ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE

Winooski 8 Hydroelectric Project, P-6470-008

Vermont

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, D.C. 20426

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ACRONYMS AND ABBREVIATIONS

APE	area of potential effect
°C	degrees Celsius
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CWA	Clean Water Act
CEQ	Council on Environmental Quality
CVTA	Cross Vermont Trail Association, Inc.
Dkey	determination key
DO	dissolved oxygen
EA	environmental assessment
EIA	U.S. Energy Information Administration
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
fps	feet per second
gpm	gallons per minute
GMP	Green Mountain Power
FWS	U.S. Fish and Wildlife Service
Interior	U.S. Department of the Interior
IPaC	Information for Planning and Consultation
kV	kilovolt
MW	megawatt
MWh	megawatt-hours
mg/L	milligrams per liter
NEPA	National Environmental Policy Act
National Register	National Register of Historic Places
NHPA	National Historic Preservation Act
NERC	North American Electric Reliability Corporation
NPCC-New England	Northeast Power Coordinating Council's New England region
NLEB	Northern long-eared bat
PM&E	protection, mitigation, and enhancement
RM	river mile
RMP	Recreation Management Plan
SD1	Scoping Document 1
SD2	Scoping Document 2
SCORP	Statewide Comprehensive Outdoor Recreation Plan
USGS	U.S. Geological Survey
Vermont ANR	Vermont Agency of Natural Resources
Vermont DEC	Vermont Department of Environmental Conservation
Vermont DHP	Vermont Division for Historic Preservation
Vermont FWD	Vermont Fish and Wildlife Department

Vermont SHPO	Vermont State Historic Preservation Office
VSWI	Vermont Significant Wetland Inventory
WQC	Clean Water Act section 401 water quality certification
WHC	Winooski Hydroelectric Company
Winooski 8 Project	Winooski 8 Hydroelectric Project

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1.0 INTRODUCTION

1.1 APPLICATION

On July 30, 2021, Winooski Hydroelectric Company (WHC) filed an application with the Federal Energy Regulatory Commission (Commission) for a subsequent minor license to continue to operate and maintain the Winooski 8 Hydroelectric Project No. 6470 (Winooski 8 Project or project).[1] The 0.856-megawatt (MW) project is located on the Winooski River in the towns of East Montpelier and Berlin, Washington County, Vermont (see Figure 1).[2] The project does not occupy federal land.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Winooski 8 Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license to WHC for the project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project would be best adapted to a comprehensive plan for improving or developing a waterway.

In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

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[1] A license for the project was issued on August 29, 1983, for a term of 40 years, with an effective date of August 1, 1983, and an expiration date of July 31, 2023. See *Winooski Hydroelectric Company*, 24 FERC ¶ 62,234 (1983). The project is operating on an annual license since the expiration of the current license.

[2] Most of the tables and figures referenced in this EA are presented in Appendices C and D.

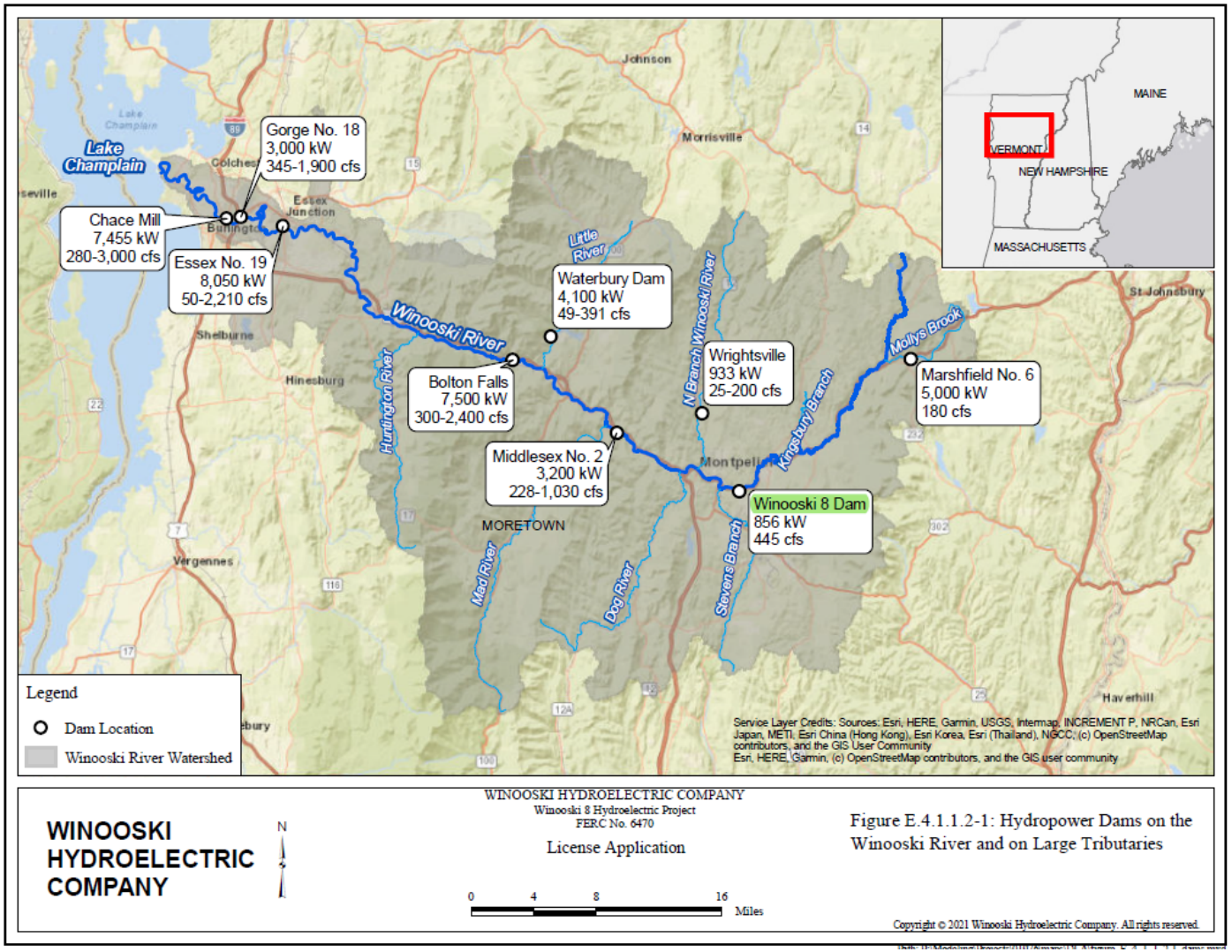

Figure 1. Location of the Winooski 8 Project and other hydroelectric dams in the Winooski River (Source: license application; staff)

Issuing a new license for the Winooski 8 Project would allow WHC to continue to generate electricity at the project for the term of the new license, making electric power from a renewable resource.

This environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969,[3] the Council on Environmental Quality (CEQ) regulations for implementing NEPA,[4] and the Commission's implementing regulations.[5] This EA assesses the environmental and economic effects associated with operation of the project, and alternatives to the proposed project. It includes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become part of any issued license.

In this EA, we assess the environmental and economic effects of continuing to operate the project: (1) as proposed by WHC (proposed action); (2) under the proposed action with staff's additional or modified measures and most of the mandatory water quality certification conditions (staff alternative); (3) the staff alternative but with all the mandatory water quality certification conditions (staff alternative with mandatory conditions); and (4) the no-action alternative. The primary issues associated with relicensing the project are the effects of continued operation and maintenance on aquatic resources (i.e., water quality, resident fish, and freshwater mussels), threatened and endangered species, recreation, and aesthetic resources.

1.2.2 Need for Power

The Winooski 8 Project would continue to provide hydroelectric generation to meet part of the region's power requirements, resource diversity, and capacity needs. The Winooski 8 Project has a generating capacity of 856 kilowatts (kW) and generates an average of 3,507 megawatt-hours (MWh) per year.

To assess the need for power, we look at the needs in the operating region in which the project is located. The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Winooski 8 Project is located within the Northeast Power Coordinating Council's New England region (NPCC-New England) of the NERC. According to NERC's 2023 Long-Term Reliability Assessment, the net internal demand for this region is projected to increase annually by about 1.32% from 2024 to 2033. The anticipated reserve margin (i.e., the primary metric used to evaluate the adequacy of projected generation resources to serve forecasted peak load) is expected to range from 9.2% in 2033 to 27.2% in 2025. The New England region is forecasted

[3] National Environmental Policy Act of 1969 amended (Pub. L. 91-190. 42 U.S.C. §§ 4321–4347, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, Pub. L. 97-258, §4(b), September 13, 1982, Pub. L. 118-5, June 3, 2023).

[4] 40 CFR Parts 1500-1508

[5] 18 CFR Part 380.

to meet NPCC-New England's reference reserve margin from 2024 to 2033, which ranges from 10.0% in 2030 to 12.9% in 2024 (NERC, 2023).

If relicensed, power from the Winooski 8 Project would continue to help meet a need for power in the New England region in both the short and long-term. The project also provides power that can displace generation from non-renewable sources and contributes to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions and create an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any new license for the project would be subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described in Appendix A.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations [18 Code of Federal Regulations (C.F.R.) §§ 5.1-5.16] require applicants to consult with appropriate resource agencies, Tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping for the project to determine what issues and alternatives should be addressed. Scoping Document 1 (SD1) was distributed to interested agencies and others on December 7, 2021 and noticed in the Federal Register on December 13, 2021 (86 FR 70832). No comments were filed in response.

1.4.2 Interventions

On October 13, 2021, the Commission issued a notice accepting the application and setting December 13, 2021, as the deadline for filing motions to intervene and protests. The notice was published in the Federal Register on October 19, 2021 (86 FR 57820). The Vermont Agency of Natural Resources (Vermont ANR) filed a motion to intervene on December 13, 2021. The U.S. Department of the Interior (Interior) filed a notice of intervention on December 14, 2021.[6]

1.4.3 Comments on the Application

On January 4, 2023, the Commission issued a notice stating that the application was ready for environmental analysis and setting March 5, 2023, as the deadline for filing comments,

[6] Late intervention was granted on January 6, 2022.

recommendations, terms and conditions, and prescriptions.[7] The notice was published in the Federal Register on January 10, 2023 (88 FR 1372). Interior filed a request to reserve authority to prescribe fishways on January 4, 2023. Vermont ANR filed comments and recommendations on March 3, 2023.

WHC filed reply comments on April 18, 2023.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate under the terms and conditions of the current license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities

The major project facilities are shown in Figure 2 below. The Winooski 8 dam is a 222.5-foot-long, 26-foot-high concrete gravity dam that consists of a 7-foot-wide gatehouse/left abutment structure, a 148-foot-long spillway section topped with 4-foot-high flashboards, a 24-foot-long crest gate, and the powerhouse which is integral to the dam. The maximum spillway crest elevation is 611 feet when the flashboards are not in place and 615 feet when the flashboards are in place. The dam creates a 4.8-acre impoundment with a storage capacity of 20 acre-feet at an elevation of 615 feet (with 4-foot flashboards in place). [8]

Water passes through a 33.5-foot-wide, 28-foot-high concrete intake structure that is integral with the powerhouse. The full trash rack opening at the project intake is 26-feet-wide by 25-feet-high. The openings have a common top and sill elevation of 616 feet to 590 feet, respectively. There are three separate hydraulically-operated trash racks with 2-inch bar spacing for the three units. Unit 1, 2. and 3 measure 6, 8, and 12 feet wide by 25 feet deep, respectively.

The powerhouse is a 39.5-foot-long and 39.25-foot-wide reinforced concrete structure that contains three turbines: two semi-Kaplan turbines with a combined capacity of 793 kW (capacity of unit 2 and unit 3 is 263 kW and 530 kW, respectively), and one fixed propeller turbine with a capacity of 63 kW (unit 1) for a total installed capacity of 856 kW. The minimum

[7] The notice established a 60-day period for filing comments, recommendations, terms and conditions, and prescriptions. The Commission's Rules of Practice and Procedure provide that if a filing deadline falls on a Saturday, Sunday, holiday, or other day when the Commission is closed for business, the filing deadline does not end until the close of business on the next business day. 18 C.F.R. § 385.2007(a)(2). Because the 60-day filing deadline fell on a Sunday (i.e., March 5, 2023), the filing deadline was extended until the close of business on Monday, March 6, 2023.

[8] All elevations in this document are based on the National Geodetic Vertical Datum of 1929 (NGVD29).

hydraulic capacity for unit 1, 2, and 3 is 25 cfs, 20 cfs, and 24 cfs, respectively and maximum hydraulic capacity for unit 1, 2, and 3 is 36 cfs, 139 cfs and 272 cfs, respectively. Flows from the 63-kW unit discharge parallel to the dam, and are used to maintain the minimum bypass flow of 25 cfs, or inflow, whichever is less. Units 2 and 3 discharge into a 100-foot-long, 25-foot-wide tailrace that is separated from the Winooski River by an 8-foot-high concrete wall, creating an approximate 100-foot-long bypassed reach.

Power from the project is transmitted to a 1,000-kilovolt-amp (kVA) station transformer located at the left (north) abutment approximately 10 feet from the powerhouse. An underground line runs approximately 10 feet from the station transformer to an aboveground pole owned by WHC which interconnects with Green Mountain Power's (GMP) regional distribution grid system.[9] Access to the powerhouse is via a 10 to 12-foot-wide, 4,100-foot-long dirt access road (PowerPlant Road) that begins at Gallison Hill Road and runs adjacent to the river before ending at the powerhouse.

[9] *See* Summary memorandum of a call held between WHC and Commission staff to discuss the extent of the project transmission line issued on May 26, 2022. *See also* WHC's filing on May 27, 2022, which included a description clarifying the project transmission line interconnection point and updated Exhibit F and G drawings.

Figure 2. Major Project Features at the Winooski 8 Hydroelectric Project (Source: Staff)

WHC allows public use of project land and waters for recreation. The project license does not require the project to provide any recreation facilities. However, an informal whitewater boating put-in and tailwater fishing access area is located below the dam and a boat take-out is located above the dam on lands owned by WHC. A portion of PowerPlant Road serves as the portage route between the take-out and put-in (see Figure 3 in Appendix C). WHC does not currently maintain these recreation facilities.

2.1.2 Current Project Boundary

The project boundary currently encompasses 7.29 acres, which includes the impoundment, access road, dam, and other project facilities. The project does not occupy federal lands.

2.1.3 Project Safety

The Winooski 8 hydroelectric project has been operating since 1985 under its current license. During this time, Commission staff have conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance.

As part of the licensing process, Commission staff will evaluate the continued adequacy of the project's facilities under a subsequent license. Special articles will be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the term of any subsequent license to assure continued adherence to Commission-approved plans and specifications; special license articles relating to construction (if any), operation and maintenance; and accepted engineering practices and procedures.

2.1.4 Current Project Operation

WHC operates the Winooski 8 Project in an automatic run-of-river mode where outflow approximates inflow at any given point in time. WHC monitors impoundment levels via a water level sensor located in the forebay upstream of the trash racks and automatically adjusts flow through its turbines in order to maintain the project impoundment water level to a point just below the top of the flashboard crest (elevation of 615 feet). WHC states that its automated system monitors impoundment level data and makes turbine adjustments in real-time.[10] When generating, water enters the three intake bays located on the river-right side of the dam (when looking downstream) and passes through the trash racks before entering the powerhouse. Turbine Unit 1 currently discharges a fixed flow of 25 cfs into the plunge pool immediately below the dam. Turbine Units 2 and 3 discharge into a 25-foot-wide tailrace channel that releases the flows to the Winooski River at a point approximately 100 feet downstream of the dam. WHC adjusts the flow through Units 2 and 3 in order to maintain the impoundment water level. If Unit 1, which releases a 25-cfs minimum flow to the bypassed reach, trips off-line, the monitoring system increases the impoundment set-point and raises the impoundment water level in order to spill the required 25-cfs minimum flow over the flashboards until Unit 1 comes back

[10] *See* telephone summary memorandum issued January 9, 2024.

online at which point the set-point is lowered back to 615 feet (just under the top of the flashboards). Similarly, if Units 2 or 3 trip offline, the impoundment level rises and flow in excess of the 25-cfs discharge through Unit 1 is spilled over the flashboards until these units come back online.

The hydraulic operating range of the turbine units are 25 to 36 cfs for Unit 1, 20 to 139 cfs for Unit 2, and 24 to 272 cfs for Unit 3. When inflow is below the required 25-cfs minimum bypassed flow, the project shuts down and all flow is spilled over the flashboards. When inflow is at 25 cfs or above, WHC sets its Unit 1 in a fixed position to discharge the required 25 cfs into the bypassed reach at the base of the dam. Once inflows reach 45 cfs, WHC starts generating using Unit 2 at 20 cfs while still maintaining 25 cfs through Unit 1. As flows increase, WHC can adjust flow through Units 2 and 3 until both are operating at their maximum capacities, at which point the total flow in the river is 436 cfs. When inflow exceeds 436 cfs, the impoundment water level can rise above 615 feet and water begins spilling over the flashboards.[11] When the water level exceeds 615.8 feet, the crest gate automatically opens (i.e. is lowered), to pass up to 800 cfs of additional flow to help maintain the impoundment at an elevation of 615.8 feet.[12] When the water level drops back below 615.2 feet, the crest gate automatically begins to close (i.e. rises) as needed to maintain the impoundment level at the normal pool elevation of 615 feet until the crest gate is fully closed. Under high flow conditions when the impoundment level reaches 617 feet (i.e., 2 feet above the top of the flashboards) and inflows are approximately 2,500 cfs, the flashboards on top of the dam begin to fail.[13] Complete flashboard failure occurs when inflows reach approximately 8,900 cfs. When the impoundment level is at 617 feet or greater, the turbine units are typically not operated due to large amounts of debris that can collect on the intake trash racks. In these instances, all flow is passed through the crest gate and over the spillway.

Sediment Dredging and Impoundment Drawdowns

The impoundment is regularly drawn down to an elevation of 610.8 feet (0.2 feet below the spillway crest) once or twice a year to repair/replace the flashboards. This usually occurs

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[11] While the maximum hydraulic capacity of the three turbines in the powerhouse is 447 cfs, WHC states that it does not operate Unit 1 at maximum hydraulic capacity, but instead, keeps Unit 1 at a fixed 25-cfs setting. Thus under existing conditions, spill over the dam occurs once flows rise above 436 cfs (i.e., the sum of 25 cfs through Unit 1; 139 cfs through unit 2; and 172 cfs through unit 3) rather than once flows rise above 447 cfs. *See* telephone summary memorandum issued January 9, 2024.

[12] WHC states the amount of flow that can pass through the crest gate varies depending on the headwater elevation. For instance, under normal pool elevation when the flashboards are in place, up to 800 cfs can pass through the gate. During flood conditions with the flashboards removed, up to 2,000 cfs can pass through the crest gate.

[13] WHC states that the flashboards are constructed of wood and held in place with steel pins. They do not fail all at once, but segments fall off as the inflows increase and the impoundment level fluctuates around 617.0 feet.

following winter ice-out in late March or April and following a high precipitation storm or flood event, and usually takes approximately one or two days to complete. WHC draws down the impoundment by increasing generation flows above inflow rates, during a time when streamflow conditions allow, which is typically when project inflows are below 200 cfs. When the repairs are completed, WHC maintains the 25-cfs minimum flow in the bypassed reach through Unit 1 but uses the "extra" inflow to refill the impoundment before resuming typical run-of-river operation. [14]

Figure 4 in Appendix C shows the two areas within the impoundment that WHC typically dredges. WHC regularly dredges the area in front of the intake for two days every three to six weeks in the winter to remove sediment and debris. WHC uses a long-reach backhoe to dredge the intake area from the riverbank. WHC states that additional dredging of the intake may occur following a severe weather event resulting in high flows. WHC states that typical dredging in front of the intake does not require the impoundment to be lowered below the flashboard crest elevation.

If the impoundment has an abnormal amount of sediment deposition, WHC consults with the Vermont Agency of Natural Resources (Vermont ANR) and develops a plan for dredging further into the impoundment as shown on Figure 4 in Appendix C. Typically during these larger dredge events, the impoundment water level is lowered to approximately 610 feet, and only the exposed sediment above an elevation of 610 feet is removed using the long-reach backhoe. Drawdowns for these dredges last approximately one week and occur every three to five years, usually taking place in September or October when weather and flow conditions are typically safest to conduct the work.

WHC states the only other time a drawdown occurs is to inspect the dam and crest gate, which typically occurs during September or October and is planned to coincide with the larger impoundment dredge.

All dredged sediment is stored onsite, within a sand berm established between the dredged pile and the river for containment. The stored material (sand/silt) is then screened by the Road Commissioner of either the town of Plainfield or Marshfield and removed later by trucks for fill offsite.

2.2 WHC'S PROPOSAL

2.2.1 Proposed Facility and Project Boundary Modifications

The applicant proposes to expand the project boundary to include the 4,100-foot-long project access road (PowerPlant Road) used by WHC to access the dam and powerhouse, and to enclose an existing unimproved recreation site that provides access to the river for boating and

[14] WHC states that it tries to use 10 percent (%) of the river inflow to refill the impoundment while the remainder is passed through the turbine units. If Unit 1 is not operating (such as when inflow is below 25 cfs), WHC uses the crest gate to pass inflow while utilizing 10% of the inflow to refill the impoundment.

fishing activities downstream of the dam. The proposed additions will add 3.56 acres to the project boundary for a total of 10.85 acres (Figure 5 in Appendix C).

2.2.2 Proposed Operation and Environmental Measures

WHC proposes to:

- Continue to operate the project in a run-of-river mode in which flow through the turbines is adjusted to maintain the project impoundment water level at 615 feet or at the level needed to provide seasonal aesthetic spill flows (described further below) so that at any given point in time, the sum of flows immediately downstream of the powerhouse tailrace approximates the sum of inflow to the project.

- When refilling the impoundment after a drawdown, store 10% of the inflow until the impoundment increases to the normal pool elevation of 615 feet.

- Implement the draft Sediment Dredging Management Plan filed with the license application that includes provisions to: (1) notify Vermont ANR prior to conducting any dredging activity of the geographic area of the proposed dredge, estimated duration of the dredge (including start and end date), and estimated river flows during the planned dredging operation; (2) conduct all dredging using a bucket loader from the shoreline rather than placing equipment in the water, and only remove sediment that is above the water line when the impoundment is drawn down to minimize the amount of sediment that is re-suspended in the water column; (3) stockpile the dredged material in an upland site, and install temporary silt fences around the stockpile to prevent runoff to the river; and (4) notify Vermont ANR upon the completion of the dredge, remove silt fences, and haul the dredge material offsite after the dredge pile has sufficient time to drain.

- From November 1 to April 30, provide a continuous minimum flow of 36 cfs or inflow, if less, in the bypassed reach to maintain aquatic habitat. Minimum flows would be discharged through Unit 1 or spilled if Unit 1 is not operational.

- From May 1 to October 31, maintain a daytime minimum flow of 41 cfs and a night time minimum flow of 36 cfs or inflow, if less, in the project bypassed reach via a combination of spill flow over the dam and discharge through Unit 1 to enhance aesthetic resources and aquatic habitat during the summer recreation season. Aesthetic flows would be provided by spilling 16 cfs (i.e., equal to 1 inch of spill over the spillway crest flashboards) during the daytime and 11 cfs (equal to 0.5 inch of spill over the spillway crest flashboards) at night. [15] The remaining minimum flow

[15] WHC is not proposing to maintain an aesthetic spill flow from November 1 to April 30 because it states that ice build-up on the flashboards prevent maintaining adequate spill over the dam. WHC defines "daytime" as beginning one half hour before sunrise and extending one half hour after sunset. Thus, staff estimate that WHC would provide its daytime aesthetic spill flows

during this period (i.e., 25 cfs) would be discharged into the bypassed reach through Unit 1 or spilled if Unit 1 is not operational. If inflow drops below proposed minimum flow levels, WHC would prioritize maintaining aesthetic spill flows over the dam rather than discharging flows through Unit 1.[16]

- Conduct a survey for mussels during the first planned maintenance drawdown of the impoundment. The survey would consist of lowering the impoundment to the lowest expected drawdown needed for maintenance[17] and having a mussel expert walk the impoundment shoreline to locate, identify and relocate any mussels found during the survey to deeper water, and file a summary report of the findings to Vermont ANR and the Commission within 120 days of the survey. If no mussels are detected, WHC would cease further mussel surveys during future drawdowns. If mussels are found during the initial survey, WHC would conduct additional surveys during maintenance drawdowns to re-locate any potentially exposed mussels to deeper water.

- Within 2 years of license issuance, install an interpretive display and overlook near the powerhouse that would include information about the hydropower facility and the history of the site.

- Within 2 years of license issuance, improve the existing parking area for 3 vehicles along PowerPlant Road near the whitewater boating put-in and tailwater fishing access by adding gravel or a similar substrate.

(i.e., 16 cfs) during the following hours (based on Eastern Standard Time or Daylight Savings Time) per month: May (4:56am to 8:42pm); June (4:38am to 9:08pm); July (4:53am to 9:04pm); August (5:26am to 8:27pm); September (6:02am to 7:32pm); and October (6:38am to 6:37pm). WHC would provide its proposed nighttime aesthetic flows (i.e., 11 cfs) the remainder of the time during these months.

[16] WHC states that aesthetic spill flows cannot be provided during maintenance drawdowns of the project impoundment as all water would be passed through the powerhouse in these cases. When a planned or unplanned drawdown below the spillway crest occurs during the period of May through October, the applicant proposes to stop spilling and increase the Unit 1 discharge up to its maximum capacity of 36 cfs during these brief periods. Once the impoundment is refilled following a maintenance drawdown, WHC would return to providing minimum flows in the bypassed reach via a combination of aesthetic spill flows over the dam and discharges through Unit 1 as proposed.

[17] Staff assumes that this means that the mussel survey would coincide with lowering the impoundment down to a level of 610 feet which is the water level that WHC lowers the impoundment when conducting a larger dredge every 3-5 years or when inspecting the dam and crest gate.

- Maintain and monitor the boating take-out, whitewater boating put-in and tailwater fishing access area, portage route,[18] improved parking area, and proposed interpretive display and overlook.

- Develop maps and promotional guide material describing project recreation opportunities.

- Continue to consult with the Vermont Division of Historic Preservation (Vermont DHP) before beginning any land-disturbing activities or alterations to known historic structures within the project boundary.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include WHC's measures as outlined above, and staff's recommended modifications and additional measures described below. Staff's additional measures include some of the mandatory conditions contained in Vermont ANR's Clean Water Act section 401 water quality certification (WQC) which is included in Appendix J:

- Consistent with WQC condition I, in consultation with Vermont ANR revise the Draft Sediment Dredging Management Plan for Commission approval to include a provision to conduct all planned non-emergency maintenance dredges that require the impoundment to be drawn down below the normal operating limit of 615 feet between July 1 and September 30 to avoid elevating turbidity levels downstream during sensitive resident trout spawning and rearing periods.

- From May 1 through October 31, provide spill flows of 16 cfs (i.e., equal to 1 inch of spill over the spillway crest flashboards) to enhance aesthetic resources during daytime hours only (rather than providing spill flows during the day and night from May 1 through October 31 as proposed by WHC or providing spill flows continuously throughout the year as required by WQC condition B). From November 1 to April 30, provide a continuous minimum flow of 36 cfs or inflow, if less, in the bypassed reach to maintain aquatic habitat as proposed by WHC (rather than a continuous minimum flow of 39 cfs as required by WQC condition B).

- Develop a flow management and monitoring plan consistent with WQC condition C that specifies the impoundment levels needed to maintain aesthetic spill flows and includes provisions for monitoring and reporting compliance with the operating requirements of the license (e.g., run-of-river operation, minimum flows, spill flows, impoundment levels), reporting deviations from operating requirements to Vermont DEC and the Commission, and a provision to consult with Vermont DEC prior to

[18] In its additional information response filed on April 22, 2022, WHC proposes to maintain and monitor the existing project recreation facilities.

conducting planned maintenance drawdowns of the impoundment consistent with WQC condition F.

- Develop a mussel protection plan in consultation with Vermont ANR that contains the following: (1) a schedule and methods for surveying for mussels during the first planned drawdown of the impoundment below an elevation of 610.7 feet; (2) procedures for safely collecting and handling mussels found within the maintenance fluctuation zone and transporting them to deeper waters; (3) criteria for deciding if and when mussel surveys would continue during subsequent maintenance drawdowns that are conducted below an elevation of 610.7 feet; and (4) provisions to notify the Commission of the survey results and any proposals for Commission approval to discontinue surveys or modify the frequency of surveys based on the survey results.

- Develop a debris disposal plan in consultation with Vermont ANR consistent with WQC condition E.

- To protect the northern long-eared bat (NLEB) and the tri-colored bat, avoid tree-trimming and the removal of trees with diameters that are equal to or greater than 3 inches at breast height from April 15 through October 31. If tree work is imminently required for trees with diameters that are equal to or greater than 3 inches at breast height during this period to protect property or human life, the applicant would be permitted to do so and then consult with Vermont Fish and Wildlife Department (Vermont FWD) and the U.S. Fish and Wildlife Service (FWS), consistent with WQC condition G.

- Develop a recreation management plan, consistent with WQC condition D, that includes:

    - a maintenance and monitoring schedule for all project recreation facilities, including the boating take-out, whitewater boating put-in and tailwater fishing access area, portage route, parking area, interpretive display and overlook;

    - a plan and schedule for installing the interpretive display and overlook and improving the parking area; and

    - a plan and schedule for installing signage directing users to the project recreation facilities.

Water Quality Certification Conditions Not Recommended

The staff alternative does not include the following WQC conditions because, pursuant to sections 4(e) and 10(a) of the FPA, staff concludes that the benefits would not justify their costs or generation losses: (1) provide minimum flows of 39 cfs in the bypassed reach year-round (WQC condition B); (2) maintain daytime (i.e., one half hour before sunrise to one half hour after sunset) spill flows of 1.0 inch and 0.5 inch during nighttime hours continuously year-round in the bypassed reach (WQC condition B); and (3) survey for mussels and relocate any mussels

found in the maintenance fluctuation zone to deeper water during each planned drawdown that falls below 610.7 feet without developing criteria for deciding if and when mussel surveys would continue (WQC condition H).

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

The staff alternative with mandatory conditions includes all the mandatory WQC conditions and staff's additional measures except where superseded by the WQC conditions (i.e., this alternative would include Vermont ANR's 39-cfs year-round minimum flow rather than staff's recommended 36-cfs year-round minimum flow in the bypassed reach, Vermont ANR's continuous daytime and nighttime aesthetic spill flows year-round rather than staff's recommendation to provide aesthetic spill flows only during daytime hours and only from May 1 through October 31, and Vermont ANR's condition requiring mussel surveys during all maintenance drawdowns below 610.7 feet rather than staff's recommendation to develop criteria as part of a mussel protection plan for deciding if and when mussel surveys would continue after the first mussel survey is completed). Additionally, this alternative would include a staff-recommended requirement that the flow management and monitoring plan identify the method(s) for maintaining 39 cfs minimum flows in the bypassed reach year-round.

2.5 ALTERNATIVE CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Certain alternatives to WHC's proposal were considered but eliminated from further analysis because they are not reasonable in this case. These alternatives are presented in Appendix B.

3.0 ENVIRONMENTAL ANALYSIS

This section includes: (1) a general description of the project vicinity, (2) an explanation of the scope of our cumulative effects analysis, and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource (aquatic resources, recreation, etc.). Historic and current conditions are described under each resource. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed protection, mitigation, and enhancement (PM&E) measures. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[19]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Winooski 8 Project is located at river mile (RM) 60 on the Winooski River in

[19] Unless otherwise indicated, our information is taken from the application for license filed by WHC on July 30, 2021, and from responses to requests for additional information filed on February 2, 2022; April 22, 2022; May 27, 2022; November 29, 2022; and December 15, 2023.

Washington County, Vermont. The Winooski River begins in the town of Cabot and flows in a northwesterly direction for approximately 90 miles to Lake Champlain. The Winooski River watershed has a total drainage area of about 1,080 square miles of which 199 square miles composes the Winooski 8 Dam drainage area. Major tributaries contributing flow into the Winooski River include Kingsbury Branch, Little River, Mad River, Dog River, Stevens Branch, North Branch, and Huntington River.

There are six existing FERC-licensed hydroelectric projects located on the Winooski River and its major tributaries (Winooski 8, North Branch No. 3, Waterbury, Bolton Falls, Essex No. 19, and Chace Mill) and three non-FERC-licensed projects (Marshfield No. 6, Middlesex No. 2, and Gorge No. 18) . The Winooski 8 Project is the sixth hydroelectric dam on the mainstem Winooski River upstream of Lake Champlain (see Figure 1 in section 1.2.1, *Purpose of Action*).

The watershed includes hundreds of small streams, ponds, and wetlands. Landscapes range from forests and floodplains to rolling hills, gorges, and the Green Mountains. The most heavily developed area of the watershed is near Burlington, along Lake Champlain. Land use surrounding the project is primarily forested, with medium and low-intensity development concentrated along the Route 2 corridor.

Mean annual precipitation in the region is 42.4 inches. Mean monthly temperatures range from 15.8 to 67.5 degrees Fahrenheit (°F) with January being the coldest month of the year and July being the hottest month of the year.

3.2 CUMULATIVE EFFECTS

According to the Council on Environmental Quality's (CEQ) regulations that implement NEPA, a cumulative effect is the effect on the environment that results from the incremental effect of the action when added to the effects of other past, present, and reasonably foreseeable actions, regardless of what agency (federal or non-federal) or person undertakes such other actions.[20] Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, water quality could be cumulatively affected by the relicensing of the Winooski 8 Project.

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of: (1) the proposed action's effect on the resources, and (2) contributing effects from other hydropower development and non-hydropower activities within the basin. We identified the geographic scope of analysis for water quality to include the approximate 17-mile reach of the Winooski River, from the non-FERC-licensed Marshfield No.

[20] 40 C.F.R. 1508.1(g)(3).

6 Dam (also known as the Molly's Falls Dam, approximately 14 miles upstream of the Winooski 8 Project) to where the North Branch enters the Winooski River in Montpelier, approximately 3 miles downstream of the Winooski 8 Project. We chose this geographic scope because the operation and maintenance of the Winooski 8 Project, in combination with other agricultural and urban development along the Winooski River could cumulatively affect water quality conditions through erosion and sediment accumulation within this reach.[21]

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis includes a discussion of past, present, and reasonably foreseeable future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of a new license, the temporal scope will look 30 to 50 years into the future. The historical discussion is, by necessity, limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present. Our analysis of cumulative effects is found in the corresponding aquatic resources section.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure project effects. We then discuss and analyze the environmental effects of the project alternatives. Only the resources that have the potential to be affected are addressed in this EA. We have determined that aquatic resources (i.e., water quality, fisheries, and freshwater mussels), terrestrial resources, threatened and endangered species, recreation and aesthetic resources would be affected by the proposed action and alternatives. We also consider the effects of the project on environmental justice communities and cultural resources. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Quantity

The Winooski 8 Project impoundment extends about 0.25-mile upstream of the dam. At the typical operating elevation of 615 feet, the impoundment has a surface area of 4.8 acres and a volume of approximately 20 acre-feet. Because the project is operated as a run-of-river facility

[21] Within this reach, water quality conditions are influenced by flow releases from the upstream Marshfield No. 6 Dam, upstream development along the Winooski River (including the towns of Plainfield and East Montpelier) and flow releases from the project. Downstream of Montpelier, flows and water quality conditions are driven by operations at Wrightsville and Waterbury Dams both located on tributaries to the Winooski as well as operations at the Bolton Falls Dam at RM 43 and the Essex No. 19 Dam at RM 18 on the mainstem Winooski River.

(i.e,, maintaining a relatively stable reservoir elevation with outflows approximating inflows), there is very little usable storage capacity under normal operating conditions. Daily inflow to the impoundment varies seasonally based upon Winooski River flows, the operation of upstream hydroelectric dams, and regulated and unregulated tributary inflow. The closest operating stream gage to the project is U.S. Geological Survey (USGS) gage no. 04286000 located about 5 miles downstream at Montpelier, Vermont. Both Stevens Branch and the North Branch tributaries flow into the Winooski River between the project and the downstream Montpelier USGS gage. On the North Branch, flow data is available for USGS gage no. 04285500 which is located approximately 3 miles upstream of the North Branch and Winooski River confluence. To estimate inflows at the project, WHC used 80 years of flow data from the Montpelier and North Branch gages for the period 1936 to 2016.[22] Rather than utilize the older dataset provided by WHC in its license application, staff pulled gage data for the past 40 years which covers the period the project has been operating and includes the recent flood event that occurred in July of 2023. Staff believe this dataset is more representative of existing conditions compared to the dataset presented by WHC in its license application.

Table 1 in Appendix D summarizes flow data by month for the Winooski River at the project based on the prorated data for the period January 1984 through October 2023.[23] The average annual flow at the Winooski 8 Project was 324 cfs and the median annual flow was 207 cfs (table 1 in Appendix D). Monthly flows typically reach their highest values in April and May and their lowest values in August and September. The minimum and maximum average daily flows during the period evaluated were 7 cfs (recorded on February 1, 2000) and 10,321 cfs (recorded during a recent flood event on July 11, 2023), respectively.

Water Withdrawals and Discharges

There are no permitted water withdrawals from the project impoundment. A total of 15 permitted wastewater discharge permits have been issued for facilities discharging to the

[22] The Montpelier gage has a drainage area of 397 square miles, the North Branch gage has a drainage area of 69.2 square miles, and the project site has a drainage area of 199 square miles. In order to provide an estimate of inflow to the project, WHC subtracted the North Branch flow and drainage from the flow and drainage at the Montpelier gage (i.e., 397 – 69.2 = 327.8 adjusted square mile drainage) and then prorated the flows by a factor of 0.61 to reflect the difference between the adjusted Montpelier gage drainage and the project site (i.e., 199 project drainage divided by 327.8 adjusted Montpelier gage drainage = 0.61 proration factor). For example, the adjusted mean monthly flow for the month of January at the Montpelier gage after adjusting for North Branch flow input was 456 cfs. Applying a correlation factor of 0.61 to account for the difference in drainage would mean the estimated monthly mean flow at the project site for the month of January would be 278 cfs (i.e., 456 x 0.61 = 278 cfs). No flow data for the Stevens Branch tributary was available; thus, neither WHC nor staff used data for Stevens Branch when estimating inflow for the project.

[23] Staff applied the same adjustments and correlation factors for this dataset that WHC used in its license application.

mainstem Winooski River. Three are located upstream of the project with the closest being the Plainfield Wastewater Treatment located approximately 8 miles upstream of the project dam. The remaining 12 permitted wastewater discharges occur on the Winooski River downstream of the project with the closest being Montpelier Wastewater Treatment Plant located approximately 4 miles downstream of the project dam. Additionally, the Barre Wastewater Treatment Facility is located approximately 3 miles upstream on the Stevens Branch tributary which enters the Winooski River mainstem approximately 1.25 miles downstream of the project dam.

Water Quality

The State of Vermont assigns classification to all its surface waters, which determines the criteria that apply to a specific water. The Winooski River in the vicinity of the project is designated as a Class B(2) water and is also classified as a cold water fishery. Class B(2) waters are managed to support the following designated and existing uses: aquatic biota and wildlife; aquatic habitat; aesthetics; public water supply, with filtration and disinfection or other required treatment; irrigation of crops and other agricultural uses; swimming and other primary contact recreation; and boating, fishing, and other related recreational uses. Relevant water quality standards for Class B(2) waters and cold water fish habitat are included in table 2 in Appendix D.

Additionally, the State of Vermont's anti-degradation policy (Vermont ANR, 2017) applies to all waters in Vermont. This policy is intended to protect, maintain, and improve water quality relative to existing conditions in order to support designated uses. For any waters that currently exceed the requirements of the state water quality criteria, the policy states that reductions in water quality are only permitted when economic and social considerations outweigh the benefits of maintaining the higher water quality and when best management practices and the highest criteria requirements are applied. The following uses are to be protected and maintained in accordance with the anti-degradation policy: aquatic biota and wildlife; habitat that supports existing aquatic biota, wildlife, or plant life; recreation and fishing; and water supply or commercial activity that depends directly on the preservation of an existing high level of water quality.

The Winooski River segment encompassing the project is not listed on the 2022 State of Vermont 303(d) List of Impaired Waters (Vermont DEC, 2022). While the reach extending from the Stevens Branch of the Winooski River (approximately 1.25 miles downstream of the project dam) upstream to Molly's Falls Brook (located approximately 14 miles upstream of the project) had previously been characterized as "stressed" by the State of Vermont due to physical alteration, sediment, nutrients, turbidity, coliform bacteria arising from streambank erosion, channel instability, road runoff, and unknown coliform sources (Vermont ANR, 2016a), these waters were no longer identified as "stressed" in the most recent 2020 Vermont Priority Waters List (Vermont DEC, 2023).

Water Quality Monitoring

From June 30 to August 22, 2022, WHC collected dissolved oxygen (DO) and water temperature data at 15-minute increments at the following locations: upstream of the project impoundment outside of the influence of the project, in the upstream end of the project impoundment, in front of the project intake, in the bypassed reach, and in the Winooski River

downstream of the powerhouse tailrace. WHC's water quality study found that flow conditions during the study represented low-flow, warm-weather conditions when DO concentrations are expected to be the lowest at the project. Hourly flow data at the project interpreted from downstream gages ranged from a low of approximately 31 cfs on August 16, 2022, to a high of 234 cfs on July 19, 2022. WHC states that due to the low flows experienced during the study, Units 2 and 3 were offline for much of the study period with Unit 2 only operating for four hours on June 30 and Unit 3 operating sporadically from June 30 to July 9 and again from July 19 through July 28. Unit 1 (minimum flow unit) operated for the entirety of the study period except during a three-hour period when it was offline on July 9. Table 3 in Appendix D displays DO and water temperature data collected during the 2022 study.

The data indicate that DO concentrations met or exceeded the State standard levels [i.e., 6 milligrams per liter (mg/L) and 70%saturation] at all seven monitoring locations throughout the duration of the study.

Water temperatures during the study ranged from 15.70 degrees Celsius (°C) to 28.90°C [or 60.26 degrees Fahrenheit (°F) to 84.02°F], averaging between 22.70°C to 23.10°C (or 72.86°F to 73.58°F). The temperatures remained similar and fluctuated in sync upstream to downstream of the project during the study period. Greater fluctuations in DO concentrations and water temperature were observed in the bypassed reach during the study compared to other monitoring locations, likely due to fluctuations that occur as the project shifts from discharging through Unit 1 to spilling during lower flow periods.

Aquatic Habitat

Impoundment

The 4.8-acre project impoundment extends approximately 1,300 feet upstream of the dam. The river-left shoreline (looking downstream) is approximately 1,260-feet-long and is relatively steep. The slope between Route 2 and the impoundment is lined with rip-rap. The river-right shoreline is approximately 860-feet-long and includes a short section of retaining wall just above the powerhouse and then becomes forested. The riverine reach on both sides of the river below the dam is lined with a buffered strip of trees and vegetation. Water depths range from 2 to 8 feet deep but typically averages 3 to 5 feet due to the high volume of sand and silt that typically settles in the impoundment from upstream sources. Substrate in the upper impoundment consists of a mix of clay, sand, gravel, cobble, occasional boulder, and limited bedrock and faster moving water. The middle and lower reaches of the impoundment consist of slower flows and homogenous silt/sand substrates closer to the project dam. The lower impoundment near the powerhouse intake is regularly dredged in order to maintain adequate flows through the intake and powerhouse.

Bypassed Reach

The project bypassed reach extends approximately 100 feet downstream of the dam. It consists of a deep run below the bedrock ledge present at the base of the dam which transitions to pocket water and shallow riffle habitat. Large and small boulders and cobble are present throughout the reach. The ledge habitat on the river-left (when looking downstream) appears to

direct most of the spill flow to the center-right side of the dam (when looking downstream) which also receives water discharged from Unit 1. The bypassed reach remains wetted throughout the year under all operating conditions from a combination of discharges through Unit 1 and spill over the dam.

Tailrace

Units 2 and 3 in the powerhouse discharge into a 100-foot-long, 25-foot-wide tailrace channel that is separated from the bypassed reach by a 8-foot-high concrete wall. The tailwater area further downstream varies in width from approximately 220 feet to 80 feet from upstream to downstream and consist of a free-flowing reach defined by riffles, runs, and pools. Depths in the tailrace channel can reach 8 feet deep.

Fish Community

Resident Fish

The Winooski River encompassing the project supports a trout fishery consisting of both wild and stocked rainbow and brown trout. The Vermont FWD regularly stocks hatchery-born rainbow and brown trout upstream and downstream of the project. Other common resident fish species found in project waters include fallfish, longnose dace, blacknose dace, white sucker, and common shiner. Most resident fish found in the project area prefer cool, well oxygenated riverine environments with a mixture of pool, riffle, and run habitats; slow to moderate velocities; substrate mixtures of rubble, gravel, and sand with silt overlays; and abundant instream and overhead cover (Vermont FWD, 2015; 2018). Rainbow trout as well as fallfish, and white sucker spawn during the period of March through May. The eggs for fallfish and white sucker incubate and hatch within 1-2 weeks whereas the eggs for rainbow trout incubate for 28 to 49 days before hatching. Thus, the egg incubation period for rainbow trout can extend through June. Longnose and blacknose dace and common shiner spawn in June and July and the eggs hatch within 3 to 4 days. Brown trout spawn during the fall months of October through December and the eggs incubate for 30 days up to 148 days depending on water temperatures.[24] In its March 3, 2023, comments, Vermont ANR indicated that resident fish spawn and rear in segments of the Winooski River downstream of the project.

Migratory Fish

No migratory fish species are thought to utilize project waters as their upstream movements are blocked by other dams located along the mainstem Winooski River all of which are several miles downstream of the Winooski 8 Project. For instance, upstream migrating

[24] See Vermont FWD (2018) for life history and reproductive characteristics of rainbow and brown trout in Vermont. See https://vtfishandwildlife.com/learn-more/vermont-critters/fish/white-sucker for life history and reproductive characteristics of white sucker (accessed March 8, 2024). See also https://animaldiversity.org/ for life history and reproductive characteristics for fallfish, longnose dace, blacknose dace, and common shiner (accessed March 8, 2024).

landlocked Atlantic salmon and steelhead trout (i.e., migratory form of rainbow trout) that are known to migrate into the Winooski River from Lake Champlain first encounter the Chace Mill Project (also known as the Winooski One Project, FERC No. 2756) where they are trapped, trucked, and subsequently released into the Winooski River upstream of Chace Mill Dam. Steelhead trout are released immediately upstream of Chace Mill Dam where their upstream movements are blocked by the next dam upstream (i.e., the non-FERC-licensed Gorge 18 Dam). Landlocked Atlantic salmon are trucked further upstream and are subsequently released in the reach upstream of Essex 19 Dam (FERC No. 2513), where their movements are blocked by the next dam upstream (i.e., Bolton Falls Dam, FERC No. 2879). Additionally, there is no information in the project record documenting the current or historical presence of American eel in project waters.

Freshwater Mussels

In early August 2019, WHC conducted a mussel survey within the entire impoundment, bypassed reach, tailrace, and downstream of the tailrace as far as 575 feet downstream of the project dam. Surveyors snorkeled and waded accessible areas going bank-to-bank focused on areas with the potential for higher quality mussel habitat. Only one live mussel (i.e., a state-threatened Eastern pearlshell mussel) was found during the survey toward the upstream end of the impoundment along the left bank. This individual was an adult found in sand at a water depth of 3.5 feet. Two large complete shells of Eastern pearlshell were also found near the live individual. In addition, one large incomplete shell (single valve) of Eastern pearlshell was found in the tailrace channel, at a water depth of 8.0 feet. No other live or dead mussels of any species were found during the survey. Additional life history information for the Eastern pearlshell mussel is provided below.

Eastern Pearlshell Mussel

The Eastern pearlshell is a medium-sized mussel growing to lengths of 120 millimeters. Preferred habitat occurs in cold, well-oxygenated streams that are heavily shaded by a riparian canopy and have stable channels with substrates of coarse sand, gravel, and cobble (Geist and Auerswald 2007; Nedeau, 2008). The species is long-lived, with individuals reportedly living 100 years or longer (Fichtel and Smith, 1995). During the breeding season (expected from mid to late summer), males release sperm into the water column where it is then picked up by the female. Egg and partial larval development then take place within the female. Freshwater mussels have a unique reproductive strategy in that most species utilize one or more fish species as temporary hosts for their larvae (also referred to as glochidia). From late August to October, female Eastern pearlshell mussels release their glochidia which then attach to the gills or fins of the host fish (i.e., resident trout and land-locked Atlantic salmon) where they feed as a blood parasite for periods ranging from a week to several weeks (Smith, 1976; Fichtel and Smith, 1995). When metamorphosis of the young mussel is complete, it drops from the host fish to the stream or lake bottom, where further development of the mussel begins. Eastern pearlshell mussels have the highest fecundity reported for any freshwater mussel with females capable of producing as many as 17 million glochidia annually, although four to eight million is more typical (Bauer 1987; 1994). They become sexually mature somewhere between 12 and 20 years of age and their fecundity does not diminish with age (Bauer 1987; Nedeau, 2008). This species also has a remarkable ability to become hermaphroditic (capable of self-fertilization) when

population densities become very low (Bauer, 1987). Adults spend their lives situated in the bottom substrates of streams or lakes feeding on microscopic plants and animals, and they rarely move more than a few meters in a lifetime (Fichtel and Smith, 1995).

3.3.1.2 Environmental Effects

Run-of-River Operation and Impoundment Levels

Flow fluctuations during the operation of hydropower projects can affect shoreline littoral and riverine habitat in impoundments and downstream reaches by exposing them to periodic dewatering, making them unsuitable for aquatic biota.

WHC proposes to continue operating the project in a run-of-river mode where at any given point in time, outflow (including combined discharge through the powerhouse and spill flows) approximates inflow. WHC would continue to monitor impoundment levels via a pond level sensor located upstream of the intake trash racks and adjust flows in real-time through the generating units to maintain the project impoundment water level just below the top of the flashboard crest (elevation of 615 feet).

Vermont ANR's WQC condition B also requires that the project be operated in an instantaneous run-of-river mode. Vermont ANR defines instantaneous run-of-river to mean no utilization of impoundment storage and that outflow from the facility is equal to inflow to the impoundment on an instantaneous basis except for short term, unavoidable deviations.

Staff Analysis

As discussed further later, WHC is capable of monitoring reservoir levels and adjusting operation in real time. Therefore, the minor daily fluctuations caused by changing turbine operation in response to changing flow conditions are not likely to result in significant changes in reservoir elevations or downstream flow. Therefore, continuing to operate the project in run-of-river mode where outflow always approximates inflow would continue to provide relatively stable impoundment levels that would protect shoreline habitat and fish or other aquatic organisms that rely on near-shore habitat in the impoundment for spawning, foraging, and cover and would avoid dewatering of Eastern pearlshell mussels in the impoundment during project operation. Some additional daily fluctuations in impoundment levels are expected as WHC implements daytime and nighttime aesthetic spill flows. However, these fluctuations would be minor (i.e., fluctuations are expected to be less than one foot and potentially only a few inches) and are not expected to impact nearshore aquatic habitat along the riverine shoreline within the impoundment to an appreciable degree except for small sections along the outermost margins of the river. Also, because the bypassed reach remains watered throughout the year, the daily fluctuations from aesthetic spill flows are not expected to cause dramatic shifts in water levels that would adversely affect fish and other aquatic biota in the bypassed reach or in the Winooski River downstream relative to existing conditions.

Bypassed Reach Flows

Under the current license, WHC is required to discharge a minimum flow of 25 cfs at the dam, or inflow, whichever is less, for the purpose of protecting and enhancing aquatic resources in the bypassed reach. WHC typically provides this minimum flow via either a fixed 25-cfs discharge through Unit 1 (the minimum hydraulic capacity for the unit) or spill over the dam if Unit 1 is offline.

WHC proposes to increase the minimum flow in the bypassed reach to 41 cfs during daytime hours from May 1 through October 31 (consisting of 16 cfs spill flow over the dam and 25 cfs through Unit 1) and to 36 cfs at night. The daytime flow would consist of 11 cfs spill and 25 cfs through Unit 1, and the night time flow would consist of 11 cfs spill and 25 cfs through Unit 1. The 16 cfs would provide 1 inch spill over the dam and the 11 cfs would provide 0.5 inch spill over the dam). WHC would provide a continuous minimum flow of 36 cfs in the bypassed reach during the remainder of the year (November 1 through April 30) by discharging the 36 cfs through Unit 1 (maximum hydraulic capacity of the unit). If Unit 1 is not operating or needs repair, WHC would provide its proposed minimum flows via spill until Unit 1 comes back online. In support of its proposed flow, WHC asserts that its proposed daytime spill flows would satisfy the state's water quality criteria for aesthetics by providing "good aesthetic value" during the summer and fall recreation season and its proposed nighttime spill flows would provide "fair to good aesthetic value" including a "good" rating for sound which is the primary benefit of nighttime spill flows (see section 3.3.5.2, *Aesthetic Resources*, *Environmental Effects* for more details on WHC's proposed aesthetic spill flows). Additionally, WHC states that its proposed minimum flows would maintain at least 77.3% of available habitat for all adult and juvenile resident fish (depending on the species and life stage) in the bypassed reach throughout the year (as discussed further below).

Vermont ANR's WQC condition B requires that WHC maintain a year-round continuous 39-cfs minimum flow in the bypassed reach. Condition B also requires that when generating, the project shall spill 1 inch in daylight hours and 0.5 inches during nighttime hours continuously year-round in the bypass reach. Vermont ANR reasons that a minimum flow of 39 cfs provides "high-quality aquatic habitat" by maintaining at least 80% of the maximum available habitat for all target resident fish species and life stages. Further, Vermont ANR states that "aesthetics is a designated use that must be supported year-round" and thus it recommends that WHC continue providing aesthetic spill flows throughout the year rather than only during the summer and fall recreation season.

Vermont ANR's WQC condition C requires that WHC develop a flow management and monitoring plan detailing how the project would operate in a run-of-river mode while also maintaining the required flow releases (i.e., minimum flows in the bypassed reach and aesthetic spill) continuously year-round.

In its reply comments, WHC states that maintaining spill flows beyond October 31 would be problematic because spilling during the winter months would result in "significant ice-build-up on the top and backside of the flashboards leading to more frequent flashboard failures from the additional weight." Additionally, WHC states that an extensive amount of ice build-up on the flashboards would likely not cause water to spill evenly or even spill at all at times which would impact the ability of the project to satisfy the aesthetic criteria for "falling waters."

Staff Analysis

Water Availability for Bypassed Reach Flows

Table 4 in Appendix D displays the median monthly inflow at the project and the anticipated spill flow expected to enter the bypassed reach under existing conditions, WHC's proposal, and Vermont ANR's mandatory WQC condition B. Under current operation, the bypassed reach remains wetted with the majority of the flow provided via discharges through Unit 1, with spillage regularly occurring only in the month of April when inflow is typically higher than the maximum capacity of the powerhouse. Based on median flows from 1984 to 2023, WHC typically spills 221 cfs during April (see table 4 in Appendix D). The only other times that the project currently spills is when Unit 1 needs repairs or when the powerhouse is shutdown.

Under WHC's proposal, WHC would need to curtail generation during the months of May through October in order to provide its proposed daytime and nighttime aesthetic spill flows. In order to implement Vermont ANR's mandatory spill flows year-round, WHC would need to curtail generation during all months except April when flows often exceed the maximum capacity of the powerhouse plus the agency's higher spill flows. During the month of April, generation would slightly increase under both WHC's proposal and Vermont ANR's spill flow alternative relative to existing conditions. This is because WHC would increase the fixed flow that is discharged through Unit 1 during April from 25 cfs to 36 cfs under these alternatives, thus causing a slight increase in generation during this month compared to existing conditions when WHC discharges a fixed 25 cfs through Unit 1 year round.

Under existing conditions, the powerhouse generally operates throughout the year except for very brief periods (i.e., 0.08% to 2.37% of the time) during the months of February, August, September and October when inflow can at times fall below the 25-cfs minimum flow needed to operate Unit 1 (see table 5 in Appendix D). Under both WHC's and Vermont ANR's required operation, the frequency that inflow to the powerhouse is insufficient to operate increases. Under WHC's proposal, there would be insufficient inflow for the powerhouse to operate during brief periods (0.08-0.75% of the time) during the months December through March and the month of June, and 3.31-9.33% of the time from July through October. Under Vermont ANR's continuous spill flow alternative, there would be insufficient inflow for the powerhouse to operate 0.40-0.80% of the time from January through March, 0.75% of the time during June, 3.31-9.33% of the time from July through October, and 0.33-0.43% of the time from November through December (see table 5 in Appendix D). Inflow is sufficient for the powerhouse to operate throughout the months of April and May under all three operational alternatives. Additionally, the above percentages would vary slightly during the daytime versus nighttime hours due to the slightly higher spill flow to be maintained during the day (i.e., 16 cfs) versus at night (i.e., 11 cfs) under both WHC's proposal and Vermont ANR's recommended operational alternative.

Additionally under existing conditions, WHC does not regularly spill during the winter months and usually passes all inflow through the powerhouse. If WHC is required to continuously spill during the winter as is required by the Vermont ANR WQC condition B,

WHC may not be able to maintain a continuous, uniform spill over the dam due to ice buildup on the flashboards.

Developing a flow management and monitoring plan as required by WQC condition C would help identify the impoundment level and any structural or operational changes needed to maintain the higher minimum flow and required spill flows.

Effects on Aquatic Habitat

In August 2019, WHC with Vermont ANR staff conducted a flow study in the bypassed reach to assess the relationship between flow and aquatic habitat for adult and juvenile rainbow trout, brown trout, longnose dace, fallfish, and white sucker. The study evaluated habitat conditions at two representative transects under five test flows ranging from 18.4 cfs to 115.4 cfs. One transect was located in a deep run below the rock ledge habitat at the base of the dam representing the majority of the upper segment of the bypassed reach and the second transect was located in pocket water just upstream from a shallow riffle characteristic of habitat in the lower segment of the reach. The study team collected depth, velocity, and substrate data across each transect and measured wetted width across the channel under the different test flows. The study team compared the field data to habitat suitability indices to compare how suitable habitat for each target species and life stage (expressed in square feet of weighted useable area) changed in the reach under the different test flows.

The study results showed that wetted width increased 19% across the range of flows at the first transect, from 42 feet at a flow of 18.4 cfs to 50 feet at the highest measured flow of 115.4 cfs. Wetted width at the second transect increased 43% across the range of flows, from 32.5 feet at a flow of 18.4 cfs to 46.5 feet at the highest flow of 115.4 cfs.

In general, the amount of suitable habitat for adult and juvenile resident fish did not vary much between the lowest and highest test flows (see Figure 6 in Appendix C). As flows increased in the bypassed reach, suitable habitat for rainbow trout and fallfish gradually increased, suitable habitat for brown trout remained stable, and suitable habitat for longnose dace and white sucker slightly declined.

At the lowest measured flow of 18.4 cfs, 68-70% of the maximum available suitable habitat was maintained for adult rainbow trout and juvenile fallfish; 80-90% was maintained for juvenile rainbow trout, adult fallfish, and adult brown trout; and 90-100% was maintained for juvenile and adult longnose dace, juvenile brown trout, and juvenile and adult white sucker. [25] At the current minimum flow of 25 cfs, at least 72% of maximum available suitable habitat would be maintained for all species and life stages with the majority of species having over 85%. At WHC's proposed seasonal 36 cfs and 41 cfs minimum flows, 77-80% of the maximum available suitable habitat would be maintained in the bypassed reach for all target species and life stages with the majority of species having over 88% of the maximum suitable habitat

[25] See Vermont ANR's filing on March 3, 2023. See also Vermont ANR's draft WQC filed on December 19, 2023.

maintained.[26] Under Vermont ANR's mandatory year-round 39-cfs minimum flow, at least 80% of the maximum available suitable habitat would be maintained for all target species and life stages throughout the year with the majority of species having over 90% of the maximum suitable habitat maintained. At flows higher than 55 cfs, maximum available suitable habitat starts to dip below 80% for juvenile fallfish. At flows higher than 95 cfs, maximum available suitable habitat starts to dip below 80% for juvenile and adult white sucker. Thus, when comparing the percentages of available habitat maintained for resident fish as a whole, WHC's proposal would enhance habitat availability (mostly for rainbow trout and fallfish) by maintaining 8% more suitable habitat for resident fish in the bypassed reach during daylight hours from May 1 through October 31 and 5% more suitable habitat for resident fish the remainder the year when compared to existing conditions. Vermont ANR's required year-round 39 cfs minimum flow would similarly enhance habitat availability by maintaining 8% more suitable habitat for resident fish (again mostly for rainbow trout and fallfish) throughout the year relative to existing conditions.

Although Vermont ANR requires a 39 cfs minimum flow in the bypassed reach, its WQC would result in a flow of 41 cfs during the day as proposed by WHC (seasonally). This is because a 1-inch spill over the dam requires a spill flow of 16 cfs and the minimum hydraulic capacity of Unit 1 is 25 cfs. Consequently, the habitat benefits to fish between WHC's proposed summer and fall minimum flow and Vermont ANR's required minimum flows would not differ during the summer and fall recreation season during the day. For the remainder of the year, Vermont ANR's required 39 cfs minimum flow and aesthetic spill requirements would result in only slightly more suitable habitat for resident fish than WHC's proposed flows.

Releasing higher minimum flows to the bypassed reach throughout the year as well as implementing aesthetic spill flows would increase water turbulence over rocks and boulders present throughout the reach, which would help to aerate water and may help cool water temperatures during the summer due to the dilution of heat energy (Poole and Berman, 2001). However, the benefits to water quality and aquatic habitat of providing any spill during late fall and winter would be minor because the reach remains wetted throughout the year and water temperatures during these months are colder and DO concentrations higher than during the summer and early fall months. Overall, increasing minimum flows released to the bypassed reach would continue to maintain and possibly improve water quality conditions in the bypassed reach and in the Winooski River downstream of the powerhouse over the next potential license term.

Project Operation Monitoring

Although compliance measures do not directly affect environmental resources, they assist the Commission in determining whether a licensee is complying with the environmental

[26] Because WHC proposes to maintain 41 cfs in the bypassed reach during daylight hours from May 1 through October 31, the maximum suitable habitat retained in the bypassed reach would be slightly higher for most species during daytime hours compared to other periods when WHC would maintain 36 cfs in the bypassed reach.

requirements of a license. Therefore, operational compliance monitoring and reporting are typical requirements in Commission-issued licenses.

WHC does not propose any formal measures for monitoring and reporting compliance with its proposed operating mode (i.e., run-of-river operation, maintaining impoundment levels, and implementing minimum flows and spill flows). However, WHC states that its automated monitoring and control system can continuously monitor impoundment levels and adjust project flow-regulating facilities in real time. The system consists of a pond level sensor installed near the powerhouse intake that continuously monitors impoundment levels and automatically adjusts powerhouse flows to maintain impoundment levels at the desired elevation (i.e., just below the top of the flashboards). WHC indicates that its automated system is capable of logging impoundment water surface elevations and powerhouse flow levels in real-time and that it could easily report the data as needed.[27] WHC would continue to use the automated system to maintain compliance with its proposed run-of-river, minimum flow, and any spill flow operating requirements.

Vermont ANR's WQC condition C requires that WHC include as part of a flow management and monitoring plan a method for continuous monitoring and reporting of flow releases at the project (including minimum flows, turbine discharge, and spill), impoundment levels, and inflows; that the plan include provisions for the flow data to be available on a near real-time basis; and that the plan include procedures for reporting deviations from operating requirements to Vermont Department of Environmental Conservation (Vermont DEC) within 15 days of the deviation indicating the cause, severity, and duration of the deviation, observed or reported adverse environmental impacts from the incident, pertinent data, and measures to be taken to avoid recurrences.

Staff Analysis

WHC's existing automated impoundment level monitoring and control system would be sufficient to monitor compliance with its proposed run-of-river operation, minimum flow, and spill flow requirements. This is because the pond level sensor coupled with logging generation outflow would adequately demonstrate compliance with maintaining defined impoundment levels and any required minimum flows (including spill flows) in real-time, which would be indicative of run-of-river operation. Identifying the impoundment elevation level needed to maintain compliance with both daytime and nighttime spill flows would enable the Commission to track compliance with spill flow requirements.

Additionally, in order to comply with Vermont ANR's mandatory 39-cfs minimum flow during nighttime hours, staff assumes there are two options that WHC could consider: (1) WHC could adjust the fixed setting on Unit 1 to discharge 28 cfs during nighttime hours (i.e., 28 cfs through Unit 1 plus 11 cfs nighttime spill flow equaling 39 cfs) or (2) WHC could spill the additional flow needed to comply (i.e., discharge a minimum 25 cfs through Unit 1 and spill 14 cfs over the dam at night equaling 39 cfs). Identifying specific procedures for providing both

[27] *See* January 9, 2024 telephone summary memorandum.

daytime and nighttime minimum flows would enable the Commission to track compliance with minimum flow requirements.

In regard to reporting deviations from operating requirements, WHC does not formally propose to maintain a log of project operation, nor does it propose to report any deviations from its proposed operating requirements to the Commission. While reporting deviations to Vermont DEC as is required by WQC condition C would assist WHC and Vermont DEC in tracking compliance with WHC's operating requirements, it would not be sufficient for the Commission to determine compliance with the operating requirements of the license. Formalizing WHC's operation monitoring procedures with requirements to maintain a log of project operation (including tracking turbine generation for each unit) in the flow management and monitoring plan that is required by WQC condition C as well as including procedures for reporting deviations to the Commission and Vermont DEC would enable WHC, the Commission, and Vermont DEC to track compliance with the operating requirements of the license and WQC.

Sediment Dredging

The project receives a heavy influx of sediment (primarily sand and silt) from upstream sources, which settles in the project impoundment, including near the project intake. Sediment discharges can come from a variety of sources including town roads, poor farming or logging practices, construction sites and development adjacent to streambanks and shorelines (Vermont ANR, 2016b). Excessive sediment buildup can increase loads on the dam and gates, damage mechanical equipment, and negatively impact hydrogeneration, discharge capacity, and flood attenuation. Dredging can disrupt aquatic habitat by disturbing sections of the impoundment bottom and re-suspending some of the disturbed sediment within the water column which can increase turbidity within the impoundment as well as in the Winooski River downstream of the dam until the sediment settles.

To maintain adequate inflow for the project, WHC regularly dredges the impoundment to remove the excess sediment. WHC routinely dredges directly in front of the intake using a long-reach backhoe from the shoreline. This typically takes one or two days every three to six weeks in the winter to complete. More extensive dredging into the impoundment is required every 3 to 5 years. This larger dredging event is typically completed within one week in the late summer or early fall months using the same equipment. Figure 4 in Appendix C displays the dredge locations. WHC states the more extensive dredges usually take place in September or October when weather and flow conditions are typically safest to conduct the work. For the larger dredges, WHC draws the impoundment down to approximately 610 feet (i.e., 5 feet below the top of the flashboards and 1 foot below the spillway crest) and removes the exposed sediment above the water line.

To minimize effects of sediment dredging on water quality and aquatic habitat, WHC proposes to implement a Sediment Dredging Management Plan. A draft plan was filed with the license application which includes provisions to: (1) notify Vermont ANR prior to conducting any dredging activity of the geographic area of the proposed dredge, estimated duration of the dredge (including start and end date), and estimated river flows during the planned dredging operation; (2) conduct all dredging using a bucket loader from the shoreline rather than placing equipment in the water and only remove sediment that is above the water line when the

impoundment is drawn down to minimize the amount of sediment that is re-suspended in the water column; (3) stockpile the dredged material in an upland site, and install temporary silt fences around the stockpile to prevent runoff to the river; and (4) notify Vermont ANR upon the completion of the dredge, remove silt fences, and haul the dredge material offsite after the dredge pile has sufficient time to drain.

In comments filed on March 3, 2023, Vermont ANR states that it "has some concerns with the current sediment dredging and management plan as proposed by WHC, including working within the stream between October 1 and June 30, and the frequency that this may occur due to fish spawning, egg incubation and rearing of young that occurs at this time downstream of the Project. The Agency believes additional consultation to finalize the sediment dredging and management plan is needed." Vermont ANR's WQC condition I requires that WHC finalize the Sediment Dredging Management Plan in consultation with Vermont ANR and that the plan be approved by Vermont ANR prior to implementation.

Staff Analysis

The heavy sediment loads require annual dredging of the intakes and periodically of the impoundment to ensure that the project operates properly. WHC's draft Sediment Dredging Management Plan formalizes WHC's dredging practices and ensures that best management practices are being followed to minimize effects on aquatic resources, including ensuring dredging equipment is only used from the shoreline rather than in the water, and controlling erosion from stockpiled spoils.

Even with WHC's proposed measures to minimize erosion and turbidity, there would still be some unavoidable short-term increases in turbidity during and immediately following dredging activities. Short-term increases in turbidity could affect resident trout downstream by increasing physiological stress (Redding et al., 1987) and lowering feeding success due to a reduction in reactive distance to drifting prey (Barrett et al., 1992). However, elevated turbidity levels downstream would be temporary and normal levels should return a short time after sediments pass through and settle out in lower velocity areas downstream.

WHC's dredging of the impoundment occurs during the generally low-flow months because conditions are safest to conduct work. Low-flow conditions at the project typically occur during the months of July, August, September, and October (see table 1 in Appendix D). Rainbow trout as well as fallfish, and white sucker spawn during the spring months of March through May; longnose dace, blacknose dace, and common shiner spawn in June and July; and brown trout spawn in the late summer and fall months Thus, WHC's dredging could occur when brown trout, longnose and blacknose dace, and common shiner are spawning and these species' eggs are incubating and fry are emerging. WHC's dredging practices could also occur when juvenile rainbow trout, fallfish, and white sucker are rearing.

The silt- and sand-bottom areas where dredging would occur in the impoundment do not contain ideal spawning habitat for resident fish including rainbow and brown trout which prefer gravel substrate at the head of a riffle or on the downstream edge of a pool (Vermont FWD, 2018). Therefore, dredging activities would not be expected to directly impact resident fish spawning within the impoundment..

The annual dredging directly in front of the intake during the winter is conducted from the shoreline and the reservoir is not drawn down. However, dredging in other impoundment areas typically involves drawing the impoundment down to conduct the work. Removing only sediment that is exposed above the water line after drawing the impoundment down would lessen but would not completely prevent suspension of impoundment sediments and discharge of the suspended sediments downstream of the dam and powerhouse. Discharge of the suspended sediments would result in increased turbidity downstream of the dam and powerhouse until the sediments pass through and settle out in lower velocity areas downstream. Increasing turbidity levels downstream could disrupt resident trout spawning or otherwise affect trout and other resident fish by increasing physiological stress (Redding et al., 1987) and lowering feeding success (Barrett et al., 1992). However, conducting these impoundment dredging events in areas other than directly in front of the intake during the typically low-flow months of July, August, and September would avoid elevating turbidity levels in the Winooski River downstream of the dam and powerhouse during sensitive spawning and egg incubation periods for state-managed rainbow trout (i.e., March through May for spawning with egg incubation extending into June) and brown trout (i.e., October through December for spawning with egg incubation potentially extending through the winter months). Revising the draft Sediment Dredging Management Plan in consultation with Vermont ANR as required by the WQC would allow WHC and Vermont ANR to develop procedures to better coordinate dredging events, including timing, to further minimize adverse effects on aquatic habitat and resident fish. .

Effects of Impoundment Drawdowns on Mussels

WHC states that it regularly draws down the impoundment to an elevation of 610.8 feet (i.e., 4.2 feet below the top of the flashboards and 0.2 feet below the spillway crest) once or twice a year for one or two days to repair/replace the flashboards following a high precipitation storm or flood event (typically in late March or April). As noted above, WHC also draws the impoundment down to approximately 610 feet (i.e., 5 feet below the top of the flashboards and 1 foot below the spillway crest) every 3-5 years for approximately one week in the late summer or early fall months to remove excess sediment accumulation in the impoundment.

To minimize impacts to state-listed Eastern pearlshell mussels from maintenance drawdowns of the impoundment, WHC proposes to conduct a mussel survey during the first planned maintenance drawdown and relocate any potentially exposed mussels to deeper waters. If no mussels are detected, WHC would cease further mussel surveys during future drawdowns. If mussels are found during the initial survey, WHC would conduct additional surveys during maintenance drawdowns and relocate any potentially exposed mussels to deeper waters. The proposed surveys would consist of a mussel expert walking the impoundment shoreline to locate, identify, and relocate any mussels found during the survey and filing a summary report of the findings to Vermont ANR and the Commission within 120 days of the survey. WHC stated it is "receptive to working with the [Vermont DEC] such that the first drawdown would reflect the lowest expected drawdown so as to eliminate the need for future mussel surveys, assuming no mussels are detected in the first drawdown."

In comments filed on March 3, 2023, Vermont ANR stated that "if the first drawdown does not yield any mussels, the Agency is open to eliminating the need for surveys and relocation for subsequent drawdowns of equal or lesser amounts." Despite Vermont ANR's

earlier comments, the WQC condition H requires that WHC conduct the mussel survey during the first planned drawdown and file the report within 120 days as proposed by WHC but also requires that WHC continue to conduct mussel surveys during all future planned drawdowns that fall below 610.7 feet "to account for the possibility that mussels will extend their geographic extent within the impoundment over the next licensing term."

WQC condition F requires that WHC consult with and receive approval from Vermont DEC "prior to conducting project maintenance or repair work that that has the potential to have an adverse effect on water quality, other than those activities described in the Sediment [Dredging] Management Plan."

Staff Analysis

Due to their sedentary nature and limited mobility, freshwater mussels can become exposed during impoundment drawdowns for the maintenance and repairs of project facilities. Because these events can last for several weeks (or more) and involve rapid changes in water levels that exceed the movement ability of freshwater mussels, such maintenance activities could cause mussels to become stranded, desiccate, and possibly die (Galbraith et al., 2015).

WHC's mussel survey conducted in August of 2019 found one live adult Eastern pearlshell mussel and two large shells in the upper reach of the impoundment within a water depth of 3.5 feet which is within the zone of fluctuation for maintenance drawdowns. While the existence of one live individual does not indicate the presence of an established reproducing population within the project impoundment, drawing down the impoundment could nevertheless expose a limited number of mussels to dewatering and potentially result in desiccation and death for mussels that are present within the five-foot maintenance fluctuation zone. WHC's proposed surveys would confirm whether mussels have become established since the 2019 survey or occur within the full five-foot depth of the fluctuation zone (i.e., down to a water level of 610 feet) would confirm if mussels are currently utilizing aquatic habitat within the maintenance fluctuation zone. Relocating any mussels found during the survey would allow these individuals to be safely transported to deeper waters to avoid prolonged exposure which could lead to death and would suggest the need for future survey and relocation efforts.

Even if no mussels are found, resident trout could serve as host fish that could spread juvenile mussels to the fluctuation zone. Vermont ANR's required surveys would ensure that if mussels establish in the reservoir fluctuation zone that WHC takes the necessary steps to relocate them to safe depths. However, given low abundance of the species, well-established operating limits over the last 40 years, and because adults are known to rarely move more than a few meters in their entire 100-year or more lifespan (Fichtel and Smith, 1995), make finding this species unlikely and the need for future surveys questionable. Therefore, revisiting the need for future surveys or changing the frequency of future surveys based on the results of sampling events may be more reasonable than a requirement to conduct mussel surveys during all future reservoir drawdowns below 610.7 feet.

Consulting with Vermont DEC prior to conducting planned maintenance or repair work besides dredging (such as when replacing the flashboards or inspecting the dam and crest gate) as is required by Vermont ANR's WQC condition F would allow the agency to make

recommendations to WHC to minimize adverse effects to mussels and aquatic habitat that may result from such maintenance drawdowns. However, Vermont ANR's requirement that WHC receive approval from Vermont DEC prior to performing planned or unplanned maintenance repairs could limit WHC's ability to complete needed repairs in a timely fashion.

Fish Impingement and Entrainment

The passage of large volumes of water through trash racks and turbines can result in fish impingement and entrainment mortality at hydropower projects. Blade strikes are thought to be the primary source of mortality for fish entrained through hydropower projects although the physical properties of turbine units also play a role in turbine mortality (Franke et al., 1997; Pracheil et al., 2016). Fish size also plays an important role in entrainment susceptibility and turbine mortality, with smaller fish more likely to be entrained but experience lower turbine mortality compared to larger fish (Čada et al., 1997; Winchell et al., 2000; Pracheil et al., 2016).

WHC proposes to maintain the project's existing trash racks at the intake which have the following dimensions: Unit 1 trash rack is 6-feet wide and 25 feet high and contains a total of 30, 0.375-inch-thick rack bars; Unit 2 trash rack is 8 feet wide and 25 feet high with a total of 55, 0.375-inch-thick rack bars; and Unit 3 trash rack is 12 feet wide and 25 feet high with 75, 0.375-inch-thick rack bars. There is also 1.75-inch clear spacing between the bars on all 3 trash racks.

No entity has recommended modifying or replacing the existing trash racks. Vermont ANR in its WQC states the following: "there does not appear to be excessive impingement and entrainment risk. Therefore, additional exclusionary measures are not required at this time."

Staff Analysis

Fish in the impoundment that approach the intake may swim away, become impinged on the racks if they are too big to pass through the rack openings and cannot overcome the water velocities at the rack, or become entrained in the powerhouse where they would encounter the project's semi-Kaplan turbines before being discharged to the Winooski River through the powerhouse tailrace flows.

To determine the potential for resident fish to be entrained, we compare the swimming capabilities of resident fish potentially utilizing the impoundment (i.e., rainbow trout, brown trout, fallfish, longnose dace, blacknose dace, white sucker, and common shiner) with the estimated range of approach[28] and through[29] velocities at the project's trash racks under the maximum hydraulic capacities of the turbines. At the maximum hydraulic capacity of Unit 1

[28] The approach velocity is calculated by dividing the hydraulic capacity of the turbine over the total cross-sectional area of the trash rack at the intake.

[29] The through velocity is calculated by dividing the hydraulic capacity of the turbine over the net cross-sectional area of the trash rack where water can actually pass through versus being blocked by bars (i.e., the cross sectional area of the rack is adjusted to remove the area occupied by the bars).

(i.e., 36 cfs), the approach velocity would be about 0.24 feet per second (fps) and the through velocity experienced directly at the rack would be 0.28 fps. At the maximum hydraulic capacity of Unit 2 (i.e., 139 cfs), the approach velocity would be about 0.70 fps and the through velocity experienced at the rack would be 0.89 fps. At the maximum hydraulic capacity of Unit 3 (i.e., 272 cfs), the approach velocity would be about 0.91 feet per second (fps) and the through velocity experienced at the rack would be 1.13 fps.

Based on available burst swim speeds for juvenile and adult resident fish as shown in table 6 in Appendix D, the maximum 0.91-fps approach velocity and maximum 1.13 fps through velocities at the trash rack could be overcome by all resident adult and juvenile fish potentially utilizing the impoundment. Therefore, the risk of entrainment and impingement at the project is low. However, even if smaller juvenile resident fish were entrained through the project, they would be expected to exhibit high turbine survival (greater than 90%) through the project's Kaplan turbines due to their small size (Winchell et al., 2000). Therefore, continuing to maintain the project's existing trash racks, as proposed by WHC, would not be expected to adversely affect resident fish populations residing in the project impoundment.

Debris Management

WHC states that all sediment and organic material as a result of cleaning the intake trash racks and dredging the impoundment is stored onsite, within a sand berm established between the dredged pile and the river for containment. The stored material is then "screened by the Road Commissioner of either the town of Plainfield or Marshfield" and removed later by trucks for fill offsite.

Without elaboration, Vermont ANR's WQC condition E requires that "debris associated with Project operations shall be disposed of in accordance with the Standards and applicable state laws and regulations."

Staff Analysis

As discussed previously, the project receives a high sediment load from upstream sources which requires that WHC routinely dredge the impoundment, store the material onsite, and later dispose the material offsite once it is adequately drained. Although no evidence suggests that WHC's current practices of disposing dredged material are inconsistent with Vermont ANR's WQC condition E, formalizing WHC's procedures for periodic disposal would prevent accumulation of unsightly debris and keep that debris from entering the river where it could degrade water quality. Developing a debris disposal plan would avoid misunderstandings and guide how and when WHC is to remove and dispose of organic and inorganic debris that accumulates during project operation.

3.3.1.3 Cumulative Effects on Water Quality

As discussed in section 3.3.1.1, *Aquatic Resources*, *Affected Environment*, the upper 17-mile reach of the Winooski River from Montpelier to Molly's Falls Brook contains waters previously identified in Vermont's 2016 Stressed Waters List due to streambank erosion, channel instability, road runoff, and elevated E. coli levels. Since that time, Vermont ANR in partnership

with local municipalities, and non-profit organizations have taken steps to improve surface water quality and decrease fluvial erosion in the upper Winooski River Basin. These actions include: implementing localized stormwater best management practices (BMPs), adopting flood resilience measures, implementing farm agronomic BMPs, implementing riparian restoration and conservation projects, controlling runoff from gravel and paved roads, and reforesting riparian buffers, among others.[30] While the waters encompassing the project are no longer identified as "stressed" in the most recent 2022 Vermont Priority Waters List (Vermont DEC, 2023), increased urban and agricultural development upstream of the Winooski 8 Project, including along Route 2 near the Town of Plainfield has constrained the river along both banks in some locations. The Town of Plainfield continues to experience significant erosion as a result of steep slopes and poor soils, further contributing to sediment and nutrient loading in surface waters (Watershed Consulting Associates, LLC, 2018). Some of this sediment from Plainfield and other upstream sources would be expected to continue to settle out in slower moving sections of the river downstream, including within the Winooski 8 impoundment.

In July of 2023, catastrophic flooding occurred across Vermont over a 7-day period which caused multiple landslides (Vermont ANR, 2024). Of particular note in the Winooski River Basin was the substantial damage to municipal infrastructure that was caused by both inundation (e.g., Barre and Montpelier) and fluvial erosion (e.g., Cabot, Calais, Marshfield, Plainfield, and Washington). The landslides occurred during and immediately following the summer flooding which exacerbated erosion. In response to the recent flood event, the 2023 Basin 8 Winooski River Tactical Basin Plan includes private property buyouts and slope stability mitigation as priority actions to take in in the near future to build longer term flood resilience in the basin in the coming years (Vermont ANR, 2024).

As discussed in sections 3.3.1.1 and 3.3.1.2, continued operation of the Winooski 8 Project is not expected to adversely affect water quality as DO concentrations generally meet or exceed the State standard levels and water temperatures generally fluctuate in sync upstream to downstream of the project. WHC's proposal to continue operating the project in a run-of-river mode while increasing minimum flows and providing seasonal aesthetic spill flows released to the bypassed reach would be expected to maintain or even enhance water quality conditions downstream of the dam over existing conditions due to increase water turbulence over rocks and boulders below the dam. While ongoing dredging activities would still continue to cause short term increases in suspended sediment and turbidity, these effects would be temporary and minimized through implementation of WHC's Sediment Dredging Management Plan.

Ongoing road construction and residential and urban development along the river are expected to continue to affect water quality in the upper Winooski River basin over the proposed license term. However, the priority actions identified and planned for the Upper Winooski Basin, including updating road erosion inventories, protecting and enhancing riparian areas, ensuring proper application of agricultural BMPs and stormwater management BMPs, and

[30] See Vermont Clean Water Initiative 2023 Performance Report available online at: https://dec.vermont.gov/sites/dec/files/WID/CWIP/Clean%20Water%20Initiative%202023%20Performance%20Report.pdf. Accessed February 15, 2024.

stabilizing riparian areas to increase flood resilience should all benefit water quality in the upper reach of the Winooski River and its tributaries over the next potential license term.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

The Winooski 8 Project is located within the Northern Piedmont ecoregion (Griffith et. al., 2009). Forests adjacent to the project support northern hardwoods such as sugar maple, birch, and beech, with the addition of boreal elements such as balsam fir and spruce at higher elevations. Upland habitat within the project boundary is limited to 4.5 acres above the Winooski River shoreline and along PowerPlant Road. Along the banks of the Winooski River, common tree and shrub species include silver maple, black willow, green ash, eastern cottonwood, boxelder, red maple, American elm, buttonbush, and viburnum (Friends of the Winooski, 2023). There are no Vermont Significant Wetland Inventory (VSWI) wetlands[31] within or adjacent to the project boundary.

Invasive plants found in the vicinity of the project include common buckthorn, Morrow's honeysuckle, Japanese knotweed, Japanese barberry and yellow iris (iNaturalist, 2023).

Mammals documented within two miles of the project include black bear, coyote, white-tailed deer, red and gray fox, fisher, striped skunk, eastern gray squirrel, muskrat, raccoon, groundhog, river otter, and beaver (iNaturalist, 2023). Herptile species in this area include spotted salamander, eastern red-backed salamander, northern two-lined salamander, eastern newt, painted turtle, snapping turtle, green frog, wood frog, spring peeper, American toad, garter snake, and red-bellied snake. A diverse population of breeding, wintering, and migrating birds is present near the project, including waterfowl, shorebirds, woodpeckers, sparrows, warblers, and birds of prey (eBird, 2023).

3.3.2.2 Environmental Effects

Run of River Operation

Flow fluctuations during operation of hydropower projects can affect wetland and riparian habitat at the edge of reservoirs and in downstream reaches by exposing them to periodic water level changes. WHC proposes to continue to operate the project in a run-of-river mode (see section 2.1.4, *Current Project Operation*) with inflow approximating outflow. No recommendations for terrestrial resources were received from stakeholders.

Staff Analysis

[31] Significant wetlands are those identified by VDEC as Class I or Class II in the Vermont Significant Wetland Inventory (VSWI) mapping, as well as those wetlands that have not been identified in the VSWI, but which meet one or more presumptions of significance as defined in the VWR.

Continuing to operate the project in a run-of-river mode would maintain stable reservoir levels and minimize effects on wetland and riparian habitat along the impoundment and the Winooski River downstream of the project. Changing from approximating run-of-river operations to instantaneous run-of-river operations, as recommended by Vermont DEC, would result in minor reductions in fluctuations of reservoir levels and downstream flows relative to current operations. However, such small fluctuations in reservoir levels and increases or decreases to flow in the Winooski River downstream of the powerhouse are not expected to result in large-scale changes in the composition, structure, or function of existing riparian and wetland plant communities.

Therefore, continuing to operate in a run-of-river mode where outflows approximate inflow as it has historically operated would maintain existing wetland and riparian habitat along the reservoir and downstream of the project.

Impoundment Drawdowns for Project Maintenance

As previously discussed in section 3.3.1.2 *Aquatic Resources*, *Environmental Effects*, WHC draws the impoundment down once or twice a year to repair/replace the flashboards in late March or April. Flashboard repair typically lasts one or two days. WHC also conducts larger dredges of the impoundment every three to five years during September or October, lowering the water level to 610.0 feet and removing all exposed sediment. Sediment and debris are dredged from in front of the intake every 2 to 3 weeks each year during the winter, but the reservoir does not need to be drawn down to conduct the intake dredge. All dredged sediment is stored onsite, within a sand berm established between the dredged pile and the river for containment. When refilling the impoundment after a drawdown, WHC proposes to store 10% of the inflow until the impoundment is refilled. WHC plans to continue these drawdown practices under the term of any license issued.

Staff analysis

Aquatic biota and wildlife in wetlands may be affected by the frequency, duration, and seasonality of the impoundment drawdowns. Drawing down the impoundment for maintenance would temporarily dewater the reservoir shoreline and expose some slower moving invertebrates and amphibians to desiccation and predation. Using 10% of the inflow to refill the impoundment would slightly prolong refilling, but would also ensure that downstream aquatic and riparian resources remain wetted. There is no evidence in the project record to suggest that the short-term, periodic drawdowns that occur at the project result in measurable effects to the diversity and abundance of aquatic and wetland biota, or have resulted in long term impacts to wetland or riparian habitat.

WHC's proposed sediment control measures for handling the dredged material would prevent sediment from entering the Winooski River where it could adversely affect wetland and riparian habitats and the species dependent of these habitats.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

The FWS Information for Planning and Consultation (IPaC) database indicates that the endangered Northern long-eared bat (*Myotis septentrionalis*) and candidate monarch butterfly (*Danaus plexippus*) have the potential to occur within the project boundary.[32] Additionally, on September 14, 2022, FWS proposed to list the tricolored bat (*Perimyotis subflavus*) as endangered.[33] The range of tricolored bats includes all, or portions of 39 states, including all of Vermont. Therefore, tricolored bats may also occur within the project boundary or be affected by the project. There are no proposed or designated critical habitats in the project area.

Northern Long-eared Bat

The Northern long-eared bat (NLEB) was listed as a federally threatened species on May 4, 2015 (FWS, 2015). In January 2016, the FWS finalized the ESA section 4(d) rule for this species, which focuses on preventing effects on bats in hibernacula associated with the spread of white-nose syndrome[34] and effects of tree removal on roosting bats or maternity colonies (FWS, 2016a). As part of the 4(d) rule, take incidental to certain activities conducted in accordance with the following habitat conservation measures, as applicable, would not be prohibited: (1) occurs more than 0.25-mile from a known, occupied hibernacula; (2) avoids cutting or destroying known, occupied maternity roost trees during the pup season (June 1 – July 31);[35] and (3) avoids cutting or destroying any tree within a 150-foot radius of a known, occupied maternity tree during the pup season. On January 5, 2016, FWS developed an optional streamlined consultation framework that allows federal agencies to rely on a programmatic biological opinion on FWS's final 4(d) rule to fulfill section 7(a)(2) consultation requirements for NLEB (FWS, 2016b).

On November 30, 2022, FWS reclassified the NLEB from a threatened species to an endangered species, effective January 30, 2023.[36] FWS extended the effective date of the final

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[32] *See* Interior's official lists of threatened and endangered species, accessed by staff using the IPaC database (https://ipac.ecosphere.fws.gov) on November 17, 2023, and placed into the records for Docket No. P-6470-000 on the same day. Staff accessed the IPaC database on February 22, 2024 and requested an updated species list, which was identical to the one in the project record.

[33] 87 Fed. Reg. 56,381.

[34] A hibernaculum is where a bat hibernates over the winter, such as in a cave. White-nose syndrome is a fungal infection that agitates hibernating bats, causing them to rouse prematurely and burn fat supplies. Mortality results from starvation or, in some cases, exposure.

[35] Pup season refers to the period when bats birth their young.

[36] 87 Fed. Reg. 73,488 (November 30, 2022).

reclassification by 60 days, from January 30, 2023, to March 31, 2023.[37] The final rule removes the 4(d) rule for this species, because 4(d) rules apply only to species listed as threatened species under the ESA. In March 2023, FWS released a new range-wide Northern Long-eared Bat determination key (Dkey), available through the IPaC website, to streamline the review of routine, predictable projects and receive automatic verification or concurrence for some actions (FWS, 2023b). This Dkey replaces the previous key that was based on the 4(d) rule biological opinion.

Traditional ranges for NLEB include most of the central and eastern U.S., as well as the southern and central provinces of Canada, coinciding with the greatest abundance of forested areas. NLEB, whose habitat includes large tracts of mature, upland forests, typically feeds on moths, flies, and other insects. These bats are flexible in selecting roost sites, choosing roost trees that provide cavities and crevices, and trees with a diameter of 3 inches or greater at breast height.[38] Human-made structures, such as buildings, barns, bridges, and bat houses can be considered potential summer habitat. However, trees found in highly developed urban areas (e.g., street trees, downtown areas) are unlikely to be suitable NLEB habitat (FWS, 2014). NLEB are generally active from April through October (FWS, 2015, FWS, 2016b), and hibernate over the winter season. Winter hibernation typically occurs in caves and areas around them, and hibernacula can also be used for fall-swarming[39] and spring-staging.[40]

The project is located within the white-nose syndrome buffer zone for NLEB.[41] Based on a review of records maintained by the Vermont FWS Natural Heritage Inventory, as of 2018 there were no known occurrences of NLEB within 1 mile of the project (WHC, 2021). Further, no critical habitat has been designated for NLEB. Although there is no documentation of NLEB use of habitat at or near the project, upland forests within the project boundary may provide suitable habitat for NLEB summer roosting and foraging activities.

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[37] 88 Fed. Reg. 4908-4910 (January 26, 2023).

[38] Diameter at breast height refers to the tree diameter as measured about 4 to 4.5 feet above the ground.

[39] Fall-swarming fills the time between summer and winter hibernation. The purpose of swarming behavior may include: introduction of juveniles to potential hibernacula; copulation; and gathering at stop-over sites on migratory pathways between summer and winter regions.

[40] Spring-staging is the time period between winter hibernation and migration to summer habitat. During this time, bats begin to gradually emerge from hibernation and exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume daily bouts of torpor (i.e., a state of mental or physical inactivity).

[41] The white-nose syndrome buffer zone encompasses counties within 150 miles of a U.S. county or Canadian district in which white-nose syndrome or the fungus that causes white-nose syndrome is known to have infected bat hibernacula.

Tricolored Bat

FWS proposed on September 14, 2022 to list the tricolored bat as endangered,[42] based upon the range-wide impacts of white-nose syndrome which have caused estimated declines of more than 90% in affected colonies. No critical habitat is being designated because current or threatened destruction, modification, or curtailment of the species' habitat or range is not having large range-wide effects on the species. Tricolored bats are known to occur in 39 states, including all of the central and eastern United States (FWS 2024).

Male and female tricolored bats converge at cave and mine entrances between mid-August and mid-October to swarm and mate. During the winter, tricolored bats hibernate in caves and mines, although in the southern U.S., where caves are sparse, tricolored bats often hibernate in road-associated culverts and sometimes tree cavities and abandoned water wells.

During the spring, summer, and fall (i.e., non-hibernating seasons), tricolored bats disperse and primarily roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees (FWS, 2021). Female tricolored bats exhibit high site fidelity, returning year after year to the same summer roosting locations. Female tricolored bats form maternity colonies and switch roost trees regularly (e.g., between 1.2 days and 7 days at roost trees in Indiana). Females typically give birth to two young between May and July. Limited reproductive potential severely limits the ability of bat populations to respond quickly to perturbations. Upland forests within the project boundary contain suitable habitat for tricolored bat summer roosting and foraging activities.

Monarch Butterfly

The monarch butterfly was listed as a candidate species under the ESA on December 17, 2020.[43] The monarch butterfly exclusively uses milkweed (*Asclepias* spp.) as its larval host plant. Adults drink nectar from milkweed and other species' flowers, while trees and shrubs are used for shade and roosting. Monarchs are not known to overwinter near the project area. Common milkweed (a widespread species of milkweed throughout Vermont) is present in plant communities at the project and in the vicinity of the Winooski River, including upland, wetland, and riparian habitats (iNaturalist, 2023).

3.3.3.2 Environmental Effects

WHC does not propose any measures for the protection of the NLEB, tricolored bat, or monarch butterfly.

Vermont ANR's WQC condition G requires that for activities requiring the clearing of trees 3-inches diameter breast height or greater, WHC shall abide by a seasonal tree clearing restrictions and only clear trees between November 1st- April 14th to avoid any roost disruption

[42] 87 Fed. Reg. 56381 (Sep.14, 2022).

[43] 85 Fed. Reg. 81813 (December 17, 2020).

of the Northern long-eared bat. If tree clearing is required during the restricted time period (April 15th- October 31st), WHC shall consult with the FWS and Vermont FWD regarding emergency tree work after it occurs.

Staff Analysis

Northern Long-eared Bat

WHC states that maintenance activities at the Winooski 8 project during the term of a new license would require occasional tree-trimming along PowerPlant Road. In the absence of protocol-level surveys indicating the NLEB is not present in the project area, we assume the species may be present and could be adversely affected by tree trimming or removal during the bats' active summer period. Placing seasonal limits on planned tree trimming and the removal of trees that are equal to or greater than 3 inches at breast height, would reduce the likelihood of disturbing NLEB and their newly born pups during their active season at the project.

The FWS states that inactive season dates for NLEB in swarming/staging areas in Vermont are November 1 to April.[44] Because no surveys for maternity roosts have been conducted in the 1.5 mile vicinity of the project, limiting tree trimming and non-hazardous tree removal to the period of November 1 through April 14 (inactive season) would protect the northern long-eared bat in a manner consistent with section 7 of the ESA, with the flexibility of permitting the removal of hazardous trees at any time of year for the protection of human life and property. The FWS NLEB Dkey[45] concluded that relicensing the project "May Affect" this species based on limited trimming conducted during the bat's inactive season. We have concluded that this is not likely to adversely affect the species.

Tricolored Bat

As noted above, WHC states that maintenance activities at the Winooski 8 project during the term of a new license would require occasional tree-trimming along PowerPlant Road. Project maintenance activities that may affect the tricolored bat are the same as those noted above for the northern-long eared bat. Project maintenance is not expected to require the removal of any trees that could affect the bat or its habitat but could require tree trimming that could remove leaf clusters that provide roosting habitat. Limiting planned tree trimming and non-hazardous tree removal within the project boundary to the period of November 1 through April 14 to protect NLEB would also avoid cutting or destroying any potential maternity roost trees that may be occupied by tricolored bats during the tricolored bat pup season, which

[44] FWS. 2023. Available at: https://www.fws.gov/sites/default/files/documents/Inactive%20Season%20Dates%20for%20Swarming%20and%20Staging%20Areas_0.pdf

[45] *See* Interior's letter, accessed by staff using the IPaC database (https://ipac.ecosphere.fws.gov) on November 14, 2023, and placed into the records for Docket No. P-6470-008 on November 17, 2023.

generally overlaps with that of NLEB. Therefore, we conclude that relicensing the Winooski 8 project with tree-trimming and tree-removal restrictions from April 15 through October 31 is not likely to adversely affect the tricolored bat, or jeopardize its continued existence.

Monarch Butterfly

Current maintenance activities at the project that could affect monarch butterflies include minor clearing and trimming of brush along the driveway, at recreation sites, and around project facilities, but there is no information to suggest that these activities would potentially remove or degrade monarch butterfly habitat, or impact individual butterflies. Therefore, we conclude that the project will have no effect on the monarch.

3.3.4 Recreation Resources

3.3.4.1 Affected Environment

Project Recreation Facilities

The current license does not require WHC to provide any recreation facilities. An unimproved boat take-out is located approximately 300 ft upstream of the dam and a whitewater boating put-in and tailwater fishing access area is located approximately 1,300 ft below the dam. The boating put-in and fishing access includes wooden steps[46] leading to the river. A portion of PowerPlant Road, a dirt road approximately 10-12 feet wide located on the north side of the Winooski River, serves as the portage route between the take-out and put-in (Figure 3 in Appendix C). WHC owns both access locations along with PowerPlant Road, but due to the passive nature of the recreation features, the recreation sites are currently not maintained by WHC or other entities. There is no designated parking for public use of these areas, but WHC allows parking at an informal pull-off from PowerPlant Road near the put-in that provides 3 unimproved spaces.

The Cross Vermont Trail Association, Inc. (CVTA) was granted an easement by WHC in 2018 to carry out recreation improvements on project lands.[47] The easement allows CVTA to install part of a trail, including a bridge over the Winooski River, as part of the Cross Vermont Trail. The Cross Vermont Trail is a project to build a multi-use, four season trail across the width of Vermont, following the Wells River and Winooski River Valleys. The Cross Vermont Trail Winooski Bridge was constructed in June 2022 and crosses the Winooski River within the project boundary upstream of the dam, but this feature is not a project recreation facility. The Cross Vermont Trail Winooski Bridge and small portion of the Cross Vermont Trail crosses within the project boundary for approximately 365 feet. WHC has no maintenance or operation responsibilities associated with the bridge or the Cross Vermont Trail.

[46] Fiddlehead Slalom organizers installed wooden stairs leading to the put-in below the dam.

[47] The easement was approved by the Commission in a letter filed December 11, 2018.

Recreation Use, Capacity, and Needs

Anecdotal evidence suggests that fishing and boating are the two primary recreation activities conducted at the Winooski 8 Project. Vermont ANR states that, "the 1.2 mile stretch of river immediately upstream of the project is the most heavily fished area of the Winooski mainstem upstream of Montpelier. Anglers typically access this section of the river by parking along the northern side of U.S. Route 2 and walking down the southern bank of the river."[48] An annual canoe and kayak slalom race is held in the whitewater below the dam and users enter the river at the boating put-in below the project dam. The CVTA developed a Recreation Management Plan for the Winooski 8 Project in January 2019.[49] The plan involved significant stakeholder involvement and public support and led to WHC's proposed recreation measures.

3.3.4.2 Environmental Effects

WHC proposes to install and maintain a combined overlook and weatherproof interpretive display near the powerhouse that would include information about the hydropower facility, history of the site, and would provide a view of the dam and river. WHC also proposes to improve and maintain a parking area for 3 vehicles along PowerPlant Road near the whitewater boating put-in and tailwater fishing access area by adding gravel or similar substrate material to the existing informal pull-off. WHC also proposes to maintain the boat take-out, the whitewater boating put-in and tailwater fishing access area, and the portage route. WHC states it would be responsible for clearing downed trees and conducting vegetation management to ensure ease of access at the put-in and take-out, as well as maintaining the stairs located at the put-in. WHC also proposes to monitor recreation use at the project and to provide maps and promotional guide material regarding project recreation opportunities.

WHC would install the overlook and interpretive display and improve the parking area within two years of license issuance.

Vermont ANR's WQC condition D requires that within 180 days of the effective date of the FERC license, WHC develop a recreation plan that includes a schedule for implementing WHC's proposed recreation measures and the frequency that project recreation facilities would be monitored.

Staff Analysis

The recreation facilities at the project are informal and in need of improvement. WHC's proposal to improve and maintain the project recreation facilities (take-out, put-in, portage trail, overlook and interpretive display, and parking area) would improve public access, enhance boating and angling opportunities, increase public safety, and improve the visitor experience.

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[48] See the Preliminary Application Document, Appendix B, Response to Winooski 8 Information Request, filed July 31, 2018.

[49] The plan was included in the license application in Appendix A, as part of WHC's correspondence log. However, the measures involved lands and actions outside of the project.

WHC's proposal to install and maintain an overlook and interpretive display near the powerhouse would educate the public about the hydropower facility and the history of the site.

Although WHC proposes to install the overlook and interpretive display and improve the parking area within two years of license issuance, there is little else in the license application describing how WHC would maintain these sites and monitor recreation at the project. Clarifying these details in a recreation plan as is required by Vermont ANR (such as describing maintenance responsibilities, signage requirements, and a monitoring schedule) would provide an understanding for how a project's recreation resources would be developed and managed throughout a license term, help guide other recreation development in the area (e.g., CVTA efforts), avoid misunderstandings of maintenance responsibilities, and facilitate Commission oversight of the license.

Section 8.2(a) of the Commission's regulations require the licensee to post and maintain at all points of public access required by the license a conspicuous sign that, at a minimum, identifies: the FERC project name and number, and a statement that the project is licensed by the Commission; the licensee name and contact information for obtaining additional project recreation information; and permissible times and activities. In addition, the licensee shall post at such locations conspicuous notice that the recreation facilities are open to all members of the public without discrimination. There does not appear to be any signage directing the public to the take-out, put-in, portage, and parking area. Installing signage would alert the public to the project recreation facilities improving public enjoyment and use of the facilities.

3.3.5 Aesthetic Resources

3.3.5.1 Affected Environment

Project Setting

Vermont Route 100 from the towns of Waterbury to Stowe is classified by the State of Vermont as a state scenic byway; the town of Waterbury is approximately 16 miles northwest of the project. Scenic byways provide access to state public lands and highlight historic, scenic, and culturally important features (State of Vermont, 2019). The 14.5-mile stretch, known as the Green Mountain Byway, offers views of the northern peaks of the Green Mountains to the west and the Worcester Mountain range to the east. Vermont's highest peak, Mount Mansfield, is visible for much of the byway. The road is spotted with forests and small villages containing historic homes, farms, and mills. Activities along the byway include hiking, skiing, snowshoeing, paddling, fishing, and biking. Vermont Routes 100 and 100B between Granville and Middlesex, with Middlesex located approximately 10 miles northwest of the project, are also classified as Vermont Scenic Byways. This section is characterized by its classic New England landscape and architecture. A point of interest near the project area is the town of Barre, approximately 5 miles south of the project, which has been recognized by the Vermont Downtown Program as a historic downtown.

Land use adjacent to, and within the current project boundary is primarily forested, with medium and low-intensity development concentrated along the Route 2 corridor. The river below the dam is generally characterized by riffles and rapids. The project reservoir, northern

shoreline, and project facilities above the dam are visible from Route 2, which runs along the southern side of the Winooski River in the project area. Views of the dam and powerhouse, and the free-flowing Winooski River below the dam are also visible from PowerPlant Road.

There is currently no required aesthetic flow at the project.

Aesthetic Flow Study

WHC conducted an aesthetic flow study on November 18, 2019, which involved Vermont ANR and Gomez and Sullivan Engineers (representing WHC) observing a series of demonstration spill flows over the dam and describing their aesthetic value. The observed spill flows were 0 cfs (leakage), 1-inch spill (16 cfs), 0.75-inch spill (13 cfs), and 0.5-inch spill (11 cfs) (Photos G-1 to G-10, Appendix G).[50] The assessment team evaluated the flows from a publicly accessible vantage point located approximately 230 feet downstream of the project dam on the northern shoreline. The evaluation addressed aesthetics on an absolute scale and relative to the previously assessed flow. Each observer considered water character, flows, water level for each spill flow and filled out an aesthetic evaluation sheet.[51] Following the individual assessments, a "consensus" form was filled out to reflect the group's overall judgment on each demonstration flow. Below is a summary of the results of the aesthetic flow demonstration study.

Ice buildup along the flashboards was noticeable in all test flows during the November study season.

The 1-inch spill (16 cfs) flow scenario was rated 'fair' on the absolute scale. As the first flow evaluated, no relative rating was assessed. Consensus notes indicated that the flow was uneven, with a thin veil and that the left end of the dam looked better than the right end of the dam.

The 0.75-inch spill (13 cfs) flow scenario was rated 'poor' on the absolute scale and 'same to worse' on the relative scale. Consensus notes indicated spill flow occurred mostly on the left half of the dam, with a thin, uneven veil of flow similar to the 1-inch spill.

The 0.5-inch spill (11 cfs) flow scenario was rated 'poor' on the absolute scale and 'same to worse' on the relative scale. Consensus notes indicated that approximately 80% of the flashboards did not experience spill, spill was present toward river left, and that the spill occurred in a thin veil similar to the first two flows.

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[50] In addition to the Aesthetic Flow Assessment photographs, photographs of the dam were taken during the study preparation phase when icing on the flashboards were not present. With no ice on the flashboards, the veil of water conveyed over the spillway is evenly distributed. All photos can be found in Appendix G of this EA.

[51] See the Aesthetic Flow Study Report, filed October 7, 2020, for the aesthetic evaluation sheets.

3.3.5.2 Environmental Effects

Diverting flow for generation affects the amount of flow available to pass over the dam, which in turn can affect the aesthetic quality of the environment for recreational users that are able to view or hear it.

To enhance aesthetics and aquatic habitat in the bypassed reach, WHC proposes to modify its current operations to increase flows from 25 cfs to 41 cfs during daytime hours from May 1 through October 31, and from 25 cfs to 36 cfs the remainder of the year (i.e., during nighttime hours from May 1 through October 31 and during both day and night from November 1 through April 30). The minimum flow would be provided through a combination of spill flow over the dam and discharges through Unit 1 to enhance aesthetic resources and aquatic habitat during the summer recreation season. Aesthetic flows would be provided by spilling 16 cfs (i.e., equal to 1 inch spill over the spillway crest flashboards) during the daytime and 11 cfs (equal to 0.5 inch spill over the spillway crest flashboards) at night. The remaining minimum flow during this period (i.e., 25 cfs) would be discharged into the bypassed reach through Unit 1 or spilled if Unit 1 is not operational. If inflow drops below proposed minimum flow levels, WHC would prioritize maintaining aesthetic spill flows over the dam rather than discharging flows through Unit 1.[52] WHC is not proposing to maintain an aesthetic spill flow from November 1 to April 30 because ice build-up on the flashboards prevents WHC from being able to maintain adequate spill over the dam during this period.

In its March 3, 2023, comments, Vermont ANR initially recommended a continuous (both day and night) spillage flow of 1-inch spill (approximately 16 cfs) over the dam crest year-round to enhance aesthetics at the dam. However, Vermont ANR revised its recommendation in the WQC which requires continuous daytime spill flows of 1-inch (i.e., 16 cfs) and continuous nighttime spill flows of 0.5-inch (i.e., 11 cfs).

In their reply comments, WHC opposed providing an aesthetic flow in the winter. In support, WHC reiterated that an aesthetic spill flow from November 1 to April 30 would result in significant ice build-up on the top and backside of the flashboards which would lead to more frequent flashboard failures, which WHC could not safely reinstall until after the spring freshets. WHC also states that "the ice would build-up on the flashboards to a point where no water is spilled over the flashboard crest, as the pond level sensor would be set to maintain the water level 1-inch above the flashboard crest." WHC compared aesthetic flows conducted in the winter and with additional videotape footage and photographs of spill flows (0 inch, 0.5 inch, 1.2 inches, 2.1 inches, and 3.7 inches) taken by WHC's consultant in August and October 2019

[52] WHC states that aesthetic spill flows cannot be provided during maintenance drawdowns of the project impoundment as all water will be passed through the powerhouse in these cases. When a planned or unplanned drawdown below the spillway crest occurs during the period of May through October, the applicant proposes to stop spilling and increase the Unit 1 discharge up to its maximum capacity of 36 cfs during these brief periods. Once the impoundment is refilled following a maintenance drawdown, WHC would return to providing minimum flows in the bypassed reach via a combination of aesthetic spill flows over the dam and discharges through Unit 1 as proposed.

when there was no ice on the flashboards. WHC concluded that 0.5 inch spill flow was fair to good, and 1.2 inches was good, with good sound. Given this, WHC concluded that "the ranking for the same spill depths of 0.5 and 1-1.2 inches varied depending on whether there was, or was not, ice formation on the flashboards with the aesthetic rankings decreasing with ice formation. The aesthetic value of falling waters declines with ice on the flashboards. It would be expected that in the heart of the winter there would be no veil of water due to the extensive amount of ice build-up on the top and backside of the flashboards. Thus, the aesthetic criteria of falling waters would be greatly impacted during freezing conditions." Lastly, WHC's argues that a 1 inch aesthetic spill flow is not warranted during nighttime hours because the dam is not visible at night, and the 0.5 inch spill flow received a 'good' rating based on sound.

Staff Analysis

Providing an aesthetic flow would provide a more aesthetically pleasing view of the dam compared to existing operations. With the recent construction of the Cross Vermont Trail Winooski Bridge, and the proposed addition of the overlook and interpretive display, recreation use at the project may increase.

As explained earlier in 3.2.1.2, *Aquatic Resources, Environmental Effects,* water is rarely spilled over the dam under existing operations, except during the high flow month of April or during brief periods when the powerhouse is shutdown either due to low flows or due to maintenance repairs. During April, median inflow (i.e., 657 cfs) often exceeds the maximum hydraulic capacity of the powerhouse resulting in a median spill of 221 cfs (see table 4 in Appendix D). Thus, under current operations, views of the dam are considered poor to fair much of the year. Given that the recreation season typically lasts from May through October each year, the project does not typically provide aesthetically-pleasing spill flows over the dam year-round under existing conditions

Based on the results of the aesthetic flow study, none of the demonstration flows conducted in November received a 'good' or 'excellent' rating. Spill flows were somewhat aesthetically pleasing (rated as 'fair' during the assessment) when a 1-inch spill (16 cfs) is flowing over the dam. The less desirable ratings were likely affected by ice buildup, which suggests that a 1 inch spill in winter is not likely to be that beneficial. Our review of the photographs collected during the study preparation phase when icing on the flashboards were not present suggests that a 1 inch spill flow would provide a "good" aesthetic rating as found by Vermont ANR and WHC (figures G-1 thru G-10 in Appendix G).

The principal difference between WHC's proposed aesthetic flow and that required by WQC condition B is winter spill flows from November 1 to April 30. Compared to existing conditions, providing a 1-inch spill (approximately 16 cfs) during daytime hours from May 1 to October 31, as proposed by WHC, would provide a more aesthetically pleasing view of the dam to visitors and those boating in the river below the dam during the prime recreation season and spring and early fall shoulder recreation seasons. Providing a 0.5-inch spill (approximately 11 cfs) during nighttime hours from May 1 through October 31 would only provide an auditory benefit as viewers cannot see the dam at night. The aesthetic benefit of providing 16 cfs spill and 11 cfs spills from November through April as required by the water quality certification would be minimal because visitor usage is likely low to non-existent due to poor weather

conditions (i.e., colder temperatures and icy, snowy conditions) and the lack of recreational activities at the site during the winter months. Furthermore, any aesthetic benefit would only be possible if WHC could maintain these flows during winter. Icing observed during the aesthetic study and WHC's experience in operating the project suggests this is not likely to be practicable. Further, recreation activities at the project area are not typically conducted during nighttime hours; therefore, the benefits from providing a nighttime auditory aesthetic flow would be minimal to nonexistent.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the National Historic Preservation Act (NHPA) requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.[53] Historic properties are those that are listed or eligible for listing in the National Register of Historic Places (National Register). The regulations implementing section 106 of the NHPA also require that the Commission seek concurrence with the State Historic Preservation Office (SHPO) on any finding involving effects or no effects on historic properties, and consult with interested Native-American Tribes that attach religious or cultural significance to historic properties that may be affected by an undertaking. In this EA, we also use the term "cultural resources" for properties that have not been determined eligible for listing in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

On September 21, 2018, the Commission designated WHC as the non-federal representative for carrying out day-to-day consultation regarding the licensing efforts, pursuant to section 106 of the NHPA. However, the Commission remains largely responsible for all findings and determinations regarding the effects of the project on any historic property.

Area of Potential Effect

Pursuant to section 106 of the NHPA, the Commission must take into account whether any historic property could be affected by the issuance of a license within a project's area of potential effects (APE). The APE is determined in consultation with the SHPO and is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE for this project includes all lands within the current project boundary. WHC proposes to add 3.56 acres to the existing project boundary, for a total project boundary encompassing 10.85 acres.

[53] An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16(y). Here, the undertaking is the potential issuance of a new license for the Winooski 8 Project.

The Vermont Division for Historic Preservation[54] (Vermont DHP) filed a letter on January 15, 2019, stating that the APE should include the access road, parking area, and transmission line; the APE includes those features in addition to all project facilities.

Cultural and Historical Background[55]

Aboriginal Settlement

The archaeological record of Vermont dates back to about 10,000 years ago and is divided into five major periods known as the Archaic, the Late Archaic and Transitional, the Woodland, the Middle Woodland, and the Late Woodland periods. A few sites have been found containing Early Archaic bifurcated-base points. These sites are found in the Missisquoi, Lamoille, Winooski, and Otter Creek Valleys; interior ponds and lakes along the foothills and lowlands of the Green Mountains; and occasionally along the margins of Lake Champlain. This diversity of environmental zones suggests that human exploitation patterns were geared to a broad resource base (Mueller et al., 1979).

The Late Archaic and Transitional Period (about 6,000 to 2,000 years ago) people relied upon hunting and gathering with evidence of nut harvesting and utilization of local lacustrine and inland aquatic resources. A small circle of post molds found in Rutland County indicates small social units and a transient occupation.

The earliest evidence of the Woodland Period (about 2,500 years ago) in Vermont comes from cemeteries along the Mississquoi River in Highgate and East Creek in Orwell. Habitation sites during this time are very rare in the Northeast United States. The cemeteries contain Adena-style artifacts indicating long distance trade networks (e.g. raw materials from the Ohio Valley, shells from the mid-Atlantic, and copper from Lake Superior). Subsistence activities such as hunting, fishing, and gathering was not markedly different from the preceding Archaic Period (Mueller et al., 1979).

The Middle Woodland Period (about 1,000 to 1,700 years ago) is not yet clearly understood and there are 14 Middle Woodland sites known in the Lake Champlain drainage of the state, although many are still unexcavated. A number of these are heavily utilized sites and

[54] The Vermont Division for Historic Preservation functions as the State Historic Preservation Office for the State of Vermont.

[55] The cultural and historical background information is taken and generalized from the Pre-Application Document, filed on July 31, 2018, and from the Bolton Falls Hydroelectric Project No. 2879 Final Environmental Assessment (Final EA), filed on April 21, 2022. The Bolton Falls Final EA cultural and historical background information was taken and generalized from the final project Historic Properties Management Plan filed on March 31, 2022, and the Pre-Application Document, filed on January 31, 2017. The Bolton Falls project is approximately 17 miles downstream on the Winooski River from the Winooski No. 8 project.

occur in the Lower Winooski, Lamoille, Missisquoi, and Otter Creek just before the rivers enter into Lake Champlain (Thomas and Robinson, 1979). Comparable data from the Hudson Valley suggests a continuation of hunting, fishing, and gathering activities with corn horticulture being introduced toward the end of this period.

During the Late Woodland Period (about 350 to 1,000 years ago) horticulture became increasingly more important while hunting, fishing, and gathering activities continued as the main subsistence base. Habitation sites of this period are fairly common and range from large villages to small campsites and rock shelters.

Euro-American Settlement and Occupation

The Winooski River has long provided a transportation corridor for populations of people and animals into the Champlain Valley uplands and through the Green Mountains. After the French and Indian War in 1763, a military road joining Crown Point, Vermont and Charlestown, New Hampshire, became one of the most traveled routes during the new period of regional travel and settlement in the region. In the early 1800s, plans had been in the works to build a 100-mile-long canal from Lake Champlain to the Connecticut River. The railroads caused the canal plans to be dropped. After the Civil War, use of waterways for travel declined, again due to the influence of railroads. In addition to the mill industries of timber and textiles, agriculture has been an important industry. By the end of the 1800s, areas located on the Winooski River had become important exports to Boston for the butter and cheese market. Hydroelectric power became a secondary income to many mills located on the Winooski River beginning as early as 1886. Today, the Winooski River and its tributaries are Vermont's second largest source of hydropower (Friends of the Winooski, 2023).

The original Winooski 8 Dam was constructed in 1908 and was used to produce about 600kW to power the electric trolley cars running between Montpelier and Barre. The dam and powerhouse were taken out of service in 1973, underwent a major reconstruction in 1985, and back in service later that year.

Archeological and Historic Resources Investigations

Prior to the relicensing efforts, two recent studies[56] were conducted in the project area to determine effects for the proposed Cross Vermont Trail Project (see section 3.2.4.1. Project Recreation Facilities). Both studies indicated that there are no cultural resources in, or adjacent to the project area, that are currently listed or eligible for listing on the National Register.

The powerhouse and associated facilities do not currently meet the 50-year age requirement for evaluation of eligibility for listing on the National Register.[57] In a letter filed on

[56] Liz Pritchett Associates conducted the architectural assessment (Pritchett, 2007), and the University of Vermont Consulting Archaeology Program (UVMCAP, 2007) conducted the archaeological assessment.

[57] 36 CFR § 60.4 (2019).

January 15, 2019, the Vermont SHPO stated that the powerhouse and associated facilities would become 50 years old during the term of the proposed license and that a provision to evaluate the hydroelectric facility in 2035 for National Register of Historic Places eligibility should be included in the license order.

3.3.6.2 Environmental Effects

WHC does not propose any changes to project facilities or ground-disturbing activities. WHC proposes to continue operating the Winooski 8 Project in a run-of-river, provide an aesthetic flow and minimum flow into the bypass reach, maintain recreation facilities, and improve and maintain a small parking area by adding gravel or a similar substrate. WHC proposes to continue to consult with the Vermont DHP (hereinafter, "State Historic Preservation Office or SHPO") before beginning any land-disturbing activities or alterations to known historic structures within the project boundary.

Staff Analysis

All available information indicates that there are no historic properties within the project APE, therefore WHC's proposed project will not affect cultural resources.

During the term of any license issued by the Commission, the applicant would occasionally need to conduct maintenance activities in the project area, such as general landscaping around project facilities, maintenance of the transmission line facilities, or ground disturbing yard maintenance within the project boundary. These activities would not require prior Commission approval; however, they could affect unidentified cultural resources in the project area. Notifying the Commission, the Vermont SHPO, and relevant Tribes if previously unidentified archaeological or cultural artifacts are discovered would ensure that historic properties are not adversely affected. In the event of any such discovery, the applicant would need to stop all land-clearing and land-disturbing activities related to the discovery until the proper treatment of any potential cultural resources is established.

Because project facilities will reach 50 years in age during the term of the new license, an evaluation of the hydroelectric facility in 2035 for National Register of Historic Places eligibility is recommended. If they are found eligible, a historic properties management plan that defines the actions required to protect the resources would likely be needed.

3.3.7 Environmental Justice

Environmental justice (EJ) is "the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[58]

[58] EPA, *Learn About Environmental Justice*, https://www.epa.gov/environmentaljustice/learn-about-environmental-justice (Aug. 16, 2023). Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations

3.3.7.1 Meaningful Engagement and Public Involvement

The Council on Environmental Quality's (CEQ) *Environmental Justice Guidance Under the National Environmental Policy Act* (CEQ, 1997) and *Promising Practices for EJ Methodologies in NEPA Reviews* (*Promising Practices*)(IWG, 2016), recommend that federal agencies provide opportunities for effective community participation in the NEPA decision-making process by: identifying potential effects and mitigation measures in consultation with affected communities; improving accessibility of public meetings, crucial documents, and notices; and using adaptive approaches to overcome potential barriers to effective participation. In addition, Executive Order 13985 and Executive Order 14096, strongly encourage independent agencies to "consult with members of communities that have been historically underrepresented in the Federal Government and underserved by, or subject to discrimination in, Federal policies and programs,"[59] and "provide opportunities for the meaningful engagement of persons and communities with environmental justice concerns who are potentially affected by Federal activities."[60]

There have been opportunities for public involvement during the Commission's environmental review processes. The Commission's communication and involvement with the surrounding communities began on September 21, 2019, with the public notice of the pre-application document, followed by *Notice of Application Tendered for Filing with the Commission and Soliciting Additional Study Requests* on August 5, 2021. On December 7, 2021, we issued the *Notice Soliciting Scoping Comments* which opened a 60-day scoping period to identify issues, concerns, and opportunities for enhancement or mitigation associated with the proposed action. We issued a *Notice of Application Accepted for Filing, Soliciting Motions to Intervene and Protests, Ready for Environmental Analysis, and Soliciting Comments, Recommendations, Terms and Conditions, and Prescriptions* on January 4, 2023, which established a 60-day comment period and intervention deadline. Finally, we issued a *Notice of Intent to Prepare an Environmental Assessment* on March 17, 2023. Each of these notices were published in the *Federal Register* and local newspapers.

All documents that form the administrative record for this proceeding, with the exclusion of privileged or critical energy infrastructure information, are available to the public on FERC's e-library website (https://elibrary.ferc.gov/eLibrary/search). We recognize that not everyone has

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or policies. *Id.* Meaningful involvement of potentially affected environmental justice community residents means: (1) people have an appropriate opportunity to participate in decisions about a proposed activity that may affect their environment and/or health; (2) the public's contributions can influence the regulatory agency's decision; (3) community concerns will be considered in the decision-making process; and (4) decision makers will seek out and facilitate the involvement of those potentially affected. *Id.*

[59] Exec. Order No. 13985, 86 Fed. Reg. 7009, at 7011 (Jan. 20, 2021).

[60] Exec. Order No. 14,096, 88 Fed. Reg. 25254 (Apr. 21, 2023).

internet access or is able to file electronic comments. Anyone may comment about the project, either in writing or electronically. [61]

3.3.7.2 Identification of Environmental Justice Communities

In conducting NEPA review of proposed hydropower projects, the Commission follows Executive Order 12898 and Executive Order 14096, which direct federal agencies to identify and address "disproportionate and adverse human health or environmental effects" of their actions on minority and low-income populations (i.e., environmental justice communities). Executive Order 14008 also directs agencies to develop "programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."

Commission staff used *Promising Practices for EJ Methodologies in NEPA Reviews* (*Promising Practices*) which provides methodologies for conducting environmental justice analyses throughout the NEPA process for this project. Commission staff's use of these methodologies is described throughout this section.

Additionally, consistent with EPA recommendations, Commission staff used EPA's Environmental Justice Screening and Mapping Tool (EJScreen) as an initial screening tool to better understand locations that require further review or additional information regarding minority and/or low-income populations; potential environmental quality issues; environmental and demographic indicators; and other important factors.

Consistent with CEQ guidance and *Promising Practices*, we consider: (1) whether environmental justice communities (e.g., minority or low-income populations) exist in the project area; (2) whether impacts on environmental justice communities are disproportionate and adverse; and (3) what mitigation measures might be needed (CEQ, 1997; IWG, 2016). Following the recommendations set forth in *Promising Practices*, FERC uses the **50%** and the **meaningfully greater analysis** methods to identify minority populations.[62] Using this

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[61] The Office of Public Participation (OPP) provides members of the public, including environmental justice communities, landowners, Tribal citizens, and consumer advocates, with assistance in FERC proceedings—including navigating Commission processes and activities relating to the Project. For assistance with interventions, comments, requests for rehearing, or other filings, and for information about any applicable deadlines for such filings, members of the public are encouraged to contact OPP directly at 202-502-6595 or OPP@ferc.gov for further information.

[62] *See generally* Exec. Order No. 12898, 59 Fed. Reg. 7629 (February 11, 1994). Minority populations are those groups that include: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. CEQ's *Environmental Justice Guidance* at 25.

methodology, minority populations are defined in this EA where either: (a) the aggregate minority population of the block groups in the affected area exceeds 50 percent; or (b) the aggregate minority population in the block group affected is 10 percent higher than the aggregate minority population percentage in the county. The guidance also directs low-income populations to be identified based on the annual statistical poverty thresholds from the U.S. Census Bureau. Using Promising Practices' **low-income threshold criteria** method, low-income populations are identified as block groups where the percent low-income population in the identified block group is equal to or greater than that of the county. Here, Commission staff selected Washington County, Vermont, in which the project action is located, as the comparable reference community to ensure that affected environmental justice communities are properly identified. A reference community may vary according to the characteristics of the particular project and the surrounding communities.

To identify potential environmental justice communities for the analysis presented here, Commission staff used 2022 U.S. Census American Community Survey as the source for the race, ethnicity, and poverty data at the block group level (Census, 2023). For this project, staff chose a 1-mile radius around the proposed project boundary as the area of study. The 1-mile radius includes all census block groups that border the Winooski 8 Project for Washington County. Staff found that a 1-mile radius is the appropriate unit of geographic analysis given the limited scope of the project proposal and concentration of project-related effects on this segment of the Winooski River.

Within the study area, staff identified three census block groups in which the populations qualify as an environmental justice community with minority populations greater than 10% than that of the reference county (see Figure 7 in Appendix C and table 7 in Appendix D). The identified block groups are Census Tract 9545, Block Group 2; Census Tract 9547, Block Group 1; and Census Tract 9549, Block Group 2, in Washington County, Vermont. No block groups met the threshold for environmental justice communities on the basis of low income.

3.3.7.3 Effects on Environmental Justice Communities

Consistent with *Promising Practices*, Executive Order 12898, and Executive Order 14096, we reviewed the project to determine if its resulting impacts would be disproportionate and adverse on minority and low-income populations and also whether impacts would be significant.[63] *Promising Practices* provides that agencies can consider any of a number of conditions in this determination, and the presence of any of these factors could indicate a potential disproportionate and adverse impact. For this project, a disproportionate and adverse

[63] *See Promising Practices* at 33 (stating that "an agency may determine that impacts are disproportionately high and adverse, but not significant within the meaning of NEPA" and in other circumstances "an agency may determine that an impact is both disproportionately high and adverse and significant within the meaning of NEPA"); see also Promising Practices at 45-46 (explaining that there are various approaches to determining whether an impact will cause a disproportionately high and adverse impact). We recognize that CEQ and EPA are in the process of updating their guidance regarding environmental justice and we will review and incorporate that anticipated guidance in our future analysis, as appropriate.

effect on an environmental justice community means the adverse effect is predominantly borne by such population.

Relevant considerations include the location and natural physical environment of project facilities and the project's human health and environmental impacts, including associated social, economic, or cultural direct, indirect and cumulative impacts, on identified environmental justice communities.

As described in section 2.2.2, *Proposed Operation and Environmental Measures*, WHC proposes to continue operating the project in a run-of-river mode. To enhance aesthetics and aquatic habitat in the bypassed reach, WHC proposes to modify its current operations to increase flows from 25 cfs to 41 cfs during daytime hours from May 1 through October 31 and from 25 cfs to 36 cfs the remainder of the year (i.e., during nighttime hours from May 1 through October 31 and during day and night from November 1 through April 30). WHC's proposal would provide an aesthetic flow over the dam crest of 1-inch (approximately 16 cfs) during daytime hours from May 1 through October 31 and 0.5-inch (approximately 11 cfs) during nighttime hours from May 1 through October 31. WHC is not proposing to maintain an aesthetic spill flow from November 1 to April 30. WQC Condition B requires WHC to provide 39 cfs, or inflow if less, into the bypassed reach year-round and when generating to spill 1 inch in daylight hours and 0.5 inches during nighttime hours continuously year-round in the bypass reach. Because the water quality conditions are mandatory, this would become a condition of the license.

WHC also proposes to implement a Sediment Dredging Management Plan, which outlines how WHC would continue its dredging activities with additional measures to control erosion and sediment releases during and following dredging operations, as described under section 3.3.1.2, *Aquatic Resources*, *Environmental Effects*. As discussed previously, to maintain adequate inflow and storage, WHC dredges the area in front of the intake every three to six weeks in the winter to remove excess sediment and debris which typically takes up to 2 days to complete. A long-reach backhoe is used to dredge the intake area from the riverbank. If the impoundment has an abnormal amount of sediment deposition, WHC conducts a larger dredge which involves drawing down the impoundment. Dredging the larger impoundment area occurs every three to five years in September or October, when flows are the lowest, and the dredge can last for approximately one week.

WHC also proposes to install an interpretive display and overlook near the powerhouse and improve a parking area for 3 vehicles at an existing pull-off area by adding gravel or a similar substrate. WHC also proposes to maintain these facilities as well as the boat take-out, whitewater boating put-in and tailwater fishing access area, and portage route.

No entity provided comments or recommendations regarding the effects of the project on environmental justice communities in response to the Commission's notice that the application was ready for environmental analysis.

3.3.7.3 Determination of Disproportionate and Adverse Impacts on Environmental Justice Communities

Staff Analysis

Staff evaluated the effects of continued project operation on aquatic resources, terrestrial resources, threatened and endangered species, land use, recreation, aesthetics, and cultural resources in sections 3.3.1 through 3.3.6 above. WHC's proposed project operation would not adversely affect environmental resources, including water supply, water quality, recreation, or fisheries. Continuing to operate in a run-of-river mode with minimal impoundment fluctuations and providing higher minimum flows in the bypassed reach throughout the year would protect aquatic and riparian habitat and would have no effect on water supply or other aquatic resources. While ongoing dredging activities would continue to cause short term increases in suspended sediment and turbidity, these effects would be temporary and minimized through implementation of WHC's proposed Sediment Dredging Management Plan. Construction-related noise, visual, and traffic impacts associated with the proposed interpretive display and improvements to the existing pull-off area should not be noticeable to the closest residence (2,600 feet) within the identified EJ communities due to the short duration (few days to 1 week) and limited scope of activity. Public access and recreation to the Winooski River would be enhanced with the improved parking area, proposed interpretive display and overlook, and scheduled maintenance of all recreation facilities. WHC's proposed and Vermont ANR's required aesthetic flow would improve the scenic quality and overall public enjoyment of the project area by all users. Although recreational use at the Winooski 8 dam could increase with improved access and maintenance, the site is unlikely to experience large increases in usage that would adversely affect the identified environmental justice communities through increases in traffic or overfishing.

Dredging activities would not impede users from accessing any of the existing or proposed recreation facilities at the project.**64** Annual dredging activities would occur in the winter months when visitation and recreation at the site is likely low and larger dredges would occur only every 3-5 years for a period of approximately one week. With minimal construction equipment used, short duration of dredge, and distance to the closest residence (2,600 feet) within the EJ communities, noise and visual impacts from dredging activities would not adversely affect residents of the EJ community.

Considering the included census data, the limited scope of the proposed project, the lack of a significant effect on environmental justice communities, and the environmental protection and enhancement measures for aquatic and recreation resources, continuing to operate the project would not result in a disproportionate and adverse impact on the environmental justice communities present within the 1-mile geographic scope of EJ analysis.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the project's use of the Winooski River for hydropower generation to see what effect various proposed or recommended environmental measures would have on the cost to operate and maintain the project and on the project's power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as

64 See telephone summary memorandum issued January 18, 2024.

articulated in *Mead Corp*.,[65] the Commission compares the current cost to produce project power to an estimate of the cost to provide the same amount of energy and capacity[66] for the region using the most likely alternative source of power (cost of alternative power). In keeping with the policy described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not anticipate or estimate changes in fuel costs that could occur during a project's license term.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the annualized cost of providing the individual measures considered in the EA; (2) the cost of the most likely alternative source of project power; (3) the total annual project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of the current alternative source of project power and the total annual project cost. If the difference between the cost to produce an equivalent amount of power from an alternative source and the total annual project cost is positive, the project produces power at a cost less than the cost of producing power from the most likely least-cost source of alternative power. If the difference between the alternative source of power's annual cost and the total annual project cost is negative, the project costs more to produce power than the cost to produce an equivalent amount of power from the most likely least-cost source of alternative power. This estimate helps support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

The power and economic benefits of the Winooski 8 Project, and the comparison of the cost of each alternative for the project, are discussed in Appendix E. Appendix F presents the cost of each of the environmental enhancement measures considered in our analysis for the Winooski 8 project. All costs are adjusted to current year dollars. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial

[65] *See Mead Corp.*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

[66] We use the term "Capacity benefit" to describe the benefit a project receives for providing capacity to the grid, which may be in the form of a dependable capacity credit or credit for monthly capacity provided.

public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on the project and our review of the environmental and economic effects of the proposed project and project alternatives, we selected the staff alternative as the preferred alternative for the Winooski 8 Project. We recommend this alternative because: (1) issuing a new license would allow the applicant to continue operating the project as a beneficial and dependable source of electrical energy; (2) the 0.856 MW of electric capacity of the Winooski 8 Project comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of the staff alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance aquatic resources (i.e., water quality, resident trout, and mussels), terrestrial resources, threatened and endangered species, recreation, and aesthetic resources at the project.

Below, we make recommendations as to which environmental measures proposed by WHC or mandatory conditions that are required by Vermont ANR in its WQC should be included in any license issued for the project. We also recommend certain modifications to WHC's proposed environmental measures and additional environmental measures to be included in any license issued for the project. Finally, for the reasons outlined below, we do not recommend including the following WQC conditions: (1) provide a year-round minimum flows of 39 cfs in the bypassed reach (WQC condition B); (2) maintain spill flows of 1.0 inch during daylight hours and 0.5 inch during nighttime hours continuously year-round in the bypassed reach rather than only during daylight hours from May 1 through October 31 (WQC condition B); and (3) survey for mussels and relocate any mussels to deeper water during each planned drawdown that falls below 610.7 feet (WQC condition H). We recognize, however, that the Commission must include these conditions in any new license issued for the project because they are mandatory.

5.1.1 Measures Proposed by WHC

Based on our environmental analysis of WHC's proposal in section 3.0, *Environmental Analysis,* and the costs presented in section 4.0, *Developmental Analysis,* and in Appendices E and F, we conclude that the following environmental measures proposed by WHC would protect or enhance environmental resources and would be worth the cost. Therefore, we recommend including these measures in any license issued for the project.

- Continue to operate the project in a run-of-river mode in which flow through the turbines is adjusted to maintain the project impoundment water level at 615 feet or at the level needed to provide seasonal aesthetic spill flows (described further below) so that at any given point in time, the sum of flows immediately downstream of the powerhouse tailrace approximate the sum of inflow to the project.

- When refilling the impoundment after a drawdown, store 10% of the inflow until the impoundment increases to the normal pool elevation of 615 feet.

- Implement the draft Sediment Dredging Management Plan filed with the license application that includes provisions to: (1) notify Vermont ANR prior to conducting any dredging activity of the geographic area of the proposed dredge, estimated duration of the dredge (including start and end date), and estimated river flows during the planned dredging operation; (2) conduct all dredging using a bucket loader from the shoreline rather than placing equipment in the water, and only remove sediment that is above the water line when the impoundment is drawn down to minimize the amount of sediment that is re-suspended in the water column; (3) stockpile the dredged material in an upland site, and install temporary silt fences around the stockpile to prevent runoff to the river; and (4) notify Vermont ANR upon the completion of the dredge, remove silt fences, and haul the dredge material offsite after the dredge pile has sufficient time to drain.

- From November 1 to April 30, provide a continuous minimum flow of 36 cfs or inflow, if less, in the bypassed reach to maintain aquatic habitat. Minimum flows would be discharged through Unit 1 or spilled if Unit 1 is not operational.

- From May 1 to October 31, maintain a daytime minimum flow of 41 cfs and a night time minimum flow of 36 cfs or inflow, if less, in the project bypassed reach via a combination of spill flow over the dam and discharge through Unit 1 to enhance aesthetic resources and aquatic habitat during the summer recreation season. During daytime hours during this period, aesthetic flows would be provided by spilling 16 cfs (i.e., equal to 1 inch of spill over the spillway crest flashboards) with the remaining minimum flow (i.e., 25 cfs) being discharged into the bypassed reach through Unit 1 or spilled if Unit 1 is not operational. If inflow drops below proposed minimum flow levels during daytime hours during this period, prioritize maintaining aesthetic spill flows over the dam rather than discharging flows through Unit 1.

- Conduct a survey for mussels during the first planned maintenance drawdown of the impoundment. The survey would consist of lowering the impoundment to the lowest expected drawdown needed for maintenance[67] and having a mussel expert walk the impoundment shoreline to locate, identify and relocate any mussels found during the survey to deeper water and file a summary report of the findings to Vermont ANR and the Commission within 120 days of the survey.

- Within 2 years of license issuance, install an interpretive display and overlook near the powerhouse that would include information about the hydropower facility and the history of the site.

[67] Staff assumes that this means that the mussel survey would coincide with lowering the impoundment down to a level of 610 feet which is the water level that WHC lowers the impoundment to when conducting a larger dredge or when inspecting the dam and crest gate.

- Within 2 years of license issuance, improve the existing parking area for 3 vehicles along PowerPlant Road near the whitewater boating put-in and tailwater fishing access by adding gravel or a similar substrate.

- Maintain and monitor the boating take-out, whitewater boating put-in and tailwater fishing access area, portage route, improved parking area, and proposed interpretive display and overlook.

- Develop maps and promotional guide material describing project recreation opportunities.

- Continue to consult with the Vermont DHP before beginning any land-disturbing activities or alterations to known historic structures within the project boundary.

We also recommend authorizing WHC's proposed modifications to the project boundary (see section 2.2.1, *Proposed Project Facility and Project Boundary Modifications*) because the 3.56 acres of additional lands that would be brought into the project boundary include features that are necessary to operate and maintain the project.

5.1.2 Additional Measures Recommended by Staff

The staff alternative includes the following additions or modifications to WHC's proposed measures:

- Consistent with WQC condition I, in consultation with Vermont ANR revise the Draft Sediment Dredging Management Plan for Commission approval to include a provision to conduct all planned non-emergency maintenance dredges that require the impoundment to be drawn down below the normal operating limit of 615 feet between July 1 and September 30 to avoid elevating turbidity levels downstream during sensitive resident trout spawning and rearing periods.

- From May 1 through October 31, provide a spill flow of 16 cfs (i.e., equal to 1 inch of spill over the spillway crest flashboards) to enhance aesthetic resources during daytime hours only (rather than providing spill flows during the day and night from May 1 through October 31 as proposed by WHC or providing spill flows continuously throughout the year as required by WQC condition B). From November 1 to April 30, provide a continuous minimum flow of 36 cfs or inflow, if less, in the bypassed reach to maintain aquatic habitat as proposed by WHC (rather than a continuous minimum flow of 39 cfs as required by WQC condition B).

- Develop a flow management and monitoring plan consistent with WQC condition C that specifies the impoundment levels needed to maintain aesthetic spill flows and includes provisions for monitoring and reporting compliance with the operating requirements of the license (e.g., run-of-river operation, minimum flows, spill flows, impoundment levels), reporting deviations from operating requirements to Vermont DEC and the Commission, and a provision to consult with Vermont DEC prior to

conducting planned maintenance drawdowns of the impoundment consistent with WQC condition F.

- Develop a mussel protection plan in consultation with Vermont ANR that contains the following: (1) a schedule and methods for surveying for mussels during the first planned drawdown of the impoundment below an elevation of 610.7 feet; (2) procedures for safely collecting and handling mussels found within the maintenance fluctuation zone and transporting them to deeper waters; (3) criteria for deciding if and when mussel surveys would continue during subsequent maintenance drawdowns that are conducted below an elevation of 610.7 feet; and (4) provisions to notify the Commission of the survey results and any proposals for Commission approval to discontinue surveys or modify the frequency of surveys based on the survey results.

- Develop a debris disposal plan in consultation with Vermont ANR consistent with WQC condition E.

- To protect the northern long-eared bat (NLEB) and tri-colored bat, avoid tree-trimming and the removal of trees with diameters that are equal to or greater than 3 inches at breast height from April 15 through October 31. If tree work is imminently required for trees with diameters that are equal to or greater than 3 inches at breast height during this period to protect property or human life, the applicant would be permitted to do so and then consult with Vermont FWD and the FWS, consistent with WQC condition G.

- Develop a recreation management plan, consistent with WQC condition D, that includes:

    - a maintenance schedule for all project recreation facilities, including the boating take-out, whitewater boating put-in and tailwater fishing access area, portage route, parking area, interpretive display and overlook;

    - a plan and schedule for improving the parking area; and

    - a plan and schedule for installing signage directing users to the project recreation facilities;

Below we discuss the reasons for recommending the additions or modifications to WHC's proposal and why some measures that are required by Vermont ANR in the WQC would not result in benefits to non-power resources that would be worth their cost or generation losses.

Sediment Dredging Management Plan

Heavy sediment loads require WHC to regularly dredge in front of the intake and occasionally much further into the impoundment. WHC dredges directly in front of the intake over one or two days every three to six weeks in the winter and conducts a larger dredge further into the impoundment over approximately one week every 3-5 years (typically during lower flow months such as September or October). For the larger dredges, WHC draws the impoundment

down to approximately 610 feet (i.e., 5 feet below the top of the flashboards) and removes the exposed sediment above the water line. WHC proposes to implement a Sediment Dredging Management Plan which would formalize WHC's standard practices for minimizing erosion and turbidity during dredging activities. A draft plan was filed with the license application that includes WHC's standard practices of: (1) notifying Vermont ANR prior to conducting any dredging activity, and providing Vermont ANR the geographic area of the proposed dredge, estimated duration of the dredge (including start and end date), and estimated river flows during the planned dredging operation; (2) conducting all dredging using a bucket loader from the shoreline rather than placing equipment in the water, and only remove sediment that is above the water line when the impoundment is drawn down to minimize the amount of sediment that is re-suspended in the water column; (3) stockpiling the dredged material in an upland site, and installing temporary silt fences around the stockpile to prevent runoff to the river; and (4) notifying Vermont ANR upon the completion of the dredge, removing silt fences, and hauling the dredge material offsite after the dredge pile has sufficient time to drain.

In comments filed on March 3, 2023, Vermont ANR stated the agency "has some concerns" with WHC dredging between October 1 and June 30 due to "fish spawning, egg incubation, and rearing of young [resident trout] that occurs at this time downstream of the project." While Vermont ANR did not include a timing restriction as a condition of the WQC, WQC condition I requires that WHC finalize the Sediment Dredging Management Plan in consultation with Vermont ANR and that the plan be approved by Vermont ANR prior to implementation.

WHC's dredging in impoundment areas other than directly in front of the intake occurs during low-flow months, which is when flow conditions are safest to conduct the work. Low-flow conditions at the project typically occur during the months of July, August, September, and October (see table 1 in Appendix D). As discussed in section 3.3.1.1, *Aquatic Resources*, *Affected Environment*, state-managed rainbow trout as well as fallfish, and white sucker spawn during the period of March through May. The eggs for fallfish and white sucker incubate and hatch within 1-2 weeks whereas the eggs for rainbow trout incubate for 28 to 49 days before hatching. Thus, the egg incubation period for rainbow trout can extend through June. Longnose and blacknose dace and common shiner spawn in June and July and the eggs hatch within 3 to 4 days. State-managed brown trout spawn during the fall months of October through December and the eggs incubate for 30 days up to 148 days depending on water temperatures. Thus, WHC's current dredging practices could occur when brown trout, longnose and blacknose dace, and common shiner are spawning and these species' eggs are incubating and fry are emerging. WHC's dredging practices could also occur when juvenile rainbow trout, fallfish, and white sucker are rearing.

The silt- and sand-bottom areas where dredging would occur in the impoundment do not contain ideal spawning habitat for resident fish including state-managed rainbow and brown trout which prefer gravel substrate at the head of a riffle or on the downstream edge of a pool (Vermont FWD, 2018). Therefore, dredging activities would not be expected to directly impact resident fish spawning within the impoundment.

Unlike with dredging directly in front of the intake, dredging in other impoundment areas typically involves drawing the impoundment down to conduct the work. Removing only

sediment that is exposed above the water line after drawing the impoundment down would lessen but would not completely prevent suspension of impoundment sediments and discharge of the suspended sediments downstream of the dam and powerhouse. Discharge of the suspended sediments would result in increased turbidity downstream of the dam and powerhouse until the sediments pass through and settle out in lower velocity areas downstream. As discussed in section 3.3.1.2, *Aquatic Resources*, *Environmental Effects*, rainbow and brown trout and other resident fish are known to spawn and rear in segments of the Winooski River downstream of the project. Thus, increasing turbidity levels downstream could disrupt resident trout spawning or otherwise affect trout and other resident fish by increasing physiological stress (Redding et al., 1987) and lowering feeding success (Barrett et al., 1992). However, conducting these impoundment dredging events in areas other than directly in front of the intake during the typically low-flow months of July, August, and September would avoid elevating turbidity levels in the Winooski River downstream of the dam and powerhouse during sensitive spawning and egg incubation periods for rainbow trout (i.e., March through May for spawning with egg incubation extending into June) and brown trout (i.e., October through December for spawning with egg incubation potentially extending through the winter months). Revising the draft Sediment Dredging Management Plan in consultation with Vermont ANR as required by the WQC would allow WHC and Vermont ANR to develop procedures to better coordinate dredging events, including timing, to further minimize adverse effects on aquatic habitat and resident fish. We do not expect that revising the plan would increase the costs of WHC's proposed plan.

Minimum Bypassed Reach Flow and Aesthetic Spill Flows

Currently, the majority of the flow in the bypassed reach is discharged through WHC's Unit 1 in the powerhouse which is set to discharge a fixed flow of 25 cfs into the bypassed reach at the base of the dam when the project is generating. WHC proposes to increase minimum flows in the bypassed reach through a combination of discharge through Unit 1 and spill over the dam to enhance aesthetics and aquatic habitat in the bypassed reach during the summer and fall recreation season. Specifically, WHC proposes to provide a minimum flow 41 cfs in the bypassed reach during daytime hours from May 1 through October 31 by discharging 25 cfs through Unit 1 while also maintaining a 1.0-inch spill (equating to 16 cfs) over the dam. During nighttime hours from May 1 through October 31, WHC would provide 36 cfs in the bypassed reach by discharging 25 cfs through Unit 1 while also maintaining a 0.5-inch spill (equating to 11 cfs) over the dam. During the remainder of the year (i.e., November 1 through April 30), WHC would not spill but would instead maintain a fixed 36 cfs in the bypassed reach by setting Unit 1 to release the 36-cfs minimum flow (the maximum hydraulic capacity of the turbine). WHC would provide the seasonal aesthetic spill flows except during periods when the impoundment is drawn down for maintenance when all flow would be directed through the powerhouse and no aesthetic spill flow would be provided. In these cases, WHC would maintain 36 cfs in the bypassed reach through Unit 1. When inflow drops below proposed minimum flow levels, WHC would prioritize spill flows over the dam rather than discharging flows through Unit 1. WHC states it is not proposing to maintain an aesthetic spill flow after October 31 because ice build-up on the flashboards would prevent WHC from being able to maintain adequate spill over the dam.

Vermont ANR's WQC condition B requires that WHC maintain a continuous year-round 39-cfs minimum flow in the bypassed reach (i.e., 3 cfs more than WHC's proposed 36 cfs

seasonal minimum flow) while also maintaining continuous spill flows of 1.0 inch (i.e., 16 cfs) during daylight hours and 0.5-inch (i.e., 11 cfs) during nighttime hours. Vermont ANR reasons that a minimum flow of 39 cfs provides "high-quality aquatic habitat" by maintaining at least 80% of the maximum available suitable habitat for all target resident fish species and life stages and would support the aesthetics designated use year-round. Vermont ANR's WQC condition C requires that WHC develop a flow management and monitoring plan detailing how the project would operate in run-of-river mode while also releasing the agency's stipulated spill flows and maintaining minimum flows in the bypassed reach continuously year-round.

The only way WHC could provide Vermont ANR's required 39 cfs minimum flow and a 1 inch spill flow over the dam is to set the Unit 1 at 25 cfs (the minimum hydraulic capacity of the unit) and spill 16 cfs over the dam. This would result in a minimum flow below the dam of 41 cfs as proposed by WHC. Thus the principal difference in Vermont ANR's required minimum flow and aesthetic spill events occurs at night and during the winter months.

Staff analysis in section 3.3.1.2, *Aquatic Resources*, *Environmental Effects*, shows that WHC's proposed 36-41 cfs minimum flows and Vermont ANR's 39 cfs minimum flow would increase wetted width in the bypassed reach and would generally enhance habitat availability by maintaining 5-8% more suitable habitat for in the bypassed reach for resident fish (mostly for rainbow trout and fallfish). Vermont ANR's 39 cfs would maintain 8% more suitable habitat for resident fish throughout the year relative to existing conditions whereas WHC's proposal would maintain 8% more suitable habitat for resident fish during daylight hours from May 1 through October 31 relative to existing conditions and maintain 5% more suitable habitat for resident fish during the remainder of the year (i.e., during nighttime hours from May 1 through October 31 and during daytime and nighttime hours from November 1 through April 30) relative to existing conditions. Providing higher minimum flows and spilling during the summer and early fall would maintain and possibly enhance water quality conditions by increasing water turbulence over rocks and boulders present throughout the reach, which would help to aerate water and cool water temperatures; however, the benefits to water quality and aquatic habitat of providing any spill during late fall and winter would be minor because the reach remains wetted throughout the year and water temperatures during these months are colder and DO concentrations higher than during the summer and early fall months. Further, providing aesthetic spill flows during the winter months would also likely be problematic as the impoundment is typically frozen and any associated ice formation on the flashboards and dam crest resulting from a spillage flow, could interfere with the proper operation of the dam and more frequent flashboard failures.

Staff analysis in section 3.3.5.2, *Aesthetic Resources*, *Environmental Effects*, shows that providing an aesthetic spill flow would enhance the aesthetic enjoyment of the river for recreation users over existing conditions. However, given that the recreation season typically lasts from May through October and recreation usage is expected to be low in the colder months of November through April, there would be little to no aesthetic benefit of providing aesthetic spill flows from November 1 to April 30. Further, there would be no reason to provide a 0.5-inch aesthetic spill flow at night anytime of the year, as the dam is not visible and recreation activities at the project area are not typically conducted during nighttime hours; therefore, the benefits from providing a nighttime auditory aesthetic flow would be minimal to nonexistent.

WHC's flow and spill proposal would reduce generation by approximately 120 MWh per year, resulting in a staff estimated annual opportunity cost of $8,750. Vermont ANR's continuous 16-cfs spill flow over the dam during daylight hours and 11 cfs during nighttime hours year-round would reduce generation by approximately 206 MWh per year, resulting in an annual opportunity cost of $14,713, which is $5,963 more than the cost of WHC's proposal. Because there would be little to no aesthetic benefits and only slightly greater aquatic benefits of providing Vermont ANR's required year-round flows and aesthetic daytime and nighttime spill flows, we conclude that the benefits of Vermont ANR's required minimum flows and spill events are not worth the higher opportunity costs. Further, because, the auditory benefits from providing a nighttime aesthetic flow would be minimal to nonexistent, staff do not recommend WHC be required to provide nighttime spill flows. Staff estimates that maintaining spill flows during daylight hours only from May 1 through October 31 would reduce generation by approximately 73 MWh per year, resulting in an annual opportunity cost of $5,214, which is $3,536 less than the cost of WHC's proposal to provide aesthetic spills both day and night during this period and would be $9,499 less than Vermont ANR's mandatory spill flow operating condition. Therefore we recommend that WHC provide a minimum flow 41 cfs in the bypassed reach during daytime hours from May 1 through October 31 by discharging 25 cfs through Unit 1 while also maintaining a 1.0-inch spill (equating to 16 cfs) over the dam. Of the alternatives considered, this recommended alternative strikes the appropriate balance between using flows for aesthetic and aquatic habitat benefits and using flow for project generation. Nonetheless, staff recognize that Vermont ANR's WQC condition B would be required in the any license issued because it is mandatory.

Flow Management and Monitoring Plan

WHC does not propose any formal measures for monitoring and reporting compliance with its proposed operating mode (i.e., run-of-river operation, maintaining impoundment levels, and implementing minimum flows and spill flows). WHC would continue to use its automated monitoring and control system to continuously monitor impoundment levels and adjust powerhouse flows to maintain the impoundment at the desired elevation. WHC indicates that its automated system is capable of logging impoundment water surface elevations and powerhouse flow levels in real-time and that it could easily report the data as needed.

Vermont ANR's WQC condition C requires that WHC include as part of a flow management plan a method for continuous monitoring and reporting of flow releases at the project (including minimum flows, turbine discharge, and spill), impoundment levels, and inflows; that the plan include provisions for the flow data to be available on a near real-time basis; and that the plan include procedures for reporting deviations from operating requirements to Vermont DEC within 15 days of the deviation.

Staff analysis in section 3.3.1.2 indicates that WHC's existing automated impoundment level monitoring and control system coupled with tracking generation would be sufficient to monitor compliance with its proposed run-of-river operation and spill flow requirements. This is because the pond level sensor coupled with logging generation outflow would adequately demonstrate compliance with maintaining defined impoundment levels and any required minimum flows (including spill flows) in real-time, which would be indicative of run-of-river operation. However, identifying the impoundment elevation level needed to maintain

compliance with both daytime and nighttime spill flows would enable the Commission to track compliance with spill flow requirements.

Additionally, while Vermont ANR's WQC condition C requires that WHC report deviations from operating requirements to Vermont DEC within 15 days of a deviation, the WQC does not require that the deviations be reported to the Commission. Typically, to reduce the reporting burden, the Commission requires licensees to report unplanned deviations that last less than 3 hours and do not result in any observable environmental effects in a yearly report. The Commission is notified of deviations that last longer than 3 hours or result in observable environmental effects within 14 days. Therefore in addition to notifying the Vermont DEC in the manner required by the WQC, we recommend that WHC notify the Commission within 14 days of deviations lasting longer than 3 hours or resulting in observable environmental effects and to include in a yearly report, deviations lasting less than 3 hours and not resulting in any observable environmental effects. Staff estimate that the annual levelized cost of developing the flow management and monitoring plan with the above provisions would be $1,444, and conclude that the compliance benefits outweigh the cost.

Even though staff do not recommend WQC condition B's slightly higher minimum flow and maintaining continuous spill flows outside of the summer and fall recreation season for the reasons discussed above, staff also recognize that these measures would be included in any license because they are mandatory. To that end, staff recommend that the flow management and monitoring plan identify the specific impoundment elevation needed to maintain Vermont ANR's required spill flows, detail how the project would provide the spill flows and maintain the higher 39-cfs minimum flow in the bypassed reach continuously throughout the year, and that the plan be provided to the Commission for review and approval prior to implementation.

Mussel Surveys During Maintenance Drawdowns

WHC states that it regularly draws down the impoundment to an elevation of 610.8 feet (i.e., 4.2 feet below the top of the flashboards) once or twice a year for one or two days to repair/replace the flashboards following a high precipitation storm or flood event and also draws the impoundment down to approximately 610 feet (i.e., 5 feet below the top of the flashboards) every 3-5 years for approximately one week in the late summer or early fall months to remove excess sediment accumulation in the impoundment. To minimize impacts to state-listed Eastern pearlshell mussels from maintenance drawdowns of the impoundment, WHC proposes to conduct a survey for mussels during the first planned maintenance drawdown which would consist of having a mussel expert walk the impoundment shoreline to locate, identify, and relocate any mussels found during the survey and file a summary report of the findings to Vermont ANR and the Commission within 120 days of the survey. WHC would draw the impoundment down to the lowest level typically needed (presumably 610 feet) when conducting the survey. If no mussels are detected, WHC would not conduct any subsequent mussel surveys during future drawdowns. If mussels are found during the initial survey, WHC would continue to conduct surveys during maintenance drawdowns, re-locate any potentially exposed mussels to deeper waters, and continue to file summary reports following each survey/relocation. However, WHC does not identify specific mussel collection or handling protocols it would follow when re-locating mussels.

Vermont ANR's WQC condition H requires that WHC continue to conduct mussel surveys during all planned drawdowns that fall below 610.7 feet "to account for the possibility that mussels will extend their geographic extent within the impoundment over the next licensing term." Vermont ANR's condition does not include any criteria or trigger for revisiting the need for conducting future mussel surveys or modifying the frequency of surveys. Thus, staff assume that WHC would be required to keep surveying for mussels even if repeated surveys indicate no mussels are located within the maintenance fluctuation zone. WQC condition F requires that WHC consult with and receive approval from Vermont DEC "prior to conducting project maintenance or repair work that has the potential to have an adverse effect on water quality, other than those activities described in the Sediment [Dredging] Management Plan." Staff assume these activities include drawdowns needed to replace the flashboards each year following a rain storm or flood event or drawdowns needed to inspect the dam and crest gate.

As discussed in section 3.3.1.2, WHC's mussel survey of the impoundment conducted in August of 2019 found one live adult Eastern pearshell mussel (which is a state-listed species that is of management concern) and two large Eastern pearlshell shells in the upper reach of the impoundment within a water depth of 3.5 feet which is within the zone of fluctuation for maintenance drawdowns. Thus, drawing down the impoundment for maintenance and dredging could expose a limited number of mussels to dewatering and potentially result in desiccation and death if mussels are present within the five-foot maintenance fluctuation zone.

WHC's proposed initial survey following license issuance would confirm whether mussels have become established since the 2019 survey or occur within the full depth of the five-foot fluctuation zone (i.e., down to a water level of 610 feet). Relocating any mussels found during the survey would allow these individuals to be transported to deeper waters to avoid prolonged exposure which could lead to death and would suggest the need for future survey and relocation efforts. Developing specific mussel collection and handling protocols in consultation with Vermont ANR would help ensure that any mussels that are collected and relocated to deeper water are done so in a safe and effective manner.

Even if no mussels are found during the initial survey conducted after license issuance, resident trout could serve as host fish that could spread juvenile mussels to the fluctuation zone. Vermont ANR's requirement to continue surveying for mussels would ensure that if mussels establish in the impoundment fluctuation zone during the next license term that WHC takes the necessary steps to relocate them to safe depths. However, given the low abundance of the species, well-established operating limits over the last 40 years, and because adults are known to rarely move more than a few meters in their entire 100-year or more lifespan (Fichtel and Smith, 1995), finding this species in the impoundment is unlikely, and the need for future surveys during every maintenance drawdown event below 610.7 feet would be minimal. Therefore, developing criteria in consultation with Vermont ANR for revisiting the need for future surveys or changing the frequency of future surveys based on the results of the survey events may be a more reasonable approach. Developing these criteria as part of a mussel protection plan and including provisions in the plan to notify the Commission and Vermont ANR of the monitoring results and any proposals to discontinue surveys or modify the frequency of surveys based on the survey results would continue to protect mussels while potentially eliminating unnecessary surveys and associated costs.

Staff estimates that WHC's proposed mussel survey and relocating any mussels would have a levelized annual cost of $839. Staff estimates that conducting mussel surveys each time (potentially every third year) that WHC draws the impoundment down below 610.7 feet (which WHC proposes if mussels are found during the first survey and as is required by Vermont ANR's WQC condition H) would have an estimated levelized annual cost of $4,347. However, for the reasons noted above, the need for continuing to conduct mussel surveys during every maintenance drawdown below 610.7 feet may not be necessary. Therefore, staff recommends that WHC prepare a mussel protection plan in consultation with Vermont ANR that defines the criteria for deciding if and when mussel surveys would continue based on the survey results. Staff estimate that developing a mussel protection plan containing criteria for deciding if and when mussel surveys would continue during subsequent maintenance drawdowns as well as procedures for safely collecting and handling mussels and transporting them to deeper water would add an estimated levelized annual cost of $444 to WHC's proposal and conclude that the benefits to freshwater mussels would be worth the cost.

We recognize that WHC would be required to conduct the surveys each time it draws down the impoundment below 610.7 feet because it is a mandatory condition of the WQC. Therefore, the Staff Alternative with Mandatory Conditions does not include staff's recommended provision for preparing a mussel protection plan with criteria for deciding if and when mussel surveys would continue.

Debris Disposal Plan

WHC states that all sediment and organic material as a result of cleaning the intake trash racks and dredging the impoundment is stored onsite, within a sand berm established between the dredged pile and the river for containment. The stored material is then "screened by the Road Commissioner of either the town of Plainfield or Marshfield" and removed later by trucks for fill offsite. Vermont ANR's WQC condition E requires that "debris associated with Project operations shall be disposed of in accordance with the Standards and applicable state laws and regulations."

As discussed in section 3.3.1.2, the project receives a high sediment load from upstream sources which requires that WHC routinely dredge the impoundment, store the material onsite, and later dispose the material offsite once it is adequately drained. Although no evidence suggests that WHC's current practices of disposing dredged material are inconsistent with Vermont ANR's WQC condition E, formalizing WHC's procedures for periodic disposal would prevent accumulation of unsightly debris and keep that debris from entering the river where it could degrade water quality. Developing a debris disposal plan would avoid misunderstandings and guide how and when WHC is to remove and dispose of organic and inorganic debris that accumulates during project operation. We estimate that the levelized annual cost of developing a debris disposal plan would be $444, and conclude that the operational and resource benefits would be worth the cost.

Time of Year Restrictions for Tree Removal

The NLEB may occur in the project area because project lands and adjacent areas support forests that may provide opportunities for summer roosting and foraging activities. Clearing

vegetation for ongoing project maintenance activities and along the transmission line during the term of a new license could require unanticipated tree removal within the project boundary. To protect NLEB, FWS recommends avoiding removal of trees greater than 3 inches in diameter at breast height during state-specific dates. In Vermont, tree work is restricted between April 15 and October 31. NLEB are not known to use trees less than 3 inches in diameter at breast height, therefore work on such trees is not expected to impact bats and can occur throughout the year. FWS states that its recommended time-of-year restriction would not apply under public safety or other emergencies, and in those instances, the applicant shall notify FWS within two business days of the unplanned safety/emergency action and provide details of the action and response. This is consistent with the requirement to consult with Vermont FWD in Vermont ANR's WQC condition G. Because maintenance activities at the project during the term of a new license are expected to only require minor trimming, brush clearing, and the removal of downed trees, there is no information to suggest that relicensing would adversely affect NLEB maternity roost habitat.

The tri-colored bat may also occur in the project area and is likely to use similar hardwood habitats for summer roosting. Implementing the time of year restriction on tree trimming an removal for NLEB would similarly protect the tri-colored bat.

Accordingly, staff recommend that any license issued for the project contain a requirement that prohibits any clearing of trees equal to or greater than 3 inches in diameter at breast height between April 15 and October 31, unless required for public or project safety. If trees are removed during this time period, the licensee must notify FWS and Vermont FWD within two business days of the unplanned safety/emergency action and provide details of the action and response. The costs to prohibit tree removal between April 15 and October 31 should be negligeable or zero.

Recreation Management Plan

The recreation facilities at the project are informal and in need of improvement. WHC's proposal to monitor and maintain the take-out, put-in, and portage trail; install an overlook and interpretive display; and improve the parking area near the put-in would improve public access, enhance boating and angling opportunities, increase public safety, and improve the visitor experience. WHC proposes to install the overlook and interpretive display and improve the parking area within two years of license issuance. WHC's proposed measures would have a levelized annual cost of $3,750 and would be worth the cost.

However, WHC does not describe how it would monitor the recreation sites and determine when maintenance is required. WQC condition D requires filing a recreation plan within 180 days of the effective date of the FERC license that includes a schedule for monitoring and maintaining the recreation sites.

Further, there does not appear to be any signage directing the public to the take-out, put-in, portage, and parking area. Installing signage that at a minimum, identifies the FERC project name and number; a statement that the project is licensed by the Commission; the licensee name and contact information; a statement acknowledging the boat launch and take-out; and

permissible times and activities would alert the public to the project recreation facilities and would improve public enjoyment and use of the facilities.

We estimate that preparing a recreation plan that contains the schedule for monitoring and maintaining the recreation sites and adding signage would increase the levelized annual cost of WHC's recreation measures by $400.

Developing a recreation plan that includes the provisions that we recommend above would provide an understanding of how the project's recreation facilities would be developed and managed throughout a license term of any license issued for the project, help guide other recreation development in the area (e.g., Cross Vermont Trail improvements), avoid misunderstandings of maintenance responsibilities, and facilitate Commission oversight of the license. Developing the recreation plan that includes the details described above would be worth the cost.

5.2 UNAVOIDABLE ADVERSE IMPACTS

Continued operation of the project would result in some unavoidable entrainment injury or mortality to resident fish passing through the intake, penstock, and powerhouse turbines although most fish would be capable of overcoming the approach and through velocities near the intake trash racks and swim away. Impoundment fluctuations associated with project maintenance could reduce near-shore aquatic habitat and result in temporary dewatering of freshwater mussels and other aquatic biota located within the five-foot fluctuation zone. However, conducting a mussel survey and relocating any mussels that are found during the maintenance drawdown would minimize adverse effects to freshwater mussels. Continuing to operate in a run-of-river mode with minimal impoundment fluctuations would result in infrequent and minimal disturbances to aquatic and riparian habitat. Routine dredging of the impoundment would temporarily increase turbidity in the impoundment and in the Winooski River downstream of the dam. However, conducting larger planned maintenance dredges outside of sensitive trout spawning and egg incubation periods would minimize the effects of impoundment dredges on resident trout.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

No section 10(j) recommendations were filed.

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C., § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the projects. We reviewed the following 15 comprehensive plans that are applicable to the Winooski 8 Project. No inconsistencies were found.

Lake Champlain Fish and Wildlife Management Cooperative. 2020. Strategic Plan for Lake Champlain Fisheries. Essex Junction, Vermont. July 2020.

Forest Service. Green Mountain National Forest land and resource management plan. Department of Agriculture, Rutland, Vermont. December 1993.

National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.

U.S. Fish and Wildlife Service. The Lower Great Lakes/St. Lawrence Basin: A component of the North American waterfowl management plan. December 29, 1988.

U.S. Fish and Wildlife Service. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C. n.d.

Vermont Agency of Environmental Conservation. Vermont Rivers Study. Waterbury, Vermont. 1986.

Vermont Agency of Natural Resources. Hydropower in Vermont: an assessment of environmental problems and opportunities. Waterbury, Vermont. May 1988.

Vermont Agency of Natural Resources. The waterfalls, cascades, and gorges of Vermont. Waterbury, Vermont. May 1986.

Vermont Agency of Natural Resources. Wetlands component of the 1988 Vermont recreation plan. Waterbury, Vermont. July 1988.

Vermont Agency of Natural Resources. Winooski river basin water quality management plan. Waterbury, Vermont. May 2012.

Vermont Agency of Natural Resources. Winooski River Tactical Basin Plan. Montpelier, Vermont. December 2018.

Vermont Department of Forests, Parks and Recreation. Vermont State Comprehensive Outdoor Recreation Plan 2019-2023. Montpelier, Vermont. December 2019.

Vermont Fish and Wildlife Department. Vermont's Wildlife Action Plan. Montpelier, Vermont. 2015.

Vermont Fish and Wildlife Department. Statewide Management Plan for Largemouth and Smallmouth Bass. Montpelier, Vermont. August 2017.

Vermont Fish and Wildlife Department. The Vermont Plan for Brook, Brown, and Rainbow Trout. Montpelier, Vermont. January 2018.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Winooski 8 Project is issued a subsequent license as proposed with the additional staff-recommended measures, the project would continue to operate while enhancing and protecting aquatic, terrestrial, recreational, and aesthetic resources in the project area.

Based on our independent analysis, we find that the issuance of a subsequent license for the Winooski 8 Project, with additional staff-recommended environmental measures and mandatory water quality certification conditions, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE CITED

The literature cited in this EA is presented in Appendix H.

8.0 LIST OF PREPARERS

The list of preparers of this EA is presented in Appendix I.

APPENDIX A. STATUTORY AND REGULATORY REQUIREMENTS

FEDERAL POWER ACT

Section 18 Fishway Prescriptions

Section 18 of the Federal Power Act (FPA), 16 U.S.C. § 811, states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce or the U.S. Department of the Interior (Interior).

By letter filed January 4, 2023, Interior requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

Section 10(j) Recommendations

Under section 10(j) of the FPA, 16 U.S.C. § 803(j)(1), each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions in any new or subsequent license unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

No section 10(j) recommendations were received by the Commission.

Clean Water Act

Under section 401(a)(1) of the Clean Water Act (CWA), 33 U.S.C. § 1341(a)(1), a license applicant must obtain either a water quality certification (WQC) from the appropriate state pollution control agency verifying that any discharge from the project would comply with applicable provisions of the CWA, or a waiver of such WQC. A waiver occurs if the state agency does not act on a request for a WQC within a reasonable period of time, not to exceed one year after receipt of such request.

On March 6, 2023, Winooski Hydroelectric Company (WHC) applied to the Vermont Department of Environmental Conservation (Vermont DEC) for a WQC for the project, which Vermont DEC received on the same day. Vermont DEC issued a WQC to WHC on February 21, 2024, and filed a copy of the WQC with the Commission on the same day. The WQC conditions are included in Appendix J and discussed in the specific resource sections of section 3.0, *Environmental Analysis*, and in section 5.1, *Comprehensive Development and Recommended Alternative*.

Endangered Species Act

Section 7 of the Endangered Species Act, 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. On February 22, 2024, staff accessed the U.S. Fish and Wildlife Service's (FWS) Information for Planning and Consultation (IPaC) database to determine whether any federally listed species could occur in vicinity of the project. According to the IPaC database, the threatened northern long-eared bat (*Myotis septentrionalis*) and candidate monarch butterfly (*Danaus plexippus*) have the potential occur within the project boundary.[68] In addition, FWS proposed on September 14, 2022, to list the tricolored bat as endangered. Based on FWS range information (FWS 2024), tricolored bats may also occur within the project boundary or be affected by the project, though the species does not currently appear in the IPaC generated list of that may occur in the area. There are no proposed or designated critical habitats in the project area.

Our analysis of the impacts of the project on the northern long-eared bat and monarch butterfly is presented in section 3.2.3, *Threatened and Endangered Species, Environmental Effects*, and our recommendations are included in section 5.1, *Comprehensive Development and Recommended Alternative*. Based on available information, staff conclude that relicensing the project as proposed is not likely to jeopardize the continued existence of the monarch butterfly.

Maintenance activities at the Winooski 8 project during the term of a subsequent license could require occasional tree trimming or removal that may affect NLEB habitat. Avoiding the removal of trees with diameters that are greater than or equal to 3 inches at breast height from April 15 through October 31 would protect NLEB and tricolored bats and their newly born pups during their active season. Staff conclude that relicensing the project, as proposed with our recommended measures, is not likely to adversely affect the NLEB and would not jeopardize the proposed endangered tricolored bat.

Staff will seek concurrence with the FWS on the above effect determinations after the EA is issued.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, requires that a federal agency "take into account" how its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American History, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

Commission staff designated WHC as its non-federal representative for the purposes of conducting section 106 consultation under the NHPA on September 21, 2018. Pursuant to section 106, and as the Commission's designated non-federal representative, WHC initiated

[68] *See* Interior's official lists of threatened and endangered species, accessed by staff using the IPaC database (https://ipac.ecosphere.fws.gov) on November 17, 2023, and placed into the records for Docket No. P-6470-008 on the same day.

consultation with the Vermont Division for Historic Preservation, which functions as the Vermont Historic Preservation Office (Vermont SHPO), and potentially affected Tribes to identify historic properties, determine National Register eligibility, and assess potential adverse effects on historic properties within the project's area of potential effects (APE). In a letter filed on January 15, 2019, the Vermont SHPO provided comments on the Preliminary Application Document and study requests. In this letter, the Vermont SHPO concurred with WHC that there are no known cultural resources issues at the project and that they did not have any study requests at that time. The Vermont SHPO also stated that the powerhouse and associated facilities would become 50 years old during the term of the proposed license and that a provision to evaluate the hydroelectric facility in 2035 for National Register of Historic Places eligibility should be included in any license issued for the project.

Our analysis of project effects on cultural resources is presented in section 3.2.7.2, *Cultural Resources, Environmental Effects*. We recommend that, prior to implementing project modifications not specifically authorized by any subsequent license, the applicant consult with the Vermont SHPO to determine the effects of the activities and the need for any cultural resource studies or measures. Further, we recommend that, if previously unidentified cultural resources are encountered during the course of maintaining and operating project facilities, the applicant stop all land-clearing and land-disturbing activities in the vicinity of the resource and consult with the Vermont SHPO to determine the need for any cultural resource studies or measures. If the project is licensed, a license condition requiring an evaluation of the hydroelectric facility in 2035 for National Register of Historic Places eligibility is recommended. If they are found eligible, a historic properties management plan that defines the actions required to protect the resources could be considered as an additional license requirement. We conclude that, with these measures in place, relicensing the Winooski 8 Project would not affect any historic properties, and a programmatic agreement is not needed to protect historic properties.

APPENDIX B. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Issuing a Non-power License

A non-power license is a temporary license that the Commission would terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this time, no agency has suggested a willingness or ability to take over the project. No party has sought a non-power license, and we have no basis for concluding that the Winooski 8 Project should no longer be used to produce power.

Federal Government Takeover

Federal takeover and operation of the Winooski 8 Project would require congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed interest in operating the project.

Project Retirement

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing in most cases.[69] Decommissioning can be accomplished in different ways depending on the project, its environment, and the particular resource needs.[70] For these reasons, the Commission does not speculate about possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or a participant in a relicensing proceeding demonstrates that there are serious resource concerns that cannot be addressed with appropriate license measures and that make decommissioning a reasonable alternative.[71]

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[69] *See, e.g., Eagle Crest Energy Co*., 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc*., 111 FERC ¶ 61,327, at PP 35-38 (2005).

[70] In the event that the Commission denies relicensing a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 C.F.R. § 6.2. This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

[71] *See generally Project Decommissioning at Relicensing*; Policy Statement, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); *see also City of Tacoma, Washington,* 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any further environmental analysis of the effects of project decommissioning would be both premature and speculative).

WHC does not propose decommissioning, nor does the record to date demonstrate there are serious resource concerns that cannot be mitigated if the project is relicensed; as such, there is no reason, at this time, to include decommissioning as a reasonable alternative to be evaluated and studied as part of staff's NEPA analysis.

APPENDIX C. FIGURES

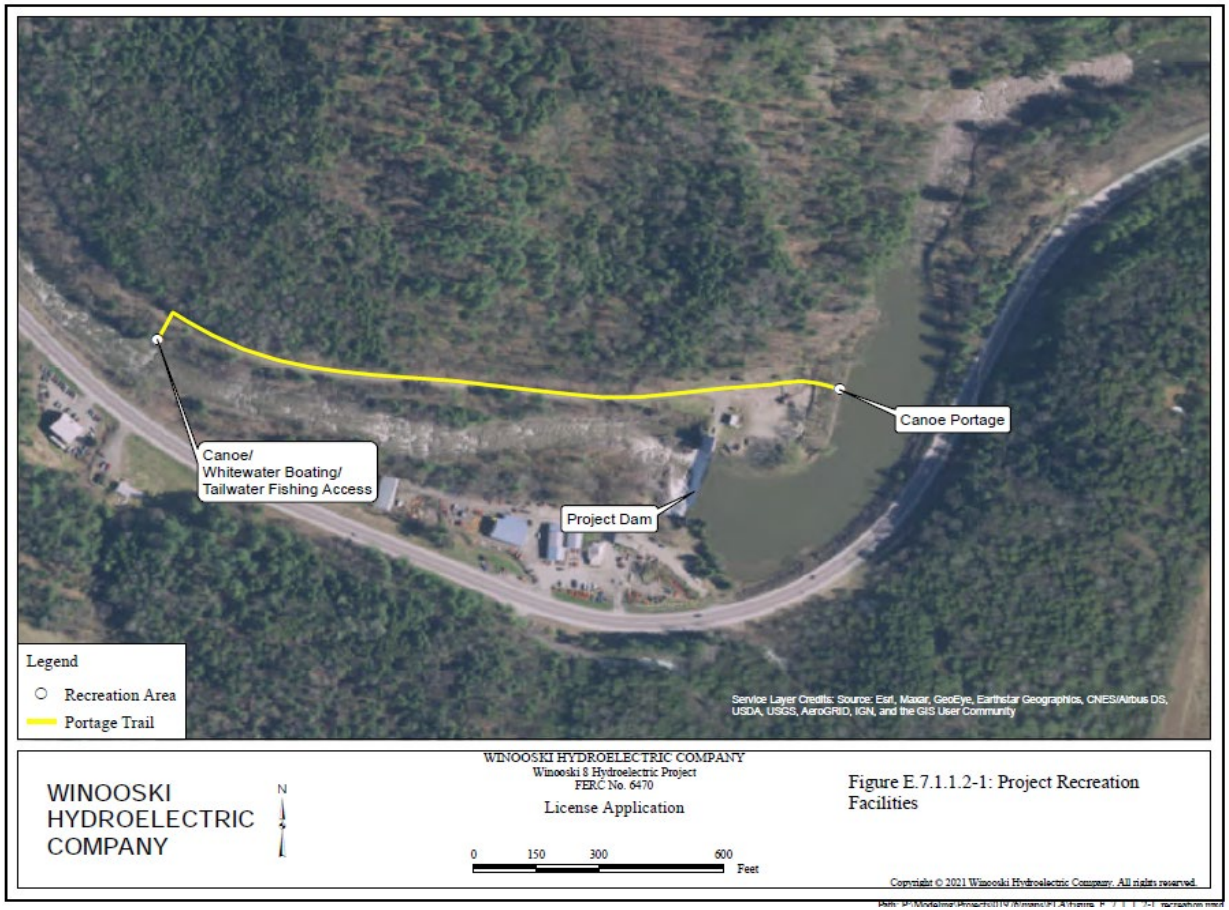

Figure 3. Existing recreation facilities at the Winooski 8 Hydroelectric Project (Source: license application)

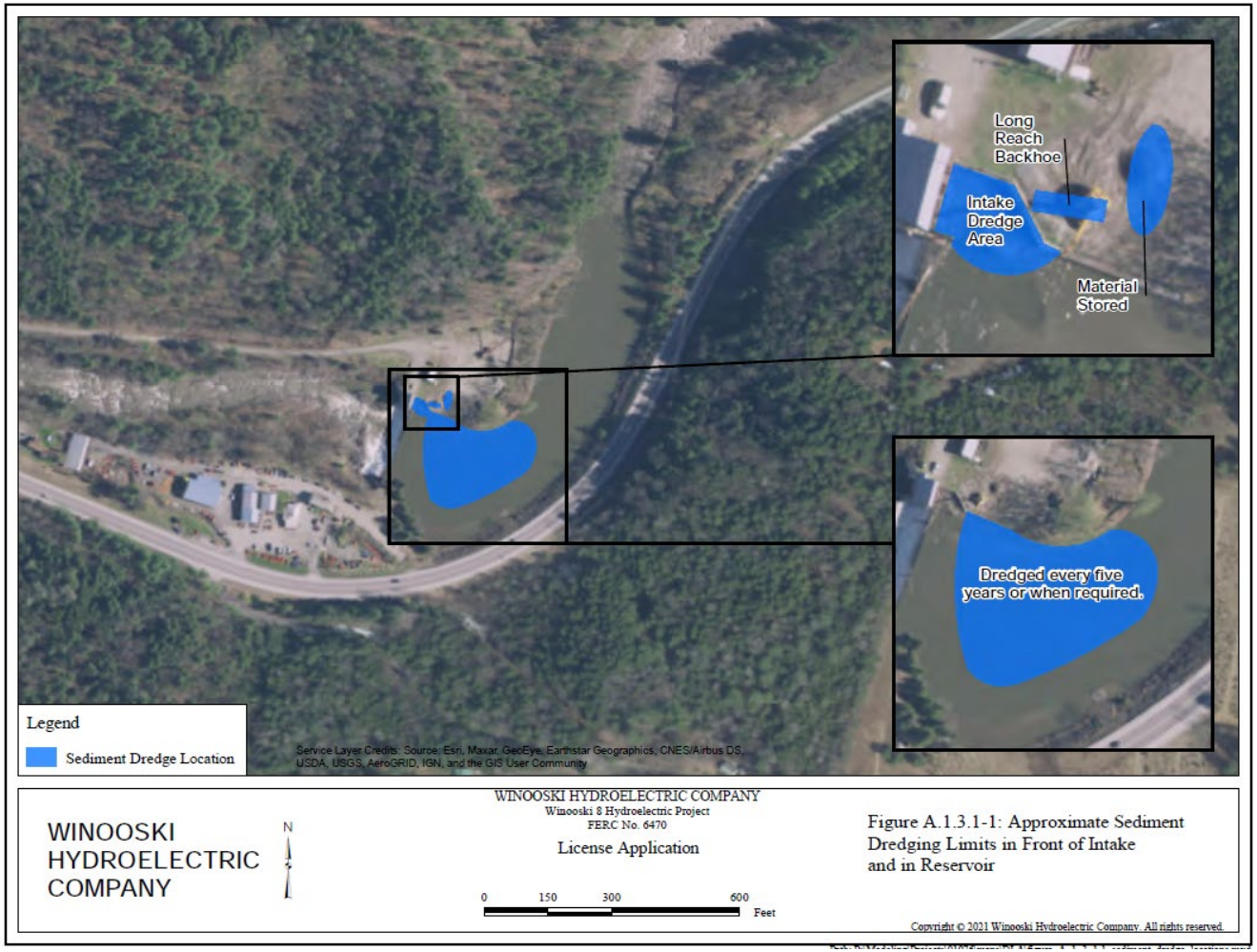

Figure 4. Project's Sediment Dredging Areas (Source: license application)

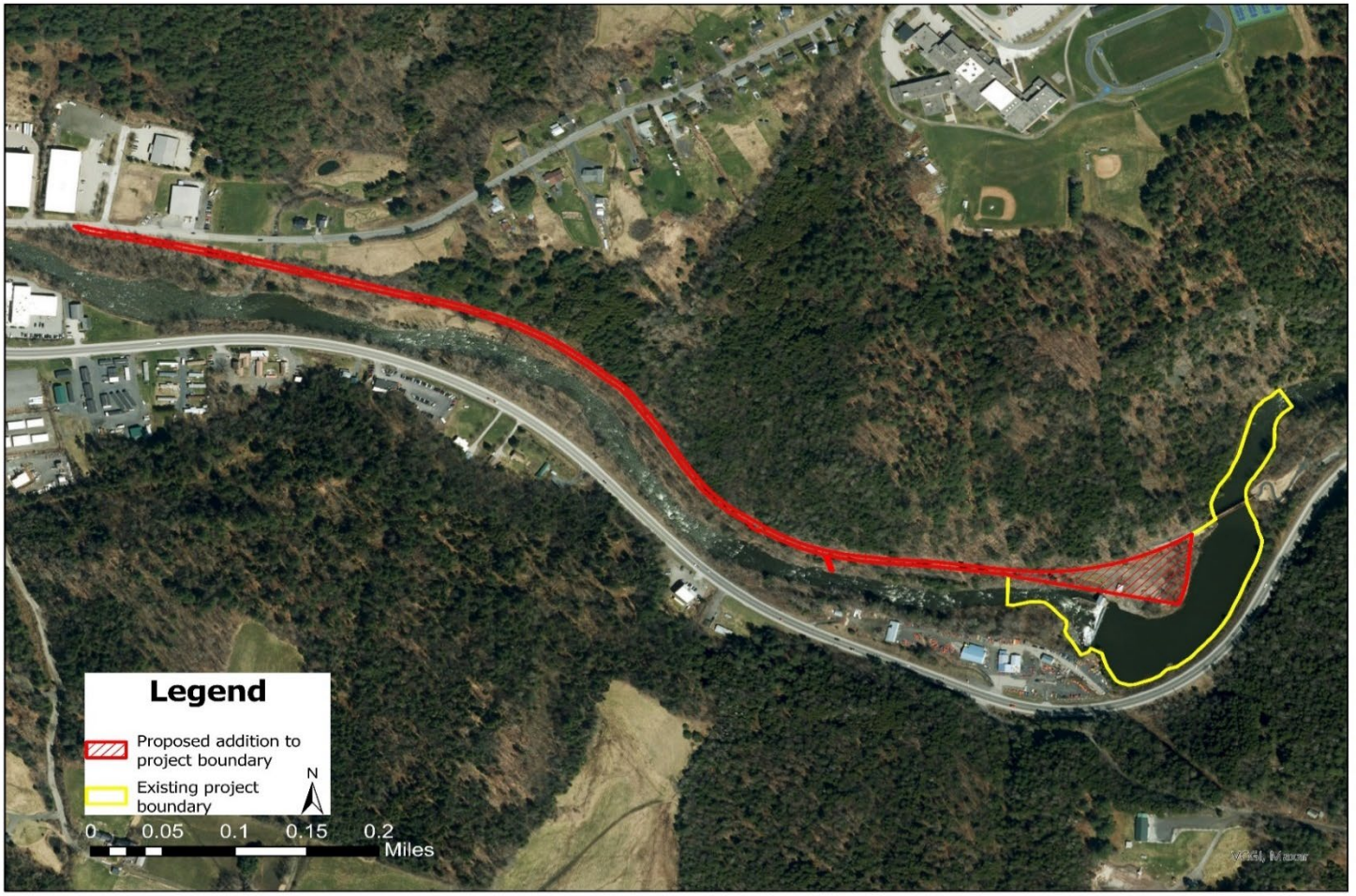

Figure 5. Proposed changes to the project boundary (Source: staff)

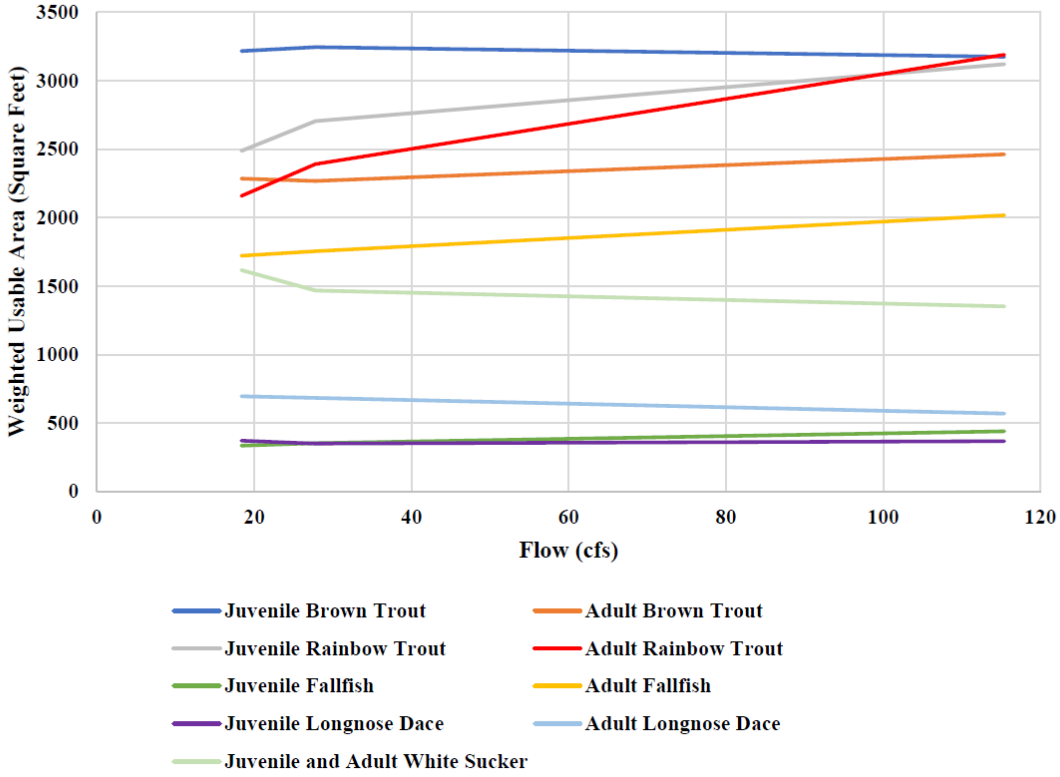

Figure 6. Habitat suitability in the bypassed reach for target resident fish under flows ranging from 18.4 cfs up to 115.4 cfs (source: license application)

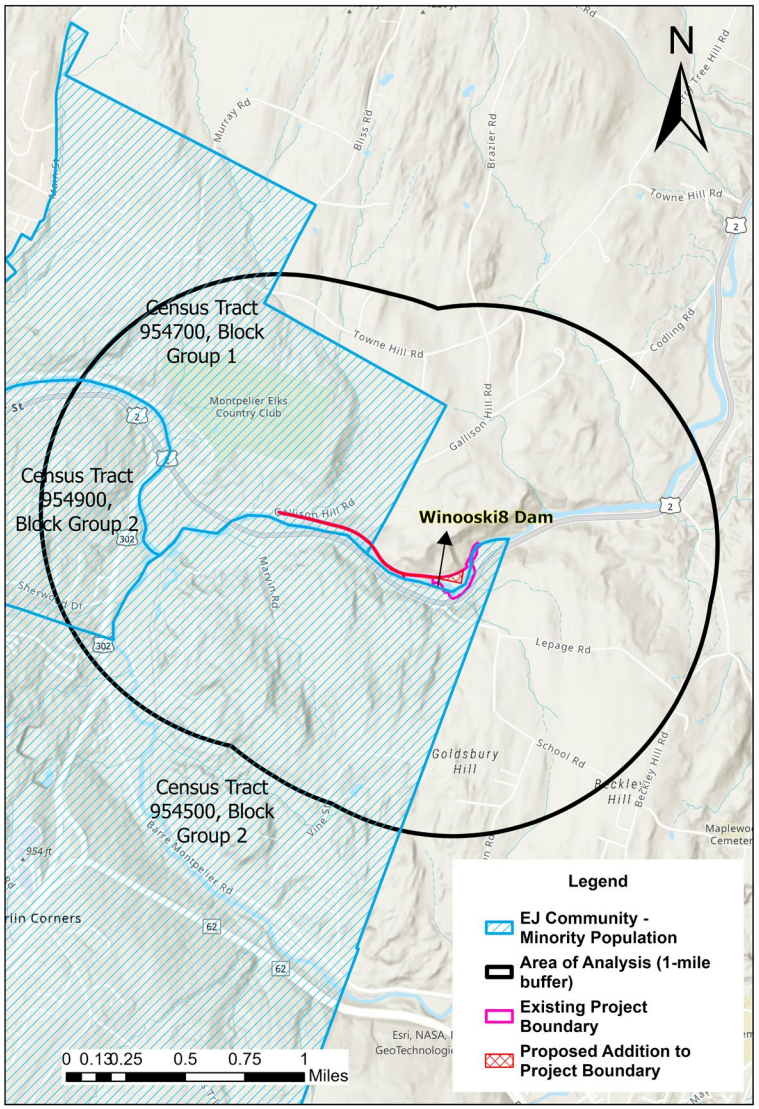

Figure 7. Environmental Justice Communities within 1-mile of the project boundary (source: United States Census Bureau)

APPENDIX D. TABLES

Table 1. Estimated mean, median, minimum, and maximum daily inflow for the project based on prorated gage data for the period January 1984 through October 2023 (source: staff).

Month	Mean (cfs)	Median (cfs)	Minimum (cfs)	Maximum (cfs)
January	278	211	33	2969
February	235	182	7	3195
March	425	297	34	3095
April	809	657	132	3445
May	435	329	81	5624
June	286	191	26	3769
July	250	131	28	10321
August	175	101	19	3,637
September	130	87	19	2,101
October	238	149	24	2,550
November	302	227	37	2,355
December	322	249	36	2,736
Annual	324	207	7	10,321

Table 2. Summary of relevant water quality criteria applicable to the Winooski 8 Project (source: license application).

Parameter	Criteria
Dissolved Oxygen	Not less than 7 mg/l and 75% saturation at all times, nor less than 95% saturation during late egg maturation and larval development of salmonids in areas that the Vermont ANR determines are salmonids spawning or nursery areas important to the establishment or maintenance of the fishery resource. Not less than 6 mg/l and 70% saturation at all times in all other waters designated as a cold water fish habitat.
Temperature	General: The change or rate of change in temperature, either upward or downward, shall be controlled to ensure full support of aquatic biota, wildlife, and aquatic habitat uses. Class B(2) Cold Water: The total increase from the ambient temperature due to all discharges and activities shall not exceed 1.0° F.
Turbidity	The turbidity standard as an annual average under dry weather base-flow conditions is 10 NTU for cold water fish habitat.
Aquatic Biota and Wildlife	Change from the natural condition for aquatic macroinvertebrate and fish assemblages not exceeding moderate changes in the relative proportions of taxonomic, functional, tolerant, and intolerant aquatic organisms.
Aquatic Habitat	Rivers and Streams: Changes to flow characteristics, physical habitat structure, and stream processes limited to moderate differences from the natural condition and consistent with the full support of high quality aquatic habitat.
Aesthetics	Water character, flows, water level, bed and channel characteristics, and flowing and falling water of good aesthetic value.
Boating	Waters shall be managed to achieve and maintain a level of water quality compatible with good quality boating.
Hydrology: Streamflow Protection	Any change from the natural flow regime shall provide for maintenance of flow characteristics that ensure the full support of uses and comply with the applicable water quality criteria.
Hydrology: High-flow Regime	No change from the natural flow regime that would result in runoff causing an increase in the frequency, magnitude, or duration of peak flows adversely affecting channel integrity or prevent the full support of uses.
Water Level Fluctuations	Riverine impoundments may exhibit artificial variations in water level when subject to water level management, but only to the extent that such variations ensure full support of uses.
mg/L = milligrams per liter; NTU - Nephelometric Turbidity Units; % - percent; °F – degrees Fahrenheit	

Table 3. Results of the 2022 Water Quality Study (source: WHC's filing on November 29, 2022).

Location	Dissolved Oxygen (mg/L)			Dissolved Oxygen (% saturation)			Water Temperature (°C)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Upstream of Impoundment	8.38	6.96	9.92	99.45	80.92	124.89	23.00	18.00	28.90
Upper Impoundment	8.65	6.71	16.20	101.92	85.36	196.91	22.70	18.00	28.70
In Front of Intake	9.03	6.32	15.49	107.11	80.42	194.93	22.90	18.60	28.30
Bypassed Reach	8.70	6.73	11.91	103.39	85.38	142.69	23.00	15.70	28.30
Downstream of Powerhouse Tailrace	8.60	7.00	11.15	102.25	86.38	135.58	23.10	18.70	28.30

Notes:
mg/L – milligrams per liter
% - percent
°C – degrees Celsius

Table 4. Spill flow into the bypassed reach and available generation flows under existing condition as well as proposed and agency-stipulated aesthetic spill flow alternatives. (Source: staff)

Month	Median inflow to Winooski 8 Dam (cfs)	Existing condition (no spill flow, maintain 25 cfs in the bypassed reach year-round)			Proposed action (16-cfs spill flow during daylight hours and 11-cfs spill flow during nighttime hours May 1 through October 31 and maintaining 36 cfs minimum flow in the bypassed reach year-round)			Vermont ANR's condition requiring 16-cfs spill flow during daylight hours and 11-cfs spill flow during nighttime hours and maintaining 39 cfs minimum flow in the bypassed reach year-round)		
		Spill flow into bypassed reach (cfs)[a]	Total Flow in the bypassed reach (cfs)	Flow available for generation (cfs)[a]	Spill flow into bypassed reach day/night (cfs)[b]	Total Flow in the bypassed reach day/night (cfs)	Flow available for generation day/night (cfs)[b]	Spill flow into bypassed reach day/night (cfs)[c]	Total Flow in the bypassed reach day/night (cfs)	Flow available for generation day/night (cfs)[c]
Jan	211	0	25	211	0	36	211	16 / 11	41 / 39	195 / 200
Feb	182	0	25	182	0	36	182	16 / 11	41 / 39	166 / 171
Mar	297	0	25	297	0	36	297	16 / 11	41 / 39	281 / 286
Apr	657	221	246	436	210	246	447	210	246	447
May	329	0	25	329	16 / 11	41 / 36	313 / 318	16 / 11	41 / 39	313 / 318
Jun	191	0	25	191	16 / 11	41 / 36	175 / 180	16 / 11	41 / 39	175 / 180
Jul	131	0	25	131	16 / 11	41 / 36	115 / 120	16 / 11	41 / 39	115 / 120
Aug	101	0	25	101	16 / 11	41 / 36	85 / 90	16 / 11	41 / 39	85 / 90
Sep	87	0	25	87	16 / 11	41 / 36	71 / 76	16 / 11	41 / 39	71 / 76
Oct	149	0	25	149	16 / 11	41 / 36	133 / 138	16 / 11	41 / 39	133 / 138
Nov	227	0	25	227	0	36	227	16 / 11	41 / 39	211 / 216
Dec	249	0	25	249	0	36	249	16 / 11	41 / 39	233 / 238

[a] Under existing conditions, the powerhouse operates when flow is at or exceeds 25 cfs (minimum inflow needed to operate WHC's minimum flow unit 1 which discharges into the bypassed reach at the base of the dam). When inflow is below 25 cfs, the powerhouse is shut down and all flow is allowed to spill over the dam. When inflow is above 25 cfs, the excess flow is routed through units 2 and 3 in the powerhouse and discharged into the tailrace. When inflow is above 436 cfs (flow required to maximize generation through units 2 and 3 while discharging the required 25-cfs minimum flow through unit 1), the excess flow enters the bypassed reach via spill over the dam.

[b] Under WHC's proposal, flows released to the bypassed reach through Unit 1 would be 25 cfs or 36 cfs depending on the time of year. From May 1 through October 31, WHC would discharge 25 cfs into the bypassed reach through Unit 1 and spill 16 cfs (equal to

1.0-inch over the dam) during daylight hours and spill 11 cfs (equal to 0.5-inch) during nighttime hours. Thus, in order to operate during daylight hours from May 1 through October 31, inflow would need to be at or above 41 cfs (minimum operating flow needed to spill 16 cfs over the dam while also discharging 25 cfs through the minimum flow unit). In order to operate during nighttime hours from May 1 through October 31, inflow would need to be at or above 36 cfs (minimum operating flow needed to spill 11 cfs over the dam while also discharging 25 cfs through the minimum flow unit). For the remainder of the year (November 1 through April 30), WHC would adjust the fixed setting on Unit 1 to discharge 36 cfs both day and night. Thus, in order to operate from November 1 through April 30, inflow would need to be at or above 36 cfs. Under WHC's proposal, when inflow is below 41 cfs during daylight hours from May 1 through October 31 or below 36 cfs during other periods, the powerhouse would be shut down and all flow would be allowed to spill over the dam.

[c] Under Vermont ANR's mandatory certification condition, the minimum flow maintained in the bypassed reach would increase to 39 cfs throughout the year. Additionally, WHC is required to spill 16 cfs during daylight hours and 11 cfs during nighttime hours year-round. Thus, in order to operate during daylight hours throughout the year, inflow would need to be at or above 41 cfs (minimum operating flow needed to spill 16 cfs over the dam while also operating its minimum flow unit at its lowest hydraulic capacity of 25 cfs). In order to operate during nighttime hours throughout the year, inflow would need to be at or above 39 cfs (minimum operating flow needed to spill 11 cfs over the dam while also releasing 28 cfs through Unit 1). When inflow is below 41 cfs during daylight hours or below 39 cfs during other periods, the powerhouse would be shut down and all flow would be allowed to spill over the dam.

Table 5. Percent time there is insufficient inflow for the powerhouse to operate under existing condition and proposed and agency-stipulated operating alternatives. (Source: staff).

Minimum Operating Flow	**Percent of Time Inflow does not Exceed Minimum Operating Flow by Month (i.e., powerhouse is shut down)**											
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Existing Condition (25 cfs minimum operating flow year round)	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%	1.37%	2.33%	0.08%	0.00%	0.00%
Proposed action during daylight hours May 1 through October 31 (41 cfs minimum operating flow)	N/A	N/A	N/A	N/A	0.00%	0.75%	3.39%	8.23%	9.33%	3.31%	N/A	N/A
Proposed Action during nighttime hours from May 1 through October 31 and remainder of the year (36 cfs minimum operating flow)	0.08%	0.44%	0.08%	0.00%	0.00%	0.33%	1.29%	4.92%	6.75%	2.02%	0.00%	0.08%
Vermont ANR mandatory condition during nighttime hours year round (39 cfs minimum operating flow)	0.08%	0.71%	0.16%	0.00%	0.00%	0.50%	2.26%	6.61%	8.50%	2.50%	0.09%	0.17%

Vermont ANR mandatory condition during daylight hours year round (41 cfs minimum operating flow)	0.40%	0.80%	0.40%	0.00%	0.00%	0.75%	3.39%	8.23%	9.33%	3.31%	0.43%	0.33%

Table 6. Expected burst speeds of adult and juvenile resident fish expected in the Winooski 8 impoundment. (Source: license application)

Species	Burst Speed (fps)[a]		Source
	Adult	Juvenile	
Rainbow Trout	2.4 to 11.5	3.6 to 5.8	Domenici and Blake, 1997; Froese and Pauley, 2010
Brown Trout	7.0 to 12.7	2.7 to 7.1	Bell, 1991
Fallfish[b]	up to 4.1	-	Bell, 1991
Longnose Dace	3.8 to 4.4	1.9 to 3.4	Aedo et al., 2009
Blacknose Dace[c]	up to 2.23	-	Nelson et al., 2003
Common Shiner	4.5	1.3	Webb, 1978
White Sucker	5.2 to 10.2	1.4 to 2.2	MTO, 2006; Bell, 1991

[a] Burst speed is the swim speed a fish can maintain for a short period of time (i.e., for a few seconds).
[b] Staff did not find direct burst speeds for adult or juvenile fallfish in our literature review but estimated burst speeds using swim speeds reported for "chub" (Bell, 1991) which are similar in size to fallfish.
[c] Staff did not find swim speeds for juvenile blacknose dace in our literature review.

Table 7. Minority and low-income populations within one mile of the project boundary. (Source: U.S. Census Bureau, 2022, as modified by staff).

Area	**Race and Ethnicity**										**Low Income**
Geographic Area	Total Population	White (%)	African America n/ Black (%)	American Indian / Alaska Native (%)	Asian (%)	Native HI & Other Pacific Islander (%)	Some Other Race (%)	Two or More Races (%)	Hispanic Origin (any race) (%)	Total Minority Population (%)	Households in Poverty (%)
Vermont	n = 643,816	91.4% n= 588,63 8	1.2% n= 7,548	0.2% n= 999	1.7% n= 10,678	>0.1% n= 133	0.2% n= 1,543	3.2% n= 20,484	2.1% n= 13,793	8.6% n = 55,178	10.6%
Washington County	n = 59,768	93% n = 55,590	0.9% n= 537	>0.1% n= 13	0.8% n= 489	>0.1% n= 4	.03% n= 206	2.9% n= 1,729	2.0% n= 1,200	7.0% n = 4,178	9.7%
Census Tract 9553, Block Group 3	n = 609	98.2% n = 598	0% n = 0	0% n = 0	0% n = 0	0% n = 0	1.3% n = 8	0.5% n = 3	0% n = 0	1.8% n = 11	0%
Census Tract 9549, Block Group 2	n = 960	78.9% n= 757	0% n = 0	0% n = 0	2.2% n = 21	0% n = 0	0% n = 0	18.4% n = 177	0.5% n = 5	21.1% n = 203	3.6%
Census Tract 9547, Block Group 1	n = 759	90.5% n = 687	5.9% n = 45	0% n = 0	1.4% n= 11	0% n = 0	0% n = 0	0.4% n = 3	1.7% n = 13	9.5% n = 72	4.4%
Census Tract 9545, Block Group 2	n = 1,331	85.9% n = 1,143	1.1% n = 15	0% n = 0	1.0% n= 13	0% n = 0	0% n = 0	9.8% n =130	2.3% n = 30	14.1% n = 188	4.4%
Census Tract 9550, Block Group 2	n = 1,487	96.3% n = 1,432	0.9% n = 14	0.3% n = 4	0% n= 0	0% n = 0	0% n = 0	1.0% n = 15	1.5% n = 22	3.7% n = 55	7.1%

Note: Gray shading indicates an environmental justice community

APPENDIX E. DEVELOPMENTAL ANALYSIS

POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 8 summarizes the assumptions and economic information used in the analysis. Most of this information is provided by the applicant in its license application. Some is developed by Commission staff. The values provided by the applicant are typically reasonable for the purposes of our analysis. If they are not, it is noted below. Cost items common to all alternatives include taxes and insurance; estimated capital investment required to develop the project or major modifications for relicensing; licensing costs; normal operation and maintenance cost; and Commission fees. All costs are adjusted to current year dollars.

Table 8. Parameters for economic analysis of the project (source: license application; staff)

Parameter	Value
Installed capacity	0.856 MW
Average annual generation (under no action alternative)	3,507 MWh
Period of analysis	30 years
State and local property tax	Included in the O&M cost
Insurance rate	Included in the O&M cost
Interest rate	8%
Application cost	$140,600
Operation and maintenance[a]	$381,800year
Cost of Alternative Power (2023)[c]	
1) Energy cost (2023)	$71.42/MWh
2) Dependable Capacity Cost (2023)	$179.08/kW-year

[a] The annual operation and maintenance cost includes insurance, interim replacements, and administrative and general costs associated with the operation of the project.

[b] The Commission collects an annual administration charge for all licensed projects which is based on the authorized installed capacity of the project and amount of federal land occupied by the project.

[c] The alternative source of power cost is based on the current cost of providing the same amount of generation and capacity from a natural gas-fired combined cycle plant, as reported by The U.S. Energy Information Administration, Annual Energy Outlook 2023, for the Division 1, New England Region. The total cost of alternative power, reported in table 9 below, is a combination of the cost of energy and capacity benefit.

COMPARISON OF ALTERNATIVES

Table 9 summarizes the installed capacity, annual generation, capacity benefit, alternative source of power's cost, estimated total project cost, and difference between the alternative source of power's cost and total project cost for each of the alternatives considered in this EA: no-action, the applicant's proposal, the staff alternative, and the staff alternative with mandatory conditions.

Table 9. Summary of the annual cost of alternative power and annual project cost for four alternatives for the Winooski 8 Project (source: staff).

	No Action	**Applicant's Proposal**	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Installed capacity	0.856 MW	0.856 MW	0.856 MW	0.856 MW
Annual generation	3,507 MWH	3,387 MWH	3,434 MWH	3,301 MWH
Capacity benefit[a]	0.42 MW	0.39 MW	0.40 MW	0.37 MW
Current alternative source of power cost[b]	$324,801	$311,601	$316,844	$301,601
Total annual project cost (2023)[c]	$538,825	$556,545	$559,721	$559,227
Difference between the alternative source of power cost and total annual project cost	($214,024)	($244,944)	($242,877)	($257,676)

[a] Staff estimated the capacity benefit based on the ratio of the mean annual flow available for generation for each of 12 months, and the hydraulic capacity of the project. This ratio is multiplied by the authorized installed capacity to determine the capacity benefit.

[b] The value of power for the Winooski 8 Project is based on the alternative source of power cost in the New England Region, as identified in table 8 above.

[c] Project costs include the cost of environmental measures listed in table 10 in Appendix F, and the costs identified in table 9. All project costs are adjusted to current year dollars.

No-Action Alternative

Under the No-Action alternative, the project has an installed capacity of 0.856 MW, a capacity benefit of 0.42 MW, and an average annual generation of 3,507 MWh. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit is $324,801. The total annual project cost is $538,825. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 3,507 MWh of power and 0.856 MW of capacity is $214,024 more than that of the alternative source of power's cost.

Applicant's Proposal

Under the applicant's proposal, the project would have a total installed capacity of 0.856 MW, a capacity benefit of 0.39 MW, and an average annual generation of 3,387 MWh. When compared to current conditions, generation would be reduced by 120 MWh/year from maintaining daytime and nighttime aesthetic spill flows over the dam from May 1 through October 31. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit would be $311,601. The total annual project cost would be $556,545. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 3,387 MWh of power and 0.856 MW of capacity would be $244,944 more than that of the alternative source of power's cost.

Staff Alternative

Under the staff-recommended alternative, the project would have a total installed capacity of 0.856 MW, a capacity benefit of 0.4 MW, and an average annual generation of 3,434 MWh. When compared to current conditions, generation would be reduced by 73 MWh/year from maintaining aesthetic spill flows over the dam during daytime hours May 1 through October 31. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit would be $316,844. The total annual project cost would be $559,721. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 3,434 MWh of power and 0.856 MW of capacity would be $242,877 more than that of the alternative source of power's cost.

Staff Alternative with Mandatory Conditions

Under the staff alternative with mandatory conditions, the project would have an installed capacity of 0.856 MW, a capacity benefit of 0.37 MW and an average annual generation of 3,301 MWh. When compared to current conditions, generation would be reduced by 206 MWh/year from maintaining daytime and nighttime aesthetic spill flows over the dam continuously throughout the year. The alternative source of power's current cost to produce the same amount of energy and provide the same capacity benefit would be $301,601. The total annual project cost would be $559,227. Subtracting the total annual project cost from the alternative source of power's current cost, the project's cost to produce 3,301 MWh of power and 0.856 MW of capacity is $257,676 more than that of the alternative source of power's cost.

COST OF ENVIRONMENTAL MEASURES

Table 10 in Appendix F presents the cost of each of the environmental enhancement measures considered in our analysis for the Winooski 8 project. All costs are adjusted to current year dollars. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

APPENDIX F. COST OF ENVIRONMENTAL MEASURES

Table 10. Cost of environmental measures considered in assessing the environmental effects of operating the Winooski 8 Project (source: WHC and staff).

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
Aquatic Resources				
1. Continue to operate the project in a run-of-river mode except when lowering or raising the impoundment during maintenance activities.[d]	WHC, Staff, Vermont ANR	$0	$0	$0
2a. Provide a continuous minimum flow of 41 cfs or inflow, if less, in the bypassed reach during daylight hours from May 1 through October 31 and minimum flows of 36 cfs during the remainder the year; provide aesthetic spill flows over the dam of 16 cfs during daylight hours and 11 cfs during nighttime hours from May 1 through October 31	WHC	$0	$8,570[e,f]	$8,750
2b. Provide a continuous minimum flow of 41 cfs or inflow, if less, in the bypassed reach during daylight hours from May 1 through October 31 and minimum flows of 36 cfs during the remainder the year; provide	Staff	$0[f]	$5,214[e,g]	$5,214

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
aesthetic spill flows over the dam of 16 cfs during daylight hours only from May 1 through October 31 (no nighttime spill flow)				
2c. Provide a continuous minimum flow of 39 cfs or inflow, if less, in the bypassed reach year-round while also maintaining aesthetic spill flows over the dam of 16 cfs during daylight hours and 11 cfs during nighttime hours over the dam year-round[d]	Vermont ANR	$0	$14,713 [e,h]	$14,713
3a. Conduct a mussel survey of the impoundment during the first planned maintenance drawdown when the impoundment is drawn down to 610 feet, identify and relocate any mussels found and file a summary report within 120 days.[d]	WHC; Vermont ANR; Staff	$9,440	$0.	$839
3b. Develop a mussel protection plan in consultation with Vermont ANR that contains the following: (1) a schedule and methods for surveying for mussels during the first planned drawdown of the impoundment below an elevation of 610.7 feet;	Staff	$5,000	$0	$444

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
(2) procedures for safely collecting and handling mussels found within the maintenance fluctuation zone and transporting them to deeper waters; (3) criteria for deciding if and when mussel surveys would continue during subsequent maintenance drawdowns that are conducted below an elevation 610.7 feet; and (4) provisions to notify the Commission and Vermont ANR of the survey results and any proposals for Commission approval to discontinue surveys based on the results				
3c. Conduct mussel surveys and relocate any mussels during each maintenance drawdown when the impoundment is lowered below 610.7 feet and continue to file reports only if mussels are found during the first survey. Surveys would stop if no mussels are found during the first survey.	WHC	$0	$9,440 every third year. Depends on if mussels are found during first survey which would trigger the need for subsequent surveys.	$4,347
3d. Conduct mussel surveys during each subsequent maintenance drawdown when the impoundment is lowered below 610.7 feet and continue to file	Vermont ANR	$0[e]	$9,440 every third year.	$4,347

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
reports regardless of whether mussels are found during the initial survey or any subsequent survey.[d]				
3e. Develop a mussel protection plan that includes criteria and schedule for continuing to conduct mussel surveys based on the survey results and includes mussel survey and handling protocols.	Staff	$5,000 [e]	$9,440 every third year but would depend on criteria being met to determine the need for future surveys over the license term.	$4,792
4a. Develop a flow management and monitoring plan that includes provisions for monitoring and reporting compliance with the operating requirements of the license (e.g., run-of-river operation, minimum flows, spill flows, impoundment levels), consulting with Vermont DEC prior to conducting planned maintenance drawdowns of the impoundment, and reporting deviations from operating requirements to Vermont DEC[d]	Vermont ANR; Staff	$5,000[e]	$1,000[e]	$1,444
4b. Include in the flow management and monitoring plan the impoundment levels that would be maintained for	Staff	$0[e]	$0[e]	$0

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
providing required aesthetic spill flows and provisions for reporting deviations from operating requirements to the Commission				
5a. Implement a Sediment Dredging Management Plan[d]	WHC, Vermont ANR, Staff	$5,900	$8,260	$8,784
5b. Revise the Sediment Dredging Management Dredging Plan in consultation with Vermont ANR to include a provision to conduct all planned non-emergency maintenance dredges that require the impoundment to be drawn down below an elevation of 615 feet between July 1 and September 30	Staff	$0[e]	$0[e]	$0
5c. Consult with Vermont ANR on the Draft Sediment Dredging Management Plan and re-file the plan once finalized[d]	Vermont ANR; Staff	$0[e]	$0[e]	$0
6a. Dispose project-related debris in accordance with state laws and regulations[d]	Vermont ANR	Unknown, as it would depend on the quantity and method of disposal	Unknown, as it would depend on the quantity and method of disposal	$0
6b. Develop a debris disposal plan in consultation with Vermont ANR	Staff	$5,000[e]	$0[e]	$444

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
Threatened and Endangered Species				
7. Avoid tree-trimming and the removal of trees with diameters that are equal to or greater than 3 inches at breast height from April 15 through October 31 to avoid roost disruption of federally-endangered northern long-eared bats; consult with Vermont Fish and Wildlife Department and the U.S. Fish and Wildlife Service if tree trimming is necessary during this period[d]	Staff, Vermont ANR	$0[e]	$0[e]	$0
Recreation				
8a. Develop a recreation management plan[d] that includes the measures identified in items 8b thru 8f and includes a schedule for maintaining the facilities and adding signage to identify the project recreation sites	Vermont ANR; Staff	$4,500	$0	$400
8b. Maintain and operate recreation facilities including the boat take-out, whitewater boating put-in and tailwater fishing access area, portage route, and interpretive display and overlook	WHC and Staff	$0	$511	$511
8c. Conduct recreation use monitoring	WHC and Staff	$0	$394	$394

Enhancement/Mitigation Measures	Recommending Entity	Capital cost[a] ($2023)	Annual Cost[a,b] ($2023)	Levelized Annual Cost[c] ($2023)
8d. Install an interpretive display and overlook that would include information about the hydropower facility and the history of the site	WHC and Staff	$5,900	$118	$642
8e. Improve a parking area for 3 vehicles along PowerPlant Road near the whitewater boating put-in and tailwater fishing access	WHC and Staff	$7,080	$1,180	$1,809
8f. Develop and provide maps and promotional guide material	WHC and Staff	$0	$394	$394
Cultural Resources				
9. Continue to consult with the Vermont Division of Historic Preservation (Vermont DHP) before beginning any land-disturbing activities or alterations to known historic structures within the project boundary	WHC; staff	$0[e]	$0[e]	$0

[a] Costs were provided by WHC in their license application or subsequent additional information request responses unless otherwise noted.

[b] Annual costs typically include project operation and maintenance costs and any other costs that occur on a yearly basis.

[c] All capital and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing all costs.

[d] Mandatory Clean Water Act Section 401 Water Quality Certification condition.

[e] Cost estimated by staff.

[f] This is an estimate of the cost that would result from providing spill flows of 16 cfs over the dam during daylight hours and 11 cfs during nighttime hours from May 1 through October 31. The proposed measure would reduce generation by 120 MWh per year.

Using an energy cost of $71.42/MWh from Table 8 in Appendix E as a proxy for the value of lost generation, 120MWh of foregone generation would be valued at $8,570/yr. All costs are adjusted to current year dollars.

[g] This is an estimate of the cost that would result from providing spill flows of 16 cfs over the dam during daylight hours from May 1 through October 31 (opportunity cost). The proposed measure would reduce generation by 73 MWh per year. Using an energy cost of $71.42/MWh from Table 8 in Appendix E as a proxy for the value of lost generation, 73 MWh of foregone generation would be valued at $5,214/year. The generation losses were estimated by staff based on information filed by WHC on February 2, 2022. All costs are adjusted to current year dollars.

[h] This is an estimate of the cost that would result from providing spill flows of 16 cfs over the dam during daylight hours and 11 cfs during nighttime hours year round. The proposed measure would reduce generation by 206 MWh per year. Using an energy cost of $71.42/MWh from Table 8 in Appendix E as a proxy for the value of lost generation, 206 MWh of foregone generation would be valued at $14,713/year. The generation losses were estimated by staff based on information filed by WHC on February 2, 2022. All costs are adjusted to current year dollars.

APPENDIX G. PHOTOGRAPHS OF THE DAM TAKEN FOR THE AESTHETIC FLOW STUDY

Photo G-1. View of the Winooski 8 Dam with a 0.5-inch spill flow over the dam, minimum flow unit off (11/18/2019). Source: license application.

Photo G-2. View of the Winooski 8 Dam with a 0.75-inch spill flow over the dam, minimum flow unit off (11/18/2019). Source: license application.

Photo G-3. View of the Winooski 8 Dam with a 1-inch spill flow over the dam, minimum flow unit off (11/18/2019). Source: license application.

Photo G-4. View of the Winooski 8 Dam with a 0-inch spill flow over the dam, minimum flow unit on (10/22/2019). Source: license application.

Photo G-5. View of the Winooski 8 Dam with a 0.5-inch spill flow over the dam, minimum flow unit on (10/22/2019). NOTE: Flows could not be maintained stable during this flow measurement, but the picture has been included and compares reasonably well with the 1.2-inch spill photograph. Source: license application.

Photo G-6. View of the Winooski 8 Dam with a 1.2-inch spill flow over the dam, minimum flow unit off (10/22/2019). Source: license application.

Photos G-7 and G-8. View of the Winooski 8 Dam with a 2.1-inch spill flow over the dam, minimum flow unit on (8/30/2019). Source: license application.

Photos G-9 and G-10. View of the Winooski 8 Dam with a 3.7-inch spill flow over the dam, minimum flow unit off (10/22/2019). Source: license application.

APPENDIX H. LITERATURE CITED

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APPENDIX I. LIST OF PREPARERS

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APPENDIX J. VERMONT AGENCY OF NATURAL RESOURCES WATER QUALITY CERTIFICATION (issued February 21, 2024)

Decision and Certification

The Department has examined the Project application and other information deemed relevant by the Department in order to issue a decision on this certification application pursuant to the Department's responsibilities under Section 401 of the federal Clean Water Act and 10 V.S.A. § 1253(h). After examination of these materials, the Department certifies that there is reasonable assurance that operation of the Project in accordance with the following conditions will not violate Standards; will not have a significant impact on use of the affected waters by aquatic biota, fish or wildlife, including their growth, reproduction, and habitat; will not impair the viability of the existing populations; will not result in a significant degradation of any use of the waters for recreation, fishing, water supply or commercial enterprises that depend directly on the existing level of water quality; and will be in compliance with sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act, 33 U.S.C. section 1341, and other appropriate requirements of state law:

A. **Compliance with Conditions.** The Applicant shall operate and maintain this Project consistent with the findings and conditions of this certification. The Applicant shall not make any changes to the Project or its operations that would have a significant or material effect on the findings, conclusions or conditions of this Certification without approval of the Department.

   See finding 122 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-101.

B. **Flow Management**. The Project shall be operated in instantaneous run-of-river mode. Instantaneous run-of-river operation means no utilization of impoundment storage and that outflow from the facility is equal to inflow to the impoundment on an instantaneous basis except for short term, unavoidable deviations.

   The Applicant shall provide 39 cfs, or inflow if less, into the bypassed reach year-round. This flow shall not be interrupted. When generating, the Project shall spill 1 inch in daylight hours and 0.5 inches during nighttime hours continuously year-round in the bypass reach unless otherwise indicated in the flow management and monitoring plan (condition C). Daylight hours are defined as one half hour before sunrise to one half hour after sunset. When the Project is not operating, all flow shall be spilled at the dam.

   See findings 125, 130-134, 139, 149-155 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-304 & § 29A-306 (b)(3)(B) & § 306 (c)(3)(B)(i).

C. **Flow Management and Monitoring Plan.** Within 180 days of the effective date of the FERC license, the Applicant shall develop a flow management and monitoring plan detailing how the Project will operate in instantaneous run-of-river mode and

manage flow seasonally to comply with the conservation flow requirements. The plan will also include a method for continuous monitoring and reporting (to allow records to be furnished upon request) of flow releases at the Project (conservation flow, spillage, and turbine discharge), impoundment levels and inflows. The plan shall include provisions for the flow data to be available on a near real-time basis.

The plan will include procedures for reporting deviations from prescribed operating conditions to the Department. Reports shall be made within 15 days after a deviation and will include, if possible, the causes, severity and duration of the deviation, observed or reported adverse environmental impacts from the incident, pertinent data, and measures to be taken to avoid recurrences.

The plan shall be subject to Department approval. The Department reserves the right to review and approve any material changes made to the plan.

See finding 121 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-304 & § 29A-306(b).

D. **Recreation**. In accordance with the Applicant's proposal, within 180 days of the effective date of the FERC license, the licensee shall develop a recreation plan providing additional details on a schedule for implementing the Applicant's recreation proposal. This plan shall include the frequency at which recreational sites for which the Applicant has agreed to maintain with be checked for maintenance needs.

See findings 104-107 and 145-147 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 030 026 § 29A-103(b)(1)(G).

E. **Debris Disposal**. Debris associated with project operations shall be disposed of in accordance with the Standards and applicable state laws and regulations.

See findings 10, 108, 109, and 148 for a statement of necessity. 10 V.S.A. § 1258 & Vt. Code R. 12 030 026 § 29A-303(1).

F. **Maintenance Plan and Repair Work**. The licensee shall consult with the Vermont Department of Environmental Conservation prior to conducting Project maintenance or repair work that has the potential to have an adverse effect on water quality, other than those activities described in the sediment management plan. Such maintenance and repair work shall be subject to review and approval by the Department.

See findings 95, 121, 139, and 143 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-103(a), § 29A-306(b) and § 29A-304(b).

G. **Threatened and Endangered Species**. For activities requiring the clearing of trees 3-inches diameter breast height or greater, the licensee shall abide by seasonal tree clearing restrictions and only clear trees between November 1st- April 14th to avoid any roost disruption of the Northern long-eared bat. Should tree clearing be required

during the restricted time period (April 15th- October 31st), otherwise shall consult with the USFWS and VTFWD regarding removal.

See findings 99 and 141 for a statement of necessity. 10 V.S.A § 5403.

H. **Mussel Plan**. The licensee shall have a mussel expert survey the impoundment and shoreline areas to locate, identify, and relocate any mussels, with a specific focus on state threatened or endangered mussels, during a planned drawdown that falls below 610.7 feet msl. A summary of the report shall be provided to the Agency of Natural Resources within 120 days of the survey.

See findings 45, 66, 101-102, and 142-144 for a statement of necessity. 10 V.S.A § 5403.

I. **Sediment Management**. The licensee shall finalize within 180 days of the effective date of the FERC license the sediment dredging management plan in consultation with, and approval from, the Agency.

See finding 46, 47, 91-94, and 136-138 for a statement of necessity. 10 V.S.A § 5403.

J. **Compliance Inspection by Department**. The Applicant shall allow the Department to inspect the Project area at any time to monitor compliance with certification conditions.

See finding 122 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-104(a).

K. **Posting of Certification**. A copy of the certification shall be prominently posed within the Project powerhouse.

See finding 122 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-104(a).

L. **Modification of Certification**. The Department may request, at any time, that FERC reopen the license to consider modifications to the license as necessary to assure compliance with Vermont Water Quality Standards.

See finding 122 for a statement of necessity. 10 V.S.A § 1258 & Vt. Code R. 12 0330 026 § 29A-104(a).