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Subject: Green Lake Hydroelectric Project Water Quality Certification

To whom it may concern:

On March 14, 2024, the Department issued a Draft Water Quality Certification (WQC) for the federal relicensing and continued operation of the Green Lake Hydroelectric Project (Project). The Project is located on Green Lake and Reeds Brook in Hancock County, in the City of Ellsworth and Towns of Dedham and Otis. Federal regulations require the Department to act on this application within one-year, by May 18, 2024. Maine Department of Marine Resources has reviewed the WQC and offers the following recommendations.

PDF page 28 of 38: "If passage for one or more of these species at the Ellsworth Project is required by a new license, or established through another means such as dam removal, then within six-months of the issuance of such new license or application for dam removal, the Applicant must implement fish passage at the Green Lake Project for the same species."

MDMR Recommendation: As currently written it appears that implementation of fish passage at the Green Lake Project would be on the same timeline as establishment of a new license at the Ellsworth Project. However, we anticipate that there will be a delay between establishment of a new license at the Ellsworth Project and implementation of fish passage at the Ellsworth Project. For that reason, we request that the language should be edited so that implementation of fish passage at the Green Lake Project will be completed within six-months of implementation of fish passage at the Ellsworth project or dam removal.

PDF page 28 of 38: "Fish passage facilities must be designed and implemented in consultation with MDMR and MDIFW."

MDMR Recommendation: The fish passage facilities for other diadromous species should be designed and implemented in a way that is consistent with operations at the Green Lake National Fish Hatchery. To ensure this is accomplished, the design of the fish passage facilities should be designed and implemented in consultation with U.S. Fish and Wildlife Service.

Thank you for the opportunity to provide comments on this WQC. Please contact Casey Clark (casey.clark@maine.gov; 207-350-9791) if you have any questions.

Sincerely,

Casey Clark, Marine Resource Scientist

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Downstream Passage Alternatives

In general, MDMR is supportive of the alternatives pursued by BB2H, however based on the CFD modeling, the current alternatives do not adequately address downstream passage at the project (see Downstream Passage Alternatives CFD Modeling section). In addition to our comments on the CFD results (See section below), none of the proposed alternatives are likely to be adequately effective for downstream migrating eels. While ¾" racks would prevent the majority of eels from being entrained in the project intakes, eels are generally bottom oriented, and the lack of a low-level bypass structure could result in long migration delays and failure to pass the facility. The delays could cost eels significant energy that is needed to successfully complete their migration to the Sargasso Sea to spawn. A low-level bypass or similar structure, coupled with effective guidance could alleviate these concerns. MDMR appreciates BB2H's discussion of various species-specific bypass structures, but none that are eel specific ultimately made it into any of the alternatives.

Finally, the alternatives do not directly address needed upgrades to the downstream bypass system. In particular, the configuration of the plunge pool (pictured on pdf pages 19-21) has the potential to kill, injure, or cause undue stress to downstream migrants that attempt to navigate the bypass structure. A bypass system that discharges directly into the tailwater in an area with adequate depth would be in line with modern standards and would be much preferred over the current structure.

General Comments

PDF Page 24: "Approach velocities near the intake rack would be too swift at full generation, which could result in impingement if an exclusion device with narrow spacing is installed without additional protocols or measures to account for velocity issues."

MDMR Comment: Please describe the specific rack spacing that was used to arrive at this conclusion. An understanding of approach and sweeping velocities across multiple rack spacing sizes (e.g., ½", ¾", 1"), including an analysis of flow scenarios developed using the flow duration curve, would help determine the most effective approach.

PDF Page 24: "Kaplan units typically have a minimum unit hydraulic capacity of approximately 20% of the maximum capacity. This equals a minimum flow through a single unit of 904 cfs, resulting in a calculated average intake velocity of 0.8 ft/s; through both units this equals a minimum flow of 1808 cfs, resulting in a calculated average intake velocity of 1.6 ft/s"

MDMR Comment: If the minimum flow through a single unit is 904 cfs with an average intake velocity of 0.8 ft/s, it would be expected that with both units operating at minimum flow (i.e., combined 1808 cfs), that the average intake velocity would be lower than 1.6 ft/s due to the increased area (i.e., two intake bays instead of one) that water flows through. Please review and correct this conclusion to clarify the increased intake rack area.

PDF Page 38: "A floating guidance boom system was also installed at the Hydro Kennebec Project, the next project upstream of the Lockwood Project, in 2012. For total station survival evaluations conducted in 2013 and 2014, the bypass effectiveness rates were calculated to be 69% and 29%, respectively. (Brookfield, 2015)."

MDMR Comment: Further down on page 38, the Licensee states "In discussion with the resource agencies, NMFS expressed that this guidance option is not preferred" in regard to barrier nets. MDMR expressed similar concerns regarding the rigid barrier approach on its own. Please add "Comments from MDMR suggest that a rigid barrier is not preferred as the only exclusionary measure" after "(Brookfield, 2015)."

Downstream Passage Alternatives CFD Modeling

While MDMR is generally supportive of the approaches to downstream passage at the site, the CFD modeling results revealed some issues. Importantly, velocities measured 1 foot upstream of the intake racks were above USFWS guidelines (< 2 fps) in most of the alternatives, even at half generation. This is unacceptable, as it could result in significant entrainment and impingement on a new rack structure. The only alternative that met USFWS guidelines across the vast majority of the rack was the angled bar rack at half generation. However, even in that scenario it is MDMR's understanding that the modeled rack spacing (1") is larger than USFWS guidelines (I.e., 3/4" or less) and resulted in minimal sweeping velocities across the structure that might not provide effective guidance. Nonetheless, the angled rack approach appears to be the best alternative of those investigated, and design changes to the structure (e.g., increased length of rack, increased angle of rack, etc.) could increase its potential effectiveness and minimize the need to reduce generation.

General Comments

PDF Page 17: "the two other entrances to the downstream bypass were closed"

MDMR Comment: Please include a rationale as to why these bypasses were closed during field data collection, clearly describe how the facility is normally operated, and include a description of how the operation differed from normal, if at all.

PDF Page 22: "The half generation scenario was modeled assuming that only one generating unit is operating at full capacity, rather than both units running at half capacity, consistent with the Project's normal operations."

MDMR Comment: MDMR appreciates the licensee considering reduced generation scenarios. Please describe why the half generation scenario was only modeled with one unit off and the other running at full capacity. If both units were running at half capacity or even slightly more, the approach velocities might be lower than currently estimated. These conditions would need to be investigated with further CFD modeling and additional information on the control mechanisms for the generation units (I.e., wicket gates) would need to be explored.

PDF Page 34: "Figure 3.1.1-2: Velocity Magnitude 1-Foot Upstream of Intake Rack – Full Generation (9,040 cfs) Scenario (125 cfs Attraction Flow) – Existing Conditions"

MDMR Comment: Please provide the entire range of velocities in each figure. While it is certainly important to generally describe where velocities are above USFWS guidelines, visualizing the full range of data will give stakeholders a complete understanding of modeled velocities at the site.

PDF Page 53: "The layout of the CFD model for Alternative 1…"

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MDMR Comment: Please describe the exact rack spacing that was modeled in each alternative.

Stranding Evaluation

In the stranding study report, BB2H indicated that there were four pools that had a high potential for fish presence that became stranded at specific scenarios. The "stranding" definition was based on whether a fish with similar morphometrics to Atlantic salmon had adequate water depth to escape a pool or not. While DMR acknowledges the appropriateness of that assumption, it is possible that small juvenile fish may become stranded through mechanisms other than pure body size (e.g., limited mobility). Thus, MDMR would have preferred to see this study completed during the proposed timeline, such that migratory fish were abundant in the project area, and stranding effects could be more thoroughly quantified. MDMR supports the BB2H proposal to adjust boulders between pools to improve connectivity.

Upstream Anadromous Fish Passage

Due to substantial outages in radio telemetry equipment, this study failed to document where tagged American shad halted their upstream migration, and if they had entered the fishway at all. In the absence of this detailed information, MDMR is evaluating upstream shad passage using the number of tagged fish that passed the project out of those that approached (0/106). Further, the Worumbo project only passed a single shad during the 2023 season. The upstream facility is also ineffective for passage of river herring (37/76 fish with complete data histories passed the project; 48.7%). Limited effectiveness of the upstream facility for alosines warrants significant infrastructure upgrades to the current facility to address this avoidable impact. MDMR looks forward to further discussions regarding the development of new/modified upstream passage infrastructure at the site.

MDMR would also propose two operational measures that should be implemented in addition to structural improvements. BB2H should increase the frequency of lift operations to improve internal efficiency for river herring. The lift is documented as operating every two hours from 9:00 am to 5:00 pm. The mean residence time for river herring within the fishway entrance was 2.2 hours for fish that passed and 1.2 hours for fish that did not. This may suggest that fish are exiting the fishway prior to passage in part due to the long wait times at the lift. Lift timing could be adaptively managed throughout the season in response to changing fish passage needs. Additionally, as BB2H suggests, expanding hours of operation may enhance fishway effectiveness for shad, as almost half of detections occurred after lift operations and attraction flows had been shut down. BB2H should consult with the resource agencies to discuss options for changing these operational conditions prior to implementing any changes.

General Comments

PDF Page 54: "They demonstrated adequate function with a combined average upstream passage rate of 86% across all studies and were as high as 100% in a given study year."

MDMR Comment: MDMR notes that neither Milford nor Lockwood are meeting the performance standards for Atlantic salmon through section 7 consultation with NMFS.

Upstream Eel

MDMR appreciates the additional year of upstream eel passage monitoring performed at the site and the eelway modifications made in an attempt to improve passage. Unfortunately, these modifications did not appear to meaningfully improve passage at the site due to difficulties in navigating the face of the dam. It appears that filling in the existing ridges on the dam face could be an option to improve passage conditions, along with minor modifications to provide infrastructure for eels to reach the entrance of the eelway more easily.

MDMR is supportive of the concept of multiple eelways it this site, and the proposed middle abutment may be an appropriate location for another eelway. Another potential location could be at the apex of the dam, although that alternative was not analyzed. An eelway at the apex of the dam might provide passage for eels that have already traversed the top of the dam and are in the "left dam and ledges" region that currently have no adequate means of upstream passage.

Finally, it is important to note that these data represent an analysis of only the spillway portion of the dam, and there is currently no information on eel attraction to the tailrace. Information on eel presence and abundance in this area would provide a full picture of eel passage conditions at the project. MDMR also notes that eel passage may need to be reevaluated if there are substantial changes in project operations and flow conditions as a result of this relicensing.

Upstream CFD

MDMR appreciates the proactive efforts of BB2H to conduct this study, and we look forward to seeing further results once the modeling approach has been validated. However, as indicated previously in these comments, limited effectiveness of the upstream facility for alosines warrants significant operational and infrastructure upgrades to the current facility. MDMR looks forward to continued discussions around upstream passage at this facility.

General Comments

PDF Page 15: "The half generation scenario was modeled assuming that only one generating unit is operating at full capacity, rather than both units running at half capacity, consistent with the Project's normal operations."

MDMR Comment: MDMR appreciates the licensee investigating reduced generation scenarios. Please describe why the half generation scenario was modeled assuming one generating unit at full capacity rather than both units running at half capacity or a combination of capacities. A different combination of capacities could raise/lower velocities in key areas and might improve passage conditions. This would need to be investigated with subsequent CFD modeling.

PDF Page 15: "The attraction water system is reported to have a total capacity of 240 cfs; as discussed below, the Operations and Maintenance Plan (BB2H 2020) current operations include a maximum total attraction flow of 190 cfs."

MDMR Comment: Please explain the rationale behind operating the facility with an attraction flow of 190 cfs rather than the 240 cfs that the infrastructure can support. MDMR notes that both flow rates are below current USFWS recommendations of 5%, and increasing attraction to the fish lift could improve fishway entrance success, but additional operational and infrastructure upgrades to the internal fishway would still be needed.