

**Full Application Review of
Low Impact Hydropower Certification of
Vergennes Hydroelectric Facility**



Prepared by:

Peter Drown, President

Cleantech Analytics LLC

April 24, 2017



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I. INTRODUCTION

This report reviews the application received by the Low Impact Hydropower Institute (LIHI) for Low Impact Hydropower Certification of the Vergennes Hydroelectric Facility (“Vergennes” or “Facility.”) The Facility is owned and operated by Green Mountain Power (GMP), an electric utility in the State of Vermont and the first certified B-Corp energy utility. GMP provides power for more than 82,000 customers in 65 Vermont municipalities. The Facility consists of three concrete gravity overflow dams and two powerhouses with total capacity of 2.4 MW at an existing natural rock falls on Otter Creek, a tributary of Lake Champlain. A more detailed description of Project Works and Watershed is provided in sections below.

The Facility was originally constructed in 1943 (Plant 9B Powerhouse,) and received an original FERC License on June 29, 1979. On July 30, 1999, FERC issued a new license for the facility, incorporating the requirements of a Water Quality Certificate issued April 15, 1999. The Facility was required to undergo a significant number of changes to enhance environmental performance, most notably converting from a daily peaking plant to run-of-river operation.

GMP submitted a complete Intake Review Application to the LIHI on August 11, 2015. Pat McIlvaine was the original LIHI Reviewer assigned to this Application, and completed her Intake Review on August 31, 2015. In her Review, she noted a number of deficiencies and potential issues to resolve in a subsequent application, which the Applicant addressed in a complete Full Certification Application submitted on December 19, 2016. Given that the project was already in the LIHI review process, it was grandfathered in under the former LIHI criteria (1st edition handbook.) I have conducted a review of this Application and all supporting materials, the project record on FERC e-library, and agency comments, and conclude that the Vergennes Hydroelectric Facility meets LIHI Criteria contained in the 1st edition handbook.

II. PROJECT LOCATION AND SITE CHARACTERISTICS

The Facility is located on River Mile 7.6 on Otter Creek, a tributary of Lake Champlain¹. The drainage area at the Facility’s intake is approximately 866 square miles. The area upstream of the project to the Weybridge Hydroelectric Project, the next upstream dam, is characterized as slow-water habitat with several elevation drops. This region supports a fishery dominated by warm-water species such as northern pike, yellow perch and smallmouth bass. The impoundment shoreline is predominantly composed of forest habitat, although there are wide variations in the vegetative buffer between the river and adjacent agricultural land. This buffer zone is likely used as a travel route for birds and mammals (Environmental Assessment, 1999.)

The immediate Facility location is surrounded by privately-owned land classified by the Addison County Regional Planning Commission as built-up, urban, or residential. Land uses include agricultural, rural residential, scattered forest lands, brush lands, and light manufacturing. The Facility is constructed on a natural rock ledge which forms a waterfall with a drop of 35-40 feet. The dam spans two islands, which each feature historic structures (Norton’s Grist Mill and a historic pump house, both constructed in the

¹ E.g., the Facility is located 7.6 miles from the main channel of Lake Champlain.

late 1800s.) The 8-acre basin immediately below Vergennes Falls is used heavily for recreational purposes, by boaters and anglers.

Downstream of the project to Lake Champlain, the habitat primarily consists of slow moving water, palustrine, emergent marshes, and floodplain broad-leafed, deciduous forests. These forested areas have been impacted by timber harvesting and cattle grazing. This section of Otter Creek is habitat for Walleye, Atlantic Salmon and Lake Sturgeon (although there is some disagreement about the extent of these species in this region.) Salmon and Walleye are stocked by Vermont Department of Natural Resources downstream of the Facility. Elevations and the corresponding shorelines in this segment of the river are highly influenced by Lake Champlain. These diverse wetlands offer habitat for migratory water birds and resident mammal species.



Figure 2 –Immediate Project Vicinity

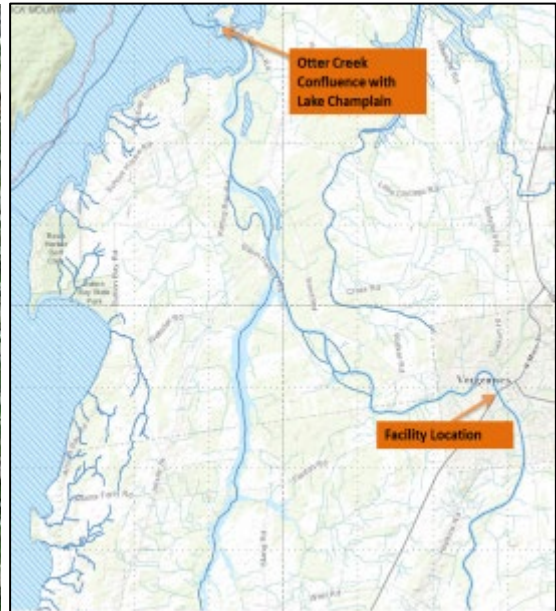


Figure 1 – Vergennes Location (Zoomed Out)

III. PROJECT WORKS

Civil Works: Water is impounded by 4 dams spanning Otter Creek. Three dams are concrete overflow spillway structures spanning two islands in Otter Creek, and the remaining dam is a 29-foot-long, non-overflow structure. Each spillway is approximately 10-foot-high, and the total length of the structures is 231 feet. The Facility contains two powerhouses, located on the North (Plant 9) and South (Plant 9B) of Otter Creek, with a total installed capacity of 2.4 MW. Each powerhouse includes a fore bay with trash racks and head gates, and two steel penstocks.

Turbine/Generator Equipment: The Plant 9B station includes one 1,000 kW vertical axis Francis turbine directly coupled to a generator, with a total operating flow range of approximately 200 cfs to 480 cfs. The runner was replaced in 1985. Plant 9 includes two 850 kW double discharge Francis turbines, with a total operating flow range of approximately 140 cfs to 726 cfs. Total hydraulic capacity for the project is approximately 1,206 cfs, and the authorized installed capacity is 2,600 kW.



Figure 3 - Project Works (Aerial View)



Figure 6 - Project Works (facing upstream)



Figure 5 – Plant 9 Intake, Penstocks and Powerhouse



Figure 4 – Plant 9B Intake, Penstocks and Powerhouse

IV. REGULATORY STATUS

FERC License: GMP was issued an original 20-year license for Vergennes on June 29, 1979. This initial license expired on May 31, 1999. GMP filed a new license application on May 30, 1997, and FERC issued a new 30-year license on July 30, 1999. During this licensing process, a Final Environmental Assessment was conducted and resulted in a finding of no significant impact to the environment. Comments filed by Vermont Agency for Natural Resources were filed late, however all recommendations are included in the terms and conditions of this most recent license. On February 26, 2008, FERC issued a License Amendment to reflect turbine rehabilitation at Plant 9, which resulted in efficiency improvements that increased annual generation by 23%.

WQC: On April 15, 1999, the Vermont Department of Environmental Conservation (VDEC) issued a Section 401 Water Quality Certificate for Vergennes, subject to 17 conditions. These included operational improvements to transition the Facility from a daily peaking mode to run-of-river operation, and other conditions which were implemented in the License.

Compliance Review: On November 13, 2007, FERC concluded that violations of Article 403 occurred during August 2007, due to the failure to release appropriate minimum flows. No adverse effects were reported and FERC did not recommend enforcement actions or penalties. GMP responded promptly to resolve the problem by installing an elevation alarm system to the plant monitoring and control system.

V. COMPLIANCE WITH LIHI STANDARDS

Note: LIHI's criteria changed effective March 7, 2016, but projects that were in review under the previous certification process were "grandfathered" in using the former criteria. This applicant successfully applied under the previous LIHI standards, and my review is based on their demonstrated compliance with those criteria.

Flows: The applicant provided data to demonstrate compliance with Resource Agency Recommendations issued after December 31, 1986, regarding flow conditions for fish and wildlife protection, mitigation and enhancement. The most recent flow standards are contained in the FERC License (issued July 30, 1999) and Water Quality Certificate (issued April 15, 1999). Under this latest License, the project was required to convert from a daily peaking mode to run-of-river operation, to minimize reservoir level fluctuations, provide flows for downstream aquatic habitat, and promote the visual aesthetic of the site. As described below under "Fish Passage," the Facility is required to provide seasonal flows over the dam (in addition to run-of-river operation) to protect downstream habitat for Atlantic Salmon, Walleye, and Lake Sturgeon which run Otter Creek from Lake Champlain for spawning.

There was one point of noncompliance (license violation) in August 2007, when minimum flows were not maintained due to an error in the flow calculation sheet used at the facility to maintain flow requirements. Due to the prompt resolution, no penalties were assessed by FERC. GMP promptly corrected this error on the flow sheets and installed an elevation alarm point on the SCADA system to properly maintain flows.

As part of the LIHI review process, the VDEC conducted a review of one year of operations data to verify compliance with flow requirements. The Applicant provided data including generation, impoundment level, and prorated flow data from the upstream USGS gage on Otter Creek in Middlebury. The VDEC requested flashboard record data, which was not available or provided. As a result, the agency was unable

to definitively conclude that the Facility operated in compliance with the conditions of the water quality certificate. As a result, the agency requested the following condition be included in the certification to ensure compliance with LIHI’s flow criterion:

“The applicant shall conduct an operations assessment of compliance with run-of-river and aesthetic spillage conditions. This assessment shall utilize the spillway and turbine rating curves included in the FERC approved flow management plan. If additional measures are needed to ensure compliance, such as monitoring flashboard condition (boards up/down, % of boards) such measures shall be proposed. The applicant shall prepare the assessment in consultation with Vermont DEC and submit this assessment including Agency consultation to LIHI within 180 days”

Given that the agency cannot definitively conclude that the Facility met all flow conditions contained in the Water Quality Certificate, I am including this as a condition of certification.

Water Quality: Otter Creek is managed to support cold water and warm water fish populations. Downstream of the Vergennes Dam, the Otter Creek is listed as impaired for contact recreation and fish consumption due to *E. coli*. This impairment is not attributed to the existence or operation of the hydroelectric facility, but rather due to the periodic and reoccurring overflows of wastewater treatment plant pump stations and atmospheric deposition. Evidence of this conclusion is available in the Environmental Assessment issued for the project during relicensing in 1999, and corroborated more recently in 2012 EPA’s Waterbody Quality Assessment Report². The Applicant provided data to demonstrate compliance with all conditions issued pursuant to their Clean Water Section 401 Water Quality Certificate (WQC), issued April 15, 1999. However, VDEC, the Agency responsible for monitoring compliance with the terms and conditions of this WQC, was unable to conclude that the Facility is in compliance. Specifically, the Applicant was unable to provide flashboard operation records, so the Agency was unable to verify that run-of-river operations were continuously maintained at the Facility (see agency comments in Appendix A). The condition requested above under “Flows” criterion applies to the water quality criterion.

2014 Waterbody Report for Lower Otter Creek below Vergennes



Designated Use	Cause	Probable Source
Primary Contact Recreation	<i>E. coli</i>	Atmospheric Deposition
Fish Consumption	Mercury	Combined Sewer Overflows

Table 1 - Impairments in Segment (VT03-01.02)

Figure 7 – EPA Waterbody Report (VT03-01.02)

² https://iaspub.epa.gov/waters10/attains_waterbody.control?p_au_id=VT03-01%2E02&p_cycle=2014&p_state=VT&p_report_type=

Fish Passage: Otter Creek is used by several species of potamodromous fish, including landlocked Atlantic Salmon, Lake Sturgeon and Walleye. The Vermont Agency of Natural Resources (VANR) stocks Walleye and Atlantic Salmon in lower Otter Creek, and these species use areas downstream of the project as spawning habitat. There are no agency recommendations to install fish passage facilities at the Facility, although there are several operational measures in the 1999 FERC License to protect and preserve these species. The Facility provides seasonal flows over the dam on April 1 – June 15 for Atlantic Salmon and Walleye, and from September 15 – November 15 for Lake Sturgeon, in addition to operating as a run-of-river Facility. Project structures are also designed to prevent entrainment and impingement – Plant 9 uses 1” clear spacing trashracks over the turbine intakes and Plant 9B uses 2” clear spacing. Water Quality Condition F requires the applicant to consult with VDEC each time they replace the trashracks, to ensure they are designed to prevent fish entrainment. The Applicant provided a letter from VDEC dated September 11, 2008, approving the most recent trashrack replacement. In addition, the Applicant requested agency comments on fish passage requirements and neither USFWS nor VDEC requested passage be installed at this Facility. In my opinion, the Facility is in compliance with Resource Agency Recommendations for riverine, anadromous and catadromous fish passage and protection.

Threatened and Endangered Species: The Applicant provided records of potential presence of 2 federally-listed species (Northern Long-Eared Bat and Indiana Bat,) and 7 state-listed species (Lake Sturgeon, Black Sandshell, Fragile Papershell, Pink Heelsplitter, Pocketbook Mussel, Giant Floater and Green Dragon.) The project provided a description of how operations are in compliance with the Recovery Plans for both bat species, and I can confirm from previous conversations with USFWS bat experts that the ongoing operations of a hydropower facility likely does not have any negative impact on bat populations, provided no new tree-cutting activity is taking place. Furthermore, the Applicant provided an email from November 9, 2016 from Vermont Department of Fish and Wildlife (VDFW) confirming project operations do not negatively affect either bat species, and an additional email from December 19, 2016 from VDFW confirming operations do not negatively affect the Green Dragon plant species (see Appendix B). The Facility is required to provide flows from April 1 to June 15 for the protection of Lake Sturgeon. During project relicensing, FERC’s Environmental Assessment concluded that the run-of-river project operations would not negatively impact mussel populations. In my opinion, the Applicant has demonstrated that the Facility operations do not negatively affect listed species.

Watershed & Shoreline Protection: The Facility does not have a buffer zone, approved watershed enhancement fund, settlement agreement or shoreland management plan for this project. As a result, the Applicant passes this Criterion under the 1st edition LIHI Handbook by answering “N/A” for each of these standards.

Cultural and Historic Resources: On February 4, 1999, a Cultural Resources Management Plan (CRMP) was executed between GMP, FERC, the Advisory Council on Historic Preservation and the Vermont State Historic Preservation Officer (SHPO). On January 8, 2001, FERC issued an Order Approving this CRMP and required annual filings of activities conducted with the SHPO. The Applicant

provided links to 10 of the most recent filings on FERC e-library, and provided record of communications with Vermont Division for Historic Preservation as recently as September 19, 2016, requesting comment on this application. In my opinion, the Facility is in compliance with all requirements regarding Cultural Resource protection, mitigation or enhancement included in the FERC License.

Recreation: The 8-acre basin downstream of the Vergennes falls is heavily used by recreational boaters and anglers. During project re-licensing in 1999, a study team was tasked with assessing flows and establishing appropriate flows to promote aesthetics at this project. The team was divided – some preferred higher target flows of 200 and 300 cfs, while others preferred lower flows. As a result, a seasonal flow regime was established to promote aesthetic resources at the Facility site. In addition, the Owner developed a Recreation Plan (approved by FERC on August 24, 2000,) to provide specific recreational improvements at the project. A FERC inspection Report from August 2015 noted: *“Considerable progress has been made over the past decade in the implementation of the Recreation Plan and all recreational facilities are complete, including interpretive and directional signage, landscaping work, improved access for small boats and parking, portage routes, picnic tables, and portable toilets.”* In my opinion, the Facility is in compliance with the recreational access, accommodation and facilities conditions in its FERC License.



Figure 8 - Canoe take-out, boat ramp and boat barrier



Figure 9 - Recreational Facilities (aerial view)

VI. PUBLIC COMMENTS RECEIVED

This Application was posted for public comment on January 6, 2017, and no comments were received during the 60-day comment period.

VII. CONCLUSIONS AND RECOMMENDATION

I have conducted a thorough review of the Application, FERC record, and other sources of public environmental data, and consulted with the Vermont Department of Environmental Conservation. I conducted my review using the LIHI 1st edition Handbook and criteria as a standard. I recommend the Vergennes Hydroelectric Facility be certified for one, new five-year term. However, to verify the Applicant has met all relevant terms in the Water Quality Certificate, I recommend the following condition as requested by the VDEC:

“The applicant shall conduct an operations assessment of compliance with run-of-river and aesthetic spillage conditions. This assessment shall utilize the spillway and turbine rating curves included in the FERC approved flow management plan. If additional measures are needed to ensure compliance, such as monitoring flashboard condition (boards up/down, % of boards) such measures shall be proposed. The applicant shall prepare the assessment in consultation with Vermont DEC and submit this assessment including Agency consultation to LIHI within 180 days”

APPENDIX A AGENCY COMMUNICATIONS

Date: April 5, 2017
Contact: Eric Davis, River Ecologist
Agency: Vermont Department of Environmental Conservation
Criteria Affected: Flows, Water Quality, Fish Passage

4/5/2017

Gmail - FW: LIHI Certification - Request For Vermont DEC Feedback on Essex 19 and Vergennes



Peter Drown <peter.drown@gmail.com>

FW: LIHI Certification - Request For Vermont DEC Feedback on Essex 19 and Vergennes

Davis, Eric <Eric.Davis@vermont.gov>
To: Peter Drown <peter.drown@cleantechanalytics.com>
Cc: "Crocker, Jeff" <Jeff.Crocker@vermont.gov>

Wed, Apr 5, 2017 at 1:42 PM

Good afternoon Peter,

Per condition B and E, the water quality certification for the Vergennes Hydroelectric Project requires the project to operate in true run-of-river mode, provide seasonal bypass flows at the dam, and continuously monitor of "flow releases at the project (below individual spillways and as discharged from each of the two powerhouses), impoundment levels, and estimated inflows". Additionally, the FERC approved flow management and operations plan details flow and water level management provisions for both "flashboards up" and "flashboards down" conditions.

In preparation for its application to LIHI, Kleinschmidt Associates, on behalf of GMP, sought Department concurrence on "Project compliance with the water quality certificate flow requirements (including aesthetic flows)". In order to provide such concurrence, the Department requested one year of operations data to verify compliance over a range of flow conditions. The data provided includes generation, impoundment level, and prorated flow data from the upstream USGS gage on the Otter Creek in Middlebury. In follow up communications, the Department requested records of flashboard status at the project. This data was not available at the time of the request.

The data does not provide the Department with the information needed to assess compliance with the flow conditions of the water quality certification. While generation and impoundment levels are instructive in informing run-of-river operations, the records do not incorporate the spillway and turbine rating curves (included in the flow management plan) needed to construct a continuous record of flow releases at the project and allow for a full assessment of run-of-river operations. Similarly, compliance with bypass flow provisions cannot be assessed without incorporation of the spillway rating curves and flashboard status. In previous compliance reports (attached), GMP had integrated these rating curves with generation and impoundment level data and appeared to track flashboard status, but it is not apparent if these monitoring practices are currently in place.

In reviewing the operations data for the project, the Department would recommend the following condition be included in any certification issued for the project to assure compliance with LIHI's flow criterion:

"The applicant shall conduct an operations assessment of compliance with run-of-river and aesthetic spillage conditions. This assessment shall utilize the spillway and turbine rating curves included in the FERC approved flow management plan. If additional measures are needed to ensure compliance, such as monitoring flashboard condition (boards up/down, % of boards) such measures shall be proposed. The applicant shall prepare the assessment in consultation with Vermont DEC and submit this assessment including Agency consultation to LIHI within 180 days"

4/5/2017

Gmail - FW: LIHI Certification - Request For Vermont DEC Feedback on Essex 19 and Vergennes

Thank you for ensuring resource agencies have an opportunity to provide input into your 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>

(Please note my new e-mail address, effective July 27, 2015)



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

From: Peter Drown [mailto:peter.drown@cleantechanalytics.com]

Sent: Friday, March 31, 2017 2:36 PM

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

Subject: Re: LIHI Certification - Request For Vermont DEC Feedback on Essex 19 and Vergennes

Hi Eric,

Thank you. Early next week should work fine for Vergennes. I have to finish the report by next Friday (03/07) because I am leaving for vacation the following week and the project is over the due date.

I appreciate your response on W8. I'm integrating into report now.

Warm regards,

Sent from my iPhone

On Mar 31, 2017, at 2:32 PM, Davis, Eric <Eric.Davis@vermont.gov> wrote:

Hi Peter,

<https://mail.google.com/mail/u/0/?ui=2&ik=4642cf9445&view=pt&search=inbox&type=15b390bdad807981&msg=15b3f3598bd0bf58&siml=15b3f3598bd0bf58>

2/11

Date: April 5, 2017
Contact: United States Fish and Wildlife Service
Agency: United States Fish and Wildlife Service
Criteria Affected: Threatened and Endangered Species



United States Department of Interior
 Fish and Wildlife Service

Project name: Vergennes Project

Endangered Species Act Species List

There are a total of 2 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Mammals	Status	Has Critical Habitat	Condition(s)
Indiana bat (<i>Myotis sodalis</i>) Population: Entire	Endangered		
Northern long-eared Bat (<i>Myotis septentrionalis</i>)	Threatened		

Date: November 9, 2016
Contact: Scott Darling, Wildlife Management Program Manager
Agency: Vermont Fish and Wildlife Department
Criteria Affected: Threatened and Endangered Species

From: [Darling, Scott](#)
To: [Katie Sellers](#)
Subject: RE: Vergennes Dam - Species Review for LIHI Application
Date: Wednesday, November 09, 2016 11:55:22 AM
Attachments: [image002.png](#)

Katie:

If no trees will be cut/harvested as a result of this project, then no impacts to both Indiana bats and northern long-eared bats can be expected. Thanks for soliciting our review.

Scott

Scott R. Darling, CWB
Wildlife Management Program Manager
Vermont Fish and Wildlife Department
271 North Main Street
Rutland, VT 05701
Office: 802-786-3862
scott.darling@vermont.gov

From: Katie Sellers [mailto:Katie.Sellers@KleinschmidtGroup.com]
Sent: Wednesday, November 09, 2016 10:12 AM
To: Darling, Scott <Scott.Darling@vermont.gov>
Subject: RE: Vergennes Dam - Species Review for LIHI Application

Hi Scott, No tree clearing. Nothing is changing at the facility.

Thanks for your review,
Katie

Katie Sellers
Regulatory Coordinator
Kleinschmidt
Office: 207-416-1218
www.KleinschmidtGroup.com



Date: December 19, 2016
Contact: Bob Popp, Department Botanist
Agency: Vermont Fish and Wildlife Department
Criteria Affected: Threatened and Endangered Species

From: [Popp, Bob](#)
To: [Katie Sellers](#)
Subject: RE: Plant Species Review for Vergennes Hydroelectric Project LIHI Certification
Date: Monday, December 19, 2016 1:44:00 PM
Attachments: [image002.png](#)

Katie, here is what we show for your project area

creeping love-grass (*Eragrostis hypnoides*). This is a rare to uncommon annual that grows along the shoreline and needs exposed mud to germinate so it relies on periodic drawdown to expose the shoreline. Most of the population is above the confluence with the Lemon Fair.

green dragon (*Arisaema dracontium*). State threatened plant that grows in floodplain forests.

Neither of these are likely to be impacted by your proposal of continuing run-of-river operations with no changes.

Thanks for checking with us.

Bob

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: Katie Sellers [<mailto:Katie.Sellers@KleinschmidtGroup.com>]
Sent: Wednesday, December 14, 2016 9:42 AM
To: Popp, Bob <Bob.Popp@vermont.gov>
Subject: RE: Plant Species Review for Vergennes Hydroelectric Project LIHI Certification

Hi Bob, thanks for the follow-up. I have attached a quick map of the subject area as well as a zoom in of the dam, bypass reach, and downstream area. Essentially the area to be evaluated is the Project impoundment, dam and bypass reach area, downstream area, and immediate shorelines along those areas. The impoundment extends 8.8 miles upstream of the dam and the downstream area of influence extends 0.3 miles downstream of the dam.

This is an evaluation for continued run-of-river operations with no changes at the project.

Let me know if you have any further information needs.

Best,