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In Reply Refer To: FERC Nos. 1855, 1892, and 1904 February 24, 2017
TransCanada Hydro Northeast, Inc.
Connecticut River
COMMENTS ON PRELIMINARY LICENSING PROPOSAL

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Dear Mr. Ragonese:

This responds to the Preliminary Licensing Proposal (PLP) submitted by TransCanada Hydro Northeast, Inc. (TC) on December 1, 2016 as part of the relicensing of the Vernon, Bellows Falls, and Wilder Projects, located on the Connecticut River in Franklin County, Massachusetts; Cheshire, Sullivan, and Grafton counties, New Hampshire; and Windham, Windsor, and Orange counties, Vermont. We have reviewed the PLP and offer the following comments.

BACKGROUND

The U.S. Fish and Wildlife Service previously commented on this relicensing in letters dated June 4, 2013, July 15, 2013, August 30, 2013, September 13, 2013, January 22, 2014, April 28, 2014, October 8, 2014, November 14, 2014, November 13, 2015, May 2, 2016, July 14, 2016 and October 3, 2016.

OVERVIEW OF PROJECTS

Vernon Project

The Vernon Project is located at river mile (RM) 141.9 on the Connecticut River in Cheshire County, New Hampshire and Windham County, Vermont. Project works include a 956-foot-long, 58-foot-high dam with the spillway portion made up of a trash sluice, Tainter gates, hydraulic flashboard bays, and stanchion bays. The dam impounds 26 miles of river. The Vernon headpond is 2,550 acres. The powerhouse is integral with the dam and contains 10 turbines: six vertical Francis and four vertical Kaplan units. The turbines range in size from 2.0 MW to 4.2 MW. Units 1-4 have an operating range of 400 cfs up to 1,092 cfs (each), units 5-8 have an operating range from 300 cfs up to 1,860 cfs, and units 9 and 10 have an operating range from 500 cfs up to 2,060 cfs. The total installed capacity of the project is 32.4 MW and the total hydraulic capacity is 15,928 cfs. The intake to the powerhouse is covered with two sets of trashracks; racks over units 9 and 10 have 3.625-inch clear spacing and racks over units 1-8 have 1.75-inch clear spacing.

The project operates as a peaking facility when flows are within the hydraulic capacity of the station, with allowable headpond fluctuations of up to 8 feet (from elevation 212.13 feet mean sea level [msl] to 220.13 feet msl). The project is required to release a minimum below-project flow of 1,250 cfs, or inflow (whichever is less). In addition, existing operating procedures call for a drawdown rate of 0.1 to 0.2 feet per hour (not to exceed 0.3 feet per hour); each 0.1 foot of elevation equates to approximately 3,000 cfs. In 1998, the station was automated, with operations controlled from the Connecticut River Control Center in Wilder, Vermont.

The project operates both upstream and downstream fish passage facilities; there is an upstream anadromous fish ladder located on the bank side of the powerhouse and two downstream fish bypasses (a partial depth louver array and fishway pipe located between units 4 and 5, and a smaller fish bypass located on the far west side of the powerhouse).

Average annual generation for the Vernon Project was 131,516 MWh for the period 1982 to 2011.

Bellows Falls Project

The Bellows Falls Project is located at RM 173.7 on the Connecticut River in Cheshire and Sullivan counties, New Hampshire and Windham and Windsor counties, Vermont. Project works include a 643-foot-long, 30-foot-high dam with the spillway portion made up of roller-type flood gates and stanchion bays. The dam impounds 26 miles of river. The Bellows Falls headpond is 2,804 acres. The powerhouse is located at the end of a 1,700-foot-long canal and contains three vertical Francis turbines. The intakes for the generating units have trashracks with 4-inch clear spacing. Each turbine has a rated capacity of 13.6 MW and a maximum hydraulic capacity of 3,850 cfs (minimum hydraulic capacity of 700 cfs). The total installed capacity of the project is 40.8 MW.

The intake to the powerhouse is covered with trashracks that have clear spacing of 4 inches. The project operates as a peaking facility when flows are within the hydraulic capacity of the station, with allowable headpond fluctuations of up to 3 feet (from elevation 288.6 feet msl to 291.6 feet msl). The project is required to release a minimum below-project flow of 1,083 cfs, or inflow (whichever is less). In addition, existing operating procedures call for a drawdown rate of 0.1 to 0.2 feet per hour (not to exceed 0.3 feet per hour); each 0.1 foot of elevation equates to approximately 3,000 cfs. In 1998, the station was automated, with operations controlled from the Connecticut River Control Center in Wilder, Vermont.

The project bypasses 3,700 feet of the Connecticut River. There is no required flow in the bypass reach. The project operates both upstream and downstream fish passage facilities; there is an upstream anadromous fish ladder located on the bank side of the powerhouse and a downstream fish bypass (a partial depth diversion boom across the canal and sluiceway/skimmer gate located on the island side of the canal, upstream from the powerhouse). A component of the existing upstream fish passage system is a barrier dam in the bypass reach that was intended to prevent upstream migrating Atlantic salmon from being attracted to spillway discharge and "dead-ending" at the dam.

Average annual generation for the Bellows Falls Project was 242,829 MWh for the period 1982 to 2011.

Wilder Project

The Wilder Project is located at RM 217.4 on the Connecticut River in Grafton County, New Hampshire and Windsor and Orange counties, Vermont. Project works include a 59-foot-high dam with a 526-foot-long spillway portion made up of Tainter gates and stanchion bays. The dam impounds 45 miles of river. The Wilder headpond is 3,100 acres. The powerhouse is integral with the dam and contains three turbines: two adjustable Kaplan turbines (units 1 and 2) and one vertical Francis turbine (unit 3). The two Kaplan turbine generators are rated at 16.2 MW each and the Francis turbine generator has a nameplate rating of 3.2 MW. The operating range of the Kaplan units is from 400 cfs up to 5,650 cfs (each), while the Francis unit has a range of 400 cfs to 825 cfs.

The intakes to units 1 and 2 have trashracks with 5-inch clear spacing and the intake to unit 3 has a trashrack with 1.625-inch clear spacing. The project operates as a peaking facility when flows are within the hydraulic capacity of the station, with allowable headpond fluctuations of up to 5 feet (from elevation 380.0 feet msl to 385.0 feet msl). The project is required to release a minimum below-project flow of 675 cfs, or inflow (whichever is less). In addition, existing operating procedures call for a drawdown rate of 0.1 to 0.2 feet per hour (not to exceed 0.3 feet per hour); each 0.1 foot of elevation equates to approximately 3,000 cfs. In 1998, the station was automated, with operations controlled from the Connecticut River Control Center in Wilder, Vermont.

The project operates both upstream and downstream fish passage facilities. There is an upstream anadromous fish ladder with both a spillway and turbine entrance. Discharge from unit 3 provides attraction flow to the ladder. Downstream fish passage is provided by the existing log sluiceway located between unit 3 and the fish ladder entrance gallery bay and spillway.

Average annual generation for the Wilder Project was 153,738 MWh for the period 1982 to 2011.

TRANSCANADA'S PROPOSAL

TC proposes no changes to the operations, maintenance, or existing environmental measures at the Vernon, Bellows Falls or Wilder projects.

PROCEDURAL

Schedule

TC was required to undertake 33 studies as part of the relicensing process. While final reports have been issued for the majority of the studies, five are outstanding: Study 9 - Instream Flow; Study 19 - American Eel Downstream Passage Assessment; Study 21 - American Shad Telemetry; Study 23 - Fish Impingement, Entrainment, and Survival Study; and Study 24 - Dwarf Wedgemussel and Co-Occurring Mussel. In addition, final reports or report supplements were issued for a number of studies (Study 10 - Fish Assemblage, Study 18 - American Eel Upstream Passage Assessment, and Study 27 - Floodplain, Wetland, Riparian, and Littoral Vegetation Habitats) after the last regulatory deadline stipulated in the Federal Energy Regulatory Commission's (FERC) process schedule. Therefore, there is no deadline currently specified for stakeholders to submit comments on those reports or supplements.

FERC has indicated that it will issue a revised process plan and schedule in the near future. The final license applications (FLA) are scheduled to be filed on April 30, 2017. While TC may have the remaining final study reports issued before it files the FLAs on April 30, 2017, it is unlikely the stakeholders will have had sufficient time to comment on them prior to that date. Therefore, we anticipate that TC will file supplements to the FLAs. FERC's updated process plan and schedule should take into consideration the need for TC to file FLA supplements and afford stakeholders a sufficient amount of time to review and comment on them.

PLP Content

In the cover letter to the PLP, TC states that, since many of its studies are not yet final, "it would be premature at this time for TransCanada to develop a complete licensing proposal....Once TransCanada's studies and FirstLight's studies are complete and TransCanada has had an opportunity to discuss the study results with resource agencies and other stakeholders, TransCanada will be in a better position to develop comprehensive proposals for relicensing the Projects." TC goes on to say that "Given that TransCanada's proposal for relicensing the Project is incomplete; TransCanada expects that stakeholders may reserve their right to provide substantive comments until after more comprehensive proposals for relicensing the Projects are presented."

As acknowledged by TC, due to the lack of substantive information in the PLP, we are unable to provide comprehensive comments at this point in the licensing process. Further, we are unable to provide preliminary recommendations, terms and conditions, and prescriptions until the license application is complete.

COMMENTS

Project Overview

The PLP includes existing license articles for each project. The only articles specifically related to project operations are the ones requiring minimum flow releases (or inflow, if less) below each project (Article 35 in the Wilder Project license; Article 33 in the Bellows Falls Project license; and Article 34 in the Vernon Project license). It is unclear from information provided in the PLP whether each project's identified operational range (maximum allowable and typical) is a requirement of the FERC license, the operational agreement between TC and the U.S. Army Corps of Engineers (ACOE), or completely voluntary. Similarly, the ramping rates identified in the PLP are characterized both as voluntary and as being an existing operating protocol (presumably as part of the ACOE agreement). The FLA should clarify whether the ramping rate and headpond operating ranges are voluntary or required. If required, the PLP should specify whether they are requirements of the FERC license or the ACOE agreement.

Major Water Uses (Page 3-7)

TC states that the Vermont Yankee Nuclear Power Station ceased operating in 2014. While generation ceased, it is our understanding that a small amount of water continues to be withdrawn from the River.

Water Quantity – Project Operations (Pages 3-81 to 3-86)

Based on the narrative description of how each project operates under "normal" conditions, it is unclear why Figure 3.4-15 (Wilder) differs from Figures 3.4-18 and 3.4-19 (Bellows Falls and Vernon, respectively) with respect to the dramatic increase in the range of headpond elevation during the month of April, as well as the lower average headpond level relative to the other months. The circumstances that create this outcome should be described.

Water Quality – Dissolved Oxygen (Page 3-199)

In the PLP, TC states that in 2015 during periods of high generation flows and no spill, dissolved oxygen (DO) levels abruptly decreased coincident with increasing discharge at all three projects. However, Figure 3.4-39 indicates that the opposite effect occurred at the Wilder tailrace (where there appeared to be a positive correlation between generation and DO level). This should be clarified.

According to TC, 2012 was an atypical year with respect to flow and temperature, which resulted in several exceedances of state DO standards at the Wilder and Bellows Falls projects. It would be helpful to put both study years (2012 and 2015) in context to the long-term data set (did flows and temperatures fall within the 25^{th} to 75^{th} percentile?).

Water Quality (Page 3-208)

While TC acknowledges that its projects, along with other factors, cumulatively affect water quality, it goes on to downplay their role by characterizing the increase in water temperature from Moore Dam down to Long Island as "expected." We do not disagree that water temperature, in general, would be expected to increase from the headwaters down to a river's confluence with the ocean. However, even though the operation of TC's projects may not contribute substantially to thermal loading through and downstream of the project areas (due to their limited storage capabilities that result in the projects passing inflow on a daily or near daily basis), the large impoundments created by the dams could contribute substantial thermal loading to the Connecticut River. Vernon and Bellows Falls dams impound over 20 miles of river each and the Wilder Dam impounds over 40 miles of river.

Although TC states on page 3-196 that "it is unknown to what magnitude the gradual warming may be attributed to effects of the impoundments…," it is possible to calculate how much thermal loading is occurring due to the impoundments, as well as model how removing a dam would affect stream temperatures (Maheu et al. 2016; Rounds 2010; Perry et al. 2011).

Resident Fish Passage (Page 3-279)

TC states that there are no effects on resident species at the Bellows Falls Project, given the low fish ladder usage and net downstream passage.

There are at least two factors that need to be taken into consideration when evaluating the passage counts of resident species. First, the fish ladders were designed to pass Atlantic salmon, therefore the efficiencies for passing non-salmonid resident species is unknown. As a result, the low net upstream movement could be due to poor passage efficiency. Second, the high number of observations relative to net upstream movement suggests that fish are using the ladders to move between upstream and downstream habitats and/or utilizing the ladders for foraging purposes. This implies that operating the ladders from spring through fall acts to increase aquatic connectivity, increasing both movement and foraging opportunities.

Our position is that, if the fish ladder designs are effectively passing resident species, they should be operated from spring through fall to facilitate movement within the mainstem river corridor.

Upstream Migratory Fish Passage

Wilder – American Eels (Page 3-287)

TC states that project effects related to upstream passage for American eels (*Anguilla rostrata*) are virtually non- existent based on the lack of eels observed during Study 18. While few eels were observed during Study 18, the fact that dozens of eels were documented using the ladder in Study 17 shows that eels are in the vicinity of the project and are attempting to pass upstream. The relatively low percent of net number passed (42 percent up to July 15 and 8 percent after July 15) could be due to the ladder's design being inefficient for passing eels. Study 17 data show that eels attempted to move past the project after the typical closure date of July 15, with the July 16 to ladder closing period having more than four times the number of observations as the period from ladder opening up through July 15.

Bellows Falls – American Eels (Page 3-287)

Similar to its rationale for concluding project effects to eels were limited at the Wilder Project, TC states that the small number of eels available to pass upstream of the Bellows Falls Project, based on the low number of eels observed during Study 18, lead TC to conclude that project effects on upstream eel passage are negligible to minimal. While only three eels were observed during Study 18 (two near the fish ladder entrance and a third in the upper bypass reach), over 400 eels were observed in the Bellows Falls fish ladder during Study 17, with the majority of those observations occurring after July 15.

As with Wilder, the relatively low percent of net number passed (a negative percentage prior to July 16, and 23 percent after July 15) could be due to the ladder's design being inefficient for passing eels. Study 17 data show that nearly four times as many eels were observed in the ladder after the typical closure date of July 15 than were observed prior to July 15.

Vernon – General (Page 3-289)

In the PLP, TC refers a number of times to a long-standing operating procedure of shutting down the attraction flow pump discharge at night. TC should elaborate on the origin of this protocol (e.g., When was it initiated? Why was it initiated? Why does it only occur at Vernon?).

Vernon – American Eel (Page 3-289)

As with Wilder and Bellows Falls, TC concludes that the Vernon Project has negligible effects on upstream migrating eels. For the same reasons noted above, we disagree with this conclusion. While only 80 eels were observed in 2015 and 70 eels in 2016 as part of Study 18, over 8,000 eels were observed in the fish ladder during 2015 as part of Study 17, with a net upstream passage of 1,500 eels (19 percent). TC suggests that the number of eels observed in 2015 and 2016 at Vernon is primarily related to the downstream Turners Falls Project (FERC No. 1889) having released 6,000 eels upstream of the Turners Falls Dam in 2014 as part of a study related to that project's relicensing proceeding.

The release likely increased the number of eels moving upstream in the reach of river between the Turners Falls and Vernon dams over the number that would have passed volitionally upstream through the two fish ladders at the Turners Falls Project in 2014. However, TC's own data from Study 17 show that eels used the fish ladders at all three of TC's projects and there is no reason to think that they do not use the ladders at Turners Falls (given that over 90 percent of the 6,000 eels released upstream were collected at the lower ends of both fish ladders).

Although the anadromous fish ladders would not be expected to maximize passage for eels (relative to dedicated upstream eelways), some percentage are expected to successfully ascend each year during the upstream anadromous passage season. The Holyoke Project (FERC No. 2004), located downstream of the Turners Falls Project, implemented upstream eel passage over ten years ago, passing an average of approximately 17,000 eels upstream annually (based on data collected between 2005 and 2016). Some of those eels continue moving upstream and, of those eels, some pass the Turners Falls Dam via the existing fish ladders. A portion of those eels continue to move upstream to the base of the Vernon Project. For those upstream migrants, the Vernon Project has a negative effect due to: (1) the dam acting as a near impassable barrier due to its height and lack of wetted surface; (2) the existing anadromous fish ladder only operating during a portion of the upstream eel passage season; and (3) when it is in operation, the anadromous fish ladder not optimizing passage for eels, due to its design.

We also note that there appears to be a discrepancy between Figure 3.5-8 and Table 3.5-22; the survey locations associated with the fish ladder in Figure 3.5-8 are numbered 13, 14, and 15, but in Table 3.5-22, the fish ladder is identified as location 17 (on Figure 3.5-8, this location appears to be associated with the sluice gate between the powerhouse and first Tainter gate). Also, Figure 3.5-8 lists the survey locations associated with the stanchion bays as sites 3, 4, 5, and 6, with eels being observed in 2016 at sites 3, 4 and 6; however, Table 3.5-22 only lists eels as being observed at sites 3 and 5. TC should modify the figure or table to make the two sets of data consistent.

Vernon – American Shad (Page 3-295)

In this section, TC summarizes the results of Studies 17 and 21 (Shad Telemetry). Based on Study 17 ladder counts, there was a net upstream passage of nearly 40,000 American shad (*Alosa sapidissima*). This represents 67 percent of the shad passed at the downstream Turners Falls Project. While TC notes that Study Report 21 is under revision, results from the preliminary report indicated a median residence time downstream of the Vernon Dam of less than 2 days (range of 4.5 hours to 18.8 days), a nearfield attraction of 56.3 percent, number of forays ranging from 1 to 33 (with successful forays being associated with high attraction flow and operation of units 9 or 10, and low success associated with all 10 units operating), an entrance efficiency of 67.2 percent, an internal ladder efficiency of just under 50 percent, and a median in-ladder "residence" time of 3.5 to 4 hours (ranging from 1 hour to 4.2 days).

Based on these results, TC states it is unlikely that there are effects from project operation on adult American shad. If only data from tagged fish were used, the overall upstream passage effectiveness would be 39 percent.[1] This is in marked contrast to the high proportion of wild fish passed at Vernon (67 percent of the shad passed at Turners Falls). While some of this difference can be attributed to effects of tagging, Study 21 results do highlight potentially important factors influencing overall passage effectiveness, such as the number of units operating and which units are operating as they relate to the number of forays and number of successful forays.

Even if a given fish ultimately passes upstream, if it takes 5 or 10 attempts (or forays), that results in increased energy expenditures that could reduce the chance of successful spawning or outmigration survival. Study 21 results indicate room for improvement in nearfield attraction, entrance efficiency, and internal ladder efficiency.

Downstream Migratory Fish Passage

All Projects – American Eel (Page 3-299)

Study 19 was designed to evaluate movement rates, timing and proportions of silver eels passing through various routes at each project. Although a study report was issued, a data processing error was discovered which required re-analyzing the data. A revised report has yet to be issued. TC states that it will analyze project effects (if any) and report them in the FLAs.

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1 Of the 135 test fish detected in the project area (64 dual-tagged fish plus 71 PIT-tagged fish), 53 successfully passed upstream.

Vernon – Adult American Shad (Page 3-300)

In this section, TC summarizes the results of Study 21 (Shad Telemetry). Taking into consideration that Study Report 21 is under revision, results from the preliminary report indicated a median residence time in the Vernon forebay of 12 hours (ranging from minutes up to 21 days), with the shortest residence time for fish that used the fish pipe (median of 36 minutes) and the longest residence time for fish passing through units 9 and 10 (median of 1.2 days). Generally, periods of spill coincided with shorter residence time.

Passage route could not be determined for approximately one third (n=14) of the radio-tagged shad. Of the 28 fish with known passage routes, 54 percent passed via spill, 29 percent passed through the fish pipe, and 18 percent passed through units 5 through 10. No explanation is given for the high proportion of fish that were detected in the forebay and downstream of the dam but were not assigned a specific passage route. More than half of the shad passed downstream at night (8 p.m. through 5 a.m.).

TC used telemetry data from Study 21 as well as data from a concurrent study conducted by FirstLight Power Resources (FL) for its Northfield Mountain Pump Storage and Turners Falls projects to determine survival of shad that passed downstream of Vernon Dam. According to data presented in Table 3.5-24, the percentage of shad that reached Turners Falls was highest for fish that passed via units 9 and 10 (100 percent) and lowest for fish that passed through units 5 through 8 (33.3 percent).

Table 1. Number of radio-tagged adult American shad detected passing various routes through the Vernon Project.

Passage Route	Study 21 Initial Report	Reported in PLP
Fish Pipe	11	8
Spill	9	15
Units 1-4	7	0
Units 5-8	9	3
Units 9, 10	3	2
Unknown	5	14
Total	44	42

Based on these results, TC concludes that the Vernon Project does not hinder the ability of adult shad to locate downstream passage routes, delay emigration, or significantly affect passage past the Project. Given that the revised study has yet to be issued, we cannot provide substantive comments on TC's conclusions regarding project effects. We do note, however, that the numbers of fish reported in the PLP as passing a given route at the project differ markedly from data presented in the initial study report (see Table 1 above). We are very interested to see the revised report which hopefully will explain why the numbers changed so much. In particular, it is striking that initially, seven fish were reported passing through units 1 through 4, yet the PLP reports no fish passing via this route. This results in the substantial differences in the proportion of fish passing through the turbines: 43 percent in the initial study report down to only 18 percent in the PLP. In addition, as the survival analysis depends on these data, it is unclear at this point in time exactly what the relationship between survival and a given passage route is.

Vernon – Juvenile American Shad (Page 3-305)

In order to assess route selection and residency time for juvenile shad, TC radio-tagged 310 fish and monitored their movements through the project (Study 22). Results of that study were provided in a report (which we commented on by letter dated July 14, 2016). In the PLP, TC states that it discovered a data processing error after it filed the Study 22 report and is in the process of re-analyzing the data and developing a revised study report. The results and project effects analyses will be included in TC's FLAs.

In addition to radio telemetry, Study 22 included a run timing evaluation via hydroacoustic sampling. In 2015, the downstream run of juvenile shad lasted 74 days (from August 17 to October 30), with peak movement occurring over a 13-day period (from September 25 to October 8). Fish targets were most abundant following a sharp decrease in water temperature and ceased when temperatures fell below 50 degrees Fahrenheit. Data suggest a correlation between fish density in the forebay and river flow, as well as between peak density and falling water temperature. Fish densities were highest in the afternoon and dusk, with schools concentrating mid-water during the day and migrating to the surface near dusk.

Based on the hydroacoustic data, TC concludes it is unlikely that Vernon project operations impede timely movement of juvenile shad and that shad successfully passed Vernon based on decreasing fish density. We note that during study plan development, TC repeatedly took the position that hydroacoustics could not be used to determine delay; therefore, it is unclear how they reached a conclusion with respect to timely movement past the project. Even if a reduced density could be attributed to downstream movement through the project, it is not possible to characterize that passage as successful based on the hydroacoustic data alone (i.e., we do not know whether those targets survived that passage).

Impingement and Entrainment (Page 3-308)

Trashrack bar spacing at all three projects is wide enough to preclude impingement for all but the largest fish species (greater than 30 inches long) found in the project areas, with the exception of Wilder unit 3 (1.625-inch bar spacing) and Vernon units 1 through 9 (1.75-inch bar spacing), which present a risk of impingement to fish greater than 15 inches long.

Turbine Survival

Desktop Analysis (Page 3-313)

Study 23 included analyzing turbine survival of both resident and migratory fish at all of the projects using a desktop approach. The final (revised) study report was issued on November 30, 2016. Because the PLP was filed on December 1, 2016, it contains some, but not all, of the information from the final report.

One of the recommendations we made in our July 14, 2016 comment letter on the initial study report was to include calculated survival estimates at maximum turbine discharge, peak turbine efficiency, and minimum flow discharge. The PLP summarizes the results of that analysis, with tabular data provided in Tables 6.1-1 through 6.1-3 of the final study report.

In general, differences in survival among the various turbine discharges for the Wilder units 1 and 2 vary little for the smallest fish (a few tenths of a percent) up to 3 percent for the largest fish (for a near-hub entry point), with the same trend holding true for Wilder unit 3. At Bellows Falls, this trend continued, although interestingly, the minimum flow discharge (which was the least efficient) had the highest predicted survival across all fish sizes. At Vernon units 1 through 4, predicted survival is the same at both maximum discharge and peak turbine efficiency. Vernon units 5 through 8 had the widest differential in predicted survival among turbine discharges, with an approximate 5 percent lower near-hub survival for 30-inch fish at peak efficiency relative to survival at maximum discharge. Vernon units 9 and 10 again showed the same trend of little difference in predicted survival among turbine discharges for small fish, up to several percentage points difference (nearly 4 percent between maximum discharge and peak efficiency discharge) among discharges for the largest fish was observed. Interestingly, the discharge that Study 19 was conducted under (1,300 cfs), which does not correspond to the maximum, peak, or minimum discharge, had the highest predicted survival across fish sizes.

Directed Studies (page 3-314)

Study 19 assessed passage route and turbine survival of adult American eels at all three projects and Study 22 assessed turbine survival of juvenile American shad at the Vernon Project. As noted above, both of those study reports are in the process of being revised, primarily related to the radio telemetry component of those studies. The PLP provides summary results of the balloon tag survival component of the studies.

Wilder – American Eel

TC evaluated survival through units 2 and 3. However, due to unit 3 discharge being used as attraction flow for the upstream fish ladder, it was subsequently abandoned for testing. Results indicate a direct survival through unit 2 of 62.2 percent. In order to estimate what survival through unit 3 would be (if it was not part of the attraction water system), TC used empirical results from Vernon unit 4 because the turbine specifications are similar. Survival through Vernon unit 4 was 93.5 percent. This differs substantially from the survival through Wilder unit 3 predicted by the Franke et al. (1997) equation. Given that the speed of Wilder unit 3 is nearly double that of Vernon unit 4 and it has one more bucket than unit 4, it is highly likely that survival through Wilder unit 3 is less than 93.5 percent.

Bellows Falls – American Eel

Survival through unit 2 was evaluated and determined to be 98 percent. This is the highest survival of all units tested at all projects. Unit 2 also had the second lowest injury rate. Although the empirical estimate differs substantially from the calculated estimate using the Franke et al. (1997) equation (54 percent to 77 percent), the results are consistent with other recent studies conducted for larger, slower speed Francis turbines.

Vernon – American Eel

Three turbines were tested at Vernon: unit 4, representing the small Francis turbines (1 through 4); unit 8, representing the newer Kaplan turbines (5 through 8); and unit 9, representing the large Francis turbines (units 9 and 10). Estimated survival through unit 4 was 93.5 percent, with 36.5 percent of eels presenting injuries (20 percent of those being classified as major injuries). Unit 8 survival was estimated at 87.5 percent at 1,000 cfs discharge and 74 percent at 1,700 cfs discharge. The lower flow tested is slightly less than peak efficiency discharge (1,178 cfs), while the high test flow was between the turbine's maximum capacity (1,860 cfs) and the minimum flow discharge (1,600 cfs). Unit 9 had the highest estimated survival, at 97.9 percent. This turbine also had the lowest rate of injuries (8.7 percent) of any of the turbines tested.

Based on these results, it can generally be surmised that eel survival is highest through large Francis units, intermediate through small Francis units, and lowest through Kaplan turbines.

Vernon – Juvenile American Shad

In its July 14, 2016 letter, we provided extensive comments on the initial study report for the balloon tag component of Study 22. TC issued a revised Study 22 report on January 17, 2017. As we have not had an opportunity to review that report yet, we do not know to what extent our comments and concerns were addressed.

Results of the turbine survival assessment show highest survival through Vernon unit 10 (95.2 percent). This is a large, slow Francis turbine. Survival through unit 8 (a large Kaplan turbine) was slightly lower, at 94.7 percent. Survival was lowest through the small Francis turbine (unit 4: 91.7 percent), which has nearly twice the runner speed of unit 10. All of the empirically derived survival estimates fall within the range of estimated survival for a given turbine type based on the Franke et al. (1997) equation.

<u>Cumulative Effects: Aquatics</u>

Upstream Passage (Page 3-319)

In the PLP, TC states that it has not identified or evaluated any cumulative effects on upstream passage of migratory fish and that its fish ladders do not appear to pose barriers to upstream passage. Our position is that study results indicate potential problems with nearfield attraction and internal efficiency of the Vernon fish ladder. In addition, eel passage data show that at least a portion of upstream migrating juvenile American eels use the anadromous fish ladders at all three projects to pass upstream, with a majority passing outside of the typical anadromous passage season. Therefore, the projects hinder eel passage both by not having dedicated upstream eel passage facilities and by not operating the anadromous upstream passage facilities during the full upstream eel migration season.

These project-level effects need to be considered along with the effects that dams downstream of TC's projects pose to diadromous fishes attempting to move upstream to reach spawning and/or rearing areas in order to assess cumulative impacts to those species and their populations within the Connecticut River.

Downstream Passage (Page 3-320)

TC states that cumulative effects may accrue for American eels, but because the revised Study 19 report has not been issued yet, a discussion of the cumulative effects will be provided in the FLAs.

This section of the PLP does not mention potential cumulative effects to adult or juvenile American shad. Although the revised Study 21 (Adult Shad Telemetry) report has yet to be issued, data presented in the initial study report indicate an entrainment rate of 43 percent.

Predicted survival rates for entrained shad based on Franke et al. (1997) for 15-to-30-inch fish range from 24.4 to 82.6 percent for units 1 through 4; 17.4 to 93.2 percent for units 5 through 8; and 45.1 to 89.3 percent for units 9 and 10. In our September 30, 2016 letter commenting on Study Report 21, we provided data showing estimated mortality by route based on telemetry databases provided by TC and FL. Calculated turbine survival was 100 percent for units 9 and 10, 62.5 percent for units 1 through 4, and 57.1 percent for units 5 through 8. Overall, project survival was 62.5 percent through all passage routes combined.

While TC reports turbine survival for the Study 21 fish in the PLP, as noted above, we have concerns about the dramatic difference in route assignments between the initial report and what is presented in the PLP. As the survival estimates depend on the route passage data, we need to understand why those fish were reassigned before providing comments on those results.

In addition to turbine survival, the telemetry data was used to estimate survival through other passage routes, such as through spill gates or the fish pipe. Data presented in our September 30, 2016 letter suggest that mortality through those passage routes also is substantial (40 percent through the fish pipe and 33.3 percent through spill gates). According to TC's revised data as presented in the PLP, 75 percent of fish passed through the fish pipe made it to Turners Falls, while only 60 percent of the shad spilled at Vernon made it to Turners Falls. Again, while we support TC performing supplemental analyses of the telemetry data (which were conducted in response to comments we made in our September 30, 2016 letter), we need a better understanding of why the passage route assignments changed so much before considering what those results may mean.

With respect to downstream passage of juvenile shad, while average estimated survival through all of the turbine types exceeded 90 percent, that was for immediate survival. After accounting for confidence intervals around those means, the range for all units is from 86.2 percent to 99.9 percent. Table 4.1.5-2 of the final Study 22 report (filed on January 17, 2017) provides the percent of radio-tagged fish that passed the Vernon Project, by route, and were subsequently detected at Stebbins Island. If we use percent detected at Stebbins Island as a surrogate for survival to that point in the River (understanding that other factors such as tag loss or predation could be influencing those rates), it results in much lower survival rates than those (immediate survival rates) estimated through the balloon tag study, with rates ranging from 59.1 percent through units 1 through 4 to 75.6 percent through units 5 through 8. Overall "survival" through all passage routes was 70.4 percent.

These project-level effects need to be considered along with the effects dams downstream of TC's projects pose to diadromous fishes attempting to move downstream to reach spawning and/or rearing areas (i.e., the ocean) in order to assess cumulative impacts to those species and their populations within the Connecticut River.

Proposed Protection, Mitigation, and Enhancement Measures (Page 3-321)

TC proposes no new protection, mitigation and enhancement measures (PMEs) related to fish and aquatic resources. The study reports provided to date suggest there are a number of potential PMEs that, if implemented, would result in the protection, conservation and/or enhancement of aquatic resources within the project areas. However, until all final reports have been issued, we are not able to provide its recommended PMEs for the projects.

Unavoidable Adverse Effects (Page 3-321)

TC states that some minor, adverse effects from normal project operations will continue to occur absent additional PMEs, such as dewatering sea lamprey nests and injury or mortality to downstream migrating eels and shad. TC characterizes these impacts as "generally small." We do not agree with this characterization. For example, study results (as reported to date) suggest that entrainment is high for downstream migrants at all projects and that turbine mortality of entrained fish varies by project and turbine type. Also, adult shad radio telemetry data suggest that there are nearfield attraction and internal efficiency issues with the existing fish ladder.

Because results of the dual flow and persistence analyses from the instream flow study report have not been issued yet, the effects peaking operations have on aquatic resources such as fish, macroinvertebrates and freshwater mussels, including the federally endangered dwarf wedgemussel (*Alasmidonta heterodon*), cannot be assessed at this time.

Most, if not all, of the impacts could potentially be avoided by modifying project operations and improving fish passage facilities.

Invasive Species (Page 3-338)

In the PLP, TC states that invasive species have been observed in abundance along the banks and in most vegetation communities within the terrestrial study area. During Study 27, 27 plant species designated as non-native, invasive or potentially invasive were documented. Mapped invasive plant stands totaled more than 163 acres, including 79 acres of Japanese knotweed (*Polygonum cuspidatum*) and 35 acres of Phragmites (*Phragmites australis*).

We request that the FLAs include tables quantifying the acreage of invasive plants by species and project.

Wildlife Resources

Bald Eagles (Page 3-358)

Bald eagles (*Haliaeetus leucocephalus*) utilize the project areas for both breeding and winter roosting. There are two known roost locations within the project areas. As part of Study 27, TC identified an additional 12 potential sites that offer suitable roosting conditions, nearly all located along the banks of the Connecticut River. Based on data provided by New Hampshire Audubon, TC reports that in 2014, nine eagle nests (eight active) were identified within the project areas, with an average per nest productivity of 0.6 fledged young. All but one of the nest trees are located within 125 feet of the Connecticut River.

We had requested that TC identify and/or map the land use where identified nest trees were located. While the PLP does not provide the requested information, in the final Study 27 report TC states, "There are no conserved lands within 250 feet of any nest, but five of the known locations are essentially on the river bank, which is partially protected from new development by statute in both Vermont and New Hampshire."

In the FLAs, TC should provide maps showing the locations of the nine nest trees, along with land use classification, landowner status (e.g., tree on land owned by TC, privately owned, etc.), and the project boundary relative to the nest tree(s).

Threatened and Endangered Species

Five federally listed species have been identified as occurring or historically occurred within the project areas: Puritan tiger beetle (*Cicindela puritana*), northern long-eared bat (*Myotis septentrionalis*), Jesup's milk vetch (*Astragalus robbinsii var. jesupii*), Northeastern bulrush (*Scirpus ancistrochaetus*) and dwarf wedgemussel.

Puritan Tiger Beetle (Page 3-372)

An assessment of potential Puritan tiger beetle (PTB) habitat was undertaken as part of Study 26. Results of that research revealed no new suitable habitat within the project areas. In light of this finding, TC focused survey work at sites selected based on cobblestone tiger beetle habitat. No PTBs were observed during the survey work.

Northern Long-Eared Bat (Page 3-372)

The northern long-eared bat (NLEB) was listed as threatened in 2015, after the study plan development phase of the Integrated Licensing Process. In 2016, we issued regulations under section 4(d) of the Endangered Species Act (50 C.F.R. §17.40(o)) prohibiting the incidental take of NLEB within the zone where white-nose syndrome occurs and related actions that could result in incidental take.

Northeastern Bulrush (Page 3-373)

One known occurrence of the northeastern bulrush is within the Bellows Falls project area. In order to determine the presence and extent of bulrush populations and potential habitat within the project areas, TC conducted surveys at eight sites chosen using aerial photographic interpretation, ecological occurrence records and personal communication with biologists who performed previous site surveys. After field review, four of the eight sites were deemed to have potentially suitable habitat: two in the Bellows Falls impoundment and two in the Vernon impoundment. Results of an intensive survey effort revealed no individuals at any of the four sites.

Jesup's Milk Vetch (Page 3-374)

There are only three known sites of Jesup's milk vetch (JMV) in the world, all along the Connecticut River downstream of Wilder Dam. Two sites are in the riverine reach below Wilder Dam and the other site is at the upstream extent of the Bellows Falls impoundment. All three sites, plus an introduction site, are monitored by the New Hampshire and Vermont natural heritage agencies. As part of that long-term monitoring program, TC undertook a hydrologic study that developed stage-discharge rating curves to determine what flows inundate features such as reference bolts and plant locations.

Dwarf Wedgemussel (Page 3-374)

The dwarf wedgemussel (DWM) has been observed in 14 rivers in the Connecticut River watershed. While the upper Connecticut River mainstem has been thought to support the largest populations remaining in the world, field data collected by TC during three separate field surveys associated with Study 24 suggest potential declines.

TC states that DWMs were found consistently along a 14-mile reach of the Wilder impoundment, were not found immediately below Wilder Dam, were found over a 17-mile distance in the Bellows Falls impoundment, were not found immediately downstream of the Bellows Falls Dam, and were not found in either the Vernon impoundment or below Vernon Dam.

Based on the data provided in Study 24 (to date), a total of 45 DWMs were found at 17 of the 35 sites within that 14-mile upper reach of the Wilder impoundment, suggesting intermittent distribution and very low abundances at all but a few sites. No DWMs were found over 39 sites within the 17-mile free-flowing river below Wilder Dam, even though there were a number of sites within this reach that historically hosted DWMs. Similarly, only 21 DWMs were found among 14 of 61 sites in the Bellows Falls impoundment, again indicating sparse distribution and extremely low densities (at all but four of the 14 sites with DWMs, only a single individual was observed). Based on historical data, the TC results suggest a contraction in the distribution of DWMs within the Bellow Falls impoundment.

Environmental Effects (Page 3-376)

Because its desktop analysis and field verification confirmed that no suitable habitat for PTBs is currently available in the project areas, TC concludes that continuing project operations will not affect this species.

With respect to NLEB, TC states that any activities that could potentially disturb the forest canopy (e.g., incidental tree removal conducted for purposes of routine facility maintenance) will be conducted in accordance with our 4(d) rule.

All four of the sites identified as having potentially suitable habitat for northeastern bulrush are occupied by beavers, which TC states are unlikely to build dams in locations that are inundated on a continual or frequent basis as a result of project operations. Therefore, any impacts to the bulrush at those sites would be attributed to the beaver activity and not project operations. Potentially, one of the four sites could be susceptible to non-flow-related project effects; the site is located near a car top boat launch and road runoff could adversely affect habitat.

The stage-discharge curve developed by TC for JMV revealed that the lowest elevations where JMV plants grew equated to discharges of at least 29,000 cfs. Because those elevations equate to discharges in excess of the Wilder Project's maximum discharge, TC concludes that project operations will not adversely affect JMV.

Because Study 24 has not been completed yet, TC has yet to assess the effects of project operations on DWMs. We look forward to reviewing the study report once it is issued.

<u>Land Use</u> (Page 3-432)

In the PLP, TC states that it holds fee ownership of 123 acres of land for the Wilder Project, including 59 acres designated for public outdoor recreation use and 11 acres retained in a natural state. At Bellows Falls, TC holds fee ownership of 835 acres, including 86 acres designated for public outdoor recreational use, 60 acres set aside as natural lands, and 627 acres supporting local agriculture, wildlife and wetland values. At the Vernon Project, TC holds fee ownership of 287 acres, with 34 of those acres in public outdoor recreational use, 14 acres leased for agricultural and other uses, and 223 acres set aside as natural land.

We request that the FLAs include maps showing the location of lands held in fee ownership by TC at each project, along with their associated land use classification.

Thank you for the opportunity to comment on the preliminary licensing proposal. If you have any questions regarding these comments, please contact John Warner at 603-223-2541, extension 6420, or Melissa Grader at 413-548-8002, extension 8124.

Sincerely yours

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