United States Department of the Interior

FISH AND WILDLIFE SERVICE

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In Reply Refer To: FERC Nos. 1855, 1892, and 1904
Great River Hydro, LLC
Connecticut River
COMMENTS ON UPDATED STUDY REPORTS

June 8, 2017

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

Dear Secretary Bose:

This is in response to study reports filed by Great River Hydro, LLC (GRH) between August 1, 2016, and April 6, 2017. These reports are part of the relicensing of the Wilder, Bellows Falls, and Vernon projects located on the Connecticut River in New Hampshire and Vermont.

These projects are non-federally owned and regulated by the Federal Energy Regulatory Commission (FERC). The Federal Power Act grants FERC jurisdiction over non-Federal hydropower projects. The U.S. Fish and Wildlife Service appreciates the opportunity to provide comments and recommendations on activities and species under our jurisdiction. Our review and comments are being provided pursuant to the Fish and Wildlife Coordination Act, as amended (16 U.S.C. §661, *et seq.*)

On March 30, 2017, GRH held a study report review meeting to discuss the study reports, and shortly thereafter submitted their study report meeting minutes to FERC on April 14, 2017. GRH provided the study reports and meeting minutes for our review. Our comments on the reports are provided below for your consideration.

Study 9 Instream Flow Report

As part of the relicensing process, GRH undertook an instream flow study to assess the extent to which operations of its three projects affect habitat for a select group of target aquatic species, including anadromous fish and the dwarf wedgemussel (*Alasmidonta heterodon*) (DWM), a federally endangered freshwater mussel.

The study methodology involved collecting physical habitat data at transects located throughout the riverine reaches between the projects and, using both one- and two-dimensional hydraulic models, to evaluate the relationship between flow and habitat for various species/life stages through steady-state, habitat time series, and dual-flow/persistent habitat analyses.

Habitat Modeling

GRH calculated a combined suitability index (CSI) at each transect by using straight multiplication of the variables rather than the geometric mean. Using straight multiplication of the variables to calculate CSI can lead to undervaluing habitat suitability (versus using the geometric mean). It is our understanding that it is standard practice to calculate CSI using the geometric mean (Brown et al. 2000; Steffler and Blackburn 2002). In order to determine how these two methods affect model results, it would be helpful if GRH would recalculate a subset of the run scenarios using the geometric mean. We suggest using DWM for the Wilder riverine reach and American shad (spawning; *Alosa sapidissima*) for the Bellows Falls and Vernon riverine reaches. We recommend this issue be further discussed following review of the revised calculations.

Also, based on the discussion that occurred during the April 6, 2017, Updated Study Report (USR) meeting, we understand that GRH is in the process of updating the habitat suitability index (HSI) curves for sea lamprey (*Petromyzon marinus*) to incorporate empirical data collected during Study 16. Once those curves have been revised, GRH will re-run the Area Weighted Suitability (AWS) steady-state and dual flow models and provide the results to stakeholders.

FirstLight (FL) is also in the process of revising its sea lamprey HSI curves. In order to have the most robust data set upon which to develop HSI curves for lamprey, we are soliciting the raw data from both companies to derive one single set of curves that will be representative of spawning habitat in the mainstem Connecticut River. We would appreciate it if GRH would wait to conduct more model runs with its new curves until we have finalized curves based on the combined data set.

For freshwater mussels, shear-related variables were also used in calculating CSI. We would appreciate GRH providing us with some example output from this analysis.

Time Series Analysis

For the time series analysis, GRH generated habitat duration curves. As noted at the April 6, 2017, USR meeting, this way of portraying how habitat varies over time masks sub-daily effects of peaking operations on habitat. The analysis most informative to project effects is the Daily Habitat versus AWS shown in Figure 4.9-1. We recommend that GRH provide those figures (which may already have been generated, as they are a component of developing the habitat duration curves provided) for the following species/life stages: sea lamprey (spawning); American shad (spawning); tessellated darter (*Etheostoma olmstedi*; broken down by season, i.e., each figure would be for a 3-month time period); co-occurring mussels (broken down by season); and DWM (for Wilder riverine, by season, for the five transects located in close proximity to historical DWM sites). For each species/life stage, the appropriate time step, as indicated in Table 4.3-1, should be used. For example, for sea lamprey spawning, the output would be for the time period May 1 through July 15.

Critical Reach Evaluation

In its analysis, GRH weighted all critical reaches (CRs) equally. Our expectation was that each component (riffles, diverse habitats, and sea lamprey spawning) would be analyzed separately and we recommend this analysis be provided. In addition, it would be helpful to analyze the five transects located in close proximity to historical DWM sites (i.e., WR2-14, WR3-1, WR3-9, WR3-11 and WR3-13) separately as another CR component.

Dual Flow and Persistent Habitat Analysis

GRH analyzed the effects of project operations on immobile life stages such as spawning and fry for target fish species as well as macroinvertebrates (including freshwater mussels) via dual flow and persistent habitat methodologies. In the flow pairs analyzed by GRH, the highest base flow was substantially less than the peak flow out of that station. For example, the highest base flow assessed for the Wilder Project was 5,000 cfs, which is roughly half that station's hydraulic capacity. The problem with limiting the base flows in this manner is that for some species/life stages, AWS values continue to increase, as with American shad spawning below Vernon (AWS of 216 at 6,000 cfs, but increases to 264 at peak flow). This represents a roughly 20 percent increase in AWS over the highest base flows assessed. We recommend that GRH provide the output from supplemental analyses for base flows of 8,000 cfs, 10,000 cfs, and 12,000 cfs for the following species/life stages: co-occurring mussels (Wilder Reach 1); American shad (spawning; Vernon riverine reach) and sea lamprey (spawning; Wilder, Bellows Falls, and Vernon riverine reaches).

Likewise, the dual flow tables in Appendices K, M, and N show the percent loss of persistent AWS, rather than the percent of maximum AWS that a given flow combination provides (which is how FL presented its dual flow results). The way GRH portrayed the dual flow results does not provide information on the relative habitat value of that flow combination, only the comparative loss in AWS within that particular flow pair. For example, for American shad spawning in the Bellows Falls riverine reach, there is a 0 percent loss of persistent AWS under a 1,300 cfs/2,500 cfs flow combination, but that AWS actually only provides 56 percent of maximum AWS. This leads to a conclusion that there is relatively little loss in AWS for a base flow of 1,300 cfs paired with peaking flows from 2,500 cfs up to 6,350 cfs. However, none of those flow combinations provide more than 56 percent of maximum AWS; to maximize AWS, you would need a base/peak combination of 6,000 cfs/6,350 cfs.

We recommend GRH provide revised dual flow tables showing the results in terms of percent of maximum AWS.

Study 18 American Eel Upstream Passage Assessment Report Supplement

The goal of this study was to provide baseline data on the presence of American eel (*Anguilla rostrata*) attempting to move upstream of the Wilder, Bellows Falls, and Vernon Projects and the locations where they congregate while attempting upstream passage. The study involved conducting nighttime visual surveys of eel presence/abundance at tailrace and spillway locations at the projects.

In 2016, GRH repeated the upstream American eel survey conducted in 2015 with one main difference: in 2015, the upstream anadromous fish ladder operated all summer long, while in 2016, it closed down on July 16. This afforded the opportunity to survey the area downstream of Vernon Dam for concentrations of eels attempting to move upstream when the fish ladder option was not available.

In addition to conducting periodic night-time surveys at locations along the face of the dam and in the vicinity of the powerhouse, GRH installed an eel ramp in the tailrace in close proximity to the ladder entrance. According to the report, GRH observed eels at the ramp location prior to its opening. However, only a single eel was collected in the ramp from the time it was installed until the end of the assessment period. Approximately 2 weeks after the ramp was installed (on September 6), minor adjustments were made to the system based on recommendations provided by Dr. Alex Haro (USGS Conte Lab) and flow to the ramp and supplemental attraction water were increased and the entrance gate to the fish ladder was closed.

There are a number of possible explanations for the low catch in the ramp, including the relatively late date of installation (September 6) or insufficient attraction water. GRH is proposing to repeat the upstream eel survey for a third year using the same eel ramp and operational settings as last year. We support this proposal, as it will allow for collecting additional data for nearly the entire upstream eel migration period (May through October), during periods when the anadromous fish ladder is operating, as well as after it has shut down.

As noted by GRH, as well as a number of stakeholders, there will likely need to be additional surveys conducted to definitively determine the best location(s) to site permanent upstream eel passage facilities at the Vernon Project (as well as the Bellows Falls and Wilder projects). For example, the best location for an eelway in the powerhouse area may depend on whether the fish ladder will operate from spring through fall or continue to close on July 15 as it does now.

Study 19 American Eel Downstream Passage Assessment Report

We intend to provide comments on this report at a later date.

Study 22 Downstream Migration of Juvenile Shad at Vernon Report

We have reviewed the revised report and have no further comments.

Study 23 Fish Impingement, Entrainment, and Survival Report Supplement

This report supplement provides revised analysis and data presentation related to estimates of total downstream project survival for adult American eel (at all three projects) and adult and juvenile American shad (only at the Vernon Project). This revised analysis was necessary because the radio telemetry data, upon which the survival analysis partly depends, were re-processed after GRH's consultant found an error in the original processing protocol.

GRH states that while the radio telemetry data were never intended to be used to estimate through-project survival, those results are provided in this study report as a point of comparison to survival estimates generated via the balloon tag study (a component of Studies 19 and 22) and the Franke et al. (1997) equation.

While we agree that there are limitations to using the radio telemetry data to assess survival, it was one of the goals identified in the Revised Study Plan (RSP) for Study 21 (American Shad Telemetry Study – Vernon):

> "The goals of this study are to: characterize effects, if any, of project operations on behavior, approach routes, passage success, survival, and residency time by adult American shad…"

In addition, under the Methods section of the RSP for Study 21, then-licensee TransCanada stated, "Passage survival through the project will be assessed with the use of motion sensor/temperature radio tags."

During a teleconference held by GRH on May 11, 2017, to discuss two study plans GRH provided to stakeholders earlier that week, we were informed that, due to low sample sizes associated with the assessment of downstream passage of adult shad at the Vernon Project, GRH is proposing to repeat the assessment in 2017. We support this proposal. However, during that call, we inquired whether GRH would be using motion sensor tags as they did in 2016 to allow for analysis of post-passage survival. GRH stated that motion sensor tags were never intended to be used to assess survival and that it had already ordered standard (non-motion sensor) tags to use during the upcoming field season. As we noted on the May 11, 2017, call, based on this information we will have to rely on survival estimates calculated using the Franke et al. (1997) equation because the radio telemetry results are insufficient upon which to draw conclusions and no balloon tag study was conducted on adult shad.

With respect to estimating adult American eel survival through the Vernon Project using the radio telemetry data, GRH based the estimates on the number of eels detected in the Vernon tailrace relative to the number of eels detected at Stebbins Island. GRH states in the report that it could not base survival on detections farther downstream (i.e., within the Turners Falls impoundment) due to the fact that FL's eel telemetry data were not available during development of the report supplement. Since filing the report supplement, FL's telemetry data have been made available. Based on the FL information, we calculated survival through each passage route at Vernon based on the number of eels detected at any of FL's receivers (Table 1).

As can be seen in the table below, basing survival estimates on detections at Stebbins Island may lead to overestimating through-project survival. Only 53 of the 102 eels detected at Stebbins Island were subsequently detected at any of FL's Turners Falls impoundment (TFI) receivers (plus two eels that were categorized as No Detect by GRH but were subsequently recorded at TFI receivers, for a total of 55 eels). Fifty-three of the 55 GRH eels recorded at FL receivers were detected at the most upstream antenna location (Shearer Farms), leading to a detection probability of 96 percent at that receiver. Therefore, it is unlikely that the majority of the remaining 49 GRH eels passed undetected through the TFI and it is reasonable to assume that most of them did not survive.

Table 1. Numbers of GRH radio-tagged eels detected at various locations downstream of Vernon Dam.

Passage Route	# Detected in Vernon Tailrace	# Detected at Stebbins Island	# Detected at FL receivers	Radio Telemetry Survival Estimate to TFI
Units 1-4	14	14	9	64%
Units 5-8	53	45	19	36%
Units 9-10	26	24	16	62%
Fish pipe	4	4	3	75%
Fish tube	1	1	0	0%
Trash/ice sluice	2	2	0	0%
Fish ladder	1	1	1	100%
Unknown	11	11	5	45%
Total	112*	102	53*	48%*

* Two eels that were categorized as No Detect by GRH in the Appendix F database were detected within the TFI, resulting in a total of 55 out of 114 GRH eels detected within the TFI, for a survival estimate of 48 percent.

The through-project survival estimate at Vernon of 48 percent, calculated using FL and GRH radio telemetry data, is substantially lower than GRH's estimate of 89 percent, using GRH data alone. It is also substantially lower than the balloon tag survival estimates for turbine passage. It is possible that the balloon tag estimates insufficiently account for internal injuries that could limit mobility, alter behavior, or otherwise induce delayed mortality beyond the 48 hours assessed. It is also possible that some of the eels not detected within the TFI are still alive but stopped migrating due to stress. Therefore, the actual through-project survival estimate likely lies somewhere between 48 percent and 86 percent.

Study 24 Co-occurring Mussel Habitat Suitability Criteria

This report specifically addresses the development of Habitat Suitability Criteria (HSC) for co-occurring mussel species.

One of the goals of Study 24 is to assess the influence of flow regime on DWM, co-occurring mussel species, and mussel habitat. The agreed-upon method to accomplish that goal was to use hydraulic modeling coupled with microhabitat selectivity data for target species. These data are termed HSC. While HSC exists for many fish species, development of HSC for freshwater mussels is an evolving process. GRH developed HSC for DWMs in a report filed in May of

2016. We submitted comments on that report (which used a Delphi-based approach) by letter dated July 14, 2016.

Because DWM is such a rare species, the study also called for assessing project effects to co-occurring mussels based on the assumption that more data would be able to be collected for co-occurring, but more common, species. Using data from the quadrat survey conducted at Chase Island, GRH chose to use Eastern elliptio (*Elliptio complanata*) as the surrogate (or co-occurring) species for DWM, because it was the dominant species in that area and other species observed were found in densities too low to develop species-specific HSC.

Although we have no objection conceptually to the methods and analysis used by GRH to develop HSC for Eastern elliptio, its use as a surrogate for DWM is not supported by habitat data used by the two species. Eastern elliptios are quite common in lakes and rivers throughout New England and are found in a variety of habitats. DWMs are not known to inhabit lakes and ponds; therefore, at least one of the core habitat parameters (water velocity) differs between the two species.

Also, developing HSC for a species such as Eastern elliptio that is known to inhabit lacustrine areas by using only data collected at a lotic site suggests that the HSC may not portray habitat suitability for the species throughout all environments where it is known to occur. Therefore, while the HSC might be a robust representation of habitat suitability at the Chase Island site, its transferability/applicability to other areas of the Connecticut River (e.g., impoundments, backwater sites, lakes, ponds, pools or deep runs) is likely limited.

Study 25 Dragonfly and Damselfly Inventory and Assessment Report

The goal of this study was to conduct a survey and gather information about the distribution of river-dependent odonate (dragonfly and damselfly) populations along the Connecticut River throughout the Wilder, Bellows Falls, and Vernon project-affected areas and to determine the effects of project operations on Vermont's seven dragonfly Species of Greatest Conservation Need, and an eighth species, *Progomphus obscures*, that may be rare.

<u>4.6 Water Level Data</u>

A 30-minute estimate representing the total time of odonate departure from the water to completion of eclosure (the emergence of an adult insect from a pupal case) was used based on a single, previous study (Wagner et al. 1995). Project-related water level fluctuations were analyzed using on-site HOBO® water level logger data. Water depths were recorded at 15-minute intervals. Water surface elevations (WSE) were then used in combination with bank elevations to evaluate the effects of water level fluctuations on odonate emergence. Water surface elevations at each study site were determined for 30-minute time periods by calculating the difference in WSE from the previous half hour.

This methodology and evaluation of water level rise at each eclosion point may underestimate the impacts of project-related water level fluctuations for the following reasons:

1. A 30-minute time interval represents the shortest time recommended by Wagner et al. (1995) and the average eclosure time based on the observation of the eclosion process for eight individual *Stylurus spiniceps*. Because *S. spiniceps* is a listed species, and only one of eight focal species in this study, we recommend basing the analysis on a more conservative time period (in this case, the longest time it took to finish the eclosure process [45 minutes]). We note that in FL's odonate study, the project effects analysis was based on the time it took a larva to depart from the water to flight (rather than just to completion of eclosion). We support using this wider time interval as it would be more protective of those adults that, although deemed to be mobile by GRH's consultant, may not be able to respond to rising water levels fast enough to avoid inundation.

2. Given that only eight *S. spiniceps* individuals were tracked during the investigation, the data set that the project effects analysis was based upon appears limited. Our concern is that the water level logger data collected during those eclosure periods may not be representative of typical conditions. We would appreciate GRH providing any information that verifies the data set is representative.

5.3 Habitat and Eclosion Behavior

The study does not currently report differences between odonate species and their preferred habitat. For example, the study does not provide details regarding those species that prefer the lotic habitat of the riverine section of the River versus those species that are generalist or prefer the semi-lotic habitat of impounded reaches. Project operations affect the impoundment sections of the River differently than the riverine sections. Differentiating between odonate species and their preferred habitat would allow the resource agencies to determine whether project operations have a disproportional effect on odonates using riverine sections versus the impounded reaches.

Thank you for the opportunity to comment on these study reports. If you have any questions regarding these comments, please contact Melissa Grader of this office at 413-548-8002, extension 8124.

Sincerely yours

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ES: MGrader:6-8-17:413-548-8002

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