Water Quality Certification Amendment
(33 U.S.C. §1341)

In the matter of: Great Bay Hydro Corporation
One New Hampshire Avenue, Suite 207
Portsmouth, NH 03801

APPLICATION FOR CLYDE RIVER HYDROELECTRIC PROJECT

The Vermont Department of Environmental Conservation (the Department) has reviewed a water quality certification amendment application dated February 19, 2009 and filed by Great Bay Hydro Corporation (Great Bay), the licensee[1] for the Clyde River Hydroelectric Project (FERC Project No. 2306). Great Bay seeks to reconfigure the West Charleston hydroelectric facility. The Project was granted a water quality certification on August 1, 2002; on July 11, 2003, the certification was modified by the Vermont Water Resources Board on appeal; and a license was granted on November 21, 2003.

The current application is subject to review under the Vermont Water Quality Standards adopted by the Water Resources Board on January 25, 2006 (Standards). Standards became effective on February 9, 2006 (Standards, Section 1-01. Applicability and Definitions).

The application and tentative decision were on public notice from March 17 through April 24, 2009. Written comments were received from the applicant.

The Department, based on the application and record before it, makes the following findings and conclusions.

Findings

1. The Clyde River Hydroelectric Project, as licensed, is comprised of two dams with hydroelectric facilities (Newport Dam and West Charleston Dam) and two dams formerly used for storage and flow augmentation (Seymour Lake Dam and Echo Lake Dam). The West Charleston hydroelectric facility has not operated since 1998 due to the poor condition of the 1,622-foot-long steel penstock. The facility is licensed to operate in a true run-of-river mode and maintain minimum bypass flows of 50 cfs (0.47 csm) from July through September and 74 cfs (0.69 csm) from October through June.

2. Great Bay proposes construction of a new powerhouse contiguous with the right dam abutment and partial removal of the existing penstock. A 26 foot by 28 foot masonry and steel powerhouse would contain a vertical axis turbine rated at 910 hp and a 675 kW generator. The hydraulic capacity of the unit would be about 300 cfs, and it can be operated down to 53 cfs. The net design head is estimated at 31.7 feet, with a target tailwater elevation of 1028.2 feet msl at full unit capacity.

[1] The original licensee was Citizens Communications Company (formerly Citizens Utilities Company). On April 1, 2004, the license was assumed by Great Bay.

3. Under the current proposal, 18-inch-high flashboards would be reinstalled on the dam crest to raise the effective crest 15 inches (elevation 1060.25 feet msl). Condition B of the water quality certification required permanent removal of the flashboards, which had been a feature of the operation until operation ceased in 1998. Article 309 of the license required the licensee to notify the Federal Energy Regulatory Commission (FERC) of compliance with this condition within 90 days of license issuance. Condition B also required the licensee to maintain the headpond no lower than 3.0 inches below the fixed dam crest; bypass flows were to be maintained via a gate release on the west end of the dam.

4. When the project is not operating, Great Bay proposes to either spill the pond inflow or pass it through a sluiceway at the intake. The method of maintaining flows during such conditions would be part of the review under articles 407 and 408 and the associated water quality certification conditions.

5. Pursuant to Article 408 and Condition D of the water quality certification, a flow management plan was filed with FERC on November 22, 2004 and approved on March 9, 2005. Pursuant to license Article 407 and conditions E and F of the water quality certification, a flow and water level monitoring plan was filed with FERC on February 19, 2004; a supplemental filing was made on May 11, 2004, and plan was approved by FERC on July 1, 2004. The proposed changes at West Charleston will necessitate updating these plans.

6. The proposed excavated tailrace extends out from the powerhouse about 80 feet at a 45-degree angle to the dam. Excavation would start at about 12 feet in depth at the powerhouse and taper to the downstream end at the streambed elevation of about 1027 feet msl. A concrete training wall with a top elevation of about 1026.0 feet msl would be constructed along the left side of the tailrace.

7. To reduce the extent of flow loss and habitat degradation in the main channel of the river between the toe of the dam and the tailrace terminus, Great Bay proposes to direct a portion of the powerhouse discharge (at least 21 cfs, the estimated 7Q10 value) over the upper end of the tailrace training wall and along the toe of the dam to the left (west) side of the river, where the flow would then course back diagonally downstream over the natural riverbed and towards the lower end of the tailrace. Reduction of the loss of aquatic habitat was also a consideration in the tailrace design length, orientation, and outlet invert elevation. Great Bay completed a full topographic survey of the river channel below the dam, except for an area near the dam toe where spillage precluded access, and completed a preliminary design for the transverse channel.

8. With the completion of a facility for upstream passage of fish at the Newport 1,2,3 powerhouse in September 2007, landlocked Atlantic salmon, brown trout, and steelhead rainbow trout from Lake Memphremagog are now trapped at the Newport powerhouse and trucked above Newport Dam to access spawning habitat in the middle portion of the Clyde River basin. Although spawning and nursery habitat is available just upstream of Charleston Pond in the tailrace area of the Barton Village hydroelectric plant, this small amount of habitat is not critical to the Lake Memphremagog salmon program. Consequently, the Agency of Natural Resources (Agency) has agreed not to require the provision of downstream passage facilities at West Charleston Dam. (letter from Jeffrey Cueto, P.E., Agency of Natural Resources to William Rodgers, Great Bay, January 20, 2009)

9. Great Bay proposes to remove the first 600 feet of the existing penstock, the section between the dam and Durgin Road. This section is entirely above ground.

10. As noted in the water quality certification (Finding 108), Charleston Pond has been documented to thermally stratify, creating low dissolved oxygen concentrations in deeper zones of the pond. The database is limited, however. The invert elevation of the proposed station intake is at elevation 1042.0 feet msl, or 17.0 feet below the dam crest and 18.2 feet below the proposed normal pool elevation. The invert is 11 feet higher than the location of the substandard sample collected in August 1982. The intake may be located such that the station would avoid withdrawing oxygen-depleted water from the hypolimnion. Samples collected on the same date in August 1982 closer to the proposed intake elevation met the dissolved oxygen saturation standard. Great Bay has offered to explore this issue further through a post-licensing water quality study. Dissolved oxygen standards were expected to be met by the prior project configuration because the station would not be operating during summer low flow periods and, when operating, the station would be releasing minimum flows via a free gate discharge twelve feet above the downstream riverbed.

11. Construction is planned to commence by January 2011, with completion within two years of the start.

12. No special drawdown of Charleston Pond or management of outflows is proposed to facilitate construction.

Analysis and Conclusions

13. The original water quality certification application was subject to review under the version of the Standards that became effective on July 2, 2000. There are no subsequent changes to the Standards that would affect the review of the proposed changes. The management objectives for Class B waters and associated criteria remain essentially the same.

14. To maximize power production, Great Bay does not propose to release any flow as spillage at the dam when inflows are within the hydraulic capacity range of the turbine, 53 to 300 cfs. Given the width and topography of the river channel and the orientation of the tailrace under the original proposal that was presented to the Agency in 2007, there would have been a loss of habitat for salmonids and other fish and aquatic organisms. In order to reduce the impact on aquatic habitat, Great Bay agreed to modify the tailrace design to provide for a transverse flow path across the river and parallel to the dam toe. The tailrace would be designed such that a flow of no less than 21 cfs spills over the left-side training wall to enter and flow through the scour pool along the toe of the dam to the opposite side of the river. The conformation of the riverbed below the dam is such that the flow will move diagonally towards the lower end of the tailrace after reaching the opposite side of the river. The alignment of the transverse channel and flow path are shown on Drawing TR-1 in Exhibit B of the application. This certification amendment adds a condition requiring Great Bay to provide the Department with a conceptual engineering design, including plans and supporting hydraulic analysis, for approval before proceeding with project construction.

15. The flow management plan will have to address lag time issues. Condition D of the water quality certification notes this issue. When the station is operating, the run-of-river mode of operation should result in essentially a natural flow condition downstream. However, when the station shuts down, there can be a transient condition when water goes into storage before natural flows are reestablished downstream. This can be addressed through special operational protocols or through the engineering design of the device used to pass flows (e.g., an automated gate). The applicant will be maintaining the pond within 1.5 inches of the top of the flashboards.

16. The use of flashboards on Charleston Pond Dam had been discontinued. Reinstallation of flashboards will result in inundation of a portion of the riverine habitat in the bypassed reach of the Barton Village Hydroelectric Project. The amount of coldwater habitat lost will be relatively small, and the habitat was judged as not critical to the Lake Memphremagog salmon program.

17. Since Great Bay will be removing the steel penstock within and along the river channel down to Durgin Road, both aesthetics and public access to the river will be enhanced. This action is consistent with and goes beyond the provisions of the original certification, which requires prior approval of the penstock replacement to reduce the impact on aesthetics under Condition I. This certification amendment revises Condition I to provide for a plan for the removal of the penstock and cradles from the dam to Durgin Road and showing any associated clearing for access, with replanting as needed.

18. The station will operate down to flows as low as 53 cfs, or 0.50 csm. At lower flows, all discharges at the dam will be via spillage through the sluiceway or over the crest, with the water benefiting from reaeration. Routing of flow through the penstock/turbine closed system eliminates the opportunity for oxygen entrainment if there is a dissolved oxygen deficit. Since the pond stratifies, there is a potential for substandard conditions below the dam when the station is operating. The original project as licensed would not have operated below a flow of 100 cfs, and, when operating during the summer, would have been discharging 50 cfs at the dam in a manner that would have provided for significant reaeration. Since a full evaluation of this issue has not been done, this certification amendment requires water quality monitoring and annual reporting to enable the Department to determine whether remediation is necessary. Remediation can take the form of either a change in operation (e.g., spilling water during critical water quality conditions) or equipment modifications (e.g., turbine aspiration).

19. This amendment is being conditioned to control potential for construction-associated discharges.

Decision and Certification

Based on its review of the applicant's proposal and the above findings, the Department concludes that there is reasonable assurance that operation and maintenance of the Clyde River Hydroelectric Project with the proposed modifications at the West Charleston facility, subject to the following revised or added 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, 33 U.S.C. §1251 et seq., as amended, and other appropriate requirements of state law:

B. Water Level and Flow Management. The Project shall be operated in accordance with the minimum flow and water level management schedule detailed below. Minimum flows shall be released on a continuous basis and not interrupted; minimum flows are the values listed below, or instantaneous inflow, if less, unless otherwise noted. True run-of-river operation, or r-o-r, where referenced, means no utilization of headpond storage and that outflow from the facility is equal to inflow to the pond on an instantaneous basis, as further described in Footnote 3, page 11, of the Certificate, incorporated by reference.

Seymour Lake Dam: Except as allowed in conditions C and H below, the dam shall be operated in a true run-of-river mode. A provision will be made in the new dam to pass a minimum flow of 4 cfs.

Echo Lake Dam: Except as allowed in Condition C below, the dam shall be operated in a true run-of-river mode. A minimum flow of 4 cfs shall be released through the gate at all times. The existing flashboards will be removed within one month of license issuance to set the effective dam crest elevation at 1248.33 feet msl. Flashboards shall not be installed unless prior approval is granted by the Department.

West Charleston: The station shall be operated in a true run-of-river mode. The pond shall be maintained at or above 0.13 feet (1.5 inches) below the top of the flashboards when the flashboards are in place and intact. When the flashboards are out or have partially failed, the pond shall be maintained at or above 0.13 feet (1.5 inches) below the fixed dam crest. When the station is not operating, all inflows shall be released at the dam in a manner approved by the Department pursuant to Condition D.

Newport 1,2,3: If flashboards are retained, the station shall be operated at full capacity any time that the pond level rises above the concrete crest. Operation shall be in accordance with the following table. When the station is not operating, all inflows shall be released at the dam, except for any flows necessary to operate fish passage facilities.

Table B. Newport 1,2,3 Operation

Period	Operating Range[1] (feet)		Conservation Flow (cfs)	
	High	Low	Bypass	Downstream
January 1 - March 31	0	-1.0	30	120
April 1 - June 7	0	-1.0	30	363
June 8 - July 15	0	-1.0	30	100
July 16 – September 30	0	-2.0	30	100
October 1 - December 15	0		30	r-o-r
December 16 - 31	0	-1.0	30	120
Notes 1. Operating range is relative to the dam crest.				

I. **Replacement of the West Charleston Penstock.** The applicant shall develop, in consultation with the Department and the Vermont Division for Historic Preservation, a plan for the removal of the penstock and penstock cradles from the dam to Durgin Road. The plan shall include information on the extent of removal, construction access, associated clearing of vegetation and earthworks, restoration of disturbed areas in the riparian zone, erosion prevention and sediment control, and disposal. The plan shall be submitted to the Department at least 90 days prior to the commencement of construction, and shall be subject to Department review and approval before construction commences.

X. **West Charleston Bypass Channel.** The applicant shall develop, in consultation with the Department and the Vermont Department of Fish and Wildlife, design plans for a transverse channel to carry a flow of not less than 21 cfs from the head of the tailrace and through the scour pool along the toe of the dam, to river left as shown on drawing TR-1 of the amendment application. The channel shall function for any period that the station is operating or the station is not operating and flows are being routed through the sluiceway. The plan shall include channel cross sections (proposed, with existing ground elevations where survey information is available), the final tailrace design, a supporting hydraulic analysis, and a proposal for post-construction evaluation of whether the transverse channel as designed and constructed functions as intended. In consultation with the Department and the Department of Fish and Wildlife, the applicant shall modify the tailrace and/or transverse channel as necessary after the post-construction evaluation to insure that the intent of this condition has been met. The plan shall be submitted to the Department at least 90 days prior to the commencement of construction, and shall be subject to Department review and approval before construction commences. The station shall not commence normal

operation until written approval is granted by the Department after the post-construction evaluation is completed and the findings filed with the Department. If the post-construction evaluation indicates that the minimum transverse flow requirement of 21 cfs is not met during all flow conditions, the station operation shall be limited to only those conditions that result in a transverse flow of at least 21 cfs, pending any further modifications, filing of a subsequent evaluation report, and written approval by the Department. The applicant shall be responsible for maintaining the functionality of the transverse channel for the term of the license.

Y. **West Charleston Construction-Related Pollution Control, Vegetation Management, and Water Management Plan.** A minimum of 90 days before the start of construction, the applicant shall file with the Department a comprehensive erosion prevention and sediment control and water management plan to address protection of water quality, cofferdamming methods, pond level management, and downstream flows during construction. The plan will include information on the disposal of construction debris and excess excavated material; all disposal shall be done in conformance with state and local laws. The plan will also include details on the extent of clearing in the riparian area, and such clearing is to be limited to that necessary to properly construct the project. A replanting plan shall be included, and to the extent feasible, disturbed areas will be replanted and hard armoring with rock avoided.

The plan shall be subject to Department approval, and construction may not proceed without an approved plan in place.

The applicant shall insure that every reasonable precaution is taken during construction to prevent the discharge of petrochemicals, wet concrete, and debris into State waters. Machinery shall be fueled away from State waters and shall be maintained in good mechanical condition in terms of integrity of hoses, seals, and gaskets. During concrete pours, water shall not be displaced from forms into State waters.

The Department maintains continuing authority over construction-related activities and may at any time order additional protective measures be taken to protect water quality

Z. **West Charleston Dissolved Oxygen Monitoring.** At least 90 days before the start of operation, the applicant shall file a water quality monitoring plan for Department approval. The plan shall provide for annual reports to the Department by year's end of prior summer sampling results, including flow and operating information for both the West Charleston station and the upstream Barton Village station. Initially, sampling shall include at a minimum weekly pre-dawn samples for dissolved oxygen and temperature from June through September, collected from the penstock, if operating, or from the pond at the depths representative of the intake. The Department may modify the sampling plan or suspend the sampling at any time based on a review of

the data. If the data discloses substandard conditions in the release, the Department may order the applicant to develop a remediation proposal, including an implementation schedule, subject to Department approval.

Dated at Waterbury, Vermont this
11TH day of May, 2009

Justin Johnson, Acting Commissioner
Department of Environmental Conservation

By
Larry R. Fitch, Director
Facilities Engineering Division

c: Distribution List

LRF/JRC