The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Clark B. Freise, Assistant Commissioner

April 23, 2018

(Electronically Distributed)

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E. Room 1A
Washington, DC 20426

RE: Comments regarding Study Reports filed by February 9, 2018 for FERC No. P-1892 (Wilder), P-1855 (Bellows Falls) and P-1904 (Vernon).

Dear Secretary Bose:

The New Hampshire Department of Environmental Services (NHDES or Department) is responsible for issuing federal Clean Water Act § 401 water quality certifications (401 certifications) in New Hampshire. State statutory authority for issuing 401 certifications is provided in RSA 485-A:12, III. NHDES is also responsible for establishing and administering surface water quality standards for New Hampshire.

In accordance with the revised process plan and schedule issued by the Federal Energy Regulatory Commission (FERC) on February 15, 2018, NHDES is submitting comments regarding study reports 2, 3, 18, 21 and 25 filed by Great River Hydro, LLC (GRH) between May 1, 2017 and February 9, 2018 as well as comments on the summary of the Study Report meeting held on March 8, 2018, for the following three hydroelectric projects on the Connecticut River:

Wilder Project (FERC No. 1892),
Bellows Falls Project (FERC No. 1855),
Vernon Project (FERC No. 1904).

ILP Study 2 and Study 3 Riverbank Transect and Riverbank Erosion Study, Supplement to Final Study Report dated November 15, 2017

NHDES has reviewed the above report (i.e., Supplemental Report) and provides the following comments. Many of our comments are similar to those filed by the Connecticut River Conservancy (CRC) which include comments from the consulting engineering firm Princeton Hydro (PH), who was retained by the CRC to peer review the Supplemental Report.

General Comment #1: The Supplemental Report concludes that based on the velocity and shear stress analysis, " ... project operations, while perhaps causing sediment entrainment in isolated incidents, cannot be responsible for widespread bank sediment entrainment or bank erosion". NHDES does not concur with this conclusion for reasons indicated below which include the need for additional information to complete our review, and that based on previous findings, entrainment is likely more prevalent than suggested in the Supplemental Report.

a. The HEC-RAS model was run at a single manning's "n" (an indication of channel roughness), with no differentiation between in-channel and floodplain, which could, therefore, produce erroneous results that do not adequately represent ambient conditions. *NHDES requests that this concern be addressed.*

b. The HEC-RAS model was run at a steady flow which is atypical and therefore doesn't account for the effects of sub-daily water surface elevation fluctuations due to project operation, which is a key concern. *NHDES requests that this concern be addressed.*

c. Near-bank velocity is one of several key parameters in velocity and shear stress analyses. The July 21, 2017 FERC Determination states the following: "The FERC Commission staff recommends that Great River Hydro include, in the November 15, 2017 addendum, near-bank velocities associated with multiple water surface elevations (e.g., minimum flow, average project operating range, maximum project hydraulic capacity), as measured at the six sites with ADCPs. For the remaining 15 sites, staff recommends that Great River Hydro include the average velocity associated with multiple water surface elevations as calculated by the HEC-RAS model. If possible, Great River Hydro should include a discussion or estimate of the near-bank velocity for these 15 sites based on available data". The near-bank velocities associated with multiple water surface elevations, as measured at the six sites with ADCPs has not been provided. *NHDES requests that this information be provided.*

   At the March 8, 2018 meeting, NHDES requested ADCP measurements of velocity across the river at various flows be compared with modeled velocities at the 21 monitoring stations. This information has not been provided and is needed to help determine how well the model is calibrated especially with regards to near-shore velocities. *NHDES requests that this information be provided.*

d. HEC-RAS model input and output should be made available to stakeholders to facilitate their review. *NHDES requests that this information be provided.*

e. To facilitate review, plotted cross-sections for each site are requested with the following information shown on the same figure for each of the 21 monitoring sites:
   - annotations of erosional features (as depicted in the February 4, 2017 Final Report Appendix A),
   - water surface elevation fluctuations as measured by the water level loggers, and
   - the locations of the three sediment samples analyzed at each site in the Supplemental Report.

   NHDES requests that this information be provided.

f. The analysis was conducted using the median particle size (D50). According to the March 8, 2018 meeting summary, and recognizing that particles smaller than D50 may be entrained, GRH stated that they will "attempt" to provide critical velocity and shear stress values for the other representative grain sizes. *NHDES requests that this information be provided.*

g. The FERC Determination of July 21, 2017, states that, "Great River Hydro file an addendum ... that includes an analysis of estimated critical shear stress, near-bank velocity, and the potential correlation of these factors with project operation at the 21 monitoring sites. This discussion should include a table for each monitoring site that lists critical shear stresses and near-bank velocities with respect to water surface elevations corresponding to project operation (e.g., minimum flow, average project operating ranges, maximum hydraulic capacity)". According to the Supplemental Report, GRH interpreted this to be the minimum flow, a mid-range flow and the maximum hydraulic capacity of the station. The Supplemental Report further states that establishing a sampling station corresponding to each of these flows is complicated by the fact that the water surface elevation (WSE) can be a function of the WSE at the downstream dam, inflows above the monitoring sites and discharge at the upstream dam for riverine sites. To guide sampling station location, the HEC-RAS model was used and the mid-range operating elevation at the dam was primarily used in the model to determine soil sample collection locations for the three flows. *NHDES requests that a table be provided that compares the elevations used to determine soil sample locations and shear stress in the Supplemental Report to the elevations representing typical operational fluctuations provided in the February 4, 2017 Final Study Report. If different, NHDES requests an explanation as to why the elevations in the February 4, 2017*

Study Report, which are reported to be representative of typical operational fluctuations, were not used in the velocity and shear stress analysis.

h. The Supplemental Report references "VANR, 2004" for some of the critical shear stresses used in the analysis. However, a citation was not provided in section 5 (Literature Cited). *NHDES requests that this information be provided.*

i. The Supplemental Report states that that the critical stress analysis is conservative because it does not account for cohesion, compaction and other forces resisting entrainment. However, the February 4, 2017 Final Study Report (p. 124) states the following which indicates that the analysis may not be as conservative as suggested in the Supplemental Report:

> "The bank sediments at the monitoring sites, representative of the study area as a whole, are nearly ubiquitously comprised of fine-grained and unconsolidated floodplain or glaciogenic sediments that are particularly prone to erosion..."

j. The Supplemental Report (p.11) states that "...only 8 out of 21 sites show any potential for sediment entrainment.". This represents 38% of the surveyed sites, which is not insignificant. If the single site that had been armored is added, the percentage increases to 43% (9/21). If site V02 is added because the difference between the predicted shear stress and the estimated critical shear stress is so small (see the table below) and likely within the margin of error for the analysis, the percentage increases to 48% (10/21).

Site	Condition	Flow (cfs)	Shear Stress (lb/ft^2)	Critical Stress (lb/ft^2)
V02	Minimum	15,000	0.022	0.023
	Medium	15,000	0.020	0.023
	Maximum	15,000	0.019	0.024

General Comment #2: The Supplemental Report and the February 4, 2017 Final Study Report do not adequately acknowledge the significant impact that project related WSE fluctuations likely have on bank instability (and ultimately erosion). Information supporting this position is provided below.

a. The July 21, 2017 FERC Determination (i.e., FERC Determination) states that the goals of studies 2 and 3 were to "...(3) characterize the process of erosion, (4) ascertain the likely causes of erosion.....". Because GRH has not adequately acknowledge the significant impact that project related WSE fluctuations likely have on bank instability (and ultimately erosion), they have not fully characterized the process of erosion or adequately addressed it as a likely cause of erosion and, therefore, have not satisfactorily addressed FERCs' study goals.

b. Visual observations strongly suggest that daily WSE fluctuations associated with project operations impact stream bank stability, and erosion potential. Examples include the following:
   - Beaches were noted at 18 (86%) of the 21 sites. Beaches do not typically occur on a free flowing riverine system. Rather, the presence of beaches is more indicative of a system with repeated changes in water surface elevations that inhibit the establishment of vegetation. Without daily fluctuations, the beach would likely re-vegetate and provide greater bank stability.
   - WSEs related to normal project operations under no-spill conditions were found to be consistent with notching and overhangs observed at the bases of 8 of the 21 (38%) of the monitored banks at some point during the two-year monitoring period (p. 138 and 139 of February 4, 2017 Final Study Report).
   - Approximately 37% (93 miles) of the 250 miles of banks that were studied were observed with notching at the base (p. 81 of February 4, 2017 Final Study Report). Although the exact elevation of the notching along the 93 miles of banks with notching could not be determined, given that the observations occurred during no spill conditions and recorded all notches/overhangs at the base of the bank – and largely near the water level – it can be

assumed that most, if not all, of the mapped notching occurs within the range of elevations associated with normal project WSE fluctuations (10/31/16 TC (now GRH) Response to Comments, comment 12, p. 6 and 7).

c. The Supplemental Report examined entrainment of particles that have already eroded. It's quite possible that the D50 values used in the analysis are high because the finer material has been removed from the banks due to WSE fluctuations. No analysis was done to account for changes in cohesion due to repeated wetting and drying of the banks (and the subsequent loss of the finer material) as a result of project related WSE fluctuations. According to the February 4, 2017 Final Study Report, "Similar to changes in pore water pressures .... water level fluctuations can also create seepage forces, particularly in finer grained sediments, because of the hydraulic gradient that results between the higher groundwater surface in the bank sediments and the lowered river stage" (p. 12). ".... normal project operations may not be a direct cause of excessive erosion, although such operations could contribute to erosion by creating seepage forces associated with daily fluctuations (p. 165). While direct measurements of seepage forces were not made, even small WSE fluctuations can still contribute to bank instability (p. 138). "The development of only minor pore-water pressures is sufficient to trigger mass failures in fine-grained weakly cohesive soils" (p.12). "The bank sediments at the monitoring sites, representative of the study area as a whole, are nearly ubiquitously comprised of fine-grained and unconsolidated floodplain or glaciogenic sediments that are particularly prone to erosion..." (p. 124).

d. The analysis did not account for velocity changes due to sub-daily WSE elevations which could exceed the critical velocities.

Recommendations and Requests

a. With regards to the velocity and shear stress analysis, NHDES requests that the information highlighted in italics under General Comment #1 above be provided and that FERC allow stakeholders at least 60 days from the date the information is filed with FERC, to review and provide responses.

b. With regards to General Comment #2, NHDES recommends the following:

- That qualified FERC staff visit the site to examine the eroding riverbanks firsthand with stakeholders.
- That FERC conduct a thorough review of the erosion studies, including the models and model input and account for the effects of project-related WSE fluctuations on bank instability and erosion when evaluating project effects.

ILP Studies 18, 21 and 25

NHDES supports the comments and recommendations filed by others including, but not limited to, the Vermont Agency of Natural Resources (VTANR), the New Hampshire Fish and Game Department (NHFGD) and the US Fish and Wildlife Services (USFWS) for studies 18, 21, 25.

We appreciate the opportunity to comment. Should you have any questions, please do not hesitate to contact me (603-271-2983, gregg.comstock@des.nh.gov).

Sincerely,

Gregg Comstock, P.E.
Supervisor, Water Quality Planning Section
New Hampshire Department of Environmental Services

Cc. FERC, E-file
Melissa Grader, USFWS
Jeff Crocker, VTDEC
Carol Henderson, NHFGD
Matt Carpenter, NHFGD
Kathy Urffer, CRC

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