA SHPO to determine the need for any cultural resource studies or measures. If a discovered cultural resource is determined to be eligible for the National Register of Historic Places, the licensee must file for FERC approval a historic properties management plan (HPMP) prepared by a qualified cultural resource specialist after consultation with the SHPO.

Based on my review, I believe this Project conditionally passes this criterion. While no archaeological or historical resources are expected to be found or impacted, as the hydropower facility has not yet been constructed, and therefore the need for approval of a protection plan not yet determined, I believe a condition is appropriate to cover this potential to ensure criterion compliance recommended in Section VIII.

The Project Conditionally Passes Criterion G – Cultural and Historic Resource Protection

H. RECREATIONAL RESOURCES

Goal: The facility accommodates recreation activities on lands and waters controlled by the facility and provides recreational access to its associated lands and waters without fee or charge.

Assessment of Criterion Passage

The Applicant has appropriately selected **Standard H-2, Agency Recommendation** for both ZOEs.

The Braddock Project is located in a highly industrialized area, and therefore offers few recreational opportunities. The Great Allegheny Passage's Steel Valley Trail runs along the Monongahela River and allows visitors along the trail a view of the Project facilities, which will be located 300 feet north of the trail. The Great Allegheny Passage is a rail-trail that offers 135 miles of hiking and biking between Cumberland, Maryland, and Munhall, Pennsylvania.

In order to improve the access to recreational activities in the vicinity of the Project, license Article 404 required submission of a plan for the installation and maintenance of a rest area along the Great Allegheny Passage's Steel Valley Trail within 180 days of license issuance. Plan requirements included: (1) a list and description of the facilities to be installed at the rest area,

which should include, at a minimum, a bench or benches, a bike rack, a bike tune-up station, and an interpretive sign that discusses the hydro project, the existing dam, and renewable energy; (2) a description of the location of the rest area, including a map of the rest area and GPS coordinates; (3) details on how the rest area will be maintained; and (4) a schedule for the construction of the rest area. The plan and schedule must be developed after consultation with the National Park Service, ACOE, the Regional Trail Corporation, the Steel Valley Trail Council, and the Allegheny Trail Alliance.

The Steel Valley Trail Rest Area Plan was submitted on September 8, 2015 and approved by FERC on February 17, 2016. Based on follow-up information provided by Hydro Friends, the interpretative signage and bicycle tune-up station will be installed as part of construction of the Project, following completion of construction financing.

There has been no FERC Environmental Inspection conducted as the facility is not yet constructed.

Based on my review, I believe the Project conditionally satisfies this criterion with the recommended condition noted in Section VIII.

The Project Conditionally Passes Criterion H – Recreational Resources

VIII. GENERAL CONCLUSIONS AND REVIEWER RECOMMENDATION

Based on my review, I believe the Braddock Lock and Hydropower Project conditionally satisfies the requirements of a Low Impact facility and recommend it be certified for a ten-year period with the following conditions:

Condition #1 – The Facility Owner shall notify LIHI as soon as possible of and no later than 30 days from commencement of commercial operation. The LIHI Certification term will become effective when the facility begins generation. LIHI reserves the right to modify, suspend or revoke the Certification should operational facility impacts cause non-compliance with the LIHI criteria.

Condition #2 – The Facility Owner shall provide copies of the final ACOE MOA, ACOE required Operating Plan, and FERC required Operation Compliance Monitoring Plan upon their finalization to confirm that the requirements of these plans demonstrate compliance with the Ecological Flow Regime criterion. If additional water quality monitoring is required by ACOE in the MOA, the schedule, results, and agency comments shall be summarized in annual compliance submittals to LIHI to confirm compliance with the Water Quality criterion.

Condition #3 – The Facility Owner shall notify LIHI within 60 days of the discovery of any cultural resource during construction. The status of actions taken, copies of correspondence with the PA SHPO and any final Plans shall be provided in the annual compliance submittals to LIHI.

Condition #4 – The Facility Owner shall notify LIHI within 60 days upon completion of the outstanding recreational features at the Steel Valley Trail rest area.

Note: Annual compliance statements will be required to be submitted in July of each pre-operational year.

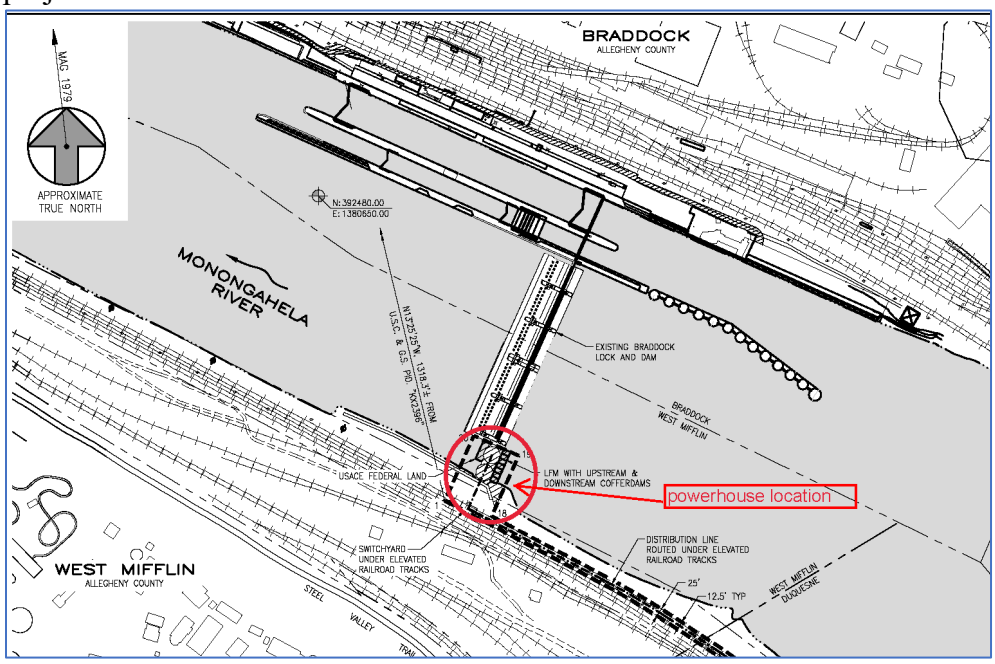
Appendix A

Follow-up Correspondence with the Applicant

Initial Questions and Answers on Braddock Hydropower Project

Project Description and Location

1) Please provide a diagram or sketch which shows the location of the proposed hydropower project at this ACOE dam.



2) Please identify the two closest dams on the Ohio River downstream of the Braddock Project. USACE Emsworth Lock and Dam, USACE, 17.4 river miles from Braddock, P-13757, there is fish passage via the large USACE locks as well as the gates of the dam, there are no diadromous fish around the Pittsburgh area since all rivers are inland rivers. USACE Dashields Lock and Dam, 24.5 river miles from Braddock, not permitted or licensed, there is fish passage via the large USACE locks, there are no diadromous fish around the Pittsburgh area since all rivers are inland rivers. Please provide their name, ownership, distance from Braddock and FERC number if FERC licensed or exempt and if they have either have installed upstream fish passage or otherwise accommodate upstream migration of diadromous fish.
3) There are discrepancies noted regarding the trash rack depth below river surface and their size between the LIHI application and FERC license. I don't see what you are referring to. Could you please provide page and paragraph of what you are looking at in both documents? Also, the application notes normal pond elevation of the Braddock pool is 718.7 feet msl while the FERC license notes it is 721.8 feet msl. Please confirm the correct values. 718.7 ft was the original normal pool for Braddock; currently the normal pool for Braddock is 721.8 ft and has been since 2004;
4) Please provide your current schedule for filing the Non-Capacity Amendment for the Project's revised turbine design. The LIHI application indicates March 1, 2022. Due to delays with the Project Engineer and USACE, we need to push that date back. It is currently looking like at the very earliest we would file that around September 30, 2022.

5) Please confirm your current schedule for commencement of project construction and expected initiation of generation. The Application currently denotes "assuming construction completion for mid-year 2023, generation is anticipated to begin during late 2023." However, your March 2021 request to FERC asks for an extension to June 4, 2025 for commencement of construction and until June 4, 2027 for project completion. It was noted that FERC did not grant this full request, extending construction initiation to June 4, 2023 and project completion to June 4, 2026. There have been a series of delays outside of our control – Covid and how the USACE has responded to Licensees review requests during Covid, plus a State issued Stay at Home Order and PJM who currently has put a full stop on the existing and new projects in the interconnection queue. USACE is slowly coming back up to speed, but are only working 1-2 days per week in the office. Based on our discussions with them they can only access information needed for our reviews at the USACE offices in the Federal Building in Pittsburgh. Also, the PJM queue full stop has not been resolved yet. It is highly unlikely that we would be able to close our construction financing without the PJM agreement completed. Therefore, our current estimate is that we would start construction at earliest in 1Q23 and have start of generation in 2Q24 or 3Q24.

Ecological Flow Regime

1) Please confirm that flow made available to the hydropower facility will be coordinated between Hydro Friend and the Corps and that only the Corps has control of the gates. Confirmed.

Water Quality

The annual water quality monitoring reports have been silent on whether or not any deviations from current water quality standards have occurred in the reporting year, although such information is required by the FERC license, even for pre-construction sampling it appears. In 2019, FERC issued an Order modifying Article 403 of our License modifying pre-construction sampling. Please confirm if any have occurred since May 2016. No DO or Temperature excursions have occurred that we are aware of since we received our FERC License in 2015, however, some occurred time to time prior to the issuance of our License. It is recommended that such information should be included in future reports to comply with your license.

Pennsylvania water quality standards applicable to the Braddock Locks and Dam Project waters (25 Pa. Code § 93.7) are as follows[1]:

Parameter	Objective/Standard
Dissolved Oxygen (DO)	Minimum daily average 5.0 mg/L; Minimum 4.0 mg/L.
pH	From 6.0 to 9.0 inclusive.
Turbidity	Maximum of 40 Nephelometric Turbidity Units [NTUs] from May 15 through September 15 and 100 NTUs from September 16 to May 14.

Period	Maximum Allowable Temperature		Period	Maximum Allowable Temperature	
	°F	°C		°F	°C
Jan 1-31	40	4	Aug 1-15	87	31
Feb 1-29	40	4	Aug 16-30	87	31
Mar 1-31	46	8	Sept 1-15	84	29
Apr 1-15	52	11	Sept 16-30	78	26
Apr 16-30	58	14	Oct 1-15	72	22
May 1-15	64	18	Oct 16-31	66	19
May 16-30	72	22	Nov 1-15	58	14
June 1-15	80	27	Nov 16-30	50	10
June 16-30	84	29	Dec 1-31	42	6
July 1-31	87	31			

A desktop water quality study conducted in 2012[2] indicated that pre-project water temperatures exceeded state water quality criteria by up to 6.3 degrees Celsius (°C), but typically exceeded criteria by less than 2°C. Approximately 18 percent of the water temperature data (1990 to 2011) exceeded state criteria, most frequently in August. DO concentrations (1990 to 2011) were almost always greater than the minimum daily average criteria (5.0 milligrams per liter [mg/L]) with the exception of periods in late August 2002 and late September 2004. [3]Approximately 0.3 percent of pH measurements (1990 to 2011) were outside the state criteria (6.0 to 9.0). Turbidity levels (1990 to 2002) were typically below 20 NTUs, only exceeding the state criteria of 40 NTUs on six occasions. Although high turbidity is often associated with high flow events, flow did not appear to substantially influence turbidity. (FERC EA, pp. 27-28).

[1] From FERC EA, 2014 https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20140117-3000&optimized=false

[2] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20121207-5132&optimized=false
[3] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20170830-5040&optimized=false

Water quality monitoring was conducted in 2016, 2017[4], 2018, 2020[5] and 2021[6]. No monitoring was conducted in 2019 due to USACE cessation of funding for the data sonde. The water quality monitoring plan was amended in 2019 by FERC[7], requiring pre-construction monitoring to start in the year that construction starts, at that time anticipated to be in 2020. All data showed that on a monthly average basis, water quality met state standards. We are monitoring even though not required by FERC. We are still required to submit annual reports and were fairly certain FERC would have rejected if blank. So, there is a conflict in the modified Article 403 that FERC created, no need to monitor, but still send reports.

[4] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20180702-5207&optimized=false
[5] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20210203-5069&optimized=false
[6] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20220124-5039&optimized=false
[7] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20190807-3035&optimized=false

From: "Wayne Krouse" <wayne@hgenergy.com>
To: "mfischer@lowimpacthydro.org" <mfischer@lowimpacthydro.org>, "PBMwork@maine.rr.com" <PBMwork@maine.rr.com>
Cc:
Bcc:
Priority: Normal
Date: Friday May 13 2022 12:02:57PM
Re: Additional Braddock Application Questions

Dear Pat,

Please see my answers below in red.

Best regards,

Wayne Krouse
President & CEO
Chairman of the Board
Hydro Green Energy
877-556-6566 x709
www.hgenergy.com

From: PBMwork@maine.rr.com <PBMwork@maine.rr.com>
Sent: Thursday, May 12, 2022 3:45 PM
To: Wayne Krouse; 'mfischer@lowimpacthydro.org'
Subject: Additional Braddock Application Questions

Hi Wayne

A few additional questions have come up on my review of your project. I apologize for not catching these sooner.

Recreational Resources

Could you please provide me a copy of the Steel Valley Trail Rest Area Plan that was submitted in August 2015? I cannot locate it on FERC eLibrary, although I did located FERC's approval of it dated February 17, 2016. I have found this to be a common problem on the FERC elibrary lately for some reason when looking at other projects. Please see attached.

Also, can you please provide me the anticipated completion date of the items listed in that 2016 Order that were not yet constructed at that time? We do not plan to start any work on the project until we close construction financing which has not happened yet and do not anticipate it happening before the end of the year, at this point. I am a little confused as the LIHI application states that the Corps, not Hydro Friends, installed the interpretative sign by 2015 yet FERC's order states it is not yet installed. There is some interpretative signage (I am only aware of one) along the trail already in the general vicinity of the project that was installed by the USACE. I don't know when it was installed We will install additional signage per approved Article 404.

Endangered and Threatened Species

I cannot locate the USFWS-Hydro Friends email requested in the Intake Review report submitted to you in July. That request asked for a copy of the the email from the USFWS supporting the application statement "Furthermore, email exchange between Hydro Friends and USFWS state there are no significant concerns regarding the Braddock Project

given its location and small footprint," That statement is on page 22 of your application. FERC also references it on page 44 of the FERC EA as an email dated September 8, 2012. Please see Maryalice's comments from yesterday.

Thanks

Pat McIlvaine