

LOW-IMPACT HYDROPOWER POWER INSTITUTE CERTIFICATION APPLICATION

CAVENDISH HYDROELECTRIC PROJECT (FERC No. 2489)



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LOW-IMPACT HYDROPOWER POWER INSTITUTE CERTIFICATION APPLICATION

CAVENDISH HYDROELECTRIC PROJECT (FERC EXEMPTION NO. 2489)

1.0 FACILITY DESCRIPTION

The Cavendish Hydroelectric Project, Federal Energy Regulatory Commission (FERC) No. 2489 (Project), is owned and operated by the Green Mountain Power Corporation (GMP)¹ and is located in southeastern Vermont on the Black River, 20.8 miles upstream of its confluence with the Connecticut River. The Black River begins in a small body of water called Black Pond in Plymouth, Vermont and has a mainstem of 40 miles. The Black and Ottauquechee Rivers drain an area that is approximately 425 square miles in size. The two rivers, their tributaries and the land drained by them is known as Basin 10 (Vermont's major drainage basins have been organized into 15 regions for assessment and planning purposes) which encompasses mountainous headwaters, industrial towns, village centers and floodplain farm fields². The Project area is located within Cavendish, Windsor County, Vermont.

The Proctor-Piper State Forest is located one-half mile southwest of the Project, while Hawks Mountain Wildlife Management Area borders the Project on the northeast. There are six, non-power related dams upstream of Cavendish Dam on the Black River and seven dams downstream, five of which include power generation (See Appendix B for a map of Black River Dam Locations). Cavendish is the only dam of the 14 dams on the Black River that is owned and operated by GMP. The closest upstream dam is the Okemo Snow Pond Diversion Structure Dam, and the closest downstream dam is the Soapstone Dam, located about six miles downstream³. Neither of these two dams include hydropower facilities.

¹ On September 13, 2012, FERC issued Order Approving Transfer of Licenses from Central Vermont Public Service (CVPS) to Green Mountain Power Corporation (GMP) for Cavendish Hydroelectric Project.

<http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13064046>

² <http://dec.vermont.gov/watershed/map/basin-planning/basin10>

³ Updated Black River dam information comes from Vermont Natural Resources Atlas:
<http://anrmaps.vermont.gov/websites/anra/>

1.1 PROJECT DESCRIPTION

The Project impounds a 10-acre reservoir that extends 3,000-feet upstream from the dam. The Cavendish Dam is a concrete gravity dam that is 75-feet-high and set into ledge outcroppings on both sides of the Black River (Figure 1). The north spillway section is 90-feet-long by 25-feet-high, topped with a 6-foot inflatable rubber flashboard installed in 1995. The south spillway section is 21-feet-long by 6-feet-high and topped with 2.5-foot flashboards. There is a concrete intake structure on the north bank of the river, which is equipped to manually operate head gates and an inclined trashrack. A power tunnel running parallel to the river carries plant flow 180-feet from the intake to a 6-foot-diameter, 1,250-foot-long steel penstock. The 64-foot-long by 34-foot-wide powerhouse contains three Francis turbine generators, each with a capacity of 480 kW, for a total combined installed capacity of 1,440 kW. Maintenance buildings are co-located with the powerhouse and substation.

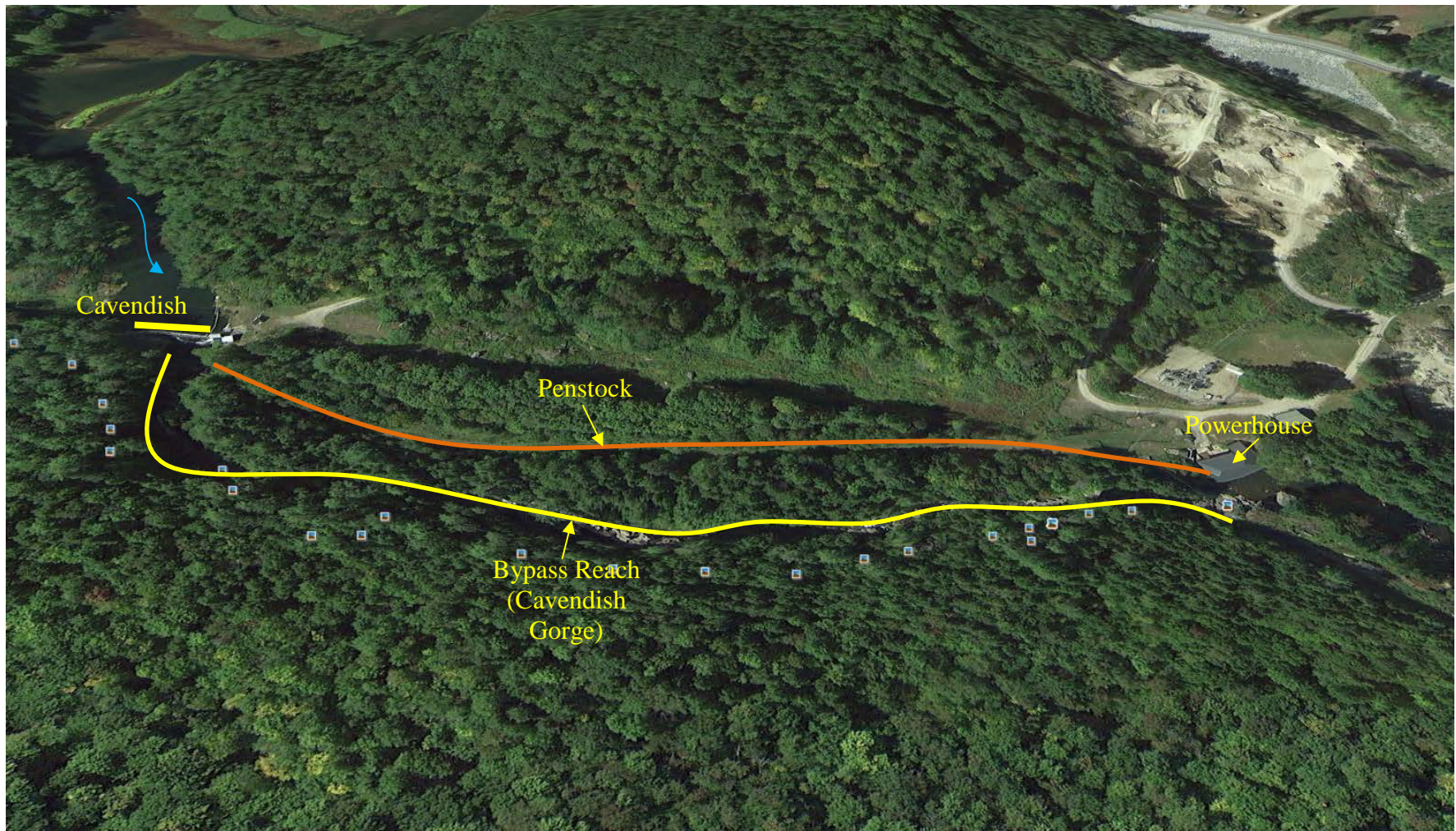


FIGURE 1 OVERVIEW OF CAVENDISH HYDROELECTRIC PROJECT FEATURES

1.2 PROJECT OPERATIONS

The Project is operated as a run-of-river facility. When the Project is not operating, all flows are spilled from the dam. The 1,570-foot-long bypass reach includes Cavendish Gorge, a series of waterfalls and cascades that flow over boulders and between steep cliffs, with numerous pools and glacial potholes in the channel (Appendix A).

For the protection of this bypass reach, the Project provides a continuous minimum flow of 10 cfs, or inflow, whichever is less, into the Black River bypassed reach. This minimum flow is used to enhance the aesthetics and aquatic habitats of the Project area.

1.3 REGULATORY AND COMPLIANCE HISTORY

Since issuance of the 2012 LIHI Certification for the Cavendish Project, the following notable actions have occurred as documented within the FERC e-library:

- On July 28, 2012, CVPS and GMP filed a joint application to FERC for approval to transfer licenses for thirteen hydroelectric projects and one transmission line project from CVPS to GMP, including the Cavendish Project. On September 13, 2012, FERC issued an Order approving the transfer of the Cavendish Project license to GMP⁴. On November 9, 2012, GMP submitted its acknowledgement of acceptance of the Commission's September 13, 2012 Order⁵.
- On December 23, 2012, GMP submitted the Annual CRMP Report for the Cavendish Project.⁶
- On October 31, 2013, GMP submitted the Annual CRMP Report for the Cavendish Project.⁷
- On January 27, 2014, FERC issued a letter reminder for the FERC Form 80 for the Cavendish Project.⁸
- On January 31, 2014, GMP submitted a letter to FERC to notify them that no easement conveyances had been made at the Cavendish Project.⁹
- On August 25, 2014, FERC issued a letter to GMP acknowledging the dam safety inspection that was conducted on August 12, 2014 for the Cavendish Project.¹⁰
- On September 17, 2014, the New York Regional Office (NYRO) submitted the Dam Safety Inspection Report for the Cavendish Dam for a period of September 28, 2011 to August 12, 2014.¹¹
- On October 16, 2014, GMP submitted the Annual Statement of Generation for the Cavendish Project with recorded generation at 3,716,806 KWH.¹²
- On November 11, 2014, GMP submitted the Annual CRMP Report for the Cavendish Project.¹³
- On October 29, 2015, GMP submitted the Annual Statement of Generation for the Cavendish Project with recorded generation at 3,768,152 KWH.¹⁴
- On November 2, 2015 GMP submitted the Annual CRMP Report for the Cavendish Project.¹⁵
- On February 1, 2016, GMP submitted a letter to FERC to notify them that no easement conveyances had been made at the Cavendish Project.¹⁶

⁴ <http://elibrary.ferc.gov/IDMWS/common/OpenNat.asp?fileID=13064046>

⁵ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13106693>

⁶ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13146226>

⁷ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13386971>

⁸ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13446378>

⁹ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13453034>

¹⁰ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13642245>

¹¹ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13637816>

¹² <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13661289>

¹³ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13682483>

¹⁴ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14031741>

¹⁵ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=14037605>

¹⁶ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14133769>

- On November 1, 2016, GMP submitted the Annual Statement of Generation for the Cavendish Project with recorded generation at 3,849,919 KWH.¹⁷
- On November 2, 2016 GMP submitted the Annual CRMP Report for the Cavendish Project.¹⁸
- On October 31, 2017 GMP submitted the Annual CRMP Report for the Cavendish Project.¹⁹

¹⁷ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14388880>

¹⁸ <https://elibrary.ferc.gov/IDMWS/common/OpenNat.asp?fileID=14390704>

¹⁹ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14746169>

1.4 CAVENDISH FACILITY DESCRIPTION INFORMATION (LIHI CERTIFICATE #97)

TABLE 1 FACILITY DESCRIPTION INFORMATION FOR CAVENDISH HYDROELECTRIC PROJECT (LIHI #97)

<i>Information Type</i>	<i>Variable Description</i>	<i>Response (and reference to further details)</i>
<i>Name of the Facility</i>	Facility name (use FERC project name if possible)	Cavendish Hydroelectric Project (FERC No. 2489) referred to as the Project throughout this application.
	River name (USGS proper name)	Black River
	River basin name	Connecticut River Drainage Basin (See Appendix B)
	Nearest town, county, and state	Cavendish, Vermont
	River mile of dam above next major river	The Project is located at RM 20.8 on the Black River.
	Geographic latitude	43°22'52.14"N
	Geographic longitude	72°35'53.56"W
<i>Facility Owner</i>	Application contact names:	John Greenan, Environmental Engineer 2152 Post Road, Rutland, Vermont 05701
	Facility owner (individual and company names)	Green Mountain Power Company (Licensee/GMP) 163 Acorn Lane, Colchester, Vermont 05446
	Operating affiliate (if different from owner)	N/A
	Representative in LIHI certification	Katie Sellers, Kleinschmidt Associates Andy Qua, Kleinschmidt Associates 141 Main Street, Pittsfield, Maine 04967
<i>Regulatory Status</i>	FERC Project Number, issuance and expiration dates	Project No. 2489 Issued: 11/4/1994 (30 years) Expires: 10/31/2024
	FERC license type or special classification	Minor
	Water Quality Certificate identifier and issuance date, plus source agency name	A Water Quality Certificate (WQ-93-08) was issued by the Vermont Agency of Natural Resources on October 7, 1993 (Appendix C).
	Hyperlinks to key electronic records on FERC e-library website (e.g., most recent Commission Orders, WQC, ESA documents, etc.)	1994 FERC License ²⁰ 1996 Order Modifying and Approving Recreation and Lands 1995 Cavendish FERC Order License Amendment and Approval for Fish Passage Facility Installation 1995 Cavendish Flow Management Plan Required by Article 403 and 404

²⁰ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13711033>

Information Type	Variable Description	Response (and reference to further details)
		1996 Cavendish FERC Order Flow Fluctuation Reduction Plan 1997 Cavendish FERC Order Downstream Passage Effectiveness 1999 Cavendish FERC Order Approving CRMP 1999 Cultural Resources Management Plan 1996 Cavendish FERC Order Scapania Umbrosa Plan
Power Plant Characteristics	Date of initial operation (past or future for operational applications)	The Cavendish facility was constructed between 1907 and 1908 and hydroelectric generation has continued since that time.
	Total name-plate capacity (MW)	1.44 MW
	Average annual generation (MWh)	5,918 MWH (10-year average).
	Number, type, and size of turbines, including maximum and minimum hydraulic capacity of each unit	<p>The powerhouse contains three horizontal-shaft Francis turbines manufactured by the Pelton Water Wheel Company, each with a capacity of 480 kW, for a total of 1,440 kW of installed capacity. The Project's minimum hydraulic capacity is 19 cfs while the maximum hydraulic capacity is 226 cfs.</p> <p>The turbines are coupled to three Fort Wayne Electric Works generators. #1 – 600 KW/650 KVA; #2 – 500 KW/ 550 KVA; #3 – 590 KW/650 KVA.</p> <p>The units have adjustable wicket gates operated by a headwater float control or remote control.</p>
	Modes of operation (run-of-river, peaking, pulsing, seasonal storage, etc.)	Run-of-River; Continuous minimum flow of 10 cfs is passed through the downstream fish passage facility year-round.
	Dates and types of major equipment upgrades	No major equipment upgrades have occurred at the Project.
	Dates, purpose, and type of any recent operational changes	No major operational changes have occurred at the Project.
	Plans, authorization, and regulatory activities for any facility upgrades	No major facility upgrades are planned in the near future.
Characteristics of Dam, Diversion, or Conduit	Date of construction	Cavendish facility was built between 1907 and 1908.
	Dam height	75-feet-high
	Spillway elevation and hydraulic capacity	North Spillway – 25-feet-high with 6-foot inflatable rubber flashboard; crest elevation of 878.13 feet mean sea level (msl).

Information Type	Variable Description	Response (and reference to further details)
		South Spillway – 6-feet-high with 2.5-foot flashboard; crest elevation 881.63 feet msl.
	Tailwater elevation	The normal tailwater elevation is 764.6 feet msl. Information is not available pertaining to tailwater elevation when operating the turbines at 19 cfs, 75 cfs, 150 cfs, or 226 cfs.
	Length and type of all penstocks and water conveyance structures between reservoir and powerhouse	A power tunnel running parallel to the river carries plant flow 180-feet from the intake to a 1,250-foot-long steel penstock. The penstock was constructed in 1908 and replaced in 1979, according to the Cultural Resources Management Plan (CRMP).
	Dates and types of major, generation-related infrastructure improvements	No major generation-related infrastructure improvements have occurred at the Project.
	Designated facility purposes	The purpose of this facility is to generate power to be supplied to the local grid.
	Water source	Black River
	Water discharge location or facility	Water utilized by the Project discharges directly into the waters of the Black River directly below the Powerhouse.
Characteristics of Reservoir and Watershed	Gross volume	The 10-acre impoundment has a useable storage capacity of 18.4 acre feet at 884.13-feet msl.
	Surface area at full pool	At full pool of 884.13-feet msl, the Project impoundment is approximately 10-acres. The impoundment elevation that occurred during the maximum historic recorded inflow is not available. Such flows are beyond the ability of Project operations to influence pond level.
	Maximum water surface elevation (ft. MSL)	884.13-feet msl
	Maximum and minimum volume and water surface elevations for designated power pool, if available	This is a run-of-river Project. No power pool available.
	Upstream dam(s) by name, ownership, FERC number (if applicable), and river mile	Upstream Dam: Okemo Snow Pond Diversion Structure Owner: Okemo Mountain Inc. FERC No.: N/A River Mile (RM): 28.1 Status: In Service Upstream Dam: Reservoir Pond Dam Owner: Town of Ludlow FERC No.: N/A RM: 30.3 Status: In Service

<i>Information Type</i>	<i>Variable Description</i>	<i>Response (and reference to further details)</i>
		<p>Upstream Dam: Lake Rescue Dam Owner: Town of Ludlow FERC No.: N/A RM: 31.4 Status: In Service</p> <p>Upstream Dam: Amherst Lake Dam Owner: Lakeside Associates, Inc. FERC No.: N/A RM: 34.1 Status: In Service</p> <p>Upstream Dam: Duck Pond Dam Owner: Ralph Michael FERC No.: N/A RM: 36.1 Status: In Service</p> <p>Upstream Dam: Black Pond Dam Owner: The Black Pond Trust FERC No.: N/A RM: 40 Status: In Service</p> <p>See Appendix B for a map of Black River dam locations. Updated Black River dam information comes from Vermont Natural Resources Atlas: http://anrmaps.vermont.gov/websites/anra/</p>
	Downstream dam(s) by name, ownership, FERC number (if applicable), and river mile	<p>Downstream Dam: Soapstone Dam Owner: Unknown FERC No.: N/A RM: 12.6 Status: Partial Breach (No longer in service)</p> <p>Downstream Dam: North Springfield Dam Owner: U.S. Army Corps of Engineers FERC No.: N/A RM: 8.7 Status: In Service</p> <p>Downstream Dam: Fellows Dam Owner: One Hundred River Street, LLC FERC No.: 9648</p>

Information Type	Variable Description	Response (and reference to further details)	
		RM: 4.7 Status: Not in Use Downstream Dam: Gilman Dam Owner: Factory Falls, Inc. FERC No.: 9650 RM: 4.5 Status: In Service Downstream Dam: Comtu Falls Dam Owner: Comtu Falls Associates FERC No.: 7888 RM:4.4 Status: In Service Downstream Dam: Slack Lower Dam Owner: Springfield Hydroelectric Co. FERC No.: 8014 RM: 4.3 Status: In Service Downstream Dam: Lovejoy Dam Owner: Lovejoy Tool Co., Inc. FERC No.:9649 RM: 4.1 Status: In Service See Appendix B for a map of Black River dam locations. Updated Black River dam information comes from Vermont Natural Resources Atlas: http://anrmaps.vermont.gov/websites/anra/	
	Operating agreements with upstream or downstream reservoirs that affect water availability, if any, and facility operation	There are no operating agreements between the Project and surrounding projects.	
	Area inside FERC project boundary, where appropriate	45 acres, approximately	
Hydrologic Setting	Average annual flow at the dam	154 cfs (according to the 1994 Environmental Assessment (attached to Project license) and 1993 WQC)	
	Average monthly flows	Annual Monthly Mean for the Period October 1929 – September 1960 as included	July – 60 cfs August – 38 cfs September – 53 cfs

Information Type	Variable Description	Response (and reference to further details)	
		within the 1994 Environmental Assessment: January – 113 cfs February – 102 cfs March – 240 cfs April – 530 cfs May – 238 cfs June – 120 cfs	October – 65 cfs November – 126 cfs December – 123 cfs
	Location and name of relevant stream gauging stations above and below the facility	<p>There are currently no good local gages to use for Cavendish river flow analysis. Gage #01152800 Black River at Covered Bridge at Weathersfield (located above the Project) only has data from 1975-1981 and Gage # 01153000 Black River at North Springfield (located below the Cavendish Project) is located downstream of a large storage reservoir and not particularly useful for operations analysis. The drainage area at the dam is 83 square miles and the drainage area at the North Springfield gage is 158 square miles.</p> <p>Kleinschmidt communicated with VDEC regarding the need Black River flow data, but DEC determined that there is no additional data available on Black River flows. A more extensive flow analysis would need to occur in order to provide current, accurate flows at the Project.</p>	
	Watershed area at the dam	The drainage area upstream of the Project is approximately 83 square miles.	
Designated Zones of Effect	Number of zones of effect	Three (3) Zones of Effect (ZOE): Impoundment ZOE Bypass Reach ZOE Downstream ZOE See Appendix A for a depiction of Project ZOEs.	
	Upstream and downstream locations by river miles	Zone 1 Impoundment ZOE: RM 21.3 (White Hill Road Bridge) to RM 20.8 (Cavendish Dam) Zone 2 Bypass Reach ZOE: RM 20.8 (Cavendish Dam) to RM 20.5 (Cavendish powerhouse tailrace) Zone 3 Downstream ZOE: RM 20.5 (Powerhouse tailrace) to RM 12.6 (Soapstone Dam)	
	Type of waterbody (river, impoundment, by-passed reach, etc.)	According to the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory ²¹ , the Impoundment ZOE is classified as both a freshwater pond and riverine area, the	

²¹ <https://www.fws.gov/wetlands/>

Information Type	Variable Description	Response (and reference to further details)
		Bypass Reach ZOE is classified as a riverine area, and the Downstream ZOE is classified as a riverine area.
	Delimiting structures	Upstream ZOE: White Hill Road Bridge to Cavendish Dam. Bypass Reach ZOE: Dam to tailwater of powerhouse. Downstream ZOE: Powerhouse tailwater to the next dam (Soapstone Dam).
	Designated uses by state water quality agency	The Black River is designated as a Class B coldwater habitat stream for its entire length. Vermont Agency of Natural Resources (VANR) classifies the Black River from the mouth to Fellows Dam (RM 4.6) as impaired due to combined sewer outflows ²² . Class B waters of Vermont are managed to achieve and maintain a level of quality that fully supports the following designated uses: aquatic biota, wildlife, aquatic habitat, aesthetics, public water supply, irrigation of crops, swimming and other primary contact recreation, boating, fishing, and other recreational uses. ²³
Additional Contact Information	Names, addresses, phone numbers, and e-mail for local state and federal resource agencies	Please see section 4.0 for the Project Contacts Form
	Names, addresses, phone numbers, and e-mail for local non-governmental stakeholders	Please see section 4.0 for the Project Contacts Form
Photographs and Maps	Photographs of key features of the facility and each of the designated zones of effect	Please see Appendix A for photographs of key features of the facility and identification of each designated ZOE, and for project drawings.
	Maps, aerial photos, and/or plan view diagrams of facility area and river basin	Please see Appendix B for aerial photos of facility area and river basin.

²² http://dec.vermont.gov/sites/dec/files/documents/WSMD_mapp_303d_Part_A_2016_final_complete.pdf

²³ http://dec.vermont.gov/sites/dec/files/documents/WSMD_WaterQualityStandards_2014.pdf

2.0 STANDARDS MATRICES

2.1 IMPOUNDMENT ZOE

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

2.2 BYPASS REACH ZOE

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

2.3 DOWNSTREAM ZOE

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

3.0 SUPPORTING INFORMATION

3.1 ECOLOGICAL FLOWS STANDARDS: IMPOUNDMENT ZOE

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
A	1	<p><u>Not Applicable / De Minimis Effect:</u></p> <ul style="list-style-type: none">• Confirm the location of the powerhouse relative to other dam/diversion structures to establish that there are no bypassed reaches at the facility.• If Run-of-River operation, provide details on how flows, water levels, and operation are monitored to ensure such an operational mode is maintained.• In a conduit project, identify the water source and discharge points for the conduit system within which the hydropower plant is located.• For impoundment zones only, explain how fish and wildlife habitat within the zone is evaluated and managed – NOTE: this is required information, but it will not be used to determine whether the Ecological Flows criterion has been satisfied. All impoundment zones can apply Criterion A-1 to pass this criterion.

- There is no bypassed reach located within the Impoundment ZOE.
- In accordance with FERC License Article 401 and Water Quality Certificate (WQC) Condition B, the Project is operated as a run-of-river facility. When the Project is not operating, all flows are spilled from the dam.

The Project's 1995 Flow Management Plan (prescribed by WQC Condition E and License Articles 403 & 405), as approved by FERC Order dated August 17, 1995²⁴, outlines flow management for the facility. As outlined within the Plan, GMP measures the impoundment level at the Project using a pressure sensor located in a stilling well mounted between the gatehouse and the intake. A second headpond level transducer adjacent to the other system is used as a backup to the primary system. The impoundment level is monitored using the Supervisory Control and Data Acquisition (SCADA) system. GMP monitors turbine output and headpond level every 15 minutes.

Typical operation of the pond is maintained at the top of the 6-foot rubber air bag. The PLC is set to raise generation when the pond level achieves 6.13 feet and lowers generation when pond level reaches 6.01 feet²⁵.

As required by the August 17, 1995 FERC Order Modifying and Approving Flow Management Plan ordering paragraph B, the Licensee filed for Commission approval on

²⁴ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=3020479>

²⁵ GMP's equipment reads only in local feet.

November 13, 1995²⁶ and supplemented on November 4, 1996²⁷ a Flow Fluctuation Plan. As approved within the November 22, 1996 Order Approving Flow Fluctuation Reduction Plan²⁸, prior to the shutdown of 2-3 units, GMP shuts down one unit and increases fish passage flow from 10 to 20 cfs. When the increased flow in the bypassed reach enters the Project's tailwater area, approximately 45 minutes later, GMP shuts down a second unit. In an event of full station shutdown, GMP would shut down the remaining unit after an additional 45 minutes. In the event of a planned shutdown of a single unit, GMP reduces load on the operating unit by half or to the minimum load point (whichever is greater), and increase fish passage flow to 20 cfs. When the increased flow in the bypassed reach enters the Project tailwater area, GMP shuts the unit down.

- This is not a conduit project.
- The Project's run-of-river operations create a stable impoundment environment. To protect wetlands and wildlife during occasional drawdowns below the dam crest, GMP undergoes agency consultation prior to drawdowns to ensure protection of the upstream resources.
- Project operations data was provided to Vermont DEC on February 14, 2018 for verification of Project run-of-river operations and Water Quality Certificate compliance. VANR responded on May 10, 2018 and confirmed that the Project is operating in accordance with the Water Quality Certificate (Appendix C).

²⁶ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8304950>

²⁷ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=36039>

²⁸ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=10759980>

3.2 ECOLOGICAL FLOWS STANDARDS: BYPASS REACH ZOE

A	2	<p><u>Agency Recommendation (see Appendix A for definitions):</u></p> <ul style="list-style-type: none"> • Identify the proceeding and source, date, and specifics of the agency recommendation applied (NOTE: there may be more than one; identify and explain which is most environmentally stringent). • Explain the scientific or technical basis for the agency recommendation, including methods and data used. This is required regardless of whether the recommendation is or is not part of a Settlement Agreement. • Explain how the recommendation relates to agency management goals and objectives for fish and wildlife. • Explain how the recommendation provides fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow variations).
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- In accordance with FERC License Article 401 and WQC Condition B, the Project is operated as a run-of-river facility. When the Project is not operating, all flows are spilled from the dam. In accordance with License Article 402 and WQC Condition 10, GMP provides a continuous minimum flow of 10 cfs, or inflow, whichever is less, into the Black River bypassed reach via the downstream fish passage facility. This minimum flow is used to enhance the aesthetics and aquatic habitats of the Project area.
- In 1993 the Licensee conducted a habitat-based flow study in the bypassed reach. The quantity of wetted area and depth and qualitative judgements were both used to determine the suitability of the bypass reach for adult trout at 3-5, 10, 15, 20, 25, and 35 cfs flows. Study results indicate that increases in total wetted area are greatest between leakage (3-5 cfs) and 10 cfs. Between 10 and 35 cfs, the wetted area continued to increase but at a lower rate. At 10 cfs the study categorizes the pool habitat for adult trout as primarily fair. The USFWS and VANR concurred with the originally proposed 10 cfs bypass flow until a *Scapania umbrosa* flow study was completed within the bypassed reach.

In accordance with License Article 409 and WQC Condition J, the Licensee filed a *Scapania umbrosa* Study Plan (microfilm only) on April 28, 1995 and a revised plan on February 8, 1996²⁹. The revised plan was approved by FERC Order dated May 10, 1996³⁰.

As prescribed by the plan, a study was conducted for a period of 5 years to assess the impact of alternative bypass flows on the bryophyte *Scampia umbrosa*, located within the Cavendish Gorge area. Studies were completed and results conclude that higher alternative flow regimes were more detrimental than the 10 cfs minimum flow required under Article 402 and WQC Condition C. It was determined that although higher minimum flows through the gorge may be optimum for fisheries habitat, it is clear that higher flows have a major impact on the existing populations of *S. umbrosa*. In fact, higher flows were such an influence on the population that the study resulted in the complete loss of *S. umbrosa* during the study period

²⁹ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8288671>

³⁰ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=10752425>

as described within the December 22, 1999 Report³¹.

- The Cavendish Project area supports stocked and wild populations of brown and brook trout, as well as stocked populations of rainbow trout. The VANR therefore manages the Black River and Project area as coldwater fisheries habitat.
- The bypass flow of 10 cfs was recommended so to provide appropriate pool/holding habitat for adult trout occurring within the bypassed reach.
- Project operations data was provided to Vermont DEC on February 14, 2018 for verification of Project run-of-river operations and Water Quality Certificate compliance. VANR responded on May 10, 2018 and confirmed that the Project is operating in accordance with the Water Quality Certificate (Appendix C).

³¹ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8105268>

3.3 ECOLOGICAL FLOWS STANDARDS: DOWNSTREAM ZOE

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
A	2	<p><u>Agency Recommendation (see Appendix A for definitions):</u></p> <ul style="list-style-type: none"> Identify the proceeding and source, date, and specifics of the agency recommendation applied (NOTE: there may be more than one; identify and explain which is most environmentally stringent). Explain the scientific or technical basis for the agency recommendation, including methods and data used. This is required regardless of whether the recommendation is or is not part of a Settlement Agreement. Explain how the recommendation relates to agency management goals and objectives for fish and wildlife. Explain how the recommendation provides fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow variations).

- In accordance with FERC License Article 401 and WQC Condition B, the Project is operated as a run-of-river facility. When the Project is not operating, all flows are spilled from the dam. Additionally, after the installation of flashboards or after maintenance activities requiring impoundment drawdown, in accordance with WQC Condition F, GMP releases the following minimum flows downstream of the Project as the impoundment is refilled: 42 cfs or inflow from June 1 through September 30, 83 cfs from October 1 to March 31, and 332 cfs from April 1 to May 31.

Additionally, as required by the August 17, 1995 FERC Order Modifying and Approving Flow Management Plan ordering paragraph B, the Licensee filed for Commission approval on November 13, 1995³² and supplemented on November 4, 1996³³ a Flow Fluctuation Plan. As approved within the November 22, 1996 Order Approving Flow Fluctuation Reduction Plan³⁴, prior to the shutdown of 2-3 units, GMP shuts down one unit and increases fish passage flow from 10 to 20 cfs. When the increased flow in the bypassed reach enters the Project's tailwater area, approximately 45 minutes later, GMP shuts down a second unit. In an event of full station shutdown, GMP would shut down the remaining unit after an additional 45 minutes. In the event of a planned shutdown of a single unit, GMP reduces load on the operating unit by half or to the minimum load point (whichever is greater), and increase fish passage flow to 20 cfs. When the increased flow in the bypassed reach enters the Project tailwater area, GMP shuts the unit down.

- In accordance with the 1994 EA, because sewage treatment plants discharge into the Black River in the Project area, it was believed that any significant reduction in river flows during refilling (before relicensing) increased the likelihood of low DO downstream of the Project in response to elevated biological oxygen demand from sewage discharges.

Although no site-specific data was available to establish the lowest flow that would prevent water quality deterioration during refilling, the Aquatic Base Flow (ABF) was adopted by the

³² <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8304950>

³³ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=36039>

³⁴ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=10759980>

agencies as the basis for flow recommendations where site specific data was unavailable. Maintaining the ABF below the Project during impoundment refill protects against fisheries impacts and water quality degradation.

- The VANR manages the Black River and Project area as Class B waters and as coldwater fisheries habitat.
- Management of downstream flows during periods when the impoundment is being refilled, enables for a more stable impoundment level, allows for continuous river flow below the Project with less potential issues with DO and temperature downstream of the Project.
- Project operations data was provided to Vermont DEC on February 14, 2018 for verification of Project run-of-river operations and Water Quality Certificate compliance. VANR responded on May 10, 2018 and confirmed that the Project is operating in accordance with the Water Quality Certificate (Appendix C).

3.4 WATER QUALITY STANDARDS: ALL ZOES

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
B	2	<p><u>Agency Recommendation:</u></p> <ul style="list-style-type: none">• If facility is located on a Water Quality Limited river reach, provide an agency letter stating that the facility is not a cause of such limitation.• Provide a copy of the most recent Water Quality Certificate, including the date of issuance.• Identify any other agency recommendations related to water quality and explain their scientific or technical basis.• Describe all compliance activities related to the water quality related agency recommendations for the facility, including on-going monitoring, and how those are integrated into facility operations.

- The 2016 State of Vermont 303(d) List of Impaired Waters³⁵ does not identify the waters in the Project area as being impaired. However, the Vermont Department of Conservation (Vermont DEC) lists two portions of the Black River on its 2016 List of Priority Surface Waters. Both portions are a considerable distance downstream of the Project: (1) A 4.6 mile stretch from the mouth to Fellows dam on Part A for E. coli due to combined sewer overflows and (2) Stoughton Pond and North Springfield Reservoir on Part F due to flow regulation associated with Army Corps flood control operations.

In an email dated June 1, 2017, the Vermont DEC confirmed that the current operations of the Project are not contributing to the River's water quality limitations (Appendix C). Project operations data was additionally provided to Vermont DEC on February 14, 2018 for verification of Project Water Quality Certificate compliance (see Appendix C for email exchange).

- Vermont DEC issued a Project WQC on October 7, 1993 (see Appendix C for a copy of the WQC). Project operations data was provided to Vermont DEC on February 14, 2018 for verification of Project run-of-river operations and Water Quality Certificate compliance. VANR responded on May 10, 2018 and confirmed that the Project is operating in accordance with the Water Quality Certificate (Appendix C).

³⁵ http://dec.vermont.gov/sites/dec/files/documents/WSMD_mapp_303d_Part_A_2016_final_complete.pdf

3.5 UPSTREAM FISH PASSAGE STANDARDS: ALL ZOES

Presently there are no migratory species located within the vicinity of the Project. The Cavendish Project area supports stocked and wild populations of brown and brook trout, stocked populations of rainbow trout, largemouth bass, smallmouth bass, and sunfish. Although Atlantic salmon were historically stocked within the Black River under the USFWS Connecticut River Atlantic Salmon Restoration Program, the approximate 40-year stocking program ended in 2012 as poor salmon return rates persisted (USFWS 2014). On April 10, 2017, the Vermont Fish and Wildlife confirmed that there are no threatened or endangered fish species in the Black River that would be impacted by the Project (Appendix E).

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
C	1	Not Applicable/De Minimis Effect: <ul style="list-style-type: none">• The facility does not create a barrier to upstream passage, or• There are no migratory fish in the vicinity of the facility and the facility is nor the cause of extirpation of such species if they had been present historically

- FERC License Article 408 reserves the Commission's authority to require the Licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of, fishways as may be prescribed by the Secretary of the Interior under Section 18 of the Federal Power Act. There are no License or WQC provisions for upstream passage at this time.
- Historically the Black River supported anadromous Atlantic salmon populations in addition to a mixture of warm and cold water resident species. Currently there are no anadromous fish runs reaching the Cavendish Project area as downstream dams on the Black River have not been required by resource agencies to provide upstream passage facilities and because the USFWS ended their Atlantic salmon stocking efforts.
- In an email dated April 10, 2017, the Vermont Fish and Wildlife Department (VFW) confirmed there are no threatened or endangered fish species in the Black River that would be impacted by the Project (Appendix E). This is additionally confirmed in the Vermont DEC email dated June 1, 2017 (Appendix C).

3.6 DOWNSTREAM FISH PASSAGE AND PROTECTION STANDARDS: IMPOUNDMENT AND BYPASS REACH ZOES

Presently there are no migratory species located within the vicinity of the Project. The Cavendish Project area supports stocked and wild populations of brown and brook trout, stocked populations of rainbow trout, largemouth bass, smallmouth bass, and sunfish. Although Atlantic salmon were historically stocked within the Black River under the USFWS Connecticut River Atlantic Salmon Restoration Program, the approximate 40-year stocking program ended in 2012 as poor salmon return rates persisted (USFWS 2014). On April 10, 2017, the Vermont Fish and Wildlife confirmed that there are no threatened or endangered fish species in the Black River that would be impacted by the Project (Appendix E).

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
D	2	<u>Agency Recommendation:</u> <ul style="list-style-type: none"> Identify the proceeding and source, date, and specifics of the agency recommendation applied (NOTE: there may be more than one; identify and explain which is most environmentally stringent). Explain the scientific or technical basis for the agency recommendation, including methods and data used. This is required regardless of whether the recommendation is part of a Settlement Agreement or not. Describe any provisions for fish passage monitoring or effectiveness determinations that are part of the agency recommendation, and how these are being implemented.

- The Project does not pose a barrier to downstream fish passage. FERC License Articles 406 (permanent downstream fish passage facility) and 407 (fish passage plan) and WQC Condition H, require implementation, operation, and maintenance of a permanent downstream fish passage facility.

On December 14, 1994, the Licensee submitted a downstream fish passage plan, functional design drawings, and a schedule for facility construction³⁶. These plans as well as the Licensee's proposal to replace Project flashboards with a rubber dam (so to allow operation of the downstream passage facility with and without flashboards) were approved by FERC Order Amending License and Approving Plan and Schedule of Installation of Downstream Fish Passage Facility on April 4, 1995³⁷. Project fish passage and inflatable crest control construction drawings were filed with FERC on May 16, 1995³⁸. On November 6, 1995, the Licensee filed an operation and maintenance plan and a plan for evaluating the effectiveness of the downstream fish passage facility pursuant to Article 407 of the License (microfilm

³⁶ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=12797957>

³⁷ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=3009474>

³⁸ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=10546567>

only). Plans were approved by FERC Order dated December 11, 1995³⁹.

- The downstream fish passage facility consists of a transition box in the spillway adjacent to the penstock intake. Inflow to the box is controlled by a motor-operated gate, allowing variable flow between 10 - 20 cfs. Stoplogs are installed to form the back of the box to maintain a minimum water depth. Fish enter the box and pass down the spillway on a 3-foot wide chute into a 3-foot deep plunge pool, with a channel at the downstream end for flow return to the Project's bypass channel. The downstream facility is operated from April 1 to June 15 and from September 15 to November 15 for spring and fall out-migrations. During the remainder of the year, the fishway is utilized to pass the minimum flow requirement, thus making downstream fish passage available year-round.
- Because of the presence of the USFWS Atlantic salmon stocking program during Project relicensing (program was decommissioned in 2012), stocked Atlantic smolts salmon needed a way to make an outmigration past the Project. In addition to aiding the Atlantic salmon smolt passage, it was concluded that downstream passage would also benefit resident trout species.

Additionally, License Article 409 and WQC Condition I stipulated that the Project's downstream fish passage facilities be operated using 10 cfs until sufficient information is available to determine whether or not operation at flows greater than 10 cfs would be detrimental to the colonies of *Scapania umbrosa* in the Cavendish Gorge. As previously noted in the Ecological Flows Section, it was determined that although higher minimum flows through the Gorge may be optimum for fisheries habitat, it is clear that higher flows have a major impact on the existing populations of *S. umbrosa*. A minimum flow above 10 cfs has not been implemented at the facility.

- On November 6, 1995, the Licensee filed an operation and maintenance plan and a plan for evaluating the effectiveness of the downstream fish passage facility pursuant to Article 407 of the License (microfilm only). Plans were approved by FERC Order dated December 11, 1995⁴⁰. In accordance with the Study Plan, the Licensee filed Annual Effectiveness Reports for the years:
 - 1996⁴¹
 - 1997⁴²
 - 1998⁴³

A 1999 Fish Passage Summary was filed on December 27, 1999⁴⁴. Per FERC letter dated February 17, 2000⁴⁵, the Licensee filed downstream passage test results for the years 2000 and 2001⁴⁶. On April 17, 2002 (Appendix D), the USFWS provided a review of the 2000 and 2001 smolt studies. As summarized by the USFWS, the fish passage effectiveness monitoring demonstrates the facility is providing acceptably safe passage past the Project.

³⁹ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=10744588>

⁴⁰ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=10744588>

⁴¹ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=8232644>

⁴² <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=43503>

⁴³ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=8092816>

⁴⁴ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=8092816>

⁴⁵ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=8360245>

⁴⁶ <https://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=1006767>

- Per the request of Vermont DEC, GMP provided details on Project downstream fish passage operation on June 29, 2017 for agency review. The Vermont DEC's email dated July 14, 2017 confirmed understanding of downstream fishway operations (Appendix D).

3.7 DOWNSTREAM FISH PASSAGE STANDARDS: DOWNSTREAM ZOE

Presently there are no migratory species located within the vicinity of the Project. The Cavendish Project area supports stocked and wild populations of brown and brook trout, stocked populations of rainbow trout, largemouth bass, smallmouth bass, and sunfish. Although Atlantic salmon were historically stocked within the Black River under the USFWS Connecticut River Atlantic Salmon Restoration Program, the approximate 40-year stocking program ended in 2012 as poor salmon return rates persisted (USFWS 2014). On April 10, 2017, the Vermont Fish and Wildlife confirmed that there are no threatened or endangered fish species in the Black River that would be impacted by the Project (Appendix D).

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
D	1	<u>Not Applicable / De Minimis Effect:</u> <ul style="list-style-type: none">• Explain why the facility does not impose a barrier to downstream fish passage in the designated zone, considering both physical obstruction and increased mortality relative to natural downstream movement (e.g., entrainment into hydropower turbines).• For riverine fish populations that are known to move downstream, explain why the facility does not contribute adversely to the sustainability of these populations or to their access to habitat necessary for successful completion of their life cycles.• Document available fish distribution data and the lack of migratory fish species in the vicinity.• If migratory fish species have been extirpated from the area, explain why the facility is or was not the cause of this.

- There are no barriers to downstream fish passage in the Downstream ZOE. Once fish cross over the Cavendish Dam with use of the downstream facility and through the bypass reach, the fish do not have any further impediments to passage through the downstream ZOE. Once fish approach the partially breached Soapstone Dam, they are able to pass around the dam and then on to the other downstream passage facilities as provided by the rest of the Black River hydroelectric facilities.
- Although the downstream fish passage facility was mainly intended to facilitate downstream passage for stocked Atlantic salmon smolts, the USFWS stocking program for Atlantic salmon ended in 2012 (USFWS 2014). Downstream passage is currently provided to local riverine species including brown trout, brook trout, and rainbow trout that are known to utilize downstream passage facilities to access different river areas. By using the downstream fish passage facility, local riverine species are able to access new habitat that may be necessary for them to complete necessary life cycle stages. The Cavendish minimum flows are passed through the downstream fish passage facility year-round, thus making downstream fish passage to resident species available year-round.

- No recent fish population studies have been conducted within the Project vicinity. Presently, though, there are no migratory species located within the vicinity of the Project. The Cavendish Project area supports stocked and wild populations of brown and brook trout, stocked populations of rainbow trout, largemouth bass, smallmouth bass, and sunfish. Although Atlantic salmon were historically stocked within the Black River under the USFWS Connecticut River Atlantic Salmon Restoration Program. The approximate 40-year stocking program ended in 2012 as poor salmon return rates persisted.
- Historically, the Black River supported anadromous Atlantic salmon populations in addition to a mixture of warm and cold water resident species. Currently there are no anadromous fish runs reaching the Cavendish Project area as downstream dams on the Black River have not been required by resource agencies to provide upstream passage facilities and because the USFWS ended their Atlantic salmon stocking efforts.

3.8 SHORELINE AND WATERSHED PROTECTION STANDARDS: ALL ZOES

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
E	1	<p><u>Not Applicable / De Minimis Effect:</u></p> <ul style="list-style-type: none"> • If there are no lands with significant ecological value associated with the facility, document and justify this (e.g., describe the land use and land cover within the project boundary). • Document that there have been no Shoreline Management Plans or similar protection requirements for the facility.

- River right of the Cavendish Project is surrounded by natural lands included within the Proctor Piper State Forest and Hawks Mountain Wildlife Management Area while river left is a mixed-use zone containing rural housing and industrial uses. Land cover units with non-significant ecological value identified within the vicinity of the Project can be found in Table 2 (based on National Land Cover Database 2011: https://www.mrlc.gov/nlcd11_leg.php).
- There are no requirements for a buffer zone, shoreline protection fund or shoreline management plan for the Cavendish Project.

TABLE 2 PROJECT AREA LAND COVER AS CLASSIFIED BY THE NATIONAL LAND COVER DATABASE 2011

<i>Class/Value</i>	<i>Classification Description</i>
11	Open Water - areas of open water, generally with less than 25% cover of vegetation or soil.
21	Developed, Open Space - areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
22	Developed, Low Intensity - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
41	Deciduous Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
42	Evergreen Forest - areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.

<i>Class/Value</i>	<i>Classification Description</i>
43	Mixed Forest- areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
81	Pasture/Hay- areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
90	Woody Wetlands- areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
95	Emergent Herbaceous Wetlands- Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

3.9 THREATENED AND ENDANGERED SPECIES STANDARDS: ALL ZOES

Criterion	Standard	Instructions
F	2	<p><u>Finding of No Negative Effects:</u></p> <ul style="list-style-type: none"> Identify all listed species in the facility area based on current data from the appropriate state and federal natural resource management agencies. Provide documentation of a finding of no negative effect of the facility on any listed species in the area from an appropriate natural resource management agency.

- A U.S. Fish and Wildlife Information for Planning and Conservation (IPaC) Trust Resources Report was generated on January 12, 2017 for the Cavendish Project area (Appendix E). The IPaC Report identified 1 endangered species, the Northern Long-eared Bat (*Myotis septentrionalis*), and 12 migratory birds protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. All of the following birds are listed as Birds of Conservation Concern: American Bittern (*Botaurus lentiginosus*), Bald Eagle (*Haliaeetus leucocephalus*), Black-billed Cuckoo (*Coccyzus erythrophthalmus*), Blue-winged Warbler (*Vermivora pinus*), Canada Warbler (*Wilsonia Canadensis*), Olive-sided Flycatcher (*Contopus cooperi*), Peregrine Falcon (*Falco peregrinus*), Pied-billed Grebe (*Podilymbus podiceps*), Prairie Warbler (*Dendroica discolor*), Short-eared Owl (*Asio flammeus*), Willow Flycatcher (*Empidonax traillii*), and Wood Thrush (*Hylocichla mustelina*). The only year-round bird found in the project area is the Bald Eagle. All of the other 11 species are found exclusively during breeding or wintering season.

Both the Northern Long-eared Bat and Bald Eagle are state-endangered species listed under the protection of the Vermont Endangered Species Law⁴⁷.

Although the rare *Scapania umbrosa* was identified within the Cavendish Gorge during the Project's 1994 licensing process, the plant no longer exists within the Gorge due to higher Gorge flows as dictated by License Article 409 flow studies. As reported in the December 22, 1999 *S. umbrosa* Report⁴⁸, it was concluded that there are no longer any more *S. umbrosa* existent within the Gorge. Vermont Department of Fish and Wildlife's email dated March 17, 2017 confirms the extirpation of *S. umbrosa* from known areas of the Gorge (Appendix E). The March 17, 2017 email also identified two other rare mosses present within the Cavendish Gorge: *Anomobryum filiforme* and *Pseudotaxiphyllum distichaceum*. Neither the *Anomobryum filiforme* nor the *Pseudotaxiphyllum distichaceum* are identified within the 2015 Vermont list of Endangered and Threatened Plants⁴⁹. Little is known about either of these species, except that they were observed in the gorge in the vicinity of the *S. umbrosa*.

- On April 10, 2017, the Vermont Fish and Wildlife confirmed that there are no threatened or endangered aquatic animal species in the Black River that would be impacted by the Project (Appendix E). June 19, 2017 Vermont Fish and Wildlife email confirmed there are no other known occurrences of rare, threatened, and endangered wildlife species at the Project site and identified that impacts to known species are minimal, if not non-existent (Appendix E). Per

⁴⁷ <http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=268519>

⁴⁸ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8105268>

⁴⁹ <http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=229829>

Vermont DEC email dated June 1, 2017, given the water quality certification and post certification adaptive management process focused on identifying a flow regime to protect the rare *S. umbrosa* communities, it would be reasonable to assume that if the Project is operated in compliance with its water quality certification, operations would not negatively affect any of the currently listed species that may occur within the Project area (Appendix C).

- The Vermont Department of Fish and Wildlife has a recovery plan for the Bald Eagle, which was finalized in October 2010⁵⁰. The recovery plan focuses primarily on the Lake Champlain region. The current known locations of bald eagles in Vermont is limited to nesting areas on the New Hampshire side of the Connecticut River and the New York side of Lake Champlain. The Project remains outside of the recovery plan vicinity and therefore, has no specific bird-related compliance points.

⁵⁰ <http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=111337>

3.10 CULTURAL AND HISTORIC RESOURCES STANDARDS: ALL ZOES

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
G	2	<p><u>Approved Plan:</u></p> <ul style="list-style-type: none"> • Provide documentation of all approved state, provincial, federal, and recognized tribal plans for the protection, enhancement, and mitigation of impacts to cultural and historic resources affected by the facility. • Document that the facility is in compliance with all such plans.

- Per License Article 412, GMP implements provisions of the Programmatic Agreement, executed on September 8, 1994. A Cultural Resources Management Plan (CRMP) was incorporated as part of the Programmatic Agreement and was developed in consultation with the State Historic Preservation Officer (SHPO), filed with FERC on September 28, 1998⁵¹, and approved by FERC on June 21, 1999⁵².
- The CRMP identified the Project's powerhouse, dam and gatehouse as eligible for inclusion in the National Register of Historic Properties. The CRMP requires filing of an annual report on the activities conducted under the CRMP. The CRMP outlines procedures that are intended to continuously protect and maintain historic properties during the term of GMP's FERC license. The limits of the Cavendish Project, as defined in the CRMP, extend roughly 2.7 miles upstream from the dam along the Black River. The Project shoreline is monitored each year in accordance with Section 3.2.3 of the CRMP with specific attention given to locations surrounding identified and potential archaeological sites.
 - The 2012⁵³ and 2013⁵⁴ CRMP Annual Reports concluded that the Black River shorelines, within the Cavendish Project area, support a healthy riparian zone, and the archeological features within the Project are well protected and preserved. No known or potential archaeological sites were found to be threatened within the Project. The Proposed Actions for 2013 and 2014 included no new mitigation efforts aside from continuous monitoring of historical properties, including specific known sites.
 - The 2014 CRMP Annual Report⁵⁵ found that the Black River shorelines within the Cavendish Project area support a healthy riparian zone, and the archeological features within the Project are well protected and preserved. No known or potential archaeological sites are threatened within the Project. The Proposed Actions for 2015 included no new mitigation efforts aside from continuous monitoring of historical properties, including specific known sites. Given the lack of potential threats to the preservation of historical properties within the project area, GMP requested that monitoring and reporting be reduced to a frequency of every three years with Vermont SHPO approval. On January 5, 2015, FERC issued a letter to GMP stating that any change to the annual monitoring schedule would require an amendment to the CRMP and Programmatic Agreement and would require Commission approval. FERC also noted that the 2014 CRMP Annual

⁵¹ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=79809>

⁵² <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=10838006>

⁵³ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13146226>

⁵⁴ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13386971>

⁵⁵ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13682483>

Report was not filed on the anniversary date of the license, but rather several days later on November 12, 2014.

- The 2015 CRMP Annual Report⁵⁶ found that the Black River shorelines within the Cavendish Project area support a healthy riparian zone, and the archeological features within the Project are well protected and preserved. No known or potential archaeological sites are threatened within the Project. The Proposed Actions for 2016 again requested that monitoring and reporting be reduced to a frequency of every three years with Vermont SHPO approval. GMP requested VT SHPO to allow the decrease, however, with no official approval from the VT SHPO, GMP continues to monitor the Project annually and submit the CRMP Annual Report on the anniversary of the License issuance.
- On November 2, 2016, GMP filed the CRMP Annual Report⁵⁷ again requesting that monitoring and reporting be reduced to a frequency of every three years with Vermont SHPO approval. The September 3, 2016 annual inspection of the shoreline showed no new changes to the shoreline or known historic properties. The riparian zone was found to be healthy around the shoreline and archaeological sites were well protected and preserved. The Proposed Actions for 2017 included no new mitigation efforts aside from continuous monitoring of historical properties, including specific known sites. FERC acknowledged the filing but reminded GMP that they must have approval from Vermont SHPO.
- On October 31, 2017, GMP filed the CRMP Annual Report⁵⁸. No notable changes to the Project shorelines or to the known historic properties within the Cavendish impoundment have been observed since the 2016 inspection. The Report states that the Cavendish Project shorelines support a healthy riparian zone, and the archaeological Fitton Mill Complex continues to be well protected and preserved. No known or potential archaeological historic properties are currently threatened within the Project. The Report again requested that monitoring and reporting be reduced to a frequency of every three years with Vermont SHPO approval.
- On Behalf of GMP, Kleinschmidt Associates sent an email on April 13, 2017 to the Vermont Division for Historic Preservation, inquiring as to whether the recommended altered three-year reporting timeline would be approved by the Division within the next five years (Appendix F). No response has been received from the SHPO regarding the timeline. GMP plans to continue conducting Annual CRMP Reports unless it hears differently from Vermont SHPO.
- In addition to fulfilling annual CRMP Report requirements, GMP works collaboratively with local organizations as facility tours are desired. In July 2013, the Cavendish Historical Society along with GMP hosted a tour of the Fitton Mill and the Cavendish Hydroelectric Project, with archaeologist Charity Baker. The tour included a walk-through of the powerhouse, a tour of the dam, and a discussion of station history. Approximately 20 participants joined the free walking tour. Historical documents, maps and photographs were

⁵⁶ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=14037605>

⁵⁷ <https://elibrary.ferc.gov/IDMWS/common/OpenNat.asp?fileID=14390704>

⁵⁸ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14746169>

presented and compared with existing conditions at the site.⁵⁹ GMP continues to work collaboratively with interested local organizations.

⁵⁹ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13386971>

3.11 RECREATIONAL RESOURCES STANDARDS: IMPOUNDMENT ZOE

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
H	2	<p><u>Agency Recommendation:</u></p> <ul style="list-style-type: none"> • Document any comprehensive resource agency recommendations and enforceable recreation plan that is in place for recreational access or accommodations. • Document that the facility is in compliance with all such recommendations and plans.

- In accordance with License Article 413 and WQC Conditions M and N, GMP provides a canoe take-out with platform and portage trail with directional signs in the Impoundment ZOE.
- In accordance with License Article 413 and WQC Conditions M and N, GMP has developed a Recreation Plan so to allow continued public access at the Project. On May 1, 1995 GMP filed the Project Recreation Plan (microfilm only), a revised sign layout plan was filed on October 13, 1995 (microfilm only), and FERC approved of the Plan on May 2, 1995⁶⁰. On July 10, 2000 the Licensee reported installation of and enhancements made to recreation facilities as required at the Project under Article 413⁶¹. On September 22, 2000, FERC acknowledged the completion of these projects and required no further information⁶².

On December 14, 2015 FERC filed a letter so to confirm Commission approved recreation facilities that exist/are required at the Project⁶³. The December 14 letter provided a draft recreation facilities and recreation amenities table for GMP review. FERC letter dated November 10, 2016, details GMP's confirmation of facilities and details the finalized amenities table⁶⁴.

- On January 27, 2014, FERC issued a notice to remind GMP of the License obligation to file a Form 80 for the period of March 15, 2014 to April 1, 2015⁶⁵. On April 1, 2015, GMP filed the FERC Form 80⁶⁶.

⁶⁰ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8393113>

⁶¹ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8428950>

⁶² <http://lowimpacthydro.org/wp-content/uploads/2012/11/Cavendish-FERC-Letter-of-Acceptance-CRMP-and-Recreation-Fi.pdf>

⁶³ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=14070315>

⁶⁴ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14396185>

⁶⁵ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13446378>

⁶⁶ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13826261>

3.12 RECREATIONAL RESOURCES STANDARDS: BYPASS REACH ZOE

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
H	2	<p><u>Agency Recommendation:</u></p> <ul style="list-style-type: none"> • Document any comprehensive resource agency recommendations and enforceable recreation plan that is in place for recreational access or accommodations. • Document that the facility is in compliance with all such recommendations and plans.

- In accordance with License Article 413 and WQC Conditions M and N, GMP provides a canoe portage trail with directional signs, 1 picnic area including a handicapped accessible table, and 8 parking spaces including a handicapped accessible space in the Bypass Reach ZOE.
- In accordance with License Article 413 and WQC Conditions M and N, GMP has developed a Recreation Plan so to allow continued public access at the Project. On May 1, 1995 GMP filed the Project Recreation Plan (microfilm only), a revised sign layout plan was filed on October 13, 1995 (microfilm only), and FERC approved of the Plan on May 2, 1995⁶⁷. On July 10, 2000 the Licensee reported installation of and enhancements made to recreation facilities as required at the Project under Article 413⁶⁸. On September 22, 2000, FERC acknowledged the completion of these projects and required no further information⁶⁹.

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- On January 27, 2014, FERC issued a notice to remind GMP of the License obligation to file a Form 80 for the period of March 15, 2014 to April 1, 2015⁷². On April 1, 2015, GMP filed the FERC Form 80⁷³.

⁶⁷ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8393113>

⁶⁸ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8044945>

⁶⁹ <http://lowimpacthydro.org/wp-content/uploads/2012/11/Cavendish-FERC-Letter-of-Acceptance-CRMP-and-Recreation-Fi.pdf>

⁷⁰ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=14070315>

⁷¹ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14396185>

⁷² <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13446378>

⁷³ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13826261>

3.13 RECREATIONAL RESOURCES STANDARDS: DOWNSTREAM ZOE

<i>Criterion</i>	<i>Standard</i>	<i>Instructions</i>
H	2	<p><u>Agency Recommendation:</u></p> <ul style="list-style-type: none"> • Document any comprehensive resource agency recommendations and enforceable recreation plan that is in place for recreational access or accommodations. • Document that the facility is in compliance with all such recommendations and plans.

- In accordance with License Article 413 and WQC Conditions M and N, GMP provides a canoe portage trail with directional signs, a portage put-in, a bank fishing site, and 1 overlook and 1 interpretative display in the Downstream ZOE.
- In accordance with License Article 413 and WQC Conditions M and N, GMP has developed a Recreation Plan so to allow continued public access at the Project. On May 1, 1995 GMP filed the Project Recreation Plan (microfilm only), a revised sign layout plan was filed on October 13, 1995 (microfilm only), and FERC approved of the Plan on May 2, 1995⁷⁴. On July 10, 2000 the Licensee reported installation of and enhancements made to recreation facilities as required at the Project under Article 413⁷⁵. On September 22, 2000, FERC acknowledged the completion of these projects and required no further information⁷⁶.

On December 14, 2015 FERC filed a letter so to confirm Commission approved recreation facilities that exist/are required at the Project⁷⁷. The December 14 letter provided a draft recreation facilities and recreation amenities table for GMP review. FERC letter dated November 10, 2016, details GMP's confirmation of facilities and details the finalized amenities table⁷⁸.

- On January 27, 2014, FERC issued a notice to remind GMP of the License obligation to file a Form 80 for the period of March 15, 2014 to April 1, 2015⁷⁹. On April 1, 2015, GMP filed the FERC Form 80⁸⁰.

⁷⁴ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8393113>

⁷⁵ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=8428950>

⁷⁶ <http://lowimpacthydro.org/wp-content/uploads/2012/11/Cavendish-FERC-Letter-of-Acceptance-CRMP-and-Recreation-Fi.pdf>

⁷⁷ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=14070315>

⁷⁸ <https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14396185>

⁷⁹ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13446378>

⁸⁰ <http://elibrary.ferc.gov/IDMWS/common/opennat.asp?fileID=13826261>

4.0 CONTACTS FORMS

Project Owner:	
Name and Title	Jason Lisai, Generation Manager
Company	Green Mountain Power Corporation
Phone	(802) 655-8723
Email Address	Jason.Lisai@greenmountainpower.com
Mailing Address	163 Acorn Lane, Colchester, Vermont 05446
Consulting Firm / Agent for LIHI Program (if different from above):	
Name and Title	Andy Qua and Katie Sellers
Company	Kleinschmidt Associates
Phone	(207) 416-1246; 207-416-1218
Email Address	Andrew.Qua@KleinschmidtGroup.com , Katie.Sellers@KleinschmidtGroup.com
Mailing Address	P.O. Box 650, Pittsfield, Maine 04967
Compliance Contact (responsible for LIHI Program requirements):	
Name and Title	John Greenan, Environmental Engineer
Company	Green Mountain Power Corporation
Phone	(802) 770-3213
Email Address	John.Greenan@greenmountainpower.com
Mailing Address	2152 Post Road, Rutland, Vermont 05701
Party responsible for accounts payable:	
Name and Title	John Greenan, Environmental Engineer
Company	Green Mountain Power Company
Phone	(802) 770-3213
Email Address	John.Greenan@greenmountainpower.com ; invoices@greenmountainpower.com
Mailing Address	Accounts Payable Processor, 2152 Post Road, Rutland, Vermont 05701

Agency Contact (Check area of responsibility: Flows <input checked="" type="checkbox"/> , Water Quality <input checked="" type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input checked="" type="checkbox"/> , T/E Spp. <input checked="" type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input 2"="" checked="" type="checkbox/>):</td> </tr> <tr> <td>Agency Name</td> <td>Vermont Department of Environmental Conservation</td> </tr> <tr> <td>Name and Title</td> <td>Jeff Crocker, Streamflow Protection Coordinator</td> </tr> <tr> <td>Phone</td> <td>802-490-6151</td> </tr> <tr> <td>Email address</td> <td>jeff.crocker@vermont.gov</td> </tr> <tr> <td>Mailing Address</td> <td>Watershed Management Division, Main Building - 2<sup>nd</sup> Floor, One National Life Drive, Montpelier, VT 05620</td> </tr> <tr> <td colspan="/> Agency Contact (Check area of responsibility: Flows <input checked="" type="checkbox"/> , Water Quality <input checked="" type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input checked="" type="checkbox"/> , T/E Spp. <input checked="" type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input checked="" type="checkbox"/>):	
Agency Name	Vermont Department of Environmental Conservation
Name and Title	Eric Davis, River Ecologist
Phone	802-490-6180
Email address	eric.davis@vermont.gov
Mailing Address	Watershed Management Division, Main Building - 2 nd Floor, One National Life Drive, Montpelier, VT 05620
Agency Contact (Check area of responsibility: Flows <input type="checkbox"/> , Water Quality <input type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input type="checkbox"/> , T/E Spp. <input type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input type="checkbox"/>):	
Agency Name	Vermont Fish and Wildlife Department
Name and Title	Bob Popp, Department Botanist
Phone	802-476-0127
Email address	bob.popp@vermont.gov
Mailing Address	5 Perry Street, Suite 40, Barre, VT 05641

Agency Contact (Check area of responsibility: Flows <input type="checkbox"/> , Water Quality <input type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input type="checkbox"/> , T/E Spp. <input type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input type="checkbox"/>):	
Agency Name	Vermont Fish and Wildlife Department
Name and Title	Lee Simard, Fisheries Biologist
Phone	802-622-4017
Email address	lee.simard@vermont.gov
Mailing Address	100 Mineral Street, Suite 302, Springfield, VT 05156

Agency Contact (Check area of responsibility: Flows <input type="checkbox"/> , Water Quality <input type="checkbox"/> , Fish/Wildlife Resources <input type="checkbox"/> , Watersheds <input type="checkbox"/> , T/E Spp. <input checked="" type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input type="checkbox"/>):	
Agency Name	Vermont Division for Historic Preservation
Name and Title	Scott Dillon, Survey Archaeologist
Phone	802-272-7358
Email address	Scott.Dillon@vermont.gov
Mailing Address	One National Life Drive Deane C. Davis Building, 6th Floor Montpelier, VT 05620-0501

Agency Contact (Check area of responsibility: Flows <input type="checkbox"/> , Water Quality <input type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input checked="" type="checkbox"/> , T/E Spp. <input type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input type="checkbox"/>):	
Agency Name	Vermont Fish and Wildlife Department
Name and Title	Tim Appleton
Phone	802-476-0198
Email address	Tim.Appleton@vermont.gov
Mailing Address	5 Perry Street Suite 40 Barre, VT 05641-4266

Agency Contact (Check area of responsibility: Flows <input type="checkbox"/> , Water Quality <input type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input type="checkbox"/> , T/E Spp. <input checked="" type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input type="checkbox"/>):	
Agency Name	U.S. Fish and Wildlife
Name and Title	Melissa Grader, Federal Activities
Phone	413-548-8002
Email address	Melissa_Grader@fws.gov
Mailing Address	300 Westgate Center Drive, Hadley, MA 01035

Agency Contact (Check area of responsibility: Flows <input type="checkbox"/> , Water Quality <input type="checkbox"/> , Fish/Wildlife Resources <input checked="" type="checkbox"/> , Watersheds <input type="checkbox"/> , T/E Spp. <input checked="" type="checkbox"/> , Cultural/Historic Resources <input type="checkbox"/> , Recreation <input type="checkbox"/>):	
Agency Name	U.S. fish and Wildlife Service
Name and Title	Brett Towler, Hydraulic Engineer
Phone	413-253-8727
Email address	Brett_Towler@fws.gov
Mailing Address	300 Westgate Center Drive, Hadley, MA 01035

5.0 SWORN STATEMENT

Sworn Statement and Waiver Form

All applications for LIHI Certification must include the following sworn statement before they can be reviewed by LIHI:

SWORN STATEMENT

As an Authorized Representative of Green Mountain Power Corporation, the Undersigned attests that the material presented in the application is true and complete.

The Undersigned acknowledges that the primary goal of the Low Impact Hydropower Institute's Certification Program is public benefit, and that the LIHI Governing Board and its agents are not responsible for financial or other private consequences of its certification decisions.

The undersigned further acknowledges that if certification of the applying facility is issued, the LIHI Certification Mark License Agreement must be executed prior to marketing the electricity product as LIHI Certified.

The undersigned Applicant further agrees to hold the Low Impact Hydropower Institute, the Governing Board and its agents harmless for any decision rendered on this or other applications, from any consequences of disclosing or publishing any submitted certification application materials to the public, or on any other action pursuant to the Low Impact Hydropower Institute's Certification Program.

PLEASE INSERT ONLY FOR PRE-OPERATIONAL CERTIFICATIONS (See Section 4.5.3):

For applications for pre-operational certification of a "new" facility the applicant must also acknowledge that the Institute may suspend or revoke the certification should the impacts of the project, once operational, fail to comply with the certification criteria.

Company Name: Green Mountain Power Corporation (CANEV DISK)

Authorize Representative Name: John Greenan

Title: Environmental Engineer

Authorized Signature: John C. Greenan

Date: 7 MAY 18

6.0 REFERENCES

- U.S. Fish and Wildlife Service (USFWS). 2014. Service Ends Rearing Atlantic Salmon for Connecticut River, Will Focus on Other Species. Richard Cronin National Salmon Station. January 6, 2014. Accessed January 4, 2017. <https://www.fws.gov/cronin/>
- Vermont Agency of Natural Resources. Basin 10 - Basin Planning for the Watersheds Drained by the Black & Ottauquechee Rivers Department of Environmental Conservation. August 05, 2012. Accessed December 15, 2016. <http://dec.vermont.gov/watershed/map/basin-planning/basin10>
- Vermont Agency of Natural Resources. Black River Watershed Updated Water Quality/Aquatic Habitat Assessment Report Including direct tribs to Connecticut River Mill Brook, Blood Brook, Spencer Brook. June 2016. Accessed December 15, 2016. http://dec.vermont.gov/sites/dec/files/documents/wsmd_mapp_basin10_black_river_assessment_report_2016.pdf

APPENDIX A

PROJECT ZOES, PHOTOS, & DRAWINGS

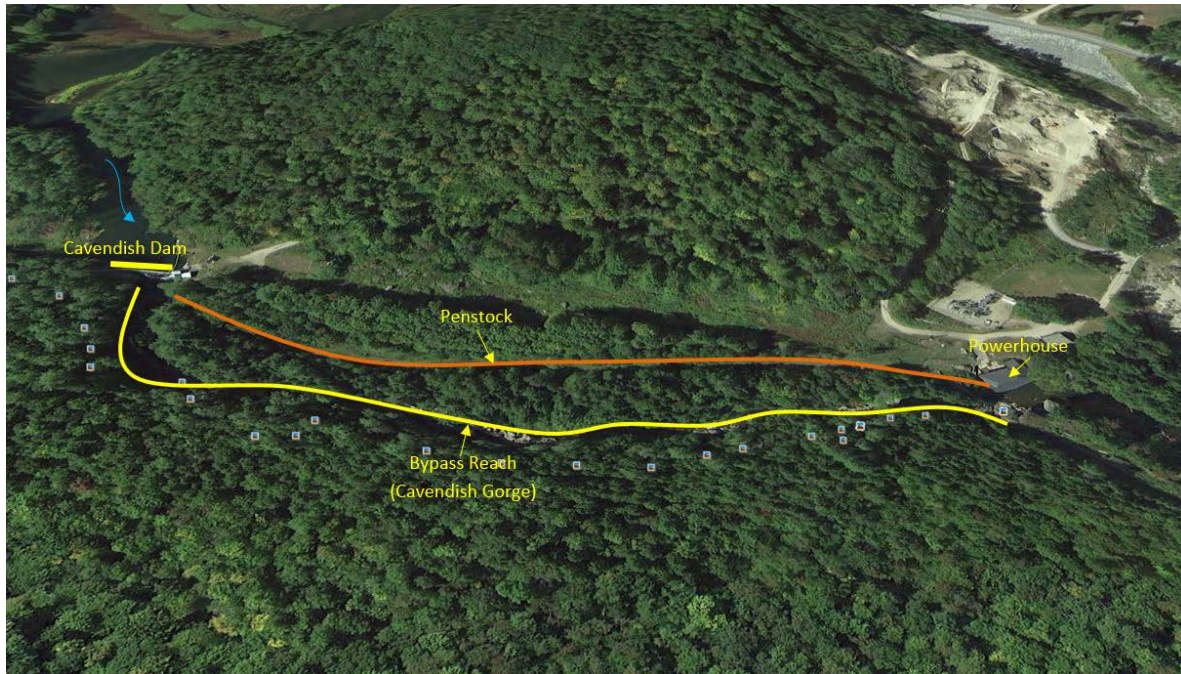


FIGURE 2 AERIAL PHOTO OF PROJECT FEATURES

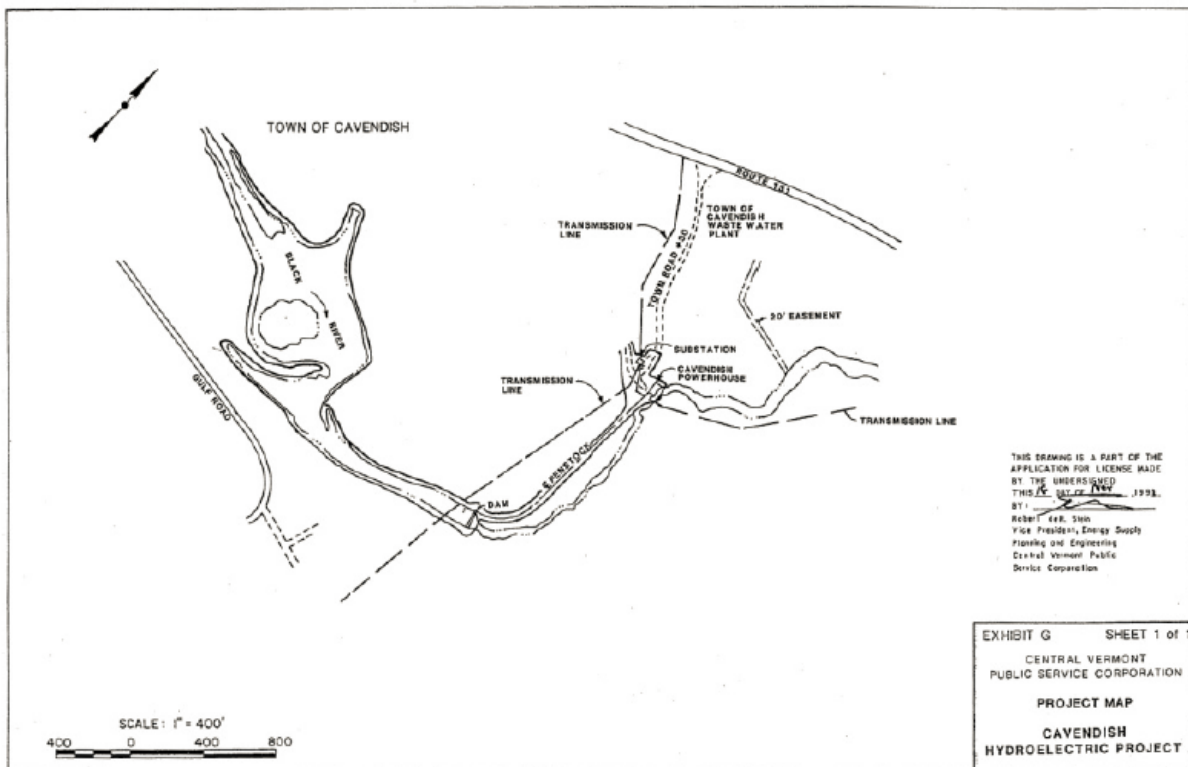


FIGURE 3 CAVENDISH PROJECT OVERVIEW

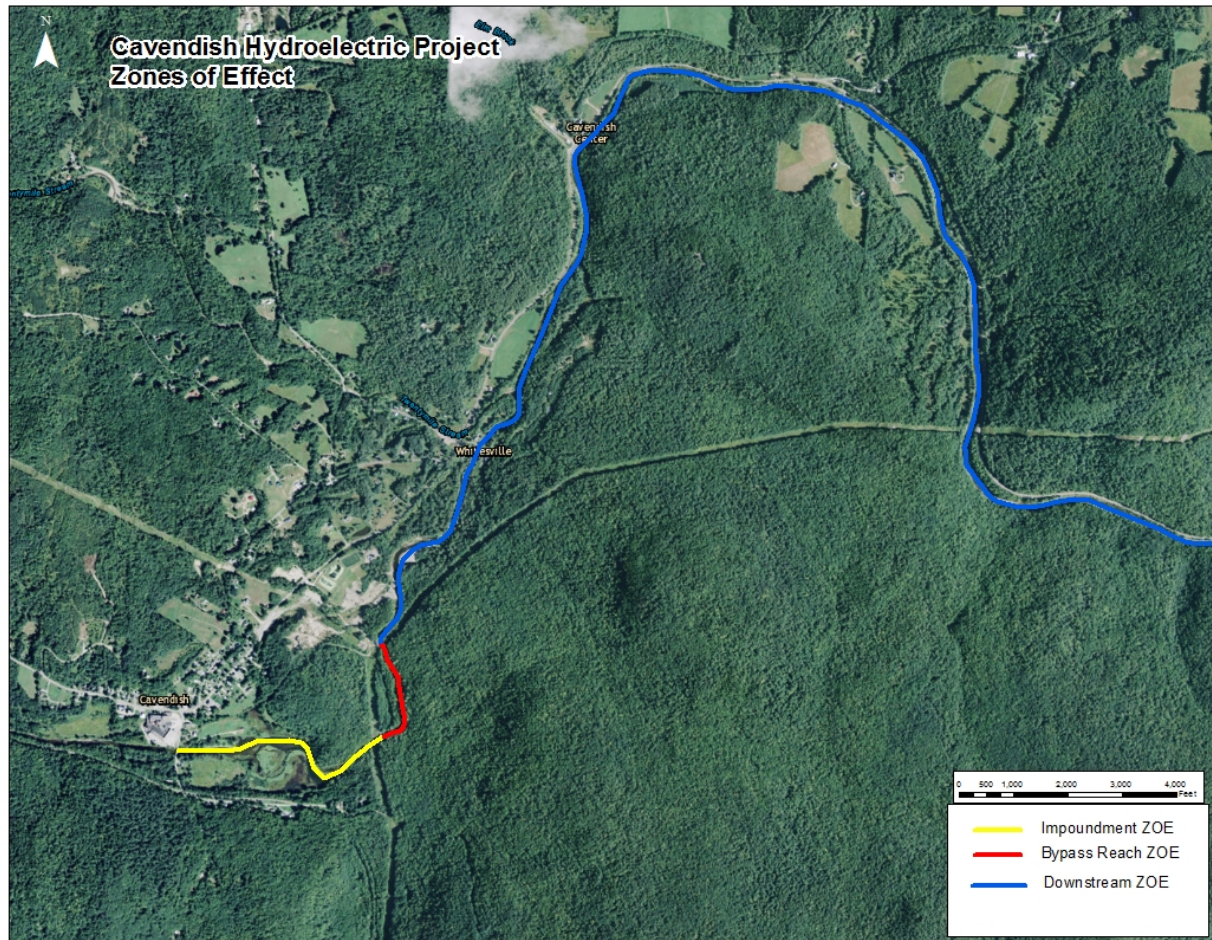


FIGURE 4 CAVENDISH HYDROELECTRIC PROJECT ZONES OF EFFECT

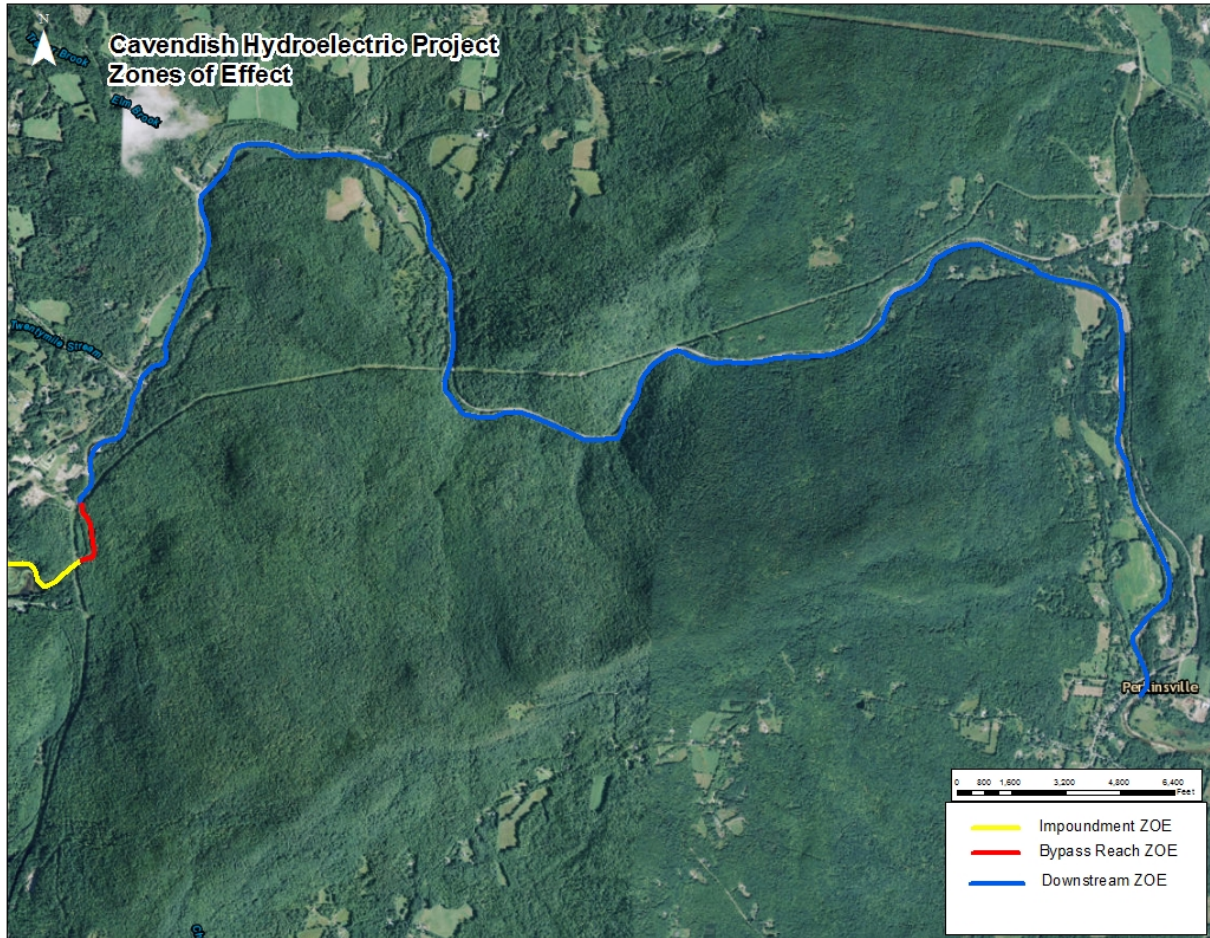


FIGURE 5 CAVENDISH HYDROELECTRIC PROJECT ZONES OF EFFECT CONT.

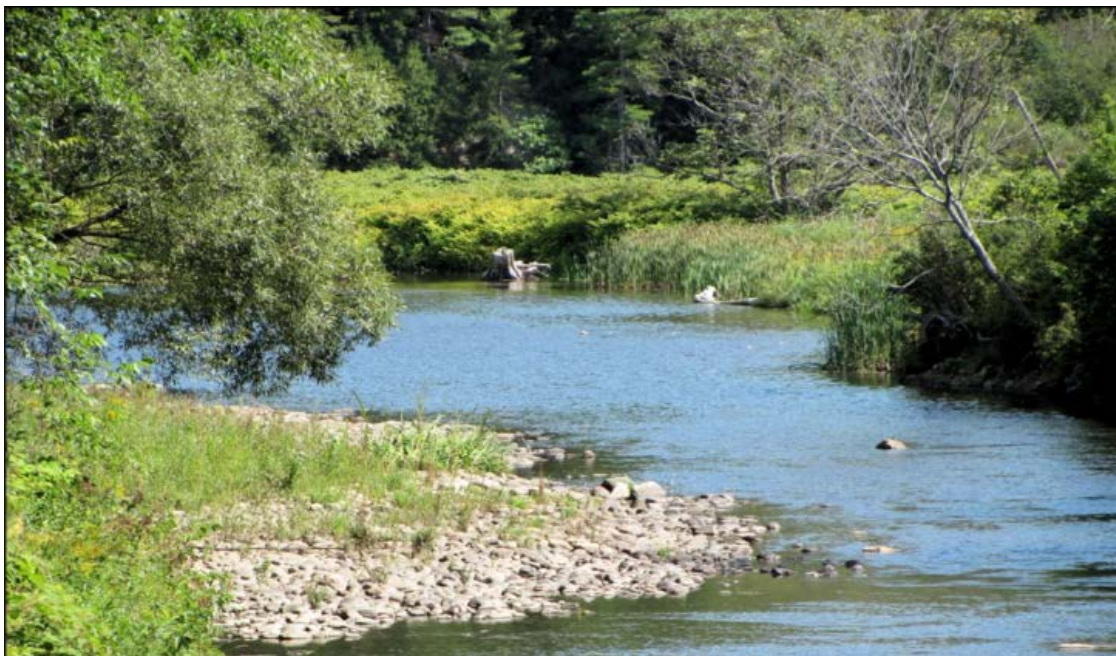


FIGURE 6 UPPER END OF PROJECT SHORELINE, LOOKING DOWNSTREAM TO THE EAST



FIGURE 7 LOOKING WEST, UPSTREAM, FROM FITTON MILL COMPLEX



FIGURE 8 CAVENDISH DAM



FIGURE 9 CAVENDISH GORGE



FIGURE 10 GLACIER POTHOLES WITHIN BYPASS REACH



FIGURE 11 CAVENDISH PROJECT POWERHOUSE



FIGURE 12 CAVENDISH POWERHOUSE AND TURBINE GENERATOR UNITS



FIGURE 13 CAVENDISH POWERHOUSE CONTROLS



FIGURE 14 VIEW OF THE POWERHOUSE FROM THE PORTAGE PATH BELOW THE CAVENDISH GORGE

APPENDIX B

AERIAL PHOTOS OF FACILITY AREA AND RIVER BASIN

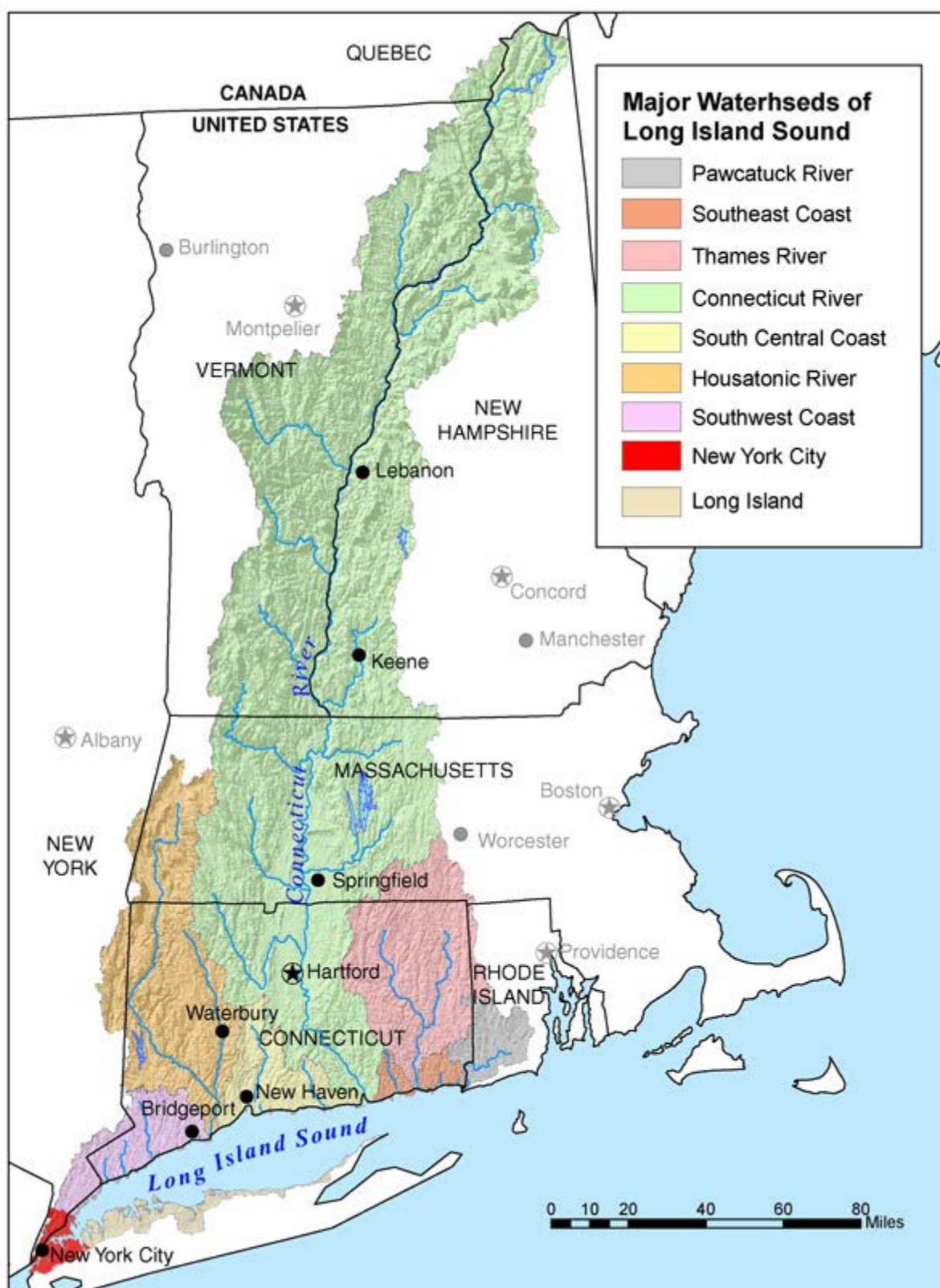


FIGURE 15 CONNECTICUT RIVER DRAINAGE BASIN

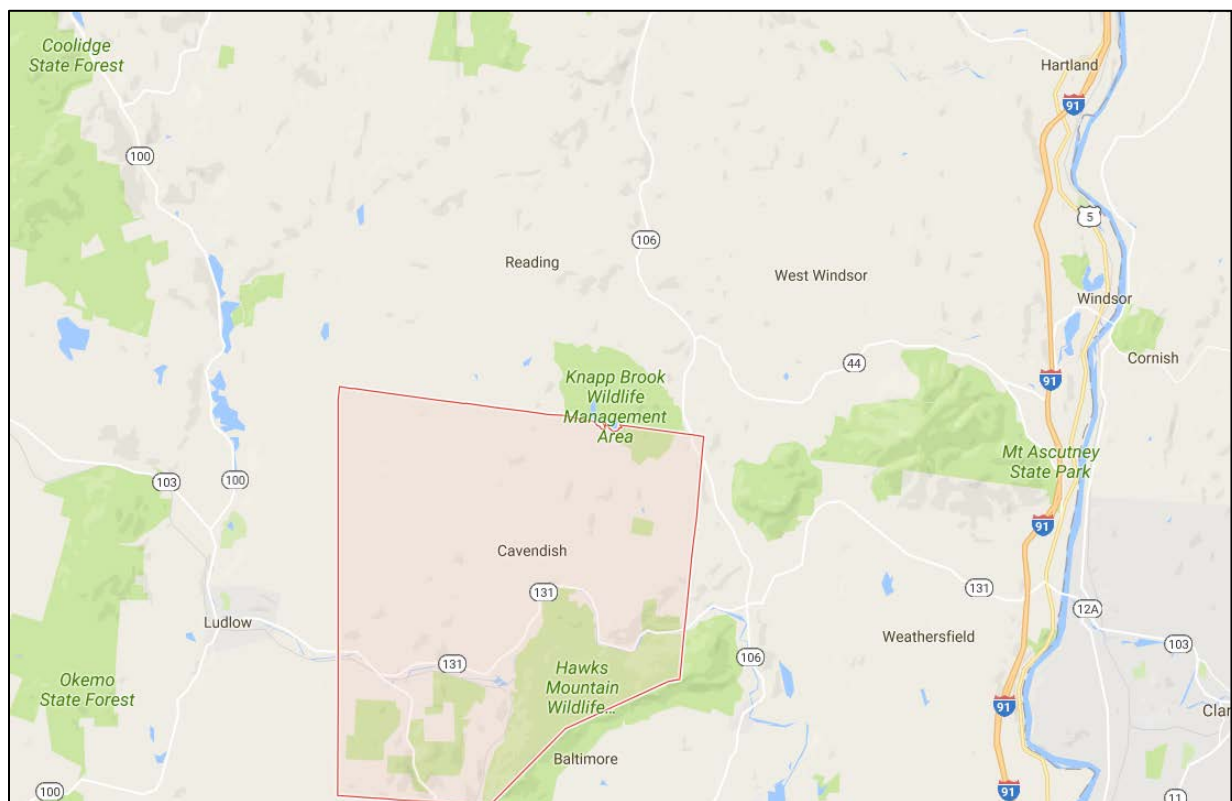


FIGURE 16 GEOGRAPHIC OVERVIEW OF CAVENDISH PROJECT LOCATION

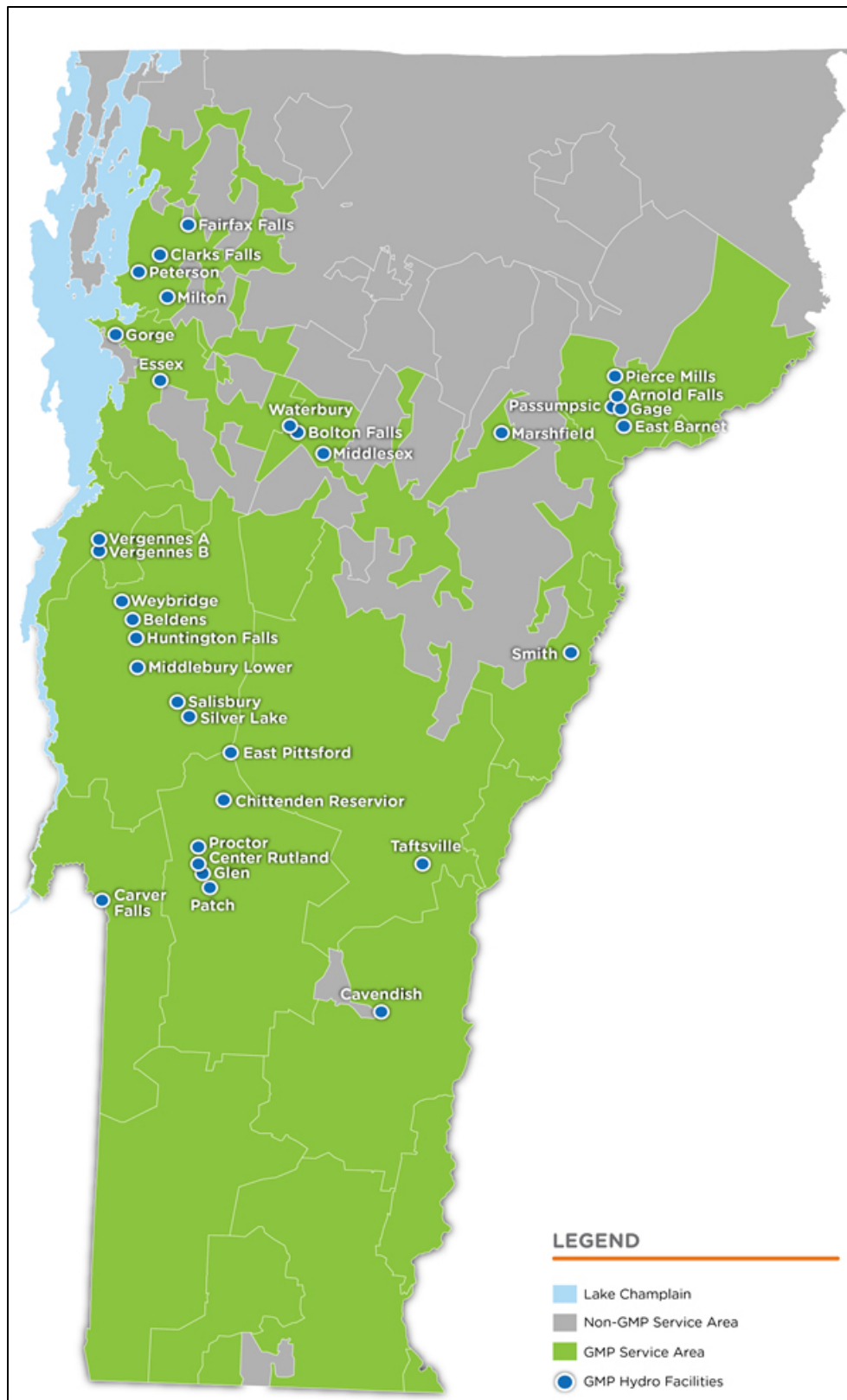


FIGURE 17 CAVENDISH HYDROELECTRIC PROJECT RELATION TO OTHER GMP HYDRO FACILITIES

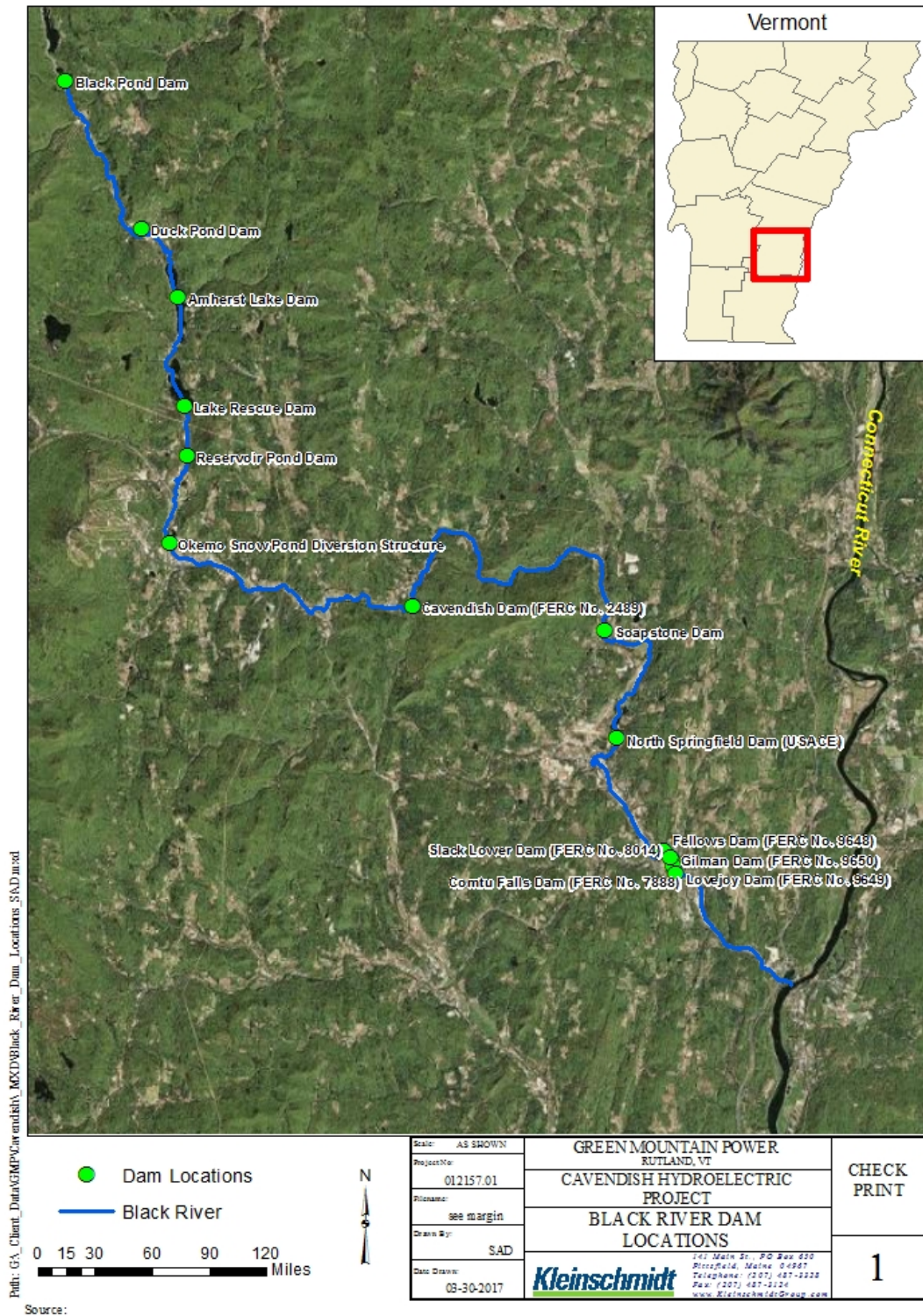


FIGURE 18 BLACK RIVER DAM LOCATIONS

APPENDIX C

WATER QUALITY

Water Quality Certification
(P.L. 92-500, Section 401)

In the matter of: Central Vermont Public Service
 Corporation
 77 Grove Street
 Rutland, Vermont 05701

APPLICATION FOR THE CAVENDISH
HYDROELECTRIC PROJECT

The Water Quality Division of the Vermont Department of Environmental Conservation (the Department) has reviewed a water quality certification application dated October 8, 1992 and filed by Central Vermont Public Service Corporation (the applicant). This application has been supplemented by a copy of the Federal Energy Regulatory Commission (FERC) license application filed with the FERC on December 31, 1991 and subsequent submittals from the applicant, including an August 1993 Additional Information Request (AIR) response to FERC. The Department, based on the application and record before it, makes the following findings and conclusions:

I. Background/General Setting

1. The applicant has applied to the FERC for relicensure of the Cavendish Hydroelectric Project located on the Black River at river mile 20.8 approximately one mile downstream of the village of Cavendish.
2. The Black River, a tributary to the Connecticut River, originates at the outlet of Black Pond in the Town of Plymouth. The Black River drains a total area of 202 square miles in Rutland and Windsor Counties. The main stem is approximately 38 miles long, from its source to its confluence with the Connecticut River. The valley of the Black River is generally narrow with the surrounding drainage composed of hilly and mountainous terrain.
3. The upper reaches of the basin are forested and support a wide range of recreational activities that are important to the local economy. The village of Cavendish, located upstream of the Cavendish impoundment, historically was a manufacturing community and some of the mill buildings that remain continue in industrial use.

Springfield, downriver of the project, is the largest community in the basin. It is primarily a manufacturing center for the machine tool industry.

4. The Cavendish Project is the most upstream hydroelectric facility on the river and the only one that is utility owned. Several facilities have been privately developed downstream in Springfield during the last decade: Fellows, Gilman (construction commenced in fall 1992), Comtu Falls, Slack Dam, and Lovejoy.
5. The Cavendish hydroelectric facility was originally developed by the Claremont Power Company and began operation in 1907.
6. Three municipal wastewater treatment facilities discharge to the Black River. The Ludlow treatment facility is located five miles upstream of the Cavendish Project and has a design discharge of 600,000 gpd. Downstream facilities include Cavendish, which discharges to the Black River 800 feet below the project at a 100,000 gpd design, and Springfield which discharges just downstream of Springfield village at a 2.2 mgd design.

II. Project and Civil Works

7. The dam is founded on rock and consists of two sections of overflow spillway. The north section is 90 feet long, and the crest elevation 878.13 feet (msl) is 25 feet above the lowest foundation level. The south section is 21 feet long and includes a 6-foot pier that separates the north and south section of the dam. The crest elevation of the south section of the dam is 881.63 feet (msl) and is only about two feet above the bedrock foundation. The north section of the dam is fitted with 6-foot high, hinged flashboards. The flashboards on the south section are 2.5 feet high and are designed to fail during periods of high flow. The normal headwater elevation is 884.13 feet (msl), and the normal tailwater elevation is 764.6 feet (msl), providing a gross head of 120 feet.
8. The impoundment has a surface area of 10 acres, a useable storage capacity of 800,000 cubic feet

(three-foot drawdown), and a normal backwater influence of 3,000 feet.

9. The concrete intake structure is located on the north bank and serves as the north abutment of the dam. The intake configuration consists of a submerged entrance set parallel to the flow of the river, manually operated headgates, and an inclined trashrack.
10. A power tunnel parallel to the river carries the plant flow 180 feet from the intake to the penstock. The 6-foot diameter penstock is 1,250 feet long. A penstock manifold located adjacent to the powerhouse divides the flow and distributes it to the turbines.
11. The powerhouse contains three horizontal-shaft Francis turbines, manufactured by the Pelton Water Wheel Company. The turbines are coupled to two 520 kw generators and one 400 kw generator. The units have adjustable wicket gates operated by a headwater float control or remote control from the applicant's dispatch office. Except for routine monitoring, inspection, and maintenance, the plant operates automatically and unattended.
12. The estimated average annual generation is 6,108,500 kwh based on the last twenty years of record.
13. The powerhouse substation is located adjacent to the access road almost directly across from the entrance to the powerhouse. The existing substation includes a 3-way transformer which steps up the voltage from 11 kv to 12.5 kv and 44 kv for distribution.

III. Flow Regime

14. The project hydraulic capacity is 19 cfs to 226 cfs.
15. The drainage area at the dam is 83 square miles. A gaging station has been operated by the U.S. Geological Survey on the Black River at North Springfield since October 1929. The drainage area at the gage is 158 square miles. Several of the flow parameters for the project have been estimated using the gage data and are shown in the

following table. Some parameters may be influenced by the artificial flow regulation caused by the Cavendish Project and the U.S. Corps of Engineers flood control reservoir at North Springfield. The 7Q10 estimate is based on the flow record preceding the construction of North Springfield Reservoir (November 1960).

Parameter	Value
Mean runoff	154 cfs (25.27 in/yr)
7Q10	9 cfs
95% Exceedance	16 cfs
50% Exceedance	72 cfs
10% Exceedance	370 cfs

16. Present operation is as a daily peaking plant with headpond drawdown from storage of 3.0 feet.
17. The applicant proposes to operate the project in a true run-of-the-river mode and maintain the impoundment level one foot (plus or minus six inches) below the top of the flashboards, except during periods of flooding and emergency local energy demand. A true run-of-river project is one which does not operate out of storage and, therefore, does not artificially regulate streamflows below the project's powerhouse. Outflow from the project is equal to inflow to the project's impoundment on an instantaneous basis. The flow regime below the project will essentially be the river's natural regime, except under special circumstances, such as following the reinstallation of flashboards and project shutdowns.
18. Routine monitoring, inspection and maintenance will continue as in the past. The plant will operate in a semi-automatic and unattended mode. The project would operate with all three units as inflows allow. As inflows to the project's impoundment diminish, a flow sensor will adjust load between the units. As flows continue to recede, two of the units would sequentially be removed from the line leaving only the most efficient turbine generator unit on line. This

turbine would also eventually be removed from service when river flows became less than the minimum operating point of 19 cfs. The applicant states that all river flow would then pass over the boards and downstream.

19. Under the applicant's operating proposal, a lag time will occur between turbine shutdown and restoration of natural flows below the powerhouse. The lag time would be a function of 1) the time required to fill the storage between the operating level and the dam surcharge necessary to spill at the reservoir inflow rate and 2) the travel time for the spillage flow to reach the project tailrace. The time alone required to refill the impoundment when the plant shuts down under low flow is over seven hours. During the lag time, below-project flows would be substantially curtailed. The applicant proposes no means of resolving this issue for all incidents, purportedly because it would occur infrequently (letter from applicant to Department, July 17, 1993). The Department reviewed streamflow records collected at the Ayers Brook gage in Randolph to estimate how frequently the transition from generation to no generation would occur as a result of low natural flows. Based on water years 1987 to 1991, the lag time and consequent flow interruption would occur 0 to 9 times per year.
20. According to September 16, 1993 comments filed by the applicant in response to the draft certification notice, a small stoplog section at the dam is removed, prior to an intentional shutdown, to release flows into the bypass. This dam release is maintained until bypass flows stabilize at the project tailrace at which point the gates to the turbines are closed and flows through the powerhouse cease. With a full pond, the applicant reports that this release equates to about 15 cfs; this is somewhat less than the 19 cfs minimum capacity of a project turbine. The applicant estimates that it takes approximately 40 to 50 minutes for the 15 cfs release to stabilize at the powerhouse. At impoundment levels less than full pond, the release through the stoplog section would be less, and the time it would take for releases at the dam to stabilize at the powerhouse would be longer. This special

operating protocol somewhat reduces the number of flow interruptions that occur.

21. No special protocols are in place or proposed to offset flow interruptions that result from non-intentional plant shutdowns.
22. The hinged flashboards are frequently dropped to reduce the upstream effect of the dam on flooding due to storm events or snowmelt runoff. The decision to lower the flashboards is based on the judgement of the operator and central dispatch, taking into consideration river conditions at the time and forecasted weather. Of the 18 panels, six to eight are usually lowered. After highwater, flashboards are typically reset when the water recedes to a two-to-four-foot surcharge over the dam crest.

With the impoundment operating level set at one foot below the top of the boards, highwater events and flashboard management would result in a one to three foot drawdown of the impoundment. However, under some circumstances, greater drawdowns to below the dam crest are effected in order to insure worker safety. An example is when ice is moving in the river. (letter from applicant to Department, July 17, 1993)

23. The following table indicates the applicant-estimated frequency that the flashboards are dropped as a result of highwater events:

Period	Frequency (no. events)
November - February	1-2
March - April	10-12
May	3-4
June - August	0-1
September - October	2-3

24. The applicant states that below-project flow is not an issue when the flashboards are reset as the project is typically operating under a full load (226 cfs, or 2.7 csm) during that time. Also, the

applicant estimates that the flow through one downed panel at two feet of head is 50 cfs. A release of 276 cfs is well above the summer aquatic base flow of 0.5 csm prescribed by the U.S. Fish and Wildlife Service Flow Recommendation Policy for the New England Area (USF&WS Flow Policy) and the Agency of Natural Resources Interim Procedure for Determining Acceptable Minimum Stream Flows, July 1993 (Agency Flow Procedure). Brown and rainbow trout may spawn in the mainstem of the Black River below the project. The USF&WS Flow Policy and Agency Flow Procedure prescribe 1.0 csm for the fall/winter period and 4.0 csm for the spring period to protect spawning and incubation. The release of 226 cfs is higher than the fall/winter prescription but lower than the spring prescription.

25. The Cavendish station supplies up to 70% of the local load under emergency conditions, using up to five feet of the storage capacity in the impoundment. These events occur on a less than annual basis, but can result in extensive dewatering upstream.
26. The applicant proposes to continue the existing method of flashboard operation.
27. The project automation (SCADA) system has an accuracy of ± 1.0 inch, and will be set to the fixed level of one foot below the top of the flashboards. Occasional use of manual control due to SCADA loss would result in a six inch fluctuation in impoundment levels; the applicant estimates that the SCADA system would be non-functional for two or three events a year on the average, and the events would last less than an hour.

IV. Bypass

28. The bypassed stream section is 1,570 feet in length, and is a natural feature named the Cavendish Gorge. The gorge is a beautiful natural resource of high local, regional, and statewide importance. The historical operating mode of the project virtually dewateres the gorge for much of the year.

29. The Agency publication The Waterfalls, Cascades, and Gorges of Vermont (1985) describes the gorge as a large beautifully sculptured gorge with pools and cascades:

Visually it is a striking place; the rocks and the mosses are beautiful, the water is clean, and there are high walls and handsome pools. You cannot hear cars from the gorge, and because it is narrow and winding you have a strong sense of privacy and isolation. A lovely and satisfying place and in good condition. (pages 219-220)

The report describes the gorge as averaging 50-100 feet wide at the base with slanting or shear rock walls from 50-80 feet high. The rock is a hard quartzite schist with garnets and quartz veins and is mapped as Cambrian Hoosic schist on the "Centennial Geologic Map of Vermont". The rock does not contain limestone. There are boulders 10 to 20 feet high in the stream channel, and many of these have potholes cut into them in the lower part of the gorge. Some are cut almost entirely away.

30. The channel consists of a series of cascades or chutes linking pools of various sizes. The largest and finest of these is about 70 feet by 40 feet with a depth of nine feet at low water. There are no sand and gravel deposits at the base of the walls, and no areas that support woody plants. Because of the lack of soil, all of the vascular plants in the gorge are confined to ledge tops and cracks in the walls. Large areas of the walls are covered with mosses and liverworts. (ibid)
31. In the lowest third of the bypass, the pools are connected by channel sections that are best characterized as riffles.
32. According to its response to FERC AIR No. 3 (August 1993), the applicant proposes to release 10 cfs into the bypass continuously from April 15 to October 31. During the remainder of the year, except when inflows either are too low for operation or exceed project capacity, the bypass would be subject to leakage flow conditions. (Leakage is supplemented by a very small amount of direct drainage.) Leakage flows are estimated by the applicant to be 3 to 5 cfs, although leakage

was measured at 2.3 cfs just before a special study in 1993.

V. Standards Designation

33. The Black River is designated as Class B waters for its full length. Recent legislation eliminated Class C zones and substituted waste management zones in Class B waters. The 16.5 mile reach of the river from the northern limits of Ludlow Village to the North Branch in Weathersfield is a waste management zone that receives the discharges from the Ludlow and Cavendish municipal wastewater treatment facilities. The Water Resources Board has designated the entire Black River as cold water fisheries habitat.

The lengths of waste management zones are being reviewed by the Department and will be reset based on rules to be promulgated by the Water Resources Board. The Agency plans to reset waste management zones for streams at the time discharge permits for treatment facilities located on those streams come up for renewal. The existing discharge permits for the Ludlow and Cavendish facilities are up for renewal in September 1996.

34. Class B stream reaches are managed to achieve and maintain a high level of quality compatible with certain beneficial values and uses. Values are high quality habitat for aquatic biota, fish and wildlife and a water quality that consistently exhibits good aesthetic value; uses are public water supply with filtration and disinfection, irrigation and other agricultural uses, swimming, and recreation. (Standards, Section 3-03)
35. Waste management zones, although Class B waters, present an increased level of health risk to contact recreational users due to the discharge of treated sanitary wastewater.
36. The project reach is a substantial distance below the Ludlow municipal facility outfall. Dieoff of pathogenic organisms over the section of river from the outfall to the head of the project impoundment minimizes the risk to contact recreationalists using the project reach. The project reach will probably be removed from the

waste management zone. (pers. comm. Peter LaFlamme, Agency Water Quality Engineer)

37. The dissolved oxygen standards for cold water habitat streams are 6 mg/l or 70 percent saturation, unless higher concentrations are imposed for areas that serve as salmonid spawning or nursery areas important to the establishment or maintenance of the fishery resource. The temperature standard limits increases from background to 1.0°F. (Standards, Section 3-01(B)) The turbidity standard is 10 ntu. (Standards, Section 3-03(B))
38. Under the general water quality criteria, all waters, except mixing zones, are managed to achieve, as instream conditions, aquatic habitat with "[n]o change from background conditions that would have an undue adverse effect on the composition of the aquatic biota, the physical or chemical nature of the substrate or the species composition or propagation of fishes." (Standards, Section 3-01(B)(5))
39. Section 2-02 Hydrology of the Vermont Water Quality Standards requires that "[the] flow of waters shall not be controlled or substantially influenced by man-made structures or devices in a manner that would result in an undue adverse effect on any existing use, beneficial value or use or result in a level of water quality that does not comply with these rules." The project dam is a man-made structure that artificially regulates streamflow.

VI. Water Quality

a. Chemical

40. The applicant collected temperature and dissolved oxygen data in 1986 and 1988 under the project's cycling mode of operation. The applicant then collected data under run-of-river conditions in June and August 1991 to evaluate the expected water quality effects of the project in the proposed operational mode. In 1989, an independent fisheries enhancement study was initiated by the applicant. Water temperature was monitored continuously during the summer of 1989 as part of this study.

41. The application indicates temperature data collection in August 1989 revealed that the impoundment thermally stratifies during the summer months. At a location 200 feet upstream of the dam, an 8° F difference was recorded between the surface temperature and bottom temperature.
42. The Department collected temperature and dissolved oxygen data in 1986 under run-of-river flows at stations above and below the project to evaluate conditions under summer low flows.
43. Data collected over the 1986-1991 period indicates the influence of algal activity on dissolved oxygen concentrations in the project's impoundment. Critical summer low flow conditions did not occur during the majority of the sampling days, the lowest flow sampled being 16 cfs (roughly twice 7Q10).
44. On July 15 and July 16, 1993, the applicant performed an around-the-clock study of dissolved oxygen and temperature conditions in the bypassed reach pursuant to a FERC additional information study request. Samples were collected at the project intake, directly below the dam, and just upstream of the powerhouse. Total river flow was estimated at 15 to 25 cfs during the study.

Surface samples taken at the intake station were at or above saturation throughout the sampling day, even in the nighttime, when deficits are usually expected due to algal respiration. Some samples directly below the dam exhibited dissolved oxygen concentrations that were less than saturation, but characteristically lower in temperature. This may be attributable to the source of the leakage being from groundwater or seepage from greater reservoir depths, although some samples were supersaturated like the impoundment surface samples. Water at the lowest station displayed cooler temperatures of as much as 2°C. All samples were well above minimum dissolved oxygen standards.

45. The applicant indicates that the impoundment becomes thermally stratified under summer low flow conditions. The project intake is located at a reservoir depth of about 25 to 28 feet. Because the penstock and turbines convey water in a closed

system, the water is not exposed to the atmosphere and reaerated. The powerhouse discharges water that is equivalent in dissolved oxygen concentration to the concentration that exists at the intake. Should substandard conditions occur in the reservoir, these conditions would be passed downstream.

46. Water spilled at the dam benefits from reaeration at the dam and through the gorge. It is likely that the water would rapidly attain saturated concentrations. This water would mix with the turbine discharge and result in an increased concentration of oxygen downstream in the zone affected by the Cavendish wastewater treatment facility discharge.
47. The applicant proposes to maintain a 10 cfs bypass release during the critical summer water quality period (the months of June through October). This flow is slightly higher than the 7Q10 drought flow condition (9 cfs) at the project. Spillage of 10 cfs during operation can reasonably be expected to maintain dissolved oxygen standards below the project, after mixing with the turbine discharge. Further, when flows recede to 29 cfs (the minimum plant capacity of 19 cfs plus the dam release), the project would suspend operation in order to maintain the run-of-the-river conditions, and all inflows would be released at the dam. Consequently, under summer low flow conditions, all flows would be released at the dam and benefit from reaeration.
48. Details on how the water would be released at the dam have not been provided. The design for the release mechanism may affect the efficiency of reaeration and the temperature of the water.
49. The conversion of the project to a true run-of-river facility is expected to improve water quality below the project, as downstream flows will no longer be subject to peaking flows and artificial drought conditions.
50. The shallow, wide impoundment causes an increase in water temperature over what would have naturally occurred; however, an impoundment or reservoir is considered a "natural" condition once constructed, for the purposes of Standards review.

Although data is limited, the low elevation of the intake probably draws water that is lower in temperature than water at the surface of the impoundment. Water discharged at the dam benefits from the cooling that occurs through the gorge, as shown by the 1993 study. Run-of-river conditions will prevent elevated temperatures attributable to unnaturally low flows downstream of the project.

51. Because natural river flows will be continuously available downstream, the impact of the project on concentrations or levels of the following parameters will not be significant:

Phosphorus
Nitrates
Settleable, floating or suspended solids
Oil, grease, and scum
Alkalinity
pH
Toxics
Turbidity
Escherichia coli
Color
Taste and odor

b. Aquatic Biota

52. Aquatic biota are defined in Standards Section 1-01(B) as "organisms that spend all or part of their life cycle in or on the water." Included, for example, are fish, aquatic insects, amphibians, and some reptiles, such as turtles.
53. Game species including brown, rainbow and brook trout, northern pike, large and smallmouth bass, and walleye are found in the Black River basin. The Black River mainstem supports wild populations of brown and brook trout.
54. The application indicates that the mainstem cannot be classified as a trout stream because of excessive summer water temperatures. Although Agency biologists as recently as 1976 believed that this was the case, the Agency now believes that the regulation of the river, with its consequent elevated water temperatures and reduced flows, was the dominant factor impacting the

density of the trout population. (August 12, 1991
Agency letter to applicant)

Below Project

55. Flows below the tailrace will essentially be unregulated. This proposed flow regime will optimize conditions for fish life downstream of the project powerhouse.
56. The station's deep water intake and use of this cooler water for the discharge at the tailrace, combined with a true run-of-river operating mode, will reduce high summer water temperatures in the Black River when the station is operating.
57. Artificial flow regulation below the tailrace is anticipated to occur during impoundment refilling following flashboard reinstallation. The applicant proposes to release half of inflows during the refill period. Artificial flow regulation below the tailrace will also occur as a result of lag time.
58. The USF&WS Flow Policy and the Agency Flow Procedure prescribe minimum flows for the perpetuation of indigenous fish species. The minimums are 4.0 csm for spring spawning and incubation, 1.0 for fall/winter spawning and incubation, and 0.5 csm for the remaining period and in cases where there is no use for spawning and incubation. When instantaneous inflows are less than these values, the inflow must be passed. At the Cavendish Project, these values are 332 cfs (4.0 csm), 83 cfs (1.0 csm), and 42 cfs (0.5 csm). Reduction of flows substantially below these minimums for the purpose of refilling the impoundment may imperil fish below the project.
59. Continuous release of the USF&WS flows or 90% of inflows, where the inflow is less than the USF&WS flow, would protect downstream fish and other aquatic organisms during the refill period.

Bypass (Cavendish Gorge)

60. The primary value of the fish habitat in the gorge is holding cover with little or no spawning use expected. Pool habitat exists at frequent intervals throughout the entire bypass reach. The

lower third of this reach has pools which are accessible to trout present in the river below the powerhouse, provided adequate flow is maintained through the riffles that connect pools in this reach. The upper two thirds of the bypass provide habitat for fish that enter the bypass via downstream movement from above the dam.

61. The applicant, with Agency participation, conducted a flow demonstration of the project bypass on December 13, 1990. Observed flows were 10, 20, 25, and 35 cfs; these flows included dam leakage. At 10 cfs, pool habitats appeared very calm with a slightly perceptible laminar flow on the water surface, or an almost stagnant quality. At a flow release of 20 cfs, surface turbulence increased only very slightly. Water depth increased 2 to 3 inches. The third flow release, 35 cfs, created a noticeable change in the character of the pools. Water depth increased several inches and the flow through the pools was distinct. The upper end of the pools in association with cascades was turbulent, but not excessive, and the pool water surface was obviously laminar and rippled. The final test involved backing off from 35 cfs to 25 cfs. The character of the pools at 25 cfs was hardly distinguishable to the eye from conditions under the higher 35 cfs flow.

Based on this demonstration, a flow range of 25 to 35 cfs provides conditions in the bypass most suitable to trout. Aeration and the exchange rate in the pools is adequate, and the degree of surface turbulence provides an additional element of fish cover without being excessive. Water velocities may approach the upper limit for trout at flows much in excess of 35 cfs. (Department of Fish and Wildlife memorandum from Kenneth Cox to Roderick Wentworth, December 28, 1990) The applicant's consultant categorized the fisheries habitat as "excellent" when flows were increased to the 20 to 25 cfs range. The consultant's opinion was that a flow of 10 cfs provided "less than optimal" habitat and that a flow of 13 to 16 cfs provided reasonable turnover of pools, adequate pool volumes, and a significant improvement over the 10 cfs condition. (letter of February 22, 1991 from Aquatec Inc. to the applicant)

62. Aquatic insects are an important component of the food chain and a primary food source for fish. With sufficient flow, the gorge reach provides habitat that supports use by aquatic insects (macroinvertebrates).
63. The applicant's proposed bypass flow regime, a seasonal release of 10 cfs, would not restore fish habitat quality in the 1,570-foot section of river. Upstream and downstream fish movement through the bypass would continue to be restricted; the quality of the pool habitat as holding cover would be poor; and no flow would be provided for over-wintering fish, insect life, and other aquatic organisms.
64. The USF&WS Flow Policy prescribes 0.5 csm, the regional average August median flow, as the flow standard for protection of indigenous fish species where higher flows are not warranted to protect spawning and incubation. The August median flow at the Cavendish site, based on the regional average, is 42 cfs. The Agency Flow Procedure states that bypass minimum streamflows at hydroelectric projects shall be set based on case-specific analysis of the bypass's potential or existing uses and values, but that prescribed flows shall generally be no less than 7Q10 in order to protect dissolved oxygen levels and aquatic habitat.
65. A spillage flow in the bypass reach of 25 cfs, or instantaneous inflow, if less, would be sufficient to support fish residence in the riffle and pool habitats; enable upstream and downstream fish movement; and provide habitat for macroinvertebrates. Year-round minimum flows set at less than 25 cfs, but greater than 3 cfs, would result in sub-optimal habitat conditions but constitute an improvement over present leakage conditions.

Impoundment

66. Fisheries habitat that was formerly riverine (lotic) has been transformed into lacustrine habitat due to the impounding of water by the dam. The quality of the impoundment as lacustrine habitat is poor. The impoundment depths are

shallow, except at the dam, relative to natural lakes and ponds, and retention times short.

67. By letter dated August 3, 1990, the Agency requested bathymetric information for the impoundment in order to study habitat availability and wetland conditions at different impoundment levels and the effects of drawdowns. As the applicant failed to furnish the bathymetric information, the assessment of project impacts on river habitat and wetlands is difficult.
68. Flashboard collapse causes dewatering of the riparian-zone habitat. Fish and other aquatic organisms that use the impoundment are subject to stranding or freezing when major drawdowns occur.

Fish Passage

69. A Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River Basin (1982) identifies the Black River as potential non-natal smolt production habitat for stocking consideration at such time in the future that the program's hatchery fry production capacity expands to meet the needs of non-natal streams. The plan estimates that there are 2,700 units (one unit = 100 sq. yards) of salmon nursery habitat upstream of the project. The Black River was stocked with 23,124 salmon fry on July 1, 1993, distributed in the 4.6 mile reach directly upstream of the project impoundment. The fry were surplus stock from the White River National Fish Hatchery. Under the plan, the river was tentatively scheduled to be stocked with 90,000 parr this fall; however, the number may be reduced somewhat due to the fry stocking. Present plans are to continue fry stocking above the project on an annual basis, barring hatchery catastrophes such as disease problems. Most salmon stocked as fry emigrate from river systems two years following stocking. (March 25, 1993 and May 14, 1993 memorandums from Roderick Wentworth, Department of Fish and Wildlife to Laurence Becker, Water Quality Division; July 1, 1993 memorandum from District Biologist James McMenemy to Roderick Wentworth)
70. Operational downstream passage facilities for Atlantic salmon will be necessary at the project

by the spring of 1995. Passage facilities should include structures or devices to safely convey fish downstream of the dam. This may include screening to minimize entrainment and impingement and a conveyance conduit. Standard design for downstream passage facilities utilize operating flows equivalent to 2% of the plant hydraulic capacity, or the flow through a 3x2 foot rectangular weir, whichever is greater. For this project, the flow need would equate to about 20 to 25 cfs. It will be necessary to operate these facilities continuously during the period April 1 - June 15 and September 15 - November 15. These periods are subject to adjustment based on knowledge gained about migration periods for salmon in the Connecticut River basin. (March 25, 1993 and May 14, 1993 memorandums from Roderick Wentworth, Department of Fish and Wildlife to Laurence Becker, Water Quality Division)

71. The applicant has agreed to provide downstream passage if the river upstream is used for annual stocking in accordance with a revised restoration plan. (license application, Page E-53)
72. The Strategic Plan was last revised in September 1982 and is presently being revised once again.
73. By letter dated September 7, 1993, the USF&WS required the installation and operation of downstream passage facilities at the project.

General

74. The applicant's consultant, Aquatec, studied the macroinvertebrate population at stations in the bypass and downstream. Aquatec classifies the water quality below Cavendish station as "good" based on the biotic index (BI) value of 2.3.
75. The mean EPT value and community richness values (biological indicators of water quality) for the site are in the "good" range. The BI value is a 2.25, indicating good water quality exists at the site in terms of organic enrichment. The EPT/Chiro ratio (4.86) shows that the sensitive EPT orders outnumber the tolerant Chironomidae family four to one. The percent composition of the major orders show the Ephemeroptera, Trichoptera and Coleoptera to dominate the stream

community. The functional groups within the community are dominated by the scraper group, with all groups being represented. The scraper group dominance probably means non-filamentous diatom/green algae is a primary food source in the stream. The collector/filterer groups are not overly dominant indicating that these generalist-type feeding strategies are not well represented, depressing community functional diversity. (May 3, 1991 memorandum to the record from Steven Fiske, Water Quality Division)

76. Aquatec sampled a pool station in the bypass. The numbers and diversity of macroinvertebrates were reduced from the values sampled in the below-project riffle. This may be more attributable to the difference in physical habitat type than the lack of sufficient bypass flows. The riffle in the lower end of the gorge above the plant was not sampled. Had it been sampled, the data collected could have been compared to the downstream riffle data in order to evaluate the impact of reduced flows on macroinvertebrate productivity.
77. An increase in minimum flows in the bypass and the resultant expansion of constantly wetted streambed would substantially improve the macroinvertebrate productivity of the bypass riffle habitat.
78. The biological integrity below the Cavendish facility was good in 1990. The data are illustrative of conditions that existed during a year when run-of-the-river flows predominated and thus represent the potential of the biological community in the Black River.
79. The river water quality and institution of a true run-of-river flow regime with continuous spillage will protect the biological integrity in the Black River below the Cavendish facility, including macroinvertebrates, fish, and other aquatic organisms.
80. Prescription of an appropriate minimum flow for the bypass is important to project economics. AIR No. 3(c) relates to the cost of alternative minimum streamflow releases into the bypass. Table 2 of the August 1993 filing indicates the production losses associated with special releases from 10 to 35 cfs. The releases are in addition

to the 4 cfs leakage flow. A continuous special release of 21 cfs (25 cfs total) would reduce project output by about 942 mwh, or 15% of the average annual energy output, for the 30-year term of the federal license; a special release of 10 cfs year round, would result in about a 300 mwh, or 5%, reduction in output. The applicant indicates that the production loss for its proposal would be 270 mwh; however, this estimate is actually for a 10 cfs special release in addition to the 4 cfs leakage.

81. The water use as proposed, with the imposition of special conditions related to operating level, and release of minimum flows, will not impair the viability of the existing population of aquatic biota and fish. The use will neither significantly impair growth or reproduction nor cause an alteration of the habitat which impairs the viability of the existing population.

c. Wildlife and Wetlands

82. Vermont Water Quality Standards requires the Agency Secretary to identify and protect existing uses of state waters. Existing uses to be considered include wetland habitats and wildlife that utilize the waterbody. Class II wetlands exist within the influence of the dam backwater zone.
83. An area of meadows is located approximately 1,400 feet upstream of the Cavendish Dam where conditions are favorable to the development of emergent wetlands. Much of the wetland complex is a shallow marsh dominated by cattail, great bulrush, and other graminoids. Some aquatics such as pickerelweed and water-plantain occur as well. These areas are continuously inundated except during periods of downed flashboards, when they may become dewatered.

Large open meadows very thickly vegetated with Joe-Pye weed, Virgin's bower, reed-canary grass and brambles are raised slightly above the shallow marsh on old river terraces and are perhaps inundated occasionally. Only a few specimens of purple loosestrife, a nuisance aquatic plant, are found. Alder thickets in the old river channels

and backwaters contain herbaceous plants in openings which are flooded on an annual basis.

84. A true run-of-river operation will, in part, eliminate several environmental concerns associated with impoundment water level fluctuations, including wildlife. However, the loss of flashboards and their anticipatory lowering prior to flood events remains a serious concern. (reference Finding 22) Lowering the pond elevation would have a detrimental effect on fish and wildlife residing in the pond or using the upstream wetland during critical seasons of the year, such as times of fish spawning and incubation, waterfowl nesting, and periods of hibernation of reptiles and amphibians.

Regarding wetland vegetation, flashboard loss could result in the dewatering of root stocks. Winter drawdowns expose rootstocks of perennial plant species in the drawdown zone to freezing conditions which prevent the further establishment of certain species. Winter drawdowns can also cause "freeze-outs" of hibernating amphibians and wintering aquatic furbearers and drawdowns during the spring and early summer can cause loss of cover and increased predation of young waterfowl broods.

85. The applicant notes concerns about herptile hibernacula in the application. A single loss of the boards during the December-to-March period could be sufficient to cause mortality to hibernating species.
86. Reducing the frequency of flashboard collapse and resultant lowering of impoundment levels, particularly in the winter months, would increase the functional value of impoundment wetlands, especially for wildlife habitat, shoreline stabilization, and food chain production.
87. To maximize wildlife utilization of emergent wetland habitat in the impoundment during the summer months, the applicant originally proposed to maintain the impoundment six inches below the top of the boards during the period June 1 - October 1. From October 2 to May 31, the impoundment would be maintained at a lower level, one foot from the top of the boards, to prevent an

ice cap that could prevent lowering of boards during a flood event. Because of the Agency's interest in stable water levels, the proposal was modified to maintain the impoundment at the minus one foot level year round.

88. Many herps begin selection of hibernacula during September, and therefore, would not be served by reduced impoundment levels in the winter months. (January 29, 1991 letter from Jim DiStefano, Department of Fish and Wildlife to Jeff Wallin)
89. A constant year round water level will protect the wetland and the wildlife that utilize the water body.
90. Institution of a run-of-the-river operating mode will protect downstream wetlands that may exist and wetlands present in the backwater zone.
91. Wildlife that use the riparian zone and river will be better supported by the improved operating regime. Typical wildlife would include furbearers such as otter, beaver, muskrat, mink, and deer and birds such as kingfisher, herons, ducks, and osprey.
92. The water use as proposed, with the conditions imposed below, will not impair the viability of the existing population of wildlife. The use will neither significantly impair growth or reproduction nor cause an alteration of the habitat which impairs the viability of the existing population.

**d. Rare and Endangered Plants and Animals;
Outstanding Natural Communities**

93. On May 28, 1991, the applicant conducted a study to assess the impact of variable flows on the bryophyte communities at Cavendish Gorge. The results of this study are presented in a report "The Impact of Variable Flows on Bryophyte Communities at Cavendish Gorge, Cavendish, Vermont" (Cyrus B. McQueen, with addendum, no date). Four sites of bryophyte communities near the current water level along the west side of the gorge were examined. These communities were selected for study based on their accessibility;

the applicant did not attempt to inventory the full extent of bryophytes in the gorge.

The four sites examined included a rare boreal species known as Scapania umbrosa. One site was found to be located within a few inches of the water surface. The other three sites, downstream from the first, contained Scapania umbrosa (one site with two colonies of plants more than 12 inches above the current water level).

94. The extent of inundation of the four bryophyte sites was observed at flows of 10.5 cfs, 14.5 cfs and 29.5 cfs. The first site with Scapania umbrosa was submerged by about 6.5 inches of water at 10.5 cfs, 10 inches at 14.5 cfs, and 15 inches at 29.5 cfs. The latter flow was observed to be more turbulent. This site is in a narrower portion of the gorge compared to the other sites. The applicant concludes that the bryophytes at this site, and particularly the Scapania umbrosa, would not survive a year round flow of 29.5 cfs. The other three sites were not submerged at any of the flows observed.
95. FERC requested, through FERC AIR No. 9, an inventory and further evaluation of the impact of minimum flows on the bryophyte. A copy of the study report was filed with the Department on July 28, 1993 and is based on field work done June 30, 1993.
96. In the report, McQueen states that Scapania umbrosa was found at six sites, including three of the original sites; the new sites were in close proximity to the original sites. One of the original sites is gone.
97. Cavendish Gorge is presently the only known location of Scapania umbrosa in Vermont. A subarctic-subalpine species, Scapania umbrosa is found from the northern limit of the spruce-fir biome to nearly its southern limit and has been collected in Labrador, Newfoundland, Nova Scotia, Quebec, Maine (Mt. Katahdin), New Hampshire (Mt. Washington and Mt. Lafayette), New York (Mt. Marcy), and on the shores of Lake Superior (Wisconsin and Ontario). Most potential habitat for the species in Vermont has been searched. The habitat of the species is in areas of continual

high humidity, commonly along wet, rocky mountain streams. It is found on rotted logs at higher elevations, but can also occur on rocks in cool, wet situations such as associated with ice caves or gorges. In gorges, it typically grows near the water level, but as with all liverworts, it is a poor competitor, slow growing, and is often abraded away by the scouring action of a stream. Liverworts can colonize by fragmentation or spore release. (McQueen 1993 report and pers. comm. with Robert Popp, Agency Heritage Program)

98. Scapania umbrosa probably represents a relict, subarctic population of bryophytes that date back to a period of time after the continental glacier retreat. Because it has a limited and disjunct distribution in North America, it is not likely that it colonized the gorge in recent time. (McQueen 1993 report)
99. The areal extent of the Scapania umbrosa population was measured as part of the second study, and trial flows were released to determine submergence. The gorge was also fully mapped and the pools given number designations starting with Pool 1 just above of the powerhouse and ascending in number to Pool 9 at the base of the dam.
100. Half of the total population of Scapania umbrosa was submerged at a flow of 12 cfs. At flows of 20 cfs and 25 cfs, 62% and 66% of the population was flooded, respectively. At 25 cfs, three sites would be inundated; a fourth would be reduced in size by 54%; a fifth would be reduced by 31%; and a sixth was postulated to be lost over time even though not flooded during the study. The remaining area projected not to be inundated over time at 25 cfs was estimated at 2.7 square feet.
101. The six sites of Scapania umbrosa are located in the area of pools 4 and 5. The extent of inundation of the plant can be controlled through modifications to the pool outlets. For example, the elevation of the water surface at a release of 12 cfs can be reduced to be equivalent to the leakage water surface elevation. For Pool 4, this would involve lowering the pool by 9 inches, and for Pool 5, 7 inches. If the scope of the work is limited to minor modifications, then such action would not be unduly intrusive to the natural

values of the gorge. Either or both outlets could be modified.

102. The distribution and size of bryophyte colonies in the gorge is dynamic, as evidenced by the loss of one site subsequent to the May 1991 survey and the existence of the bryophyte under both pre-project and post-project conditions. The pool outlets are composed of cobbles and boulders that can move during extreme flow events, naturally changing the hydraulic conditions at the pool outlets under base-flow conditions.
103. If the outlet to Pool 4 is modified, the 50% inundation estimate under 12 cfs flow can be reduced to 34%.
104. Site 1, the second largest of the six sites, comprising an area of 2.37 square feet, is directly below the outlet of Pool 6 and at the head of Pool 5. Increased flows surcharge a portion of the pool control on river left and flood Site 1. This site could be protected by either modifying the outlet of Pool 6 or selecting a base flow that is slightly below the flow that surcharges the left portion of the control. Protection of this site would further reduce the loss of the bryophyte population from 34% to 23%.
105. Jerry Jenkins, in The Waterfalls, Cascades, and Gorges of Vermont, notes that the gorge walls at the largest pool in the gorge are covered with liverworts Marsupelia emarginata and Scapania nemorosa to heights of 40 to 60 feet above the river. The authors of that publication considered Cavendish Gorge to be an important bryophyte habitat, having seen few Vermont gorges with bryophytes so lush or extending up the walls to such heights.
106. The six sites studied by McQueen are close to the level of leakage flow; it cannot be predicted with certainty how the bryophytes may redistribute in the gorge in reaction to a change in the base-flow regime and whether Scapania umbrosa would persist. Minor modification of the pool outlets may be feasible and result in close to status quo conditions for one or more of the plant sites.

107. Scapania umbrosa is not protected under Vermont's endangered species law. McQueen states that more information on its number of populations in Vermont and research on its ecology and reproductive biology are needed before it can be considered for listing as rare or endangered. The Agency will ask that the Endangered Species Committee consider the plant's eligibility for listing.
108. McQueen recommended a trial period at a minimum flow of not more than 10 cfs during which extensive research would be done on the reaction of the several bryophyte species to the change in gorge hydrology; he recommended four to five years of flow manipulation and experimentation. If Scapania umbrosa were able to recover its lost habitat (total area), then further experimentation at higher flow levels could go forward. Loss of areal coverage beyond his projected levels would be cause for considering a reduction in base flows.
109. A conservatively designed study would allow research on the ability of the plant to adapt to changes in the gorge base flow with minimal risk of large loss or extirpation from the gorge. The study components should include initial examination of non-intrusive minor modification to pool controls, implementation of any feasible modifications, and staged increases in base flows with ongoing evaluation of bryophyte community distribution and strength, which would be the factor upon which to base any changes in minimum flows. Coupled with the study would be the determination of the plant's listing qualifications.
110. No endangered or threatened plants or animals are known to inhabit the project reach.

e. Shoreline Erosion and Impoundment Desilting

111. The application indicates no areas of severe shoreline erosion within the Cavendish impoundment that need correction in order to prevent excessive turbidity and sedimentation. The applicant's fisheries, archeological, and botanical consultants substantiate this claim. The applicant's proposed operating mode will minimize

the potential for new problems to develop in the future.

112. Impoundment desilting can result in significant degradation of water quality if not executed properly. Due to the deep intake, desilting has been neither severe or frequent at this project according to the applicant. Development of a desilting plan is, therefore, unnecessary at this time. Should the need to desilt arise in the future, the applicant should seek review by and approval from the Agency under the existing Agency desilting policy.

f. Recreation and Aesthetics

113. The river in the project vicinity is popular for several recreational uses, including fishing, swimming, sunbathing, boating, photography and viewing. Reference also Finding 28, which describes the gorge as reported in the publication The Waterfalls, Cascades, and Gorges of Vermont.
114. The area surrounding Cavendish hydroelectric project is largely undeveloped. Neighboring the project and approximately 3,000 feet to the southwest is the Proctor-Piper State Forest, a public landholding of 1,513 acres. To the northeast is the Hawk Mountain Wildlife Management Area, which borders the project. The area provides for hunting and hiking opportunities.
115. Access to the waters within the project has always been free and open to the public, whether for fishing in the impoundment or downstream of the station or for sightseeing in the gorge. Established paths lead through the woods to the pool and riffle area below the station and are used on occasion by fishermen and picnickers. An undeveloped maintenance road exists into the dam/impoundment area from the west and offers car-top boating access. There is also a pathway leading from the powerhouse to a scenic overlook onto the gorge, as shown on a site assessment concept proposal provided to the Department in a June 3, 1993 letter.
116. From the Agency's site investigation, it is evident that a substantial amount of recreational activity occurs in the area of the undeveloped

access road on the south side of the river. This use will increase in the future after the implementation of environmental constraints related to project operation and with the general trend towards increased public use of parks and natural areas.

117. The uncontrolled use of the area, at this time, is causing some degradation of the site. This was evident in the number of trails criss-crossing the area, presence of fire rings, and the lack of sanitation. Without proper controls and management, further degradation will occur and the "wild and pristine" character of the site will be compromised. (August 12, 1991 Agency letter to applicant)
118. Vermont Water Quality Standards require the protection of existing water uses, including the use of the water for recreation. The Standards also require the management of the waters of the State to improve and protect water quality in such manner that the beneficial values and uses associated with a water's classification is attained.
119. Beneficial values and uses of Class B waters include water that exhibits good aesthetic value and use for swimming and recreation. Section 2-02 of the Standards prohibits regulation of river flows in a manner that would result in an undue adverse effect on any existing use, beneficial value or use.
120. The river is a navigable and boatable water of the State.
121. The applicant presents a site assessment concept proposal in a June 3, 1993 letter to the Department ("Site Assessment Concept Proposal - Cavendish Gorge Hydroelectric - Visual Aesthetic Evaluations", rev. October 30, 1992). This proposal includes development of a parking and picnic area below and north of the powerhouse. Understory planting between existing trees and around the substation will help to reduce visual prominence from the proposed public parking and picnicking areas. From the parking area, a trailhead and directional signs to the river are proposed and a winding trail to a hemlock grove

along the river below the powerhouse for river access. The applicant proposes to allow continued access via the undeveloped maintenance road into the dam/impoundment area from the west for cartop boating and viewing the gorge. A canoe access site is proposed on the east side of the gorge from a point directly upstream of the dam. The canoe access point was originally proposed in the license application as the take out for a canoe portage on the east side of the gorge.

122. The applicant proposes to develop and maintain the proposed recreational facilities at the site. Should vandalism become a problem, however, the applicant states such facilities would be removed and open access may be restricted. (Page E-58 of license application)
123. By letter dated August 12, 1991, the Agency recommended that the undeveloped maintenance road be maintained to allow vehicle access and limited parking and that the road should remain primitive but use of a four wheel drive vehicle should not be a prerequisite for access. The Agency also recommended that a vehicle turn around be provided at the end of the road, within easy foot access to the eastern side of the gorge below the dam. The applicant stated that it would accommodate the Agency's recommendations to the extent acceptable to the town of Cavendish.
124. The Appalachian Mountain Club River Guide - New Hampshire/Vermont (second edition, 1989) indicates that the Black River provides good runs on easy to moderate rapids, although sectioned by dams. The Black River from the lake reach above Ludlow through Perkinsville supports boating up to a Class III level over a length of 25 miles. Take-out above the dam is difficult, and a carry of one quarter mile is necessary. Reentry below the dam is also a problem.
125. One of the most limiting factors to boating the river is the lack of provisions for portaging the applicant's dam. The dam, therefore, impairs boating on a navigable river. Recreation and recreational boating are designated uses for the Black River. Where designated uses have been impaired or eliminated, all reasonable steps should be taken to restore such uses.

126. On June 6, 1989, the Agency commented on the applicant's FERC initial consultation document for relicensing. The Agency stated "[c]onvenient portage routes should be provided where there are none presently."
127. On June 14, 1993, the Agency participated in a site recreational evaluation with the applicant and Cavendish town manager. It was determined that a feasible portage route exists on the east side of the gorge and that provision of a portage would necessitate minimal improvements--signage, limited trail brushing, and other minor work. However, the applicant stated that a portage was not a desirable amenity for the site and that it did not plan to provide one. Instead, it offered an ingress point below the powerhouse and on the west bank of the river. (memorandum to the file from William Martinez, June 23, 1993)
128. The applicant has not committed to providing a portage at its dam.
129. According to staff observation and the publication The Waterfalls, Cascades, and Gorges of Vermont, the gorge is a popular local swimming area. Changes in the minimum flow through the gorge will affect the character of the gorge pools for swimming. The significance of this issue has not been explored, but can be addressed in concert with the bryophyte study that is being required as a condition of this certification.
130. In the absence of the conditions below, the proposed project would result in a significant degradation of the existing use of water for recreation in or on the water and for fishing. These uses depend on the preservation of the existing level of water quality.
131. The area is highly scenic with a number of hiking trails. The dam, powerhouse, and penstock are not visible from most of the gorge and much of the gorge is undisturbed and secluded.
132. The project's civil works alter the morphological and physical character of the river. The adverse impacts on river aesthetics that have occurred can be mitigated in part through the establishment of an adequate minimum flow.

133. Spillage of flows over the dam and through the gorge is a significant aesthetic component of the project setting. The gorge appears bare and lifeless under existing leakage flow conditions. The sight and sound of flowing water is essential to the character and visual enjoyment of the area.
134. The applicant conducted a flow demonstration to document on video-cassette tape various flow releases through the gorge for aesthetics. The applicant's consultant, New England Land Plan, determined based on this demonstration that a flow of 10 to 20 cfs "provides adequate visual relief to compliment the more dominant geological features of the gorge area." (license application, Page E-36)
135. It is the opinion of the Agency's landscape architect that a minimum flow release of at least 15 cfs is needed to satisfy aesthetic concerns in the bypass. Anything less would be lost in the boulders and crevices of the gorge. (Rodney Barber memorandum, June 24, 1991)
136. In 1993, the Agency contracted with a independent landscape architect, Robert White, to review the issue of site aesthetics, especially with respect to bypass flows. Mr. White filed his report, Aesthetic and Recreation Facility Analysis of the Cavendish Dam and Hydroelectric Station, by letter dated August 30, 1993. Mr. White reviewed the applicant's flow-demonstration video and visited the site on August 27, 1993. During the site visit, the station was down, and the flow in the bypass was about 14 to 20 cfs according to the plant manager, who was at the site. In completing his assessment, he considered several variables: the sound level, which increased with rising flows; visual quality of the water falling into the series of pools; the visual quality of water flowing through the cascades or riffles connecting pools; and the visual quality of water spilling uniformly over the dam as opposed to a weir discharge.
137. Mr. White recommends a flow of 15 cfs to support the aesthetic qualities of the gorge and suggests the investigation of measures to pass the flow uniformly over the dam. His report includes a tabular evaluation of the visual and aural

qualities from three vantage points at the several flows video taped (a leakage of 2 cfs to 38 cfs). At each of the three vantage points, all of which are on the top of the north gorge wall, good visual qualities were attained when flows increased to the 12 to 17 cfs range from the low of 2 cfs. Further enhancement continued as flows increased above that range.

138. The applicant's proposal to spill 10 cfs, or instantaneous inflow if less, during the period of mid-April through October, and leakage flows the remainder of the year would be sufficient to support the intrinsic value of the gorge and user enjoyment when most public use occurs. Leakage flow through the remainder of the year would not support the gorge's intrinsic values, including aesthetics.

VII. Other Uses

139. Downstream, the river is used for wasteload assimilation at the Cavendish Wastewater Treatment Plant. If the project is operated run-of-the-river with adequate bypass flows, the river as a receiving water will have sufficient dissolved oxygen concentrations and dilution capability to assimilate Cavendish's wastewater. The river is also used for electrical production at several hydroelectric projects in the Springfield. The proposed project, as conditioned below, is compatible with this use.

VIII. Other Applicable State Laws

Vermont Endangered Species Law (Title 10, Sections 5401 to 5403)

140. The Vermont Endangered Species Law (Title 10, Sections 5401 to 5403) governs activities related to the protection of endangered and threatened species. Generally, a person shall not "take, possess or transport wildlife or plants that are members of an endangered or threatened species." (Title 10, Section 5403(a)) Disturbance of a endangered or threatened species is considered a taking. (Title 10, Section 4001)
141. The applicant does not propose any construction or operational activities at the site that would

impact any endangered or threatened species. Although it is known only from this single site in Vermont, the liverwort Scapania umbrosa is not currently listed on the Vermont Endangered and Threatened Species list. The applicant proposes protection of this plant. The Department agrees that protection is desirable and is so conditioning the certification, along with initiating further investigation of eligibility for listing.

Agency Regulatory Powers over Fish and Wildlife

142. Under 10 V.S.A. Chapter 103, "[i]t is the policy of the state that the protection, propagation control, management and conservation of fish, wildlife and fur-bearing animals in this state is in the interest of the public welfare, and that safeguarding of this valuable resource for the people of the state requires constant and continual vigilance."
143. The water use as proposed, with the conditions imposed below, will be consistent with this state policy.

IX. State Comprehensive River Plans

The Agency, pursuant to 10 V.S.A. Chapter 49, is mandated to create plans and policies by which Vermont's water resources are managed and uses of these resources are defined. These plans implement the Agency policy. The Agency must, under Chapter 49 and general principles of administrative law, act, when possible, consistently with these plans and policies.

Hydropower in Vermont, An Assessment of Environmental Problems and Opportunities

144. The Department's publication Hydropower in Vermont, An Assessment of Environmental Problems and Opportunities is a state comprehensive river plan. The hydropower study, which was initiated in 1982, indicated that hydroelectric development has a tremendous impact on Vermont streams. Artificial regulation of natural stream flows and the lack of adequate minimum flows at the sites were found to have reduced to a large extent the success of the state's initiatives to restore the

beneficial values and uses for which the affected waters are managed.

At the Cavendish project, the plan recommends that studies be conducted to evaluate project impact on downstream fish and macroinvertebrates; project impact on water quality; impact of leakage flows on fisheries, aesthetics and recreational values in the project's bypass. Mitigation recommendations were to be based on the results of such studies. A specific recommendation of the plan is that minimum flow requirements be established for this project in order to improve the downstream fishery, water quality, and aesthetics.

1988 Vermont Recreation Plan

145. The 1988 Vermont Recreation Plan (Department of Forests, Parks and Recreation), through extensive public involvement, identified water resources and access as top priority issues. The planning process disclosed that, while Vermonters and visitors focus much of their recreational activities on surface waters, growing loss of public visual and recreational access to those waters causes substantial concern to the users. The plan projects that access is "likely to become the critical river recreational issue of the 1990s." The need for development of portage trails and canoe access sites is cited as among the major issues relative to canoe trails in Vermont.

146. The Water Resources and Access Policy is:

It is the policy of the State of Vermont to protect the quality of the rivers, streams, lakes, and ponds with scenic, recreational, and natural values and to increase efforts and programs that strive to balance competing uses. It is also the policy of the State of Vermont to provide improved public access through the acquisition and development of sites that meet the needs for a variety of water-based recreational opportunities.

147. Enhancement of access, provision of a portage, and improved flow management would be compatible with this policy and balance competing uses of the river for recreation and hydropower. Nonassurance of access or failure to provide a convenient

portage trail would exacerbate a critical state recreational problem.

148. Another priority issue identified in the Recreation Plan is the loss or mismanagement of scenic resources. The plan notes "[few] recreational activities in Vermont would be the same without the visual resources of the landscape," and that protection of those resources is "necessary if the state is to remain a desirable place to live, work, and visit."

149. The Scenic Resources Protection and Enhancement Policy is:

It is the policy of the State of Vermont to initiate and support programs that identify, enhance, plan for, and protect the scenic character and charm of Vermont.

150. Landscaping, provision of dam spillage, and maintenance of bypass and downstream flows will protect the scenic characteristics of the shoreline area and river.

Vermont Comprehensive Energy Plan

151. Pursuant to Executive Order No. 79 (1989), the Department of Public Service produced the Vermont Comprehensive Energy Plan, January 1991. This plan sets out an integrated strategy for controlling energy use and developing sources of energy. Several goals of the plan are to reduce global warming gases and acid rain precursors by 15% by the year 2000 through modified energy usage; to reduce by 20% by the year 2000 the per capita consumption of energy generated using non-renewable energy sources; and to maintain the affordability of energy.

152. The loss of electrical power production associated with mitigation needed to meet water quality standards will have a negligible effect on overall power availability and rates.

The expected regional power surplus from the New England and New York power pools is 13,389 megawatts for Winter 2002-2003. Because the facility would be operated in a base-load fashion (run-of-the-river), no operating reserve (storage function) is available. The applicant has large

amounts of base-load power at its disposal.
(testimony of Robert Howland, Central Vermont
Power's Manager of Power Supply, before the State
Public Service Board in Docket No. 5171)

153. Continued availability of electricity generated by this renewable source, with proper environmental constraints in place, is consistent with the State energy plan.

ACTION OF THE DEPARTMENT

Based on its review of the applicant's proposal and the above findings, the Department concludes that there is reasonable assurance that operation of this project as proposed by the applicant and in accordance with the following conditions will not cause a violation of Vermont Water Quality Standards and will be in compliance with sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act, P.L. 92-500, as amended, and other appropriate requirements of state law:

- A. The applicant shall operate and maintain this project as set forth in the findings of fact and conclusions above and these conditions.
- B. Except as allowed in Condition F below, the facility shall be operated in a true run-of-the-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

The applicant shall, within 90 days of issuance of this certification, furnish a description, hydraulic design calculations, and plans for the measure to be used to maintain true run-of-river flows below the project tailrace. This plan shall include operating protocols or measures that will eliminate or substantially reduce the effects of lag time and deviations from true run-of-the-river conditions below the project.

- C. When available from inflow, a minimum instantaneous flow of 10 cfs shall be released at the dam at all times. If the instantaneous inflow falls below the hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam. Within 90 days of the issuance of this certification, the applicant shall furnish a description, hydraulic design calculations, and plans for the measure to be used to pass this minimum flow.

- D. Except during periods when the project's control system is down or the flashboards have failed, the level of the impoundment shall be maintained no lower than 6 inches below the design crest of the flashboards. When the control system is down, the impoundment shall be maintained no lower than 12 inches below the crest of the boards.
- E. The applicant shall manage impoundment levels such that deviations in excess of minus two feet from the normal operating level are eliminated. The applicant shall develop and propose for Department approval a management plan for such controls within 90 days of issuance of this certification. Consideration may be given to a permanent reduction in the normal operating level of the impoundment; however, such an option would have to include an assessment of the impact on upstream wetlands and their values.
- F. Following the reinstallation of flashboards or an approved special maintenance operation necessitating a drawdown, the impoundment shall be refilled by reducing downstream flows, but to no less than 42 cfs from June 1 to September 30, 83 cfs from October 1 to March 31, and 332 cfs from April 1 to May 31. Under circumstances where the natural inflow to the project is insufficient to permit both passage of these minimum flows and refilling of the impoundment, the impoundment can be refilled while releasing 90% of instantaneous inflow downstream at all times.
- G. The applicant shall file for review and approval, within 90 days of the issuance of this certification, a plan for monitoring instantaneous flow releases at the project, both in the bypass and below the tailrace. Following approval of the monitoring plan, the applicant shall then measure instantaneous flows and provide records of discharges at the project on a regular basis as per specifications of the Department. Upon receiving a written request from the applicant, the Department may waive, all or in part, this requirement for flow monitoring at this project provided the applicant satisfactorily demonstrates that the required flow will be discharged at all times.

H. On or before April 1, 1994, the applicant shall submit a plan for downstream fish passage to the Department of Fish and Wildlife for review and written approval. Downstream passage shall be provided April 1 - June 15 and September 15 - November 15 and shall be functional with and without flashboards in place, with the period subject to adjustment by the Department based on knowledge gained about migration periods for migratory salmonids. Unless deferred by the Agency, the approved plan shall be implemented by April 1, 1995. The plan shall include provisions to:

1. minimize passage of fish into the generating unit(s);
2. minimize impingement of fish on trashracks or on devices or structures used to prevent entrainment; and
3. convey fish safely and effectively downstream of the project, including flows as necessary to operate conveyance facilities.

I. The applicant shall file with the Department for prior review and approval within 90 days of issuance of this certification, a plan of study for assessing the impact of alternative bypass minimum flows on Scapania umbrosa. The results of the study will be used to assess the environmental feasibility of increasing the minimum flow to a level not to exceed 20 cfs and the effects of the interim minimum flow set in Condition C above. The applicant shall work closely with the Agency during the development and implementation of this study, which shall include, but not be limited to, the following steps:

1. A feasibility analysis and plan to protect Site 1 (located at the head of Pool 5) at a flow release of 10 cfs, including a determination of the threshold flow (between leakage and 12 cfs) at which the site becomes inundated.
2. A feasibility analysis and plans to modify the outlet controls of pools 4 and 5 to protect existing populations of Scapania

umbrosa within the backwater influence of the pools.

3. A maintenance plan to include annual inspections of any measures undertaken to protect Scapania umbrosa in accordance with the plans referenced in nos. 1 and 2 above.
4. A plan for a long term study of the gorge to assess a) the size and distribution of the Scapania umbrosa population under staged alternative minimum flows, the study to include other factors that may affect bryophyte distribution and b) any impairment of swimming use that may occur due to increases in the minimum flow through the gorge.
5. Annual reporting to the Department of study progress and findings.
6. A five-year report summarizing the findings of the study and recommending action to be taken or study continuation.

Plans for protective measures are subject to prior review and approval by the Department and shall be implemented before passage of minimum flows in accordance with Condition C above.

During the fall period, the fish passage conveyance structure shall be operated at 10 cfs until sufficient information is available to determine whether or not operation at higher flows would be detrimental to Scapania umbrosa. When the dam release exceeds 10 cfs, such as during high flow periods, the conveyance structure shall be operated at its design capacity, inflow permitting.

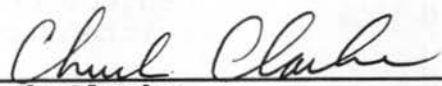
The analyses and plans referenced in nos. 1-3 above shall be filed with the Department on or before June 1, 1994, with completion of any approved modifications by October 1, 1994. The bryophyte study shall be initiated on or before July 1, 1994.

- J. The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for

the record within one year of the issuance of this certification.

- K. Within 90 days of the issuance of this certification, the applicant shall submit a plan for proper disposal of debris associated with project operation, including trashrack debris, for written approval by the Department.
- L. Any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval.
- M. The applicant shall provide a canoe portage at Cavendish Dam by May 1, 1994. The applicant shall consult with the Recreation Section of the Department of Forests, Parks and Recreation in the design of the portage. Design plans for the portage shall be filed with the Department of Environmental Conservation and the Department of Forests, Parks and Recreation for review and approval before construction of the portage.
- N. The applicant shall allow continued public access to the river for utilization of the public resources, subject to reasonable safety and liability limitations.
- O. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with certification conditions.
- P. A copy of this certification shall be prominently posted within the facility.
- Q. Any change to the project that would have a significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval.

R. The Department may request, at any time, that FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.



Chuck Clarke
Secretary
Agency of Natural Resources

Dated at Waterbury, Vermont
this 7th day of October, 1993.

cc: distribution list

AMD/9J_CAV.401

From: [Davis, Eric](#)
To: [Kayla Easler](#)
Cc: [Katie Sellers](#)
Subject: RE: Cavendish LIHI consultation
Date: Thursday, June 01, 2017 4:19:10 PM

Hi Kayla,

The Agency has reviewed our records for the Cavendish project and provides the following information regarding water quality and rare, threatened, and endangered species requested by Kleinschmidt to aid in the development of a complete LIHI application.

Water Quality

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The 2010 Clean Water Action Section 303(d) List of Impaired Waters did not identify the waters in the Project as being impaired. However, the Black River, both upstream and downstream of the Project have been impaired by metal manufacturing, hazardous materials and runoff from old landfills (Vermont Agency of Natural Resources 2016, 8-9).

Could you please confirm, to your best abilities, that the Project's current operations continue to not be a contributing cause to the river's water quality limitations?

The Agency lists two portions of the Black River on its 2016 List of Priority Surface Waters. Both portions are a considerable distance downstream of the project: (1) A 4.6 mile stretch from the mouth to Fellows dam on Part A for E. coli due to combined sewer overflows and (2) Stoughton Pond and North Springfield Reservoir on Part F due to flow regulation associated with Army Corps flood control operations.

I can confirm that the current operations of the project are not a contributing cause to the river's water quality limitations.

-

Rare, Threatened and Endangered Species

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Could you a) review the below species list to make sure it is accurate and/or suggest updates as appropriate; and b) review this list to confirm that the Project continues to not negatively affect any of the currently listed species that may occur within the Project area?

Species List:

Northern Long-eared Bat (federally and state endangered)

Bald Eagle (state endangered)

rare byrophyte (Scapania umbrosa)

-

Our Natural Heritage Program has records of two additional rare moss species that occur within the project area in addition to *Scapania umbrosa*: *Anomobryum filiforme* (S1, very rare) and *Pseudotaxiphyllum distichaceum* (S2S3, rare to common). No threatened rare, threatened, or endangered aquatic animal species have been reported in sections of the Black River potentially

impacted by this project.

Little is known about either of these species, except that they were observed in the gorge in the vicinity of the Sacpania. Given the water quality certification and post certification adaptive management process focused on identifying a flow regime to protect the rare *Scapania umbrosa* communities, it would be reasonable to assume that if the project is operated in compliance with its water quality certification, operations would not negatively affect any of the currently listed species that may occur within the Project area.

-

Formal Application Review

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The Agency hopes the input above assists you in developing a complete LIHI application. As you may know the Agency's review of LIHI applications has evolved, and the Agency has now developed a practice of requesting one year of project operations records to review for compliance with certification conditions in order to provide meaningful input into the LIHI review process. While we could request these when the application is noticed, we thought it may be beneficial to the review process to flag this as an information need as early as possible.

In addition to operating records, our preliminary review has also identified GMPs plans for operating the fish passage facility under a new LIHI certification term as an information need for our review of the LIHI application.

Please let me know if you have additional questions,

Eric

Eric Davis, River Ecologist

1 National Life Drive, Main 2
Montpelier, VT 05620-3522
802-490-6180 / eric.davis@vermont.gov
<http://www.watershedmanagement.vt.gov/rivers>
(Please note my new e-mail address, effective July 27, 2015)



See what we're up to on our [Blog. Flow.](#)

From: Kayla Easler [mailto:Kayla.Easler@KleinschmidtGroup.com]

Sent: Monday, May 22, 2017 4:13 PM

To: Davis, Eric <Eric.Davis@vermont.gov>

Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>

Subject: FW: Cavendish LIHI consultation

Good afternoon Eric,

I am following up on the Cavendish consultation. Have you had a chance to review this yet? Is there any additional information I can for you?

Thank you,

Kayla A. Easler
Regulatory Coordinator



Direct: (207) 416-1271

www.KleinschmidtGroup.com

*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Kayla Easler

Sent: Thursday, March 16, 2017 2:07 PM

To: 'Eric.Davis@vermont.gov' <Eric.Davis@vermont.gov>

Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>

Subject: Cavendish LIHI consultation

Good morning, Eric,

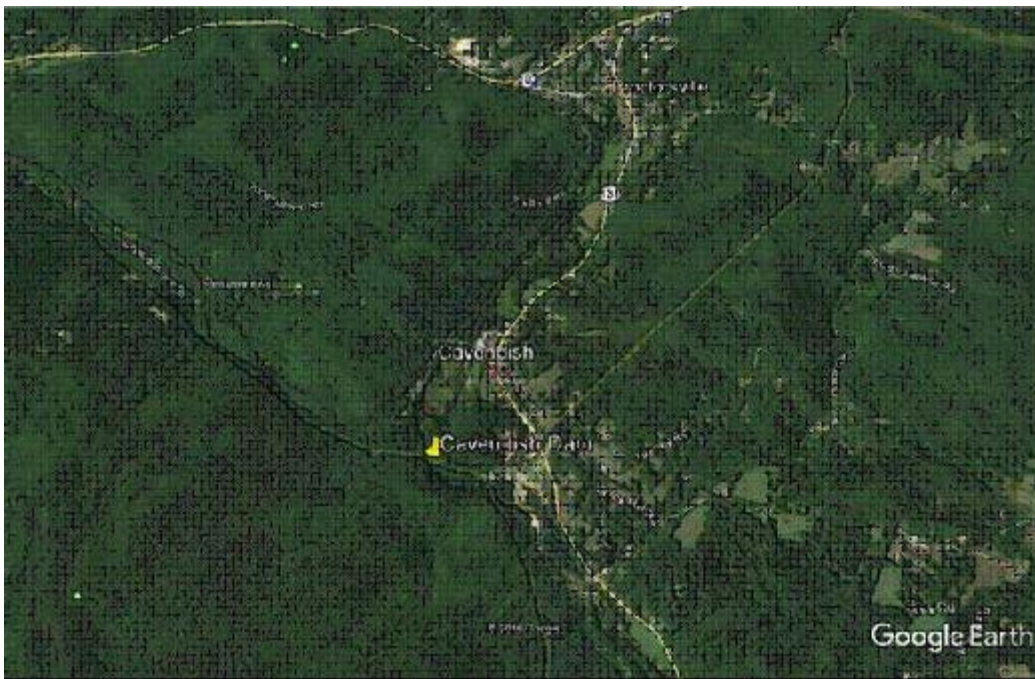
Here is another LIHI re-certification application for Green Mountain Power: Cavendish Hydroelectric Project (FERC No. 2489) located on the Black River in Cavendish, Vermont.

The LIHI application asks that we gain your feedback on the following water quality information:

The 2010 Clean Water Action Section 303(d) List of Impaired Waters did not identify the waters in the Project as being impaired. However, the Black River, both upstream and downstream of the Project have been impaired by metal manufacturing, hazardous materials and runoff from old landfills (Vermont Agency of Natural Resources 2016, 8-9).

Could you please confirm, to your best abilities, that the Project's current operations continue to not be a contributing cause to the river's water quality limitations?

When you have a moment to review, could you please provide us with your feedback on this topic?



Thank you,

Kayla A. Easler
Regulatory Coordinator
KLEINSCHMIDT
Office: (207) 487-3328
Direct: (207) 416-1271
www.KleinschmidtGroup.com

From: [Davis, Eric](#)
To: [Katie Sellers](#)
Cc: [Andy Qua](#); [Greenan, John](#)
Subject: RE: Cavendish Operations Data for LIHI Application
Date: Thursday, May 10, 2018 7:51:13 AM

Hi Katie,

Thank you for submission of operations data for the Cavendish Project in accordance with the LIHI Application review protocol.

While we discussed my initial review of the Cavendish operations data sometime back, I've had the opportunity to complete my review and wanted to provide formal feedback. Considering the Agency has previously provided feedback on the water quality, fish passage, & rare, threatened, and endangered species criteria, feedback on the flow criterion should close the loop on ANRs LIHI review for this project.

Previously, I had indicated that the data looked complete and I did not see any issues with the data . Subsequently, I've had the opportunity to include five months of flow data that is collected on the Black River for the November through March and reported to DEC. This additional source of flow data further confirms that the Cavendish project has operated in true run-of-river mode in compliance with Condition B of the water quality certification issued for the project. The Applicant has previously described how the fishway is operated to release the minimum flow requirement year round in compliance with condition C.

This review demonstrates that the project complies with the LIHI "flows" criterion.

Thanks to Kleinschmidt and GMP for helping to facilitate this review.

Eric

Eric Davis, River Ecologist

1 National Life Drive, Main 2
Montpelier, VT 05620-3522
802-490-6180 / eric.davis@vermont.gov
<http://www.watershedmanagement.vt.gov/rivers>



See what we're up to on our [Blog](#). [Flow](#).

From: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Sent: Wednesday, February 14, 2018 5:03 PM

To: Davis, Eric <Eric.Davis@vermont.gov>

Cc: Andy Qua <Andy.Qua@KleinschmidtGroup.com>; Greenan, John
<John.Greenan@greenmountainpower.com>

Subject: Cavendish Operations Data for LIHI Application

Hi Eric – In accordance with the LIHI Application review protocol, we have developed an excel spreadsheet from the Cavendish Project (FERC No. 2489) SCADA data to depict 2016-2017 facility operations. We attempted to insert Black River flow data into this operations analysis, but it turns out there are no good local gages to use for Cavendish river flow analysis. Gage #01152800 Black River at Covered Bridge at Weathersfield only has data from 1975-1981 and Gage # 01153000 Black River at North Springfield is located downstream of a large storage reservoir and not particularly useful for operations analysis. That said, we wanted to check in with you to see if the attached operations data suffices for the purposes of LIHI operations review or if you might have any internal Black River flow data that we might be able to use for this analysis?

Thanks

Katie

Katie E. Sellers, M.S.

Regulatory Coordinator

Kleinschmidt

Office: 207-416-1218

www.KleinschmidtGroup.com

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APPENDIX D

FISH PASSAGE



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087



REF: FERC No. 2489
Central Vermont Public Service Corporation

April 17, 2002

Mr. Michael Scarzello
Central Vermont Public Service Corporation
77 Grove Street
Rutland, VT 05701

Dear Mr. Scarzello:

We have completed our review of the reports on the 2000 and 2001 Downstream Smolt Bypass System Evaluation studies and the 2000 Assessment of Smolt Safety for the Cavendish Hydroelectric Project, located on the Black River in Vermont. These reports were transmitted by your letter dated February 4, 2002.

2000 Assessment

The evaluation in 2000 tested the FishPath flow inducer, along with an oil boom used to assist guidance to the bypass. Bypass flows of 5 cfs and 7 cfs were evaluated.

The test results were confounded by spill conditions during the testing periods, whereby passage efficiencies were reduced as tagged smolts spilled over the dam. Bypass efficiencies were better for later releases when spill subsided.

2001 Assessment

The 2001 evaluation tested the same system as in 2000, with a 7 cfs discharge. Once again, spill confounded results. However, despite spill, overall bypass efficiency over the course of the study was 57%.

Smolt Safety Study

In order to assure that bypassed smolts are safely conveyed downstream, the bypass chute and plunge pool were evaluated at the 7 cfs bypass test flows. During initial tests, fish survived passage into the plunge pool but a significant percentage of the fish were found to remain in

the plunge pool and not leave. In all cases, smolts survived and appeared in good shape. Delayed mortality was assessed for a 72 hour period with only one delayed mortality.

In order to address the failure of smolts to exit the plunge pool, a submerged orifice and pipe was installed in lieu of the overflow weir. CVPS thought that the smolts were reluctant to exit via the weir given the surface turbulence and air entrainment since smolts in the plunge pool remained in deeper in a quieter area of the plunge pool. Three tests of the modified plunge pool exit were conducted. Egress was vastly improved by the modification.

Discussion

The 2000 and 2001 bypass evaluations tested a bypass configuration with the flow inducers and oil boom and a bypass discharge of 5 to 7 cfs. Evaluations in 1999 also tested these lower bypass discharges, which are significantly below a standard bypass passing 20 cfs. Although the reduction in bypass size and discharge likely reduces bypass efficiency, this reduction was needed in order to protect a rare bryophyte species that inhabits the Cavendish Gorge below the dam. In addition, the bypass plunge pool proved to be an unsafe passage route at a 20 cfs discharge.

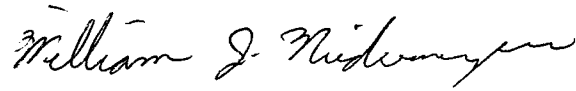
The 1999, 2000 and 2001 evaluations of the FishPath system with reduced fish bypass discharges demonstrated reasonable passage efficiency, given the periodic spill that occurred during the evaluations. Smolts likely use a downed or overtopped rubber dam section when spill occurred. Therefore, overall safe passage at the project is likely higher than the bypass monitoring alone indicated. Since periodic spill is common during the smolt migration period, we would expect that on average, safe passage past the project to be acceptable.

The plunge pool safety evaluations demonstrated that the bypass and plunge pool, when operated at a reduced 7 cfs, flow provided a safe passage route. The modification to the plunge pool of an orifice in place of a overflow weir proved effective in speeding egress. On a conference call on April 11, 2002, your consultant, Jeff Wallin, suggested that further improvements in egress from the plunge pool could be achieved if the orifice location were moved to the upstream portion of the plunge pool. This would provide for egress from the quiet area smolts congregated in and would assist in transition from the plunge pool to the natural spill pool area below the dam apron. A pipe would be attached to the orifice if this was deemed necessary to convey fish to the natural pool. We concur with this proposed modification.

With the proposed plunge pool modifications we recommend that CVPS implement the current bypass systems with a 7 cfs bypass flow as the project's permanent smolt passage system.

We appreciate this opportunity to comment. If you have any questions, please contact John Warner of this office at (603) 223-2541 or e-mail at john_warner@fws.gov.

Sincerely,

A handwritten signature in cursive script, reading "William J. Neidermyer".

William J. Neidermyer
Assistant Supervisor Federal Projects
New England Field Office

cc: FERC -OHL
RO-ENG - Curt Orvis
CT River Coord. - Jan Rowan
VDFW-Springfield - Jay McMenemy
VDFW - Rod Wentworth

ES: JWarner:dw:4-17-02 :603-223-2541



Central Vermont Public Service Corporation

February 4, 2002

Mr. John Warner
US Fish & Wildlife Service
70 Commercial St., Suite 300
Concord, NH 03301-5087

RE: FERC No. 2489
Cavendish Project - Downstream Fish Passage

Dear John:

Enclosed please find the downstream passage test results for the years 2000 and 2001. Appended to the 2000 report are the results of the passage system mortality test and the system retention time test.

As you are aware, this study is complicated by extraneous site factors that influence results of our testing. Protection of the bryophytes limits attraction flows, the amount of head coupled with the configuration of the gorge makes it difficult to test a permanent passage system, and, perhaps most importantly, the narrow width of river and low hydraulic capacity of the project results in frequent spillage over the dam during the spring testing period.

A typical spring rain event generally results in dam spillage. Such events have plagued us each year and is evident in the temporal results of the yearly studies. Our best recapture rates always come from the releases made late in the season when river flow has subsided. Recaptures in 1999 jumped from 49% and 37% for the early releases to 66% and 72% for the late releases; in 2000 (a very wet spring) recaptures went from 8% and 2% to 28% and 31%; and for 2001 recaptures of the five releases increased chronologically from 36% to 54% to 60% to 72% to 91%.

Though perhaps anecdotal, we need to assess what is being accomplished within the complex parameters surrounding the project and what is the most practical direction to head. We believe that controlling factors are outside of our influence and our time and money would be better spent correcting physical impairments within our reach. We would like to move forward and make the necessary refinements to the plunge pool to get the smolts safely into the streambed below.

After review of the enclosed reports, I would suggest that we confer by phone to map out a productive strategy to finalize this challenging effort. I will contact you shortly to set up a conference call with the parties involved.

Sincerely,

Michael Scarzello, P.E.
Principal Engineer

C: A. Sidoti, FERC, NYRO
R. Wentworth, VDFW

BC DC
Wollin
Trube

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D. C. 20426

Project No. 2489-031 & 032-Vermont
Cavendish Hydroelectric Project
Central Vermont Public Service
Corporation

Mr. John C. Greenan
Central Vermont Public
Service Corporation
77 Grove Street
Rutland, VT 05701

FEB 17 2000

Dear Mr. Greenan:

This acknowledges receipt of *Progress Report 3 - Report of the Results of the 1998 Study of the Effectiveness of the Downstream Fish Passage Facility at the Cavendish Hydroelectric Project* and a 1999 fish passage summary, filed on December 27, 1999.

On June 15, 1998, the Commission issued its Order Approving Downstream Fish Passage Facility Effectiveness Monitoring Plan. In that order, we reviewed the results of the 1997 fish passage monitoring, agency comments, and licensee recommendations. The order approved your proposal to conduct further monitoring in 1998 and to send the final report to the Commission by November 15, 1998. In addition, via the June 1998 order, we reserved the right to the Commission to require modifications to the passage facility or additional monitoring.

In January 1999, you forwarded a draft report of your 1998 monitoring to the U.S. Fish and Wildlife Service (FWS) and the Vermont Department of Fish and Wildlife (VDFW). The draft report concluded: 1) fishway efficiencies of 55.3 and 75.0 percent equal or approach efficiencies that can be expected at passage retrofits such as Cavendish and, therefore, further monitoring would be terminated; and 2) modifications to the plunge pool is needed and would be completed during 1999.

By letter dated February 19, 1999, the FWS disagreed with the conclusions regarding fishway efficiencies and outlined several modifications or alternatives that could increase passage efficiency. The FWS also noted that increased bypass flow would not be an option because increased flows in the bypassed reach may have an adverse effect on a rare bryophyte (*Scapania umbrosa*).

In response to the FWS comments, you stated that you would pursue FWS recommendations and test a flow inducer device during 1999. Emphasis would be on improving passage efficiency while reducing the fish passage flow requirement in an effort to increase smolt survivability of the plunge pool and lower bypass flow impacts on the rare bryophyte in the bypassed reach.

In your downstream fish bypass system evaluation summary for 1999, you reported recovery rates as high as 72 percent. In your cover letter to the FWS accompanying your December 1999 filing, you stated that you would install the flow inducer if the FWS concludes that the system creates acceptable passage efficiencies. You also stated in your cover letter to us that you would continue to evaluate the relationship between operation of the fish passageway and the bryophyte of concern in the bypassed reach. You would also continue to consult with the FWS and the VDFW and keep the Commission apprised of your progress.

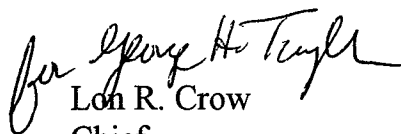
After review of the 1998 report and the FWS' February 19, 1999 letter, we concur with the FWS' comments and recommendations. We would also have required additional modifications and additional fishway effectiveness monitoring during 1999 if you had filed the report with us by November 15, 1998 as required by our June 1998 order. Therefore, we request that by March 10, 2000, you provide us with the final report of modifications to the downstream fish passage facility and fish passage effectiveness monitoring completed during 1999, to include agency comments and recommendations, and your recommendations for fish passage modifications and/or monitoring during 2000.

Please file an original and seven copies of the materials requested with:

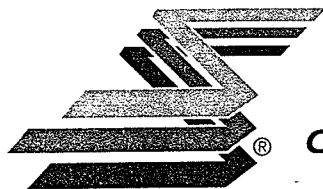
The Secretary
Federal Energy Regulatory Commission
Mail Code: DLC, HL-11.2
888 First Street, NE
Washington, DC 20426

Thank you for your attention to this matter. If you have any questions, please contact Robert Grieve at (202) 219-2655.

Sincerely,


Lon R. Crow
Chief

Environmental Compliance Branch



Central Vermont Public Service



December 17, 1999

Mr. John Warner
US Fish & Wildlife Service
22 Bridge Street, Unit #1
Concord, NH 03301-4986

RE: Central Vermont Public Service Corporation
Cavendish Station, FERC Project #2489
1999 Downstream Fish Passage

Dear Mr. Warner:

CVPS has yet to formally report on the results of fish passage testing and experimental fishway enhancements completed at the Cavendish Station project earlier this year. I regret the delay in our formal report, however, I am pleased with our overall progress on fish passage and other issues at the project. Enclosed is a summary from Current Solutions, L.L.C. on the FishPath system that CVPS voluntarily evaluated. These results appear quite favorable and CVPS, with your endorsement, will continue to evaluate the possibility of installing a permanent FishPath system at the site. This submittal also includes two other documents, namely Progress Report 3 (results of the 1998 effectiveness testing) and the 1999 bryophyte survey of the Cavendish Gorge.

Fish passage through the gorge and bryophyte populations in the gorge continue to present conflicting requirements. As you may be aware, Dr. McQueen, the bryologist who monitored bryophytes in the gorge since 1990, died last April. With the help of VANR, we hired Dr. Norton Miller, curator of the Bryophyte Herbarium and Quaternary Paleobotany Collection at the New York State Museum, to perform the final annual review of the five-year study in the gorge. His report states that he could not find any *Scarpania umbrosa*, however, two other rare bryophytes were found growing at the 10 cfs water level. His recommendation is to limit bypass flows to 5 cfs. I mention this only to refresh the concept of the complexity of the gorge with particular consideration of downstream fish passage flows.

Throughout the 1999 fish passage study, CVPS' consultant team made minor adjustments to the system with each study group of smolts released. Our recapture rate increased to 72% with only a 7 cfs passage flow. In light of the competing requirements, CVPS feels that with the addition of the FishPath system to permanently enhance downstream smolt movement we could balance all concerns. CVPS is willing to permanently install a FishPath if the results from this year's work allows you to conclude the FishPath system creates acceptable passage efficiencies.

I would appreciate an opportunity to discuss where we stand after you review the enclosed material. I will call you in a few days to schedule a convenient time to discuss the project. Thank you for your assistance and patience with this project.

Sincerely,

John Greenan, P.E.
Project Coordinator

Cc: R. Wentworth VDFW
A. Sidoti FERC NYRO
J. Wallin MRM w.o. enclosures
T. Tarpey Current Solutions w.o. enclosures
M. Scarzello CVPS

Cavendish Hydroelectric Project

1999 Downstream Fish Bypass System and Evaluation

July 1999 Revision 2

Background

The Central Vermont Public Service Corporation (CVPSC) Cavendish Hydroelectric Project is located in Vermont on the Black River, a tributary to the Connecticut River. CVPSC completed the relicensing of this project for the Federal Energy Regulatory Commission in November of 1994. Articles pursuant to this license required that CVPSC install downstream fish passage facilities for Atlantic salmon smolts. These facilities were completed for the 1996 smolt run. The facilities consisted of a downstream fish passage entrance on the left side of the dam, with a sluiceway down to a plunge pool and trap for evaluation of the fish passage. Initial results from the evaluation of the system showed recapture rates between 4.7% and 9.0%, with fish bypass flows at 20 cfs and 10 cfs, respectively. Since that testing, a rare bryophyte has been found in the bypass channel. Experts believe that the fish bypass flow should be further reduced to 5 cfs to limit damage done to this bryophyte.

Project Description

The Cavendish Project consists of five main components:

Cavendish Dam: An 111-foot-long, 25-foot-high concrete gravity dam with a 90-foot-long north spillway section topped with a 6-foot-high inflatable rubber dam, and a 21-foot-long south spillway section with 2 ½ foot flashboards. This dam diverts water from the Black River to the project powerhouse via an intake structure and 1,250-foot-long penstock.

Bypass Channel: The approximately 1,600-foot-long channel between the Cavendish Dam and the project powerhouse tailrace.

Penstock Intake Structure: A submerged entrance concrete structure (on the north bank) with an electrically operated headgate and inclined trashracks. The top of the intake is 12.5 feet below normal water level and the invert is 21.5 feet below normal water level. The trashracks are 16 feet wide by 27 feet deep with clear bar spacing of 1.5 inches. A power tunnel extends 180 feet from the trashrack to the 6 foot diameter penstock.

Powerhouse: The powerhouse houses three horizontal shaft Francis turbine generators with a combined hydraulic range of 19 to 226 cfs. Turbine rotation speed is 600 rpm. The approximate gross head of the project is 120 feet.

Powerhouse Tailrace: The powerhouse tailrace and the Bypass Channel join immediately below the powerhouse.

Installation of the FishPath System

In April of 1999, Current Solutions, L.L.C. was contacted about the possibility of installing a FishPath system to improve the fish bypass effectiveness at the Cavendish project. The FishPath system is a mechanically generated current and turbulence lead to divert downstream migrating fish to the bypass entrance area. Upon inspection of the site, this appeared to be a good candidate for a FishPath. The target species, Atlantic salmon smolts, typically move near the top of the water column. There was little existing surface current directed toward the bypass entrance, or any discernable surface currents in the headpond. This may have disoriented migrating fish previously, but also meant there would be little competing current toward the turbines for the FishPath to compete with.

On April 30, Current Solutions delivered and installed a FishPath system on the left bank upstream of the turbine intake area. See Photos 1 and 2. The system consisted of a single, 2 HP submersible current inducer with 3-foot diameter blade mounted in a frame. The frame had floats on each end, as well as legs to hold the frame in position off the bank. A coarse trashrack was installed around the propeller, as well as a fine plastic mesh trashrack on the upstream side of the frame. The frame permitted adjustment of the tilt of the propeller, while adjustment of the leg length changed the orientation of the current plume. After installation, the current plume was adjusted such that it was tilted upward slightly, and angled so the edge of the plume would just reach the area of the bypass entrance.

Modifications were also made to the bypass entrance area. To allow passage of the smaller bypass flows while maintaining the depth in the bypass entrance, a picture-frame-style restrictor plate was installed. This reduced the gate width to 18" while having a minimum water depth of 1'. The edges of this were made of pipe to reduce the edge turbulence at the bypass entrance. Also installed was a video monitoring system for evaluation of the addition of the current inducer. To obtain clear images of the fish passing into the trap, an additional weir with counting board on the weir invert was placed near the entrance to the fish trap.

Evaluation of the Downstream Fish Passage with the FishPath

In order to evaluate the downstream fish passage, 375 Atlantic salmon smolts were obtained from the White River National Fish Hatchery. At the hatchery, the smolts were divided into lots of 125 fish and tagged with Floy T-Bar tags. Each lot was tagged with white, orange, or green tags. The tagging was done to identify the hatchery smolts versus the wild smolts when trapped, distinguish between lots released on different dates, and facilitate observations of the fish movements in the impoundment. Before trucking to the Cavendish project, one green tagged smolt died at the hatchery holding tank and one white tagged smolt died in the live car on site. Before each release, 25 fish from each lot were held as controls. All controls were eventually released as a fourth study lot.

The green tagged smolts were released in two batches, 10 on April 30th after installation of the FishPath and the remaining 89 on May 3rd. Only 2 of the original 10 were captured after two days, consequently the fish bypass flow release was increased from 5 cfs to 7 cfs before the second batch of green tags were released. The target fish

passage attraction flow was then maintained at 7 cfs for the remainder of the study. Of the 99 green tagged fish released, 49 were recovered in the trap for a 49% recovery rate. The majority of these smolts were recovered between 4 and 6 days after their release.

On May 10th, a speed controller was added to the current inducer. Confusion for the migrating fish created by induced current reflecting off the wall adjacent to the bypass opening could now be reduced by matching the speed of the current inducer to the varying river flow. Field measurements and adjustments were made to establish a gradual acceleration into the bypass of approximately 1 ft/s². On this date the orange-tagged lot of fish was also released. Of the 100 released, 37 were recaptured for a 37% recovery rate. The majority of these fish were recovered the day after release.

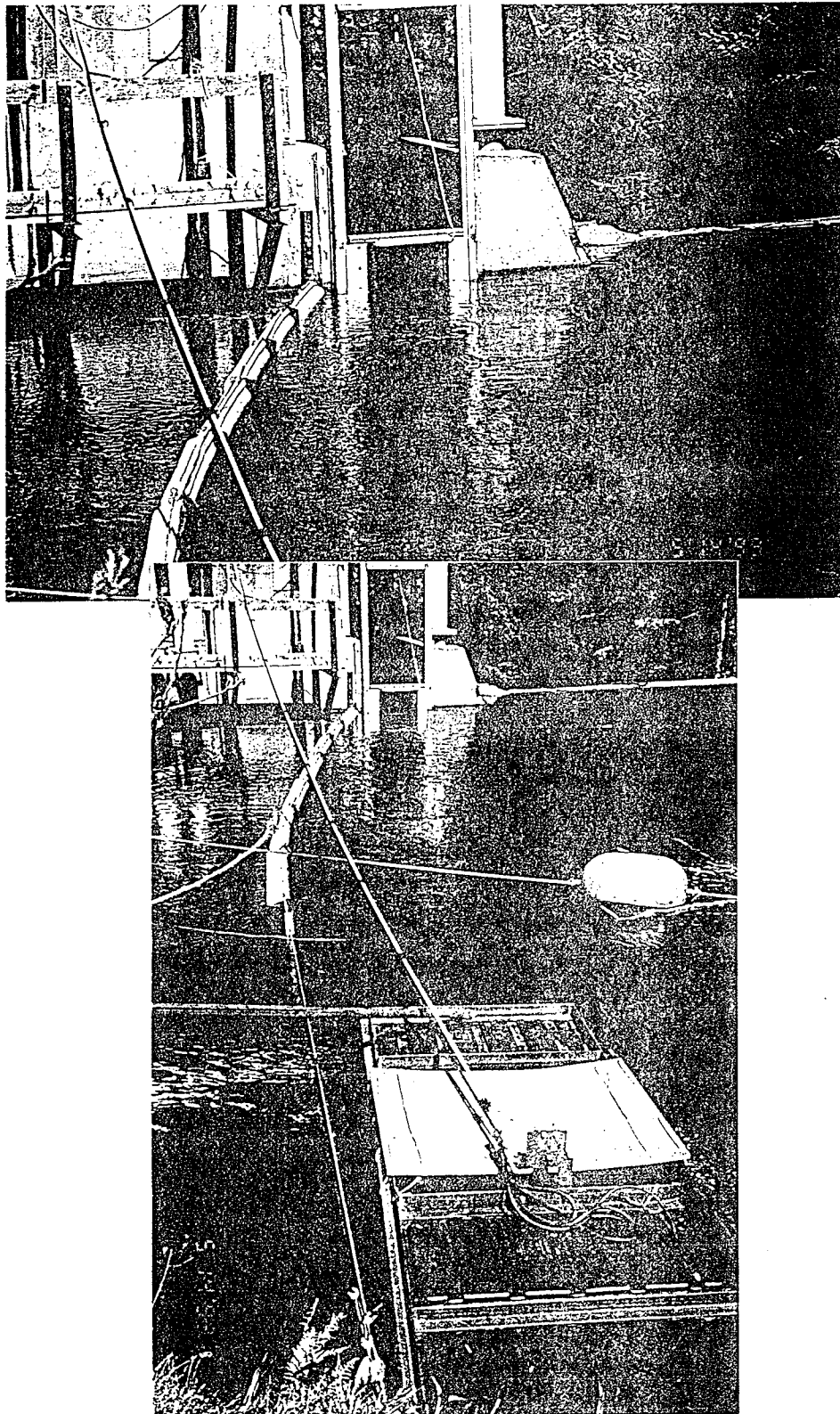
An oil boom used as a floating fish lead was installed on May 14. This lead extended from the edge of the current inducer to the edge of the bypass. See Photos 1 and 2. It consisted of a long, narrow float on top, with an impermeable membrane stretching down 3'. The lead had a cable through the float and along the bottom of the membrane to keep it taught. The purpose of this lead was to ensure the surface current could be carried from the current inducer to the bypass entrance, as well as to provide a visual cue to the fish. The video camera and a fluorescent light were moved from the plunge pool to the bypass entrance area. The white-tagged lot of fish was also released on May 14. Of the 99 fish released, 66 were recaptured for a 66% recovery rate. Visual observations showed, when the fish were initially released, they schooled deep and crossed under the fish lead to the intake area. They were also swimming head into the current generated by the FishPath. As time went by, however, the fish began to swim with the generated current as they would in a river situation, and they did not pass under the fish lead. See Photos 3 and 4. Review of the videotape confirmed that the fish followed the lead because the majority of fish entering the bypass did so from the left side of the entrance, near the termination of the fish lead.

On May 18, the tags on the 75 remaining control fish were clipped shorter to distinguish them from those previously tagged, and then released. Of the 75 released, 54 were recaptured for a 72% recovery rate.

As outlined on the accompanying table, a total of 187 wild smolts were captured in the fish trap during the period the trap was operated for study purposes.

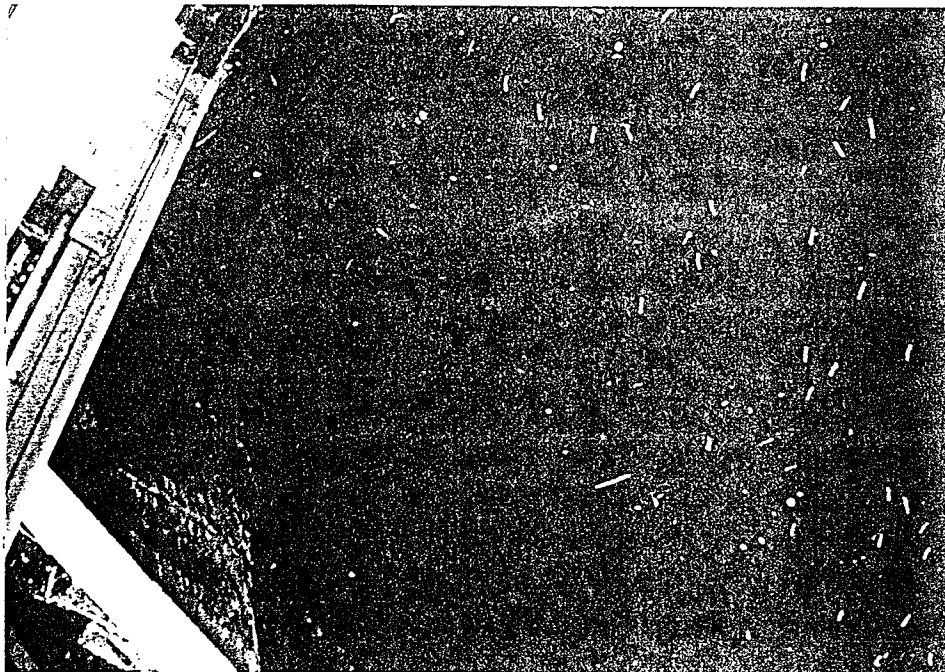
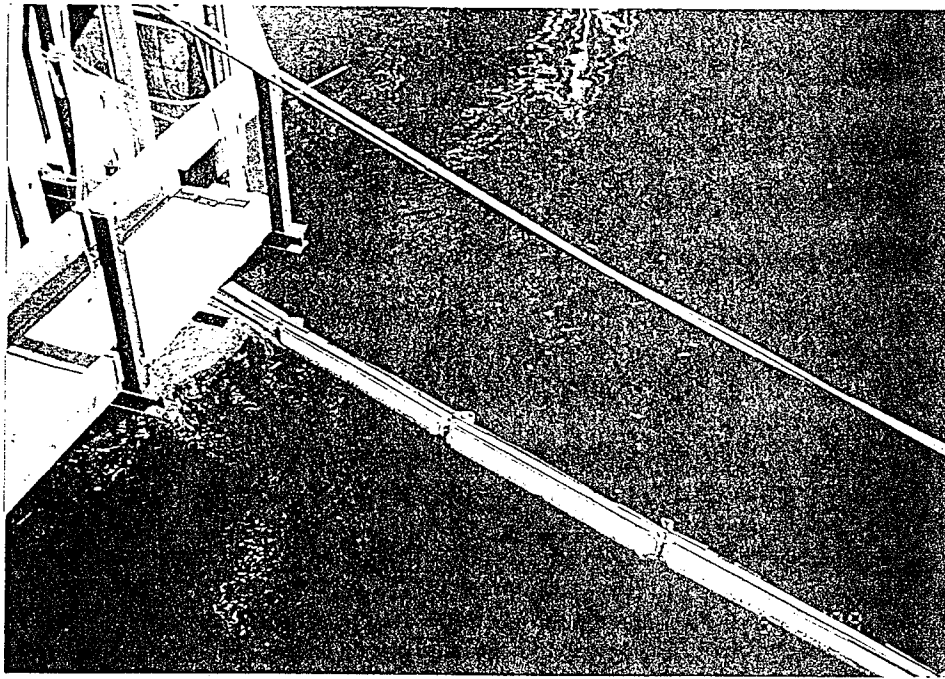
1999 Downstream Fish Bypass Summary												
Date	Turbine Output (MW)	Turbine Flow (cfs)	Water Temp. (F)	Green Release	Green Recapture	Orange Release	Orange Recapture	White Recapture	White Recapture	Control Release	Control Recapture	Wild Recapture
4/30/99	0.647	101		10								
5/1/99	0.964	146	48		1							
5/2/99	0.84	129	50		1							
5/3/99	0.679	106	52	89								
5/4/99	0.441	72	56		13							
5/5/99	1.13	170	55		10							10
5/6/99	0.95	144	55		18							9
5/7/99	0.631	99	58									17
5/8/99	0.838	128	58		3							11
5/9/99	1.566	231	56		2							34
5/10/99	1.587	234	55		1	100						5
5/11/99	0.587	93	52				31					14
5/12/99	0.868	133	52				1					6
5/13/99	0.546	87					3					6
5/14/99	0.906	138	48				1	99				13
5/15/99	0.57	91	53						58			11
5/16/99	0.457	75	56				1		5			8
5/17/99	0.549	88	57						1			13
5/18/99	0.499	80	59						2	75	2	12
5/19/99	0.461	75	63								52	5
5/22/99	1.563	231	54									4
5/23/99	1.362	202	56									2
5/24/99	1.531	226	57									2
5/25/99	1.594	235	53									5
Total				99	49	100	37	99	66	75	54	187
% Recapture					49%		37%		66%		72%	

Current Inducer Installation at the Cavendish Hydroelectric Project - 1999



Photos 1 & 2: Looking downstream toward the bypass entrance. The current inducer is in the foreground while the oil boom surface lead extends to the fish bypass entrance in the background. The turbine intake is on the left and the spillway is to the right.

Current Inducer Installation
at the Cavendish Hydroelectric Project - 1999



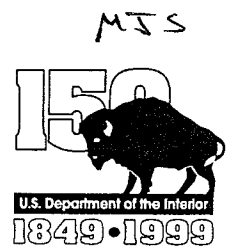
Photos 3 & 4: Tagged fish in the forebay at Cavendish. Oil boom leads to the fish bypass entrance in the upper left corner of the photos. The turbine intake is in the lower left.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986



REF: FERC No. 2489
Central Vermont Public Service Corporation

February 19, 1999

Mr. John C. Greenan
Central Vermont Public Service Corporation
77 Grove Street
Rutland, VT 05701

Dear Mr. Greenan:

We have completed our review of the "Draft Report of the Results of the 1998 Study of the Effectiveness of the Downstream Passage Facility at the Cavendish Hydroelectric Project (FERC No. 2489), Black River, Vermont", dated January 1999.

The Draft Report is generally complete and provides a good summary of smolt bypass studies from 1996 through 1998. Due to the poor results of the 1996 evaluation and questionable behavior of smolts of landlocked stock used in 1997, the evaluation was repeated again in 1998 using smolts of Connecticut River sea-run stock.

We have the following comments and recommendations.

3.2 Status of Restoration

To complete the entries in your table on fry stocking, 91,120 salmon fry were stocked upstream from the Cavendish Project in 1998.

5.3 Study Results

On page 33 the report lists the numbers of wild salmon smolts recorded at the bypass on specific days. We are somewhat surprised at the number of salmon smolts passing the project in June under high water temperature conditions and are concerned that some of these fish may have been misidentified as salmon smolts. Depending upon the experience of the monitoring staff and the condition of any dead fish that were trapped, misidentification of salmon parr or trout as smolts is possible. If photographs were taken or if any mortalities from the trap were saved and frozen, we recommend that they be checked by an experienced consultant and provided to Jay McMenemy of the VDFW office in Springfield for identification. The data summary in Table 3 does not identify the size of individual wild smolts. This data would help in evaluating whether these are true smolts or parr.

Although in various places in the report, river temperatures and river flows, including the amount of spill flow was identified, the data is not presented in a manner that allows for adequate review of these data. We request that you provide a daily tally sheet that includes number of smolts, river flow, amount of spill and river temperature for the entire study period. This information is important in assessing smolt passage timing at this and other projects.

5.4 Discussion and Conclusions

This section includes the statement: "It would appear that these efficiencies may equal or approach those that can be expected for fish passage retrofits such as Cavendish." We strongly disagree with this statement. First, there are many projects where proven technology (angled screens and bypasses) have been retrofitted to existing projects. In this case, screening was opposed by CVPS due to cost considerations and the lack of screening may explain the low bypass efficiency. However, screening or other measures could be installed that could improve passage effectiveness at the project.

This section also cites the increase in enumerated wild smolts over the last two years and suggests that this increase may indicate an increased efficiency of the bypass in recent years. We think that it is more likely that given the limited number of captured smolts, minor differences in spill conditions or trapping effectiveness can explain the increases.

CVPS Conclusions

CVPS concludes that:

- the efficiency of the fishway is adequate and as good as can be achieved, so that further effectiveness testing should be terminated;
- modifications to the fishway plunge pool are needed to improve survival of fish using the bypass; and
- plunge pool modifications should take place in 1999

Conclusions and Recommendations

Based on our review of the report, we reach the following conclusions and recommendations.

Bypass Efficiencies

As stated above, we do not agree that the efficiency of the existing bypass facility is the best that could be attained at the project. Under such circumstances where tested facilities do not produce acceptable efficiencies, various alternatives should be considered. Bypass flow could be increased, the bypass entrance could be modified or screens or guidance louvers could be

added to the project. Alternatively, operational changes that spill water during key migration periods could be considered.

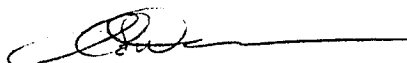
In the case of the Cavendish Project, increased bypass flow is not an acceptable alternative given concerns that even the 20 cfs bypass flow has contributed to the decline of the rare bryophyte (Scapania umbrosa) whose population in the bypass reach gorge has experienced a dramatic decline in recent years. If more water were to be used for passage, pumping back to the headpond from the bypass collection box would be needed in order to avoid increased bypass reach flows. Other alternatives we recommend that CVPS consider include programmed spill during peak passage periods and hours to augment passage success, or the installation of a flow inducer device, to create a flow field that guides fish to the bypass opening. Such a device was developed by Lakeside Engineering and Essex Power Services, and has been tested on a limited scale on projects on the Contoocook and Ashuelot Rivers. The configuration of the Cavendish site may be conducive to such a device. We suggest you contact Lakeside Engineering for more information on this option.

Plunge Pool Improvements

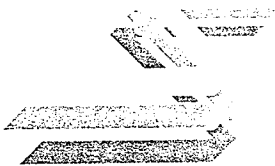
Despite our reservations about bypass effectiveness, we strongly agree that the safety of the bypass facility for salmon smolts needs substantial improvements and that these improvements should be implemented in 1999. There are two approaches that could be taken to achieve this improvement. The plunge pool itself could be modified. This will require a substantial increase in the plunge pool size by constructing higher side walls and/or by additional rock removal. Alternatively, the volume of flow for fish conveyance could be reduced, with some of the water used to attract fish to the bypass pumped back to the headpond. In this way, fish attraction flow to the bypass is not reduced, but the flow for conveying the fish is reduced. Fish could then be captured in a smaller plunge pool or transitioned to a pipe and conveyed downstream to a safer discharge area. Lastly, a dewatering mechanism such as wedge wire screening could be used to reduce the amount of flow conveying fish. With either approach to reduce conveyance flows, the size of the existing plunge pool may be adequate, or its expansion could be minimized.

We recommend that you consider the alternatives discussed above for improving bypass effectiveness and safety of salmon smolts using the bypass, and revise the report as recommended. A meeting or on-site inspection can be scheduled as needed. Thank you for this opportunity to comment. If you have any questions, please call me at (603) 225-1411.

Sincerely yours,



John P. Warner
Energy Coordinator
New England Field Office



Central Vermont Public Service Corporation

February 27, 1995

Ms. Lois Cashell, Secretary
Federal Energy Regulatory Commission
825 N. Capitol Street, N.E.
Washington D.C. 20426

RE: L.P. No. 2489-001, Cavendish
Interim Downstream Fish Passage Plans

Dear Ms. Cashell:

Pursuant to Article 405 of the license for the above referenced project, I am enclosing an original and 8 copies of the interim downstream fish passage plan, design drawing, and agency correspondence.

The plan utilizes the method by which we have been passing the required minimum flow since receipt of the new license in November 1994. As such, the fishway is operational now.

AGENCY CORRESPONDENCE

In a letter dated November 23, 1994, the U.S. Fish and Wildlife Service (USFWS) suggested that the interim downstream passage could be accomplished with our method for releasing minimum flow, without detailed designs or modifications.

By letters dated January 16, 1995, I requested comments on the draft plan based on the minimum flow release method from the USFWS and the Vermont Department of Fish and Wildlife (VDFW). The VDFW responded by letter dated February 14, 1995, requesting a design flow of 10 cfs to 25 cfs. By letter dated February 27, 1995, I responded that CVPS cannot increase minimum flow above 10 cfs, except during periods of high flow, without an order from the FERC following a study of the impact of higher flows on the rare bryophyte *Scapania umbrosa*, pursuant to article 409 of the license. No additional comments were received from the USFWS.

Please call me at (802) 747-5463 if you should have any questions.

Sincerely,

A handwritten signature in cursive script, appearing to read "B. Peacock", with a long horizontal flourish extending to the right.

Bruce M. Peacock
Manager of Production Engineering

Attachments

cc: A. Sidoti FERC NYRO
J. Cueto ANR
J. Warner USFWS
R. Wentworth VDFW
S. Sease ANR

Central Vermont Public Service Corp.

Cavendish Station L.P. # 2489

Interim Downstream Fish Passage Plan

Purpose

The purpose of this plan is to describe the interim measures for passing Atlantic Salmon smolt downstream of the Cavendish Dam.

Per the suggestion of USFWS personnel, the interim passage will be the existing sluiceway. The sluiceway is the northern most flashboard located adjacent to the headworks. This flashboard has been modified by cutting a rectangular hole three feet wide and installing stop logs as shown in the attached drawing. This flashboard is normally used to sluice surface debris away from the intake, but upon receipt of the new license, 3 stoplogs were removed and it has been used to pass the 10 cfs minimum flow to the bypassed reach.

The proposed passage was demonstrated to USFWS and Vermont Fish and Wildlife personnel on October 13, 1994. No additional modifications for interim fish passage are proposed.

Design Flow - 10 cfs¹

Schedule

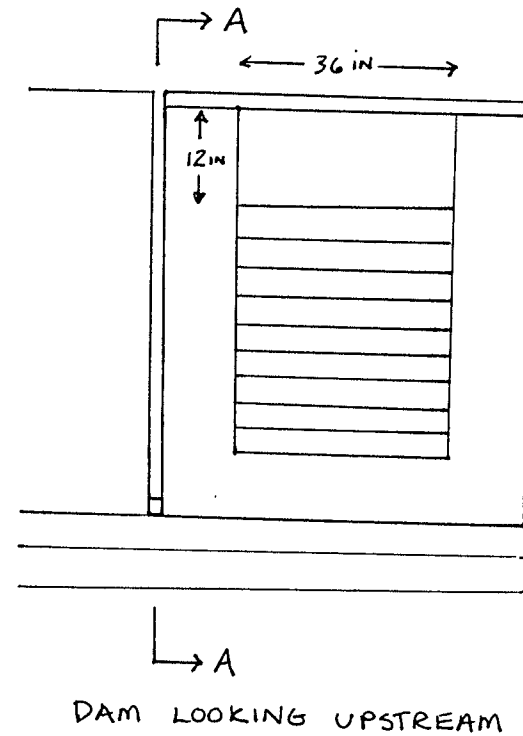
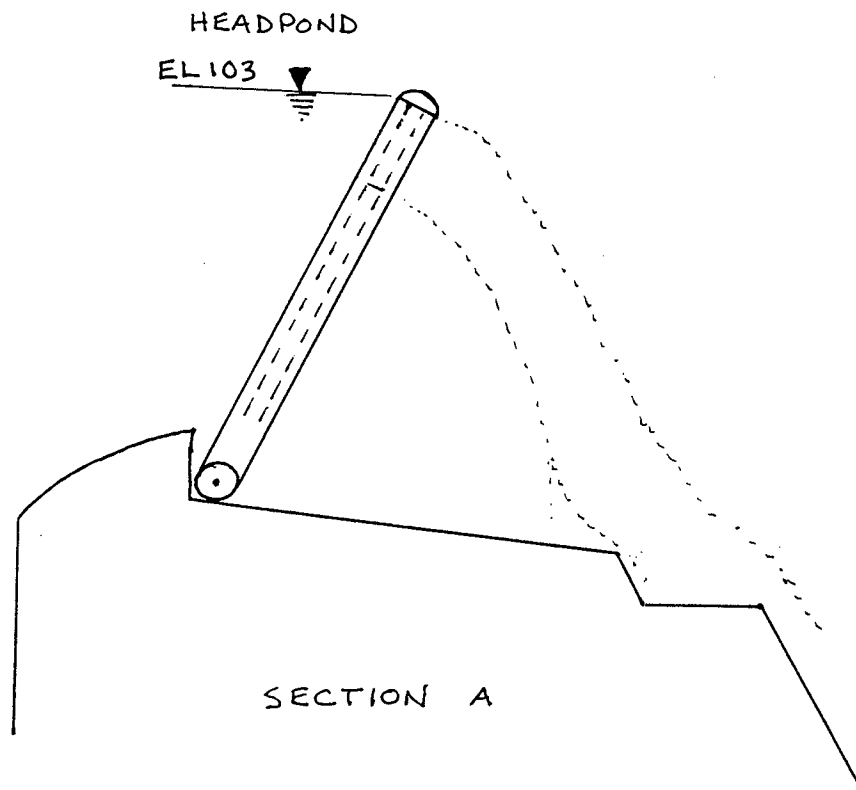
Construction - completed

Operational Period - April 1 - June 15, 1995²

¹During high flow periods when water is spilling over the flashboards, attraction flow will be increased to 20 - 25 cfs.

²The permanent downstream passage, submitted for approval to the FERC December 14, 1994, is scheduled to be operable by the fall 1995 migration season.

Central Vermont Public Service Corp.
Cavendish Station L.P. # 2489
Interim Downstream Fish Passage



ABUTMENT

SCALE $\frac{3}{8}" = 1'$



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

REF: FERC No. 2489
Central Vermont Public Service Corporation

October 27, 1995

Mr. Bruce M. Peacock
Central Vermont Public Service Corporation
77 Grove Street
Rutland, VT 05701

Dear Mr. Peacock:

We have completed our review of the "Plan for Evaluation of the Effectiveness of the Downstream Fish Passage Facility at the Cavendish Project", dated September 1995, and have the following comments.

You propose to conduct a mark-recapture study using hatchery-reared salmon smolts. Two lots of approximately 250 smolts each would be marked and released, and the plunge pool at the base of the downstream fishway would be modified to serve as a trapping facility.

The proposed plan is generally acceptable, and has included suggestions made by John Warner of this office in preliminary consultation on the effectiveness study. We do, however, note the following:

- o We cannot emphasize enough the need to coordinate closely with the White River National Fish Hatchery and the Connecticut River Coordinator's office on smolt allocation, tagging and handling, and transport. This is especially important given the expected appointments in upcoming months of a new hatchery manager at White River and a new Coordinator.
- o The plan calls for the checking of the trap at least once per day depending on the number of fish captured. We recommend that you also be prepared to monitor the trap more frequently if necessary to prevent clogging of the trap screening by floating debris.
- o The proposed schedule suggests that the report on the study results will be prepared as required by FERC. We recommend that a draft report be circulated for our review no later than 3 months following completion of the monitoring, or approximately mid-September, 1996.
- o Depending upon the study results, the report should include proposals for modifications to the downstream fishway or for further monitoring, as appropriate.

Thank you for this opportunity to comment. If you have any questions, please call Mr. Warner at (603) 225-1411.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Michael J. Bartlett". The signature is fluid and cursive, with a prominent loop at the end.

Michael J. Bartlett
Supervisor
New England Field Office

cc: Director, DPCA, FERC
CRASC
WRNFH
RO/Engineering - Curt Orvis
VDFW-Springfield - Ken Cox
VDFW - Cheryl Kieffer
ES: JWarner:10-27-95:(603)225-1411

From: [Davis, Eric](#)
To: [Katie Sellers](#)
Cc: [Kayla Easler](#); [Greenan, John](#)
Subject: RE: Cavendish LIHI consultation
Date: Friday, July 14, 2017 9:18:12 AM

Hi Katie,

Thank you for the update on operations data and fish passage details. The information that you provided on fish passage operations addresses our questions on the downstream fish passage criterion.

With the public comment deadline approaching in a week, we do not plan to issue formal comments at this time. Please do let us know when operations data are available though, so that we can respond to the LIHI reviewer later in the process when contacted.

Thanks,
Eric

Eric Davis, River Ecologist

1 National Life Drive, Main 2
Montpelier, VT 05620-3522
802-490-6180 / eric.davis@vermont.gov
<http://www.watershedmanagement.vt.gov/rivers>
(Please note my new e-mail address, effective July 27, 2015)



See what we're up to on our [Blog](#). [Flow](#).

From: Katie Sellers [<mailto:Katie.Sellers@KleinschmidtGroup.com>]
Sent: Thursday, June 29, 2017 3:49 PM
To: Davis, Eric <Eric.Davis@vermont.gov>
Cc: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>; Greenan, John <John.Greenan@greenmountainpower.com>
Subject: RE: Cavendish LIHI consultation

Thank you Eric for the review. As with the other LIHI applications, we are working towards providing you with the operations data for review.

I have confirmed with GMP operations personnel, and the fish passage facility operates as follows:

The downstream fish passage facility consists of a transition box in the spillway adjacent to the penstock intake. Inflow to the box is controlled by a motor-operated gate, allowing variable flow between 10 - 20 cfs. Stoplogs are installed to form the back of the box to maintain a minimum water

depth. Fish enter the box and pass down the spillway on a 3-foot wide chute into a 3-foot deep plunge pool, with a channel at the downstream end for flow return to the Project's bypass channel. The downstream facility is operated from April 1 to June 15 and from September 15 to November 15 for spring and fall out-migrations. During the remainder of the year, the fishway is utilized to pass the minimum flow requirement.

The gate is left open at between 25 and 30% all year long including through the winter. The flow inducer is installed as early as possible based on access up to the dam for a boom truck and is removed shortly before freeze up.

Best,
Katie

Katie E. Sellers, M.S.
Regulatory Coordinator

Kleinschmidt

Office: 207-416-1218

www.KleinschmidtGroup.com

*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Davis, Eric [<mailto:Eric.Davis@vermont.gov>]
Sent: Thursday, June 01, 2017 4:19 PM
To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: RE: Cavendish LIHI consultation

Hi Kayla,

The Agency has reviewed our records for the Cavendish project and provides the following information regarding water quality and rare, threatened, and endangered species requested by Kleinschmidt to aid in the development of a complete LIHI application.

Water Quality

-

The 2010 Clean Water Action Section 303(d) List of Impaired Waters did not identify the waters in the Project as being impaired. However, the Black River, both upstream and downstream of the Project have been impaired by metal manufacturing, hazardous materials and runoff from old landfills (Vermont Agency of Natural Resources 2016, 8-9).

Could you please confirm, to your best abilities, that the Project's current operations continue to not be a contributing cause to the river's water quality limitations?

The Agency lists two portions of the Black River on its 2016 List of Priority Surface Waters. Both portions are a considerable distance downstream of the project: (1) A 4.6 mile stretch from the

mouth to Fellows dam on Part A for E. coli due to combined sewer overflows and (2) Stoughton Pond and North Springfield Reservoir on Part F due to flow regulation associated with Army Corps flood control operations.

I can confirm that the current operations of the project are not a contributing cause to the river's water quality limitations.

-

Rare, Threatened and Endangered Species

-

Could you a) review the below species list to make sure it is accurate and/or suggest updates as appropriate; and b) review this list to confirm that the Project continues to not negatively affect any of the currently listed species that may occur within the Project area?

Species List:

Northern Long-eared Bat (federally and state endangered)

Bald Eagle (state endangered)

rare byrophyte (Scapania umbrosa)

-

Our Natural Heritage Program has records of two additional rare moss species that occur within the project area in addition to *Scapania umbrosa*: *Anomobryum filiforme* (S1, very rare) and *Pseudotaxiphyllum distichaceum* (S2S3, rare to common). No threatened rare, threatened, or endangered aquatic animal species have been reported in sections of the Black River potentially impacted by this project.

Little is known about either of these species, except that they were observed in the gorge in the vicinity of the Scapania. Given the water quality certification and post certification adaptive management process focused on identifying a flow regime to protect the rare *Scapania umbrosa* communities, it would be reasonable to assume that if the project is operated in compliance with its water quality certification, operations would not negatively affect any of the currently listed species that may occur within the Project area.

-

Formal Application Review

-

The Agency hopes the input above assists you in developing a complete LIHI application. As you may know the Agency's review of LIHI applications has evolved, and the Agency has now developed a practice of requesting one year of project operations records to review for compliance with certification conditions in order to provide meaningful input into the LIHI review process. While we could request these when the application is noticed, we thought it may be beneficial to the review process to flag this as an information need as early as possible.

In addition to operating records, our preliminary review has also identified GMPs plans for operating the fish passage facility under a new LIHI certification term as an information need for our review of the LIHI application.

Please let me know if you have additional questions,

Eric

Eric Davis, *River Ecologist*

1 National Life Drive, Main 2
Montpelier, VT 05620-3522
802-490-6180 / eric.davis@vermont.gov
<http://www.watershedmanagement.vt.gov/rivers>
(Please note my new e-mail address, effective July 27, 2015)



See what we're up to on our [Blog, Flow](#).

From: Kayla Easler [<mailto:Kayla.Easler@KleinschmidtGroup.com>]
Sent: Monday, May 22, 2017 4:13 PM
To: Davis, Eric <Eric.Davis@vermont.gov>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: FW: Cavendish LIHI consultation

Good afternoon Eric,

I am following up on the Cavendish consultation. Have you had a chance to review this yet? Is there any additional information I can for you?

Thank you,

Kayla A. Easler
Regulatory Coordinator

Direct: (207) 416-1271
www.KleinschmidtGroup.com
*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Kayla Easler
Sent: Thursday, March 16, 2017 2:07 PM
To: 'Eric.Davis@vermont.gov' <Eric.Davis@vermont.gov>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: Cavendish LIHI consultation

Good morning, Eric,

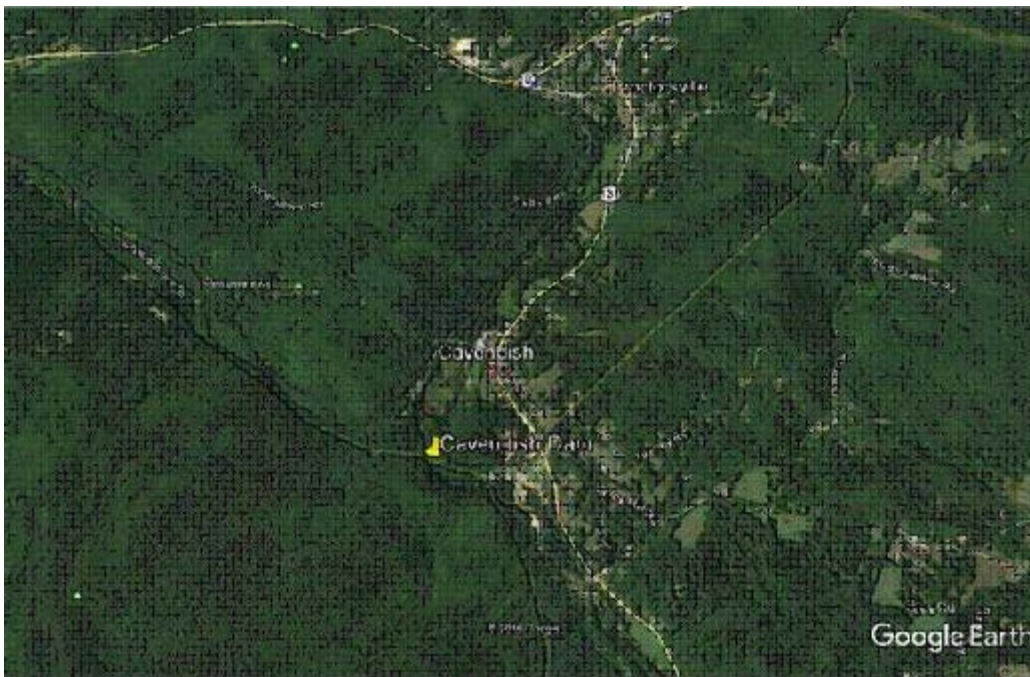
Here is another LIHI re-certification application for Green Mountain Power: Cavendish Hydroelectric Project (FERC No. 2489) located on the Black River in Cavendish, Vermont.

The LIHI application asks that we gain your feedback on the following water quality information:

The 2010 Clean Water Action Section 303(d) List of Impaired Waters did not identify the waters in the Project as being impaired. However, the Black River, both upstream and downstream of the Project have been impaired by metal manufacturing, hazardous materials and runoff from old landfills (Vermont Agency of Natural Resources 2016, 8-9).

Could you please confirm, to your best abilities, that the Project's current operations continue to not be a contributing cause to the river's water quality limitations?

When you have a moment to review, could you please provide us with your feedback on this topic?



Thank you,

Kayla A. Easler
Regulatory Coordinator
KLEINSCHMIDT
Office: (207) 487-3328
Direct: (207) 416-1271

www.KleinschmidtGroup.com

APPENDIX E

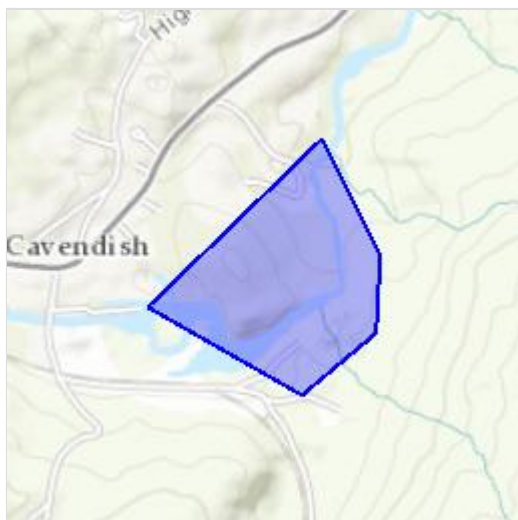
THREATENED AND ENDANGERED SPECIES

IPaC**U.S. Fish & Wildlife Service**

IPaC resource list

Location

Windsor County, Vermont



Local office

New England Ecological Services Field Office

☎ (603) 223-2541

📠 (603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

<http://www.fws.gov/newengland>

Endangered species

This resource list is for informational purposes only and should not be used for planning or analyzing project level impacts.

[Section 7](#) of the Endangered Species Act **requires** Federal agencies to “*request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action*” for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Review section in IPaC or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by creating a project and making a request from the Regulatory Review section.

Listed species

¹ are managed by the [Endangered Species Program](#) of the U.S. Fish and Wildlife Service.

1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/9045	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Birds are protected under the Migratory Bird Treaty Act

¹ and the Bald and Golden Eagle Protection Act².

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service

³. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Conservation measures for birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Year-round bird occurrence data <http://www.birdscanada.org/birdmon/default/datasummaries.jsp>

The migratory birds species listed below are species of particular conservation concern (e.g. [Birds of Conservation Concern](#)) that may be potentially affected by activities in this location, not a list of every bird species you may find in this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the [AKN Histogram Tools](#) and [Other Bird Data Resources](#).

NAME	SEASON(S)
American Bittern <i>Botaurus lentiginosus</i> http://ecos.fws.gov/ecp/species/6582	Breeding
Bald Eagle <i>Haliaeetus leucocephalus</i> http://ecos.fws.gov/ecp/species/1626	Year-round
Black-billed Cuckoo <i>Coccyzus erythrophthalmus</i> http://ecos.fws.gov/ecp/species/9399	Breeding
Blue-winged Warbler <i>Vermivora pinus</i>	Breeding
Canada Warbler <i>Wilsonia canadensis</i>	Breeding
Olive-sided Flycatcher <i>Contopus cooperi</i> http://ecos.fws.gov/ecp/species/3914	Breeding
Peregrine Falcon <i>Falco peregrinus</i> http://ecos.fws.gov/ecp/species/8831	Breeding
Pied-billed Grebe <i>Podilymbus podiceps</i>	Breeding
Prairie Warbler <i>Dendroica discolor</i>	Breeding
Short-eared Owl <i>Asio flammeus</i> http://ecos.fws.gov/ecp/species/9295	Wintering
Willow Flycatcher <i>Empidonax traillii</i> http://ecos.fws.gov/ecp/species/3482	Breeding
Wood Thrush <i>Hylocichla mustelina</i>	Breeding

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAA/NCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAA/NCCOS models: the models were developed as part of the NOAA/NCCOS project: [Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#). The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the [Northeast Ocean Data Portal](#), which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The [Avian Knowledge Network \(AKN\)](#) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest, survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the [Migratory Bird Programs AKN Histogram Tools](#) webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS [Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project](#) webpage.

Facilities

Wildlife refuges

Any activity proposed on [National Wildlife Refuge](#) lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

[PSS1/EMC](#)

FRESHWATER POND

[PUBHh](#)

A full description for each wetland code can be found at the National Wetlands Inventory website: <https://ecos.fws.gov/ipac/wetlands/decoder>

Not for
consultation

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

From: [Popp, Bob](#)
To: [Kayla Easler](#); [Ferguson, Mark](#); [Mackenzie, Chet](#)
Cc: [Katie Sellers](#); [Nuria Claudio](#)
Subject: RE: Cavendish LIHI Review
Date: Friday, March 17, 2017 3:58:52 PM

Kayla, the liverwort, *Scapania umbrosa*, was extirpated from the known areas of the gorge after the flows were altered. It is categorized as very rare (S1) but not listed as T or E.

See notes below from our documenting the rather rapid decline.

S_NAME *Scapania umbrosa*
S_RANK_DES S1: very rare in Vermont
SITE CAVENDISH GORGE
DIRECTION1 Along the Black River, directly below the CVPS power plant.
SURVEYDATE 1999-10-07
LAST_OBS 1998-08-11
FIRST_OBS 1991-05-28
EO_DATA1 1999: No *Scapania umbrosa* found at known sites. Likely exists elsewhere in Gorge.
1998: Total area declined to .03 square feet. 1997: Population occupies 1.11 square feet. 1996: Total area is 2.94 square feet. 1993: Six populations total 8.92 square feet at a leakage flow of approximately 2 cfs. 1991: Two colonies were found growing 12 inches above the current water level.
MGMTCOM1 1999 Miller: Recommendations: 'Institute a minimum bypass flow to 5 cfs' and 'permanently install the FishPath system and operate it during the spring downstream fish passage period of April 1 through June 15 with [a bypass flow] limited to 7 cfs'. 1998:
MGMTCOM2 The population has been reduced by 99.7% due to increase in water flows by CVPS.
CITATIONS1 N98MCQ01VTUS: McQueen, Cyrus. 1998. The Effects of Increased Water Flows on Populations of *Scapania Umbrosa* in Cavendish Gorge, Cavendish, Vermont: 1998 Report. *
U99MCQ01VTUS: McQueen, C. and N. Miller. 1999. The effects of increased water flows on populations of *Scapania umbrosa* (Schrad.) Dumort. in Cavendish Gorge, Cavendish, Vermont: A summary of five annual reports. Prepared for Central Vermont Public Service Corporation, Rutland, Vermont. * U99MIL01VTUS: Miller, N.G. 1999.
GENERALCOM 1999 Miller: The loss of *Scapania umbrosa* is associated with inundation, abrasion, siltation, competition from larger and faster growing plants, algal blooms, and bacterial/fungal decay of weakened plants; all likely attributable to the increased flows in the gorge.

There are also two other rare mosses in the gorge:

S_NAME *Anomobryum filiforme* S1: very rare in Vermont
DIRECTION1 Along the Black River, directly below the CVPS power plant, at the 10 cubic feet per second water level.
LAST_OBS 1999-10-07
EO_DATA1 1999: Small patches growing on rock at and just above the 10 cfs water level at Sites 1 and 2.

S_NAME *Pseudotaxiphyllum distichaceum* S2S3: rare to uncommon in Vermont
DIRECTION1 Along the Black River, directly below the CVPS power plant.
LAST_OBS 1999-10-07

EO_DATA1 1999: Miller report states it is present, but no location or abundance data given.

Bob Popp
Department Botanist
VT. Dept of Fish & Wildlife
5 Perry St. Suite 40
Barre, VT. 05641

(802) 476-0127
bob.popp@vermont.gov

From: Kayla Easler [mailto:Kayla.Easler@KleinschmidtGroup.com]
Sent: Friday, March 17, 2017 9:52 AM
To: Ferguson, Mark <Mark.Ferguson@vermont.gov>; Mackenzie, Chet <Chet.Mackenzie@vermont.gov>; Popp, Bob <Bob.Popp@vermont.gov>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>; Nuria Claudio <Nuria.Claudio@Kleinschmidtgroup.com>
Subject: Cavendish LIHI Review

Good afternoon,

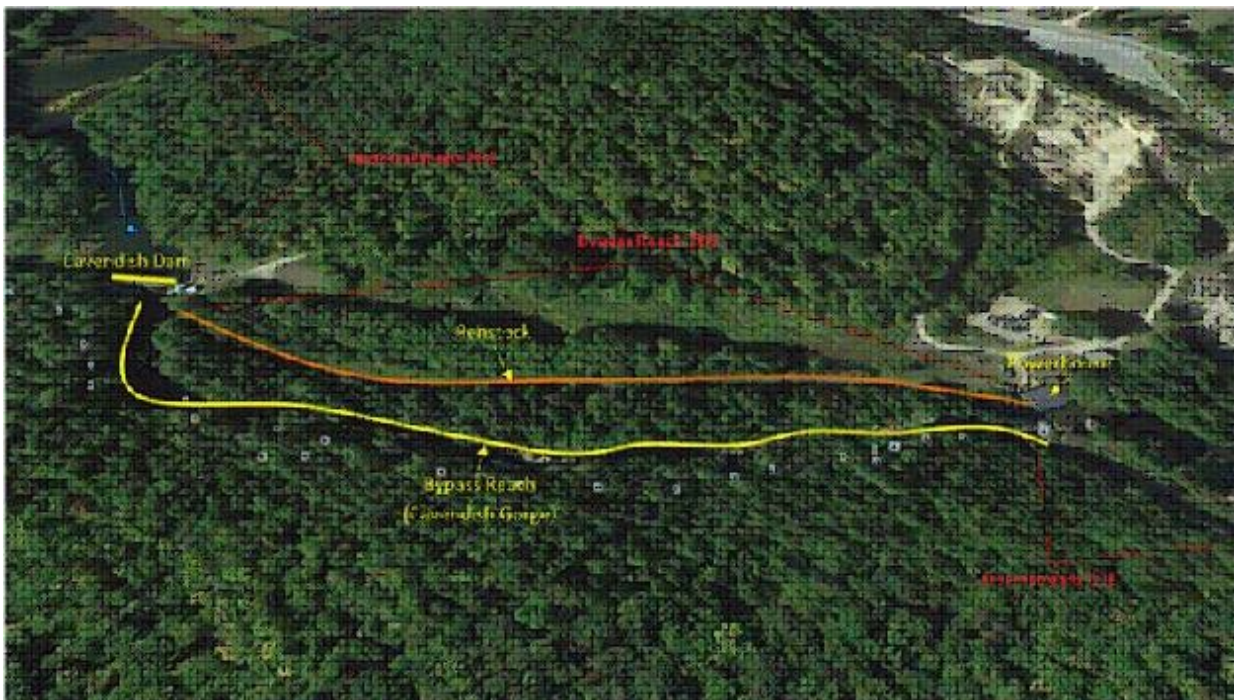
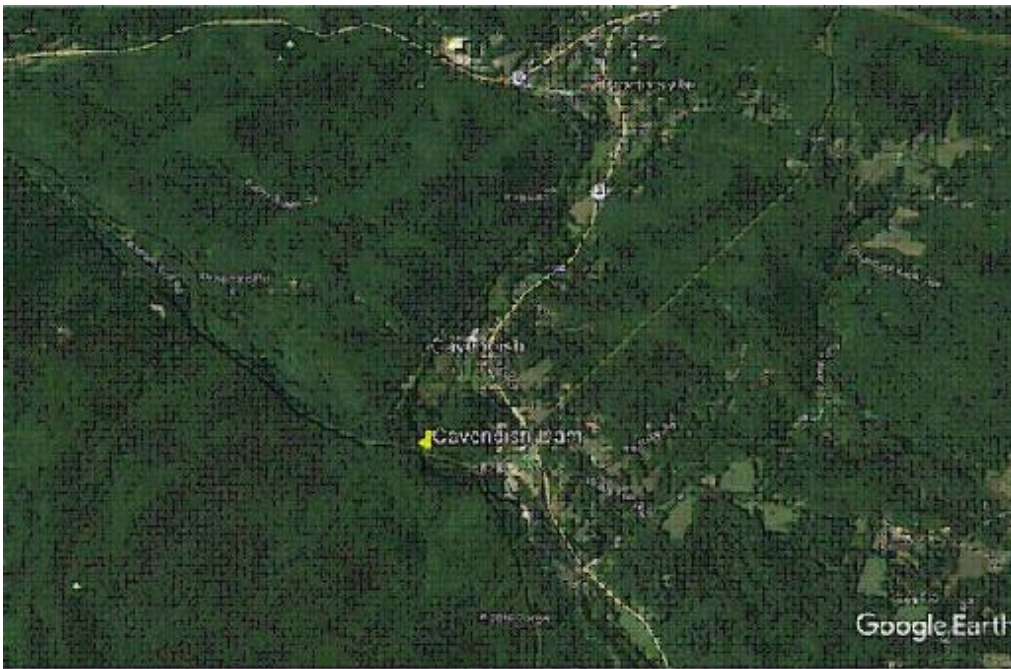
I have another LIHI application in need of threatened and endangered species review. This is for the Cavendish Hydroelectric Project (FERC No. 2489) a run-of-river project located on Black River.

Upon reviewing the USFWS IPAC Report and previous LIHI Application for this Project, a list of potential threatened and endangered species that may occur within this project area has been developed. Could you a) review the below species list to make sure it is accurate and/or suggest updates as appropriate; and b) review this list to confirm that the Project continues to not negatively affect any of the currently listed species that may occur within the Project area?

Species List:

Northern Long-eared Bat (federally and state endangered)
Bald Eagle (state endangered)
rare byrophyte (*Scapania umbrosa*)

Scapania umbrosa: The 2015 Vermont list of Endangered and Threatened Plants does not include the plant species *Scapania umbrosa*, which is known to be found in the Cavendish Gorge. In fact, this species is not listed as rare, threatened or endangered at the state or federal levels. The Cavendish Gorge is an area identified as the only known location in the state of Vermont to have this rare bryophyte, a moss-like species of liverwort present at six sites. Article 409 of the License and Condition I of the WQC required GMP to undertake a five-year study of the effects of alternative bypass flow regimes on the species. FERC approved the study plan on May 10, 1996. Results in 1996, 1998 and 2000 indicated that alternative flows were more detrimental than the 10 cfs minimum flow required under Article 402 and WQC Condition C. The mandated 10 cfs flows remain the most protective to the *S. umbrosa*.



No changes to the project or tree cutting are planned at this time. Do let me know if you have any follow-up questions.

Kayla A. Easler
Regulatory Coordinator
KLEINSCHMIDT
Office: (207) 487-3328
Direct: (207) 416-1271

www.KleinschmidtGroup.com

From: [Appleton, Tim](#)
To: [Kayla Easler](#)
Cc: [Katie Sellers](#); [McHugh, Peter](#); [Davis, Eric](#)
Subject: RE: Cavendish LIHI Review
Date: Monday, June 19, 2017 12:56:17 PM
Attachments: [image018.png](#)
[image019.png](#)
[image021.png](#)
[image026.png](#)
[image024.wmz](#)
[image027.wmz](#)
[image030.wmz](#)
[image035.wmz](#)
[image001.png](#)
[image002.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.png](#)
[image008.png](#)
[image011.png](#)
[image012.png](#)
[image014.png](#)
[image017.png](#)
[image028.png](#)

Hi Kayla,

With regard to terrestrial wildlife species for this project review, your USFWS IPAC search indicated the presence of Bald Eagle and Northern Long-eared Bat. There are no other known occurrences of rare, threatened or endangered wildlife species at this site location. You mentioned that there is no tree cutting or changes to the project operation proposed, so impacts to Bald Eagle and Northern Long-eared Bat habitat should be minimal, if not non-existent. It is requested that should Bald Eagle nesting activity or discoveries of bats be found on the property, those be reported to the VT Fish & Wildlife Department. That would give the Department an opportunity to document these occurrences and to work with the project applicant to provide for proper protection and conservation.

I will also attempt to include these comments within the VT Agency of Natural Resources response for this project if such response has not already been provided to you.

Again, I apologize for the delay in responding to you. I believe future requests for our participation in these types of reviews will be funneled through Eric Davis' office within the VT Department of Environmental Conservation.

Let me know if you have questions or concerns.

-Tim

Timothy J. Appleton, Wildlife Biologist
VT Fish & Wildlife Department
5 Perry Street, Suite 40
Barre, VT 05641-4266
Phone: 802-476-0198 Fax: 802-476-0129
www.vtfishandwildlife.com

From: Kayla Easler [mailto:Kayla.Easler@KleinschmidtGroup.com]
Sent: Friday, May 26, 2017 11:38 AM
To: Appleton, Tim <Tim.Appleton@vermont.gov>
Cc: Simard, Lee <Lee.Simard@vermont.gov>; Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: RE: Cavendish LIHI Review

Thank you Tim,

Yes, Bob replied with comments. See below.

Kayla, the liverwort, *Scapania umbrosa*, was extirpated from the known areas of the gorge after the flows were altered. It is categorized as very rare (S1) but not listed as T or E.

See notes below from our documenting the rather rapid decline.

S_NAME Scapania umbrosa
S_RANK_DES S1: very rare in Vermont
SITE CAVENDISH GORGE
DIRECTION1 Along the Black River, directly below the CVPS power plant.
SURVEYDATE 1999-10-07
LAST_OBS 1998-08-11
FIRST_OBS 1991-05-28
EO_DATA1 1999: No Scapania umbrosa found at known sites. Likely exists elsewhere in Gorge. 1998: Total area declined to .03 square feet. 1997: Population occupies 1.11 square feet. 1996: Total area is 2.94 square feet. 1993: Six populations total 8.92 square feet at a leakage flow of approximately 2 cfs. 1991: Two colonies were found growing 12 inches above the current water level.
MGMTCOM1 1999 Miller: Recommendations: 'Institute a minimum bypass flow to 5 cfs' and 'permanently install the FishPath system and operate it during the spring downstream fish passage period of April 1 through June 15 with [a bypass flow] limited to 7 cfs'. 1998:
MGMTCOM2 The population has been reduced by 99.7% due to increase in water flows by CVPS.
CITATIONS1 N98MCQ01VTUS: McQueen, Cyrus. 1998. The Effects of Increased Water Flows on Populations of Scapania Umbrosa in Cavendish Gorge, Cavendish, Vermont: 1998 Report. * U99MCQ01VTUS: McQueen, C. and N. Miller. 1999. The effects of increased water flows on populations of Scapania umbrosa (Schrad.) Dumort. in Cavendish Gorge, Cavendish, Vermont: A summary of five annual reports. Prepared for Central Vermont Public Service Corporation, Rutland, Vermont. * U99MIL01VTUS: Miller, N.G. 1999.
GENERALCOM 1999 Miller: The loss of Scapania umbrosa is associated with inundation, abrasion, siltation, competition from larger and faster growing plants, algal blooms, and bacterial/fungal decay of weakened plants; all likely attributable to the increased flows in the gorge.

There are also two other rare mosses in the gorge:

S_NAME Anomobryum filiforme S1: very rare in Vermont
DIRECTION1 Along the Black River, directly below the CVPS power plant, at the 10 cubic feet per second water level.
LAST_OBS 1999-10-07
EO_DATA1 1999: Small patches growing on rock at and just above the 10 cfs water level at Sites 1 and 2.

S_NAME Pseudotaxiphyllum distichaceum S2S3: rare to uncommon in Vermont
DIRECTION1 Along the Black River, directly below the CVPS power plant.
LAST_OBS 1999-10-07
EO_DATA1 1999: Miller report states it is present, but no location or abundance data given.

Bob Popp
Department Botanist
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5 Perry St. Suite 40
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(802) 476-0127
bob.popp@vermont.gov

Kayla A. Easler
Regulatory Coordinator

Kleinschmidt

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*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Appleton, Tim [<mailto:Tim.Appleton@vermont.gov>]

Sent: Friday, May 26, 2017 11:24 AM

To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>

Cc: Simard, Lee <Lee.Simard@vermont.gov>

Subject: RE: Cavendish LIHI Review

Hi Kayla,

I apologize for the run-around with appropriate reviewers....attached is a current map indicating areas of regulatory review responsibility for wildlife division staff. I'll review what you have sent and get back to you in the near future. Thanks!

PS. Did Mark Ferguson or Bob Popp provide any comments to you? I see you sent your original 3-17-17 email to them.
-Tim

Timothy J. Appleton, Wildlife Biologist
VT Fish & Wildlife Department
5 Perry Street, Suite 40
Barre, VT 05641-4266
Phone: 802-476-0198 Fax: 802-476-0129
www.vtfishandwildlife.com

From: Kayla Easler [<mailto:Kayla.Easler@KleinschmidtGroup.com>]
Sent: Friday, May 26, 2017 11:09 AM
To: Appleton, Tim <Tim.Appleton@vermont.gov>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: FW: Cavendish LIHI Review

Good morning Tim,

After a few rounds of incorrect contacts, I am hoping that you will be able to help and review the Cavendish LIHI information found below.

If you have any questions, please let me know.

Kayla A. Easler
Regulatory Coordinator

Kleinschmidt

Direct: (207) 416-1271

www.KleinschmidtGroup.com

*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Hammond, Forrest [<mailto:Forrest.Hammond@vermont.gov>]
Sent: Friday, May 26, 2017 11:01 AM
To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: RE: Cavendish LIHI Review

Kayla,

My apologies for the delay in responding to your emails. Tim Appleton is actually the person handling wildlife reviews for the town of Cavendish. His contact is tim.appleton@vermont.gov or phone number 802-476-0198.

Good luck with your project.

Forrest



Forrest Hammond, Wildlife Biologist
Black Bear Project Leader
Environmental Review Biologist

[phone] 802-289-0626 [fax] 802-885-8890

[email] forrest.hammond@vermont.gov

[website] www.vtfishandwildlife.com

Fish & Wildlife Department
100 Mineral Street, Suite 302
Springfield, VT 05156-3168

Please note new phone number.

From: Kayla Easler [<mailto:Kayla.Easler@KleinschmidtGroup.com>]
Sent: Monday, May 22, 2017 4:17 PM
To: Hammond, Forrest <Forrest.Hammond@vermont.gov>

Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>

Subject: FW: Cavendish LIHI Review

Good afternoon,

I am following up on the Cavendish review that I sent on April 10th. Have you had a chance to look over the project? Is there additional information that I can provide for you?

Thank you,

Kayla A. Easler
Regulatory Coordinator

Kleinschmidt

Direct: (207) 416-1271

www.KleinschmidtGroup.com

*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Kayla Easler

Sent: Monday, April 10, 2017 12:39 PM

To: 'forrest.hammond@vermont.gov' <forrest.hammond@vermont.gov>

Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>

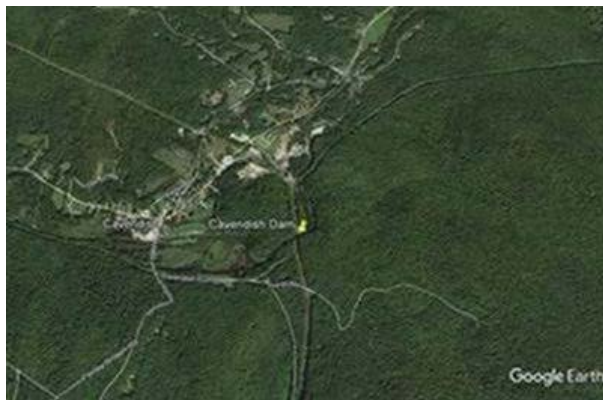
Subject: FW: Cavendish LIHI Review

Good afternoon,

I am in hopes that I have found the correct reviewer, if not could you please direct me to the correct individuals.

I previously sent out a Project Review Request for the Cavendish LIHI Project to Chet Mackenzie; however, he explained that the project was not within his management area.

We are looking for a threatened and endangered species review for the Cavendish Hydroelectric Project (FERC No. 2489) which will be applying for LIHI Certification. The project is operated in run-of-river mode and is located on the Black River. Please see the forwarded email below for additional information on the project.





Please let me know if you have any questions.

Thank you,

Kayla A. Easler
Regulatory Coordinator



Direct: (207) 416-1271

www.KleinschmidtGroup.com

*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Simard, Lee [<mailto:Lee.Simard@vermont.gov>]

Sent: Monday, April 10, 2017 12:32 PM

To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>

Subject: RE: Cavendish LIHI Review

Kayla,

Ryan Smith is probably not the terrestrial contact person. Forrest Hammond (forrest.hammond@vermont.gov) is one of the wildlife biologists out of our office in Springfield. If he is not the correct person, he should be able to point you in the correct direction.

Thanks,

Lee



Lee Simard, Fisheries Biologist

[phone] 802-622-4017 [fax] 802-885-8890

[email] lee.simard@vermont.gov

[website] www.vtfishandwildlife.com

Fish & Wildlife Department

100 Mineral Street, Suite 302

Springfield, VT 05156-3168

From: Kayla Easler [<mailto:Kayla.Easler@KleinschmidtGroup.com>]

Sent: Monday, April 10, 2017 12:22 PM

To: Simard, Lee <Lee.Simard@vermont.gov>

Cc: Will, Lael <Lael.Will@vermont.gov>

Subject: RE: Cavendish LIHI Review

Thank you, Lee, for the quick turnaround. Could you tell me if Ryan Smith is the correct contact for Terrestrial?

Kayla A. Easler
Regulatory Coordinator



Direct: (207) 416-1271

www.KleinschmidtGroup.com

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From: Simard, Lee [<mailto:Lee.Simard@vermont.gov>]
Sent: Monday, April 10, 2017 9:30 AM
To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>
Cc: Will, Lael <Lael.Will@vermont.gov>
Subject: RE: Cavendish LIHI Review

Hello Kayla,

There are no threatened or endangered fish species in the Black River that would be impacted by this project. In my position as a Fisheries Biologist, I cannot comment on any of the species that you do have listed.

However, we have submitted comments on other aspects of this project through our streamflow protection department which do impact other fish species in the Black River.

Please feel free to contact me or my counterpart biologist for this district, Lael Will, regarding any other questions or concerns you might have.

Thank you,
Lee Simard



Lee Simard, Fisheries Biologist
[phone] 802-622-4017 [fax] 802-885-8890
[email] lee.simard@vermont.gov
[website] www.vtfishandwildlife.com

Fish & Wildlife Department
100 Mineral Street, Suite 302
Springfield, VT 05156-3168

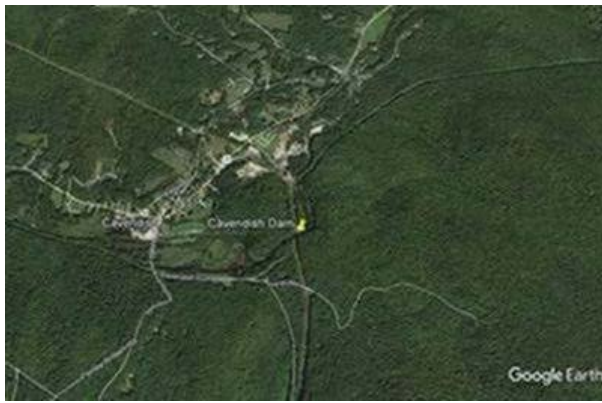
From: Kayla Easler [<mailto:Kayla.Easler@KleinschmidtGroup.com>]
Sent: Friday, April 07, 2017 10:20 AM
To: Smith, Ryan <Ryan.Smith@vermont.gov>; Simard, Lee <Lee.Simard@vermont.gov>
Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>
Subject: FW: Cavendish LIHI Review

Good morning,

I am in hopes that I have found the correct reviewers, if not could you please direct me to the correct individuals.

I previously sent out a Project Review Request for the Cavendish LIHI Project to Chet Mackenzie; however, he explained that the project was not within his management area.

We are looking for a threatened and endangered species review for the Cavendish Hydroelectric Project (FERC No. 2489) which will be applying for LIHI Certification. The project is operated in run-of-river mode and is located on the Black River. Please see the forwarded email below for additional information on the project.



Please let me know if you have any questions.

Thank you,

Kayla A. Easler
Regulatory Coordinator

Kleinschmidt

Direct: (207) 416-1271

www.KleinschmidtGroup.com

*Providing **practical** solutions for **complex** problems affecting energy, water, and the environment*

From: Mackenzie, Chet [<mailto:Chet.Mackenzie@vermont.gov>]

Sent: Tuesday, March 28, 2017 7:30 AM

To: Kayla Easler <Kayla.Easler@KleinschmidtGroup.com>

Cc: Kirn, Rich <Rich.Kirn@vermont.gov>

Subject: RE: Cavendish LIHI Review

Good morning:

I don't manage the Black River. I think it is in the Springfield District.

My e-mail has been changed to: chet.mackenzie@vermont.gov.

Chet MacKenzie

Fisheries Program Manager

Vermont Fish & Wildlife Dept.

271 North Main St., Suite 215

Rutland, VT 05701-2423

chet.mackenzie@vermont.gov

802-786-3864

From: Kayla Easler [<mailto:Kayla.Easler@KleinschmidtGroup.com>]

Sent: Friday, March 17, 2017 9:52 AM

To: Ferguson, Mark <Mark.Ferguson@vermont.gov>; Mackenzie, Chet <Chet.Mackenzie@vermont.gov>; Popp, Bob <Bob.Popp@vermont.gov>

Cc: Katie Sellers <Katie.Sellers@KleinschmidtGroup.com>; Nuria Claudio <Nuria.Claudio@Kleinschmidtgroup.com>

Subject: Cavendish LIHI Review

Good afternoon,

I have another LIHI application in need of threatened and endangered species review. This is for the Cavendish Hydroelectric Project (FERC No. 2489) a run-of-river project located on Black River.

Upon reviewing the USFWS IPAC Report and previous LIHI Application for this Project, a list of potential threatened and endangered species that may occur within this project area has been developed. Could you a) review the below species list to make sure it is accurate and/or suggest updates as appropriate; and b) review this list to confirm that the Project continues to not negatively affect any of the currently listed species that may occur within the Project area?

Species List:

Northern Long-eared Bat (federally and state endangered)

Bald Eagle (state endangered)

rare bryophyte (*Scapania umbrosa*)

Scapania umbrosa: The 2015 Vermont list of Endangered and Threatened Plants does not include the plant species *Scapania umbrosa*, which is known to be found in the Cavendish Gorge. In fact, this species is not listed as rare, threatened or endangered at the state or federal levels. The Cavendish Gorge is an area identified as the only known location in the state of Vermont to have this rare bryophyte, a moss-like species of liverwort present at six sites. Article 409 of the License and Condition I of the WQC required GMP to undertake a five-year study of the effects of alternative bypass flow regimes on the species. FERC approved the study plan on May 10, 1996. Results in 1996, 1998 and 2000 indicated that alternative flows were more detrimental than the 10 cfs minimum flow required under Article 402 and WQC Condition C. The mandated 10 cfs flows remain the most protective to the *S. umbrosa*.



APPENDIX F
CULTURAL RESOURCES

From: Katie Sellers
To: ["Dillon, Scott"](#)
Cc: ["Greenan, John"](#)
Subject: Cavendish Hydroelectric Project - Annual CRMP Report Question
Date: Thursday, April 13, 2017 9:58:00 AM
Attachments: [2016 Cavendish Annual CRMP Report.pdf](#)

Hi Scott,

Want to also touch base with you in regards to the Annual CRMP Report for the Cavendish Hydroelectric Project (FERC No. 2489).

Like the Passumpsic Projects, we are applying to the Low Impact Hydropower Institute (LIHI) for re-Certification of the Cavendish Project. After reading through the Annual CRMP Reports for this facility, it appears that Charity Baker recommended an altered 3-year CRMP Reporting timeline in the last several years of Annual Reports. Seeing no commentary from the Division on this topic, would you be able to comment as to whether or not this altered reporting timeline would be approved by the Division within the next 5-years (approximate LIHI certification term)? The 2016 CRMP Report is attached for your reference.

Any thoughts you have on this topic would be much appreciated. Also, if you would like to set-up a call to discuss this project and the Passumpsic projects in further detail do let us know.

Thank you,
Katie

Katie E. Sellers, M.S.
Regulatory Coordinator

Kleinschmidt

Office: 207-416-1218

www.KleinschmidtGroup.com

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