

REVIEW OF APPLICATION FOR CERTIFICATION OF OCCUM HYDROELECTRIC PROJECT

This report provides review findings and recommendations related to the application submitted to the Low Impact Hydropower Institute (LIHI) on March 1, 2013 by the City of Norwich, Connecticut, Department of Public Utilities (Applicant) for Low Impact Hydropower Certification of the Occum Hydroelectric Project (the Project).

I. PROJECT'S GEOGRAPHIC LOCATION

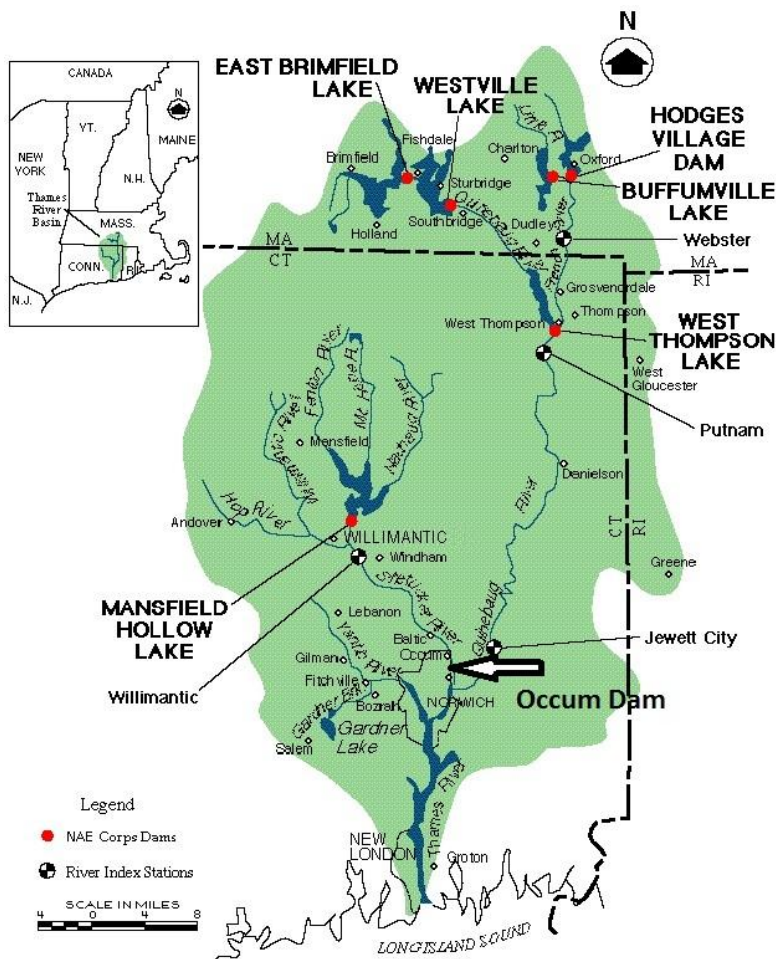


Figure 1. Thames River Basin showing Project location.

The Occum Hydroelectric Project is located on the Shetucket River at river mile 6.4. The dam is between, to the west, the village of Occum in town of Norwich, Connecticut and, to the east, the village of Versailles in the town of Sprague, Connecticut about 3.1 miles upstream of the Quinebaug River confluence. The dam is the third dam upstream of the river's mouth, where the river combines with the Yantic River to form the Thames River 15 miles upstream of Long Island Sound in New London, Connecticut. The Thames River basin is the third largest major river basin in Connecticut and includes portions of eastern Connecticut, south-central

Massachusetts, and northwestern Rhode Island. The Shetucket River, with a basin area of about 1,270 square miles, drains an estimated 93% of the Thames River watershed.

The Applicant is concurrently filing for LIHI certification of a second facility located at Greenville Dam (FERC Project No. 2441), also located on the Shetucket mainstem and about five miles downstream of Occum Dam. Intermediate between the two projects is a third dam, Taftville Dam, an unlicensed hydroelectric facility owned and operated by FirstLight Power Resources, which also owns and operates another unlicensed facility, the Tunnel Hydroelectric Project at the mouth of the Quinebaug River and a federally licensed facility, the Scotland Hydroelectric Project, seven miles upstream of Occum Dam.

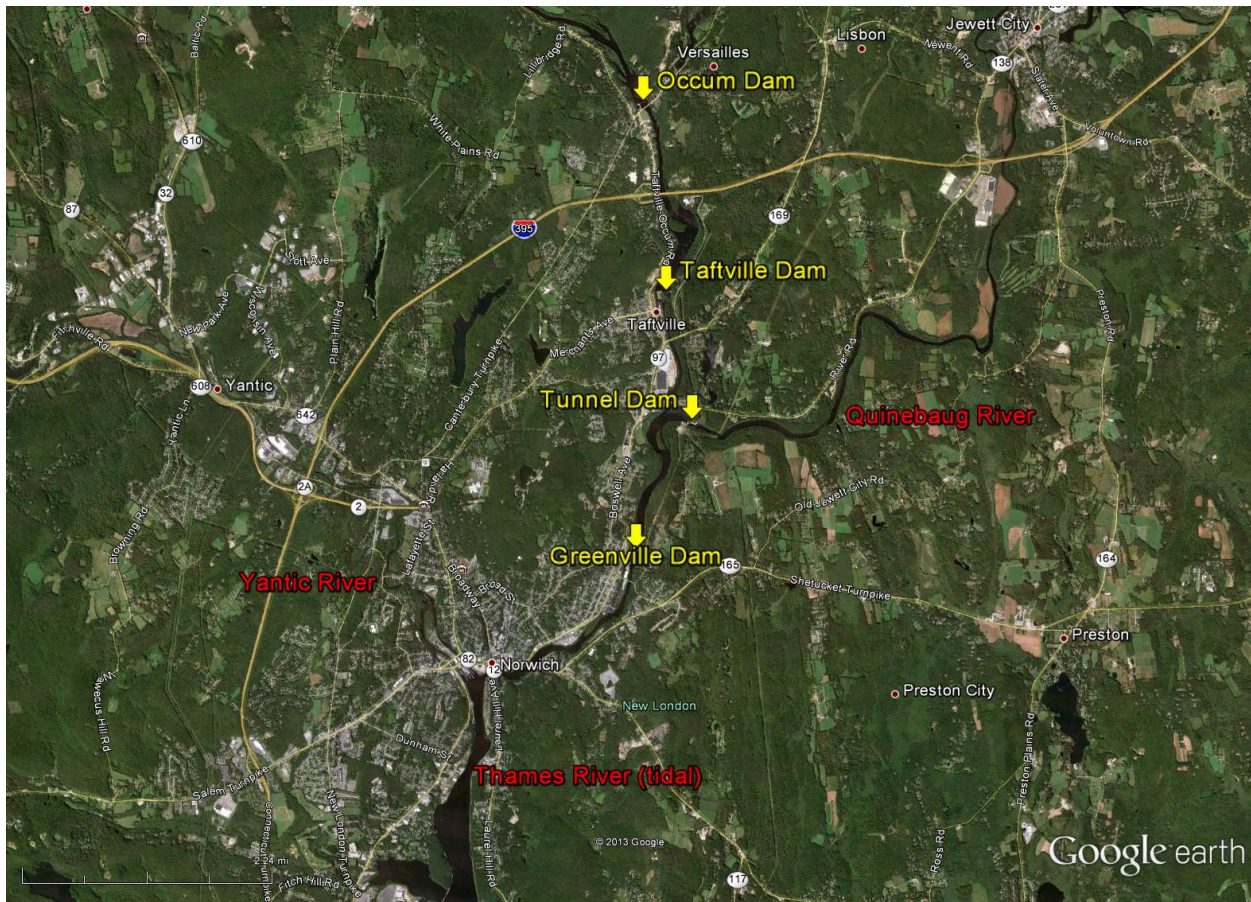


Figure 2. Occum Hydroelectric Project dam and nearby dams on Shetucket River.

II. PROJECT AND IMMEDIATE SITE CHARACTERISTICS

The site was originally developed around 1865 by the Occum Company, a group of Norwich businessmen, who sold power to a textile mill on the west side of the river. The Applicant purchased the Project facilities in 1932 from a local manufacturing company and redeveloped the site for hydroelectric power over a four year period starting in 1934. Commercial operation started in April 1937.

The Project utilizes a 16-foot-high, 895-foot-long dam consisting of earthen embankments on either end (185 feet long on river left and 260 feet long in three sections on river right); a 170-foot-long concrete ogee spillway section with a crest elevation of 66.1 feet msl; and a 280-foot-long stone masonry spillway (crest elevation 64.35 feet msl) that carries 1.75-foot-high flashboards. The masonry spillway incorporates a six-foot-wide trash sluice with a sill elevation of 60.3 feet msl.

An 85-foot-long intake structure incorporates six motorized gates to control flow into the forebay area as shown in Figure 3 below. On the east side of the forebay, there is a separate spillway parallel to the river between the earthen embankment to the north and the Project powerhouse to the south; the crest of that spillway is at elevation 64.4 feet msl and flashboards 1.7 feet in height are maintained on the crest to maintain the forebay at the same normal water surface elevation as the Project impoundment, elevation 66.1 feet msl.

Two upstream fishways, one for anadromous fish and one for eels, are located between the forebay and the masonry spillway.

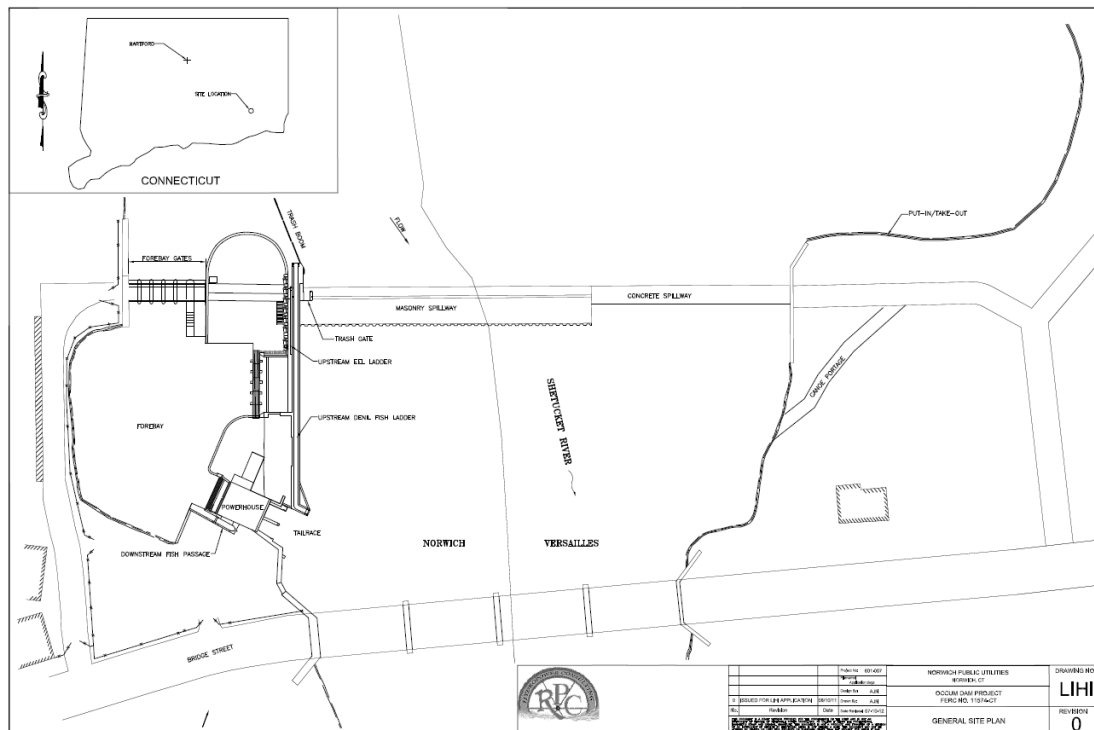


Figure 3. Project layout.

The Project impoundment extends about 10,000 feet upstream and has a surface area of about 90 acres.

The powerhouse, 32 feet wide by 40 feet long, contains a single vertical Kaplan unit with an installed capacity of 800 kW. The reported average annual production is 3,750 MWH.

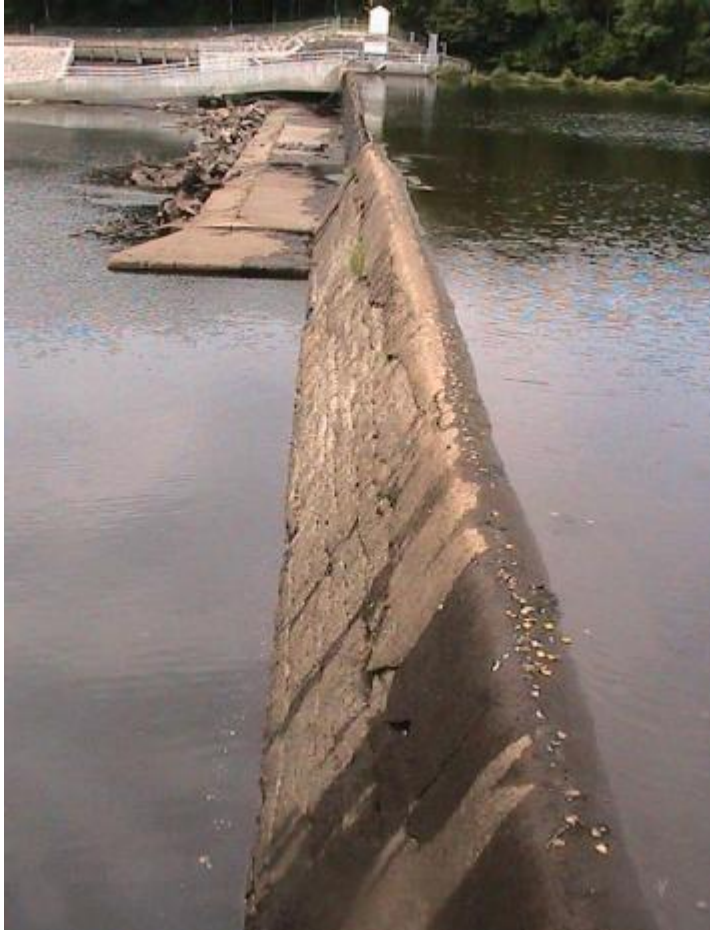


Figure 4. Occum dam, concrete spillway in foreground, then masonry spillway and forebay area.



Figure 5. Aerial view of forebay and powerhouse. Denil fish ladder and downstream fish passage pipe (on left) shown.

III. REGULATORY AND COMPLIANCE STATUS

On September 29, 1999, the Federal Energy Regulatory Commission (FERC) issued a 40-year license for FERC Project No. 11574. The Project previously was unlicensed. There were no protests or objections to issuance of a license. FERC staff completed an environmental assessment (EA) in August 1999, recommending licensure; the EA is appended to the license order.

The license contains special articles addressing operations and minimum flows, flow monitoring, fish passage, recreational enhancements, and cultural resources protection.

The Connecticut Department of Environmental Protection (now the Connecticut Department of Energy and Environmental Protection (CTDEEP)), by letter dated February 11, 1997, conditionally certified the Project under Section 401 of the federal Clean Water Act. The four conditions address flow management and fish passage, and the license articles are consistent with the certification requirements.

The U.S. Fish and Wildlife Service (USFWS) made a Federal Power Act Section 10(j) recommendation that the Project release a minimum flow of 155 cfs when offline during periods

when the downstream Taftville headpond drops below elevation 48.9 feet msl. FERC staff completed a wetted area analysis comparing the 155 cfs with its proposed 100 cfs and held that the difference in available fish habitat was relatively minor. USFWS by letter dated March 23, 1999 concurred with FERC staff's analysis and proposal as long as the trigger elevation of 48.9 feet msl was used instead of the elevation of 48.3 feet msl proposed in the license application.

The license contains articles consistent with recommendations made by USFWS and CTDEEP: 1) impoundment drawdown limitations, Article 401; 2) minimum flow releases when the tailwater elevation drops below a target elevation, Article 402; 3) operations monitoring, Article 403; and 4) fish passage, articles 405 and 406.

The Project facilities were listed on the National Register of Historic Places. The license required preparation of a cultural resources management plan under Article 408. FERC approved the plan on August 30, 2001.

No compliance issues were revealed in my review of the last ten years of documents in FERC's eLibrary.

IV. PUBLIC COMMENTS RECEIVED BY LIHI

The LIHI application was publicly noticed on March 6, 2013. No comments were received during the notice period, which ended on May 6, 2013.

V. LIHI CRITERIA REVIEW

Under each of the issue sections that follow, I include a table that contains the related LIHI questionnaire sections and my analysis and conclusions.

General Conclusions and Recommendations. I recommend that the facility be conditionally certified for the standard period of five years, with one recommended condition to address fish passage, specifically American eel passage. The recommended condition is set forth below. If this condition is attached to the certification, it is my opinion that the Project will meet all of LIHI's criteria.

Regarding flows, the facility as licensed operates in a manner consistent with Resource Agency Recommendations made during the licensing process, which was post 1986, meeting the LIHI flow criterion under A.1. It is a peaking facility that operates in tandem with the next upstream hydroelectric facility, the Scotland Hydroelectric Project, and utilizes 2.0 feet of impoundment storage; when the station is off line, minimum flows are released as recommended by the resource agencies for the new license. Compliance records are kept as required by a license article.

Regarding water quality, the Project is subject to a water quality certification issued by CTDEEP after 1986. Further, there is no 303(d) listing for a use impairment in the Project reach; CTDEEP has not assessed conditions in the river segment from Greeneville Dam to the head of Occum impoundment.

Regarding fish passage, the Project has passage facilities for both anadromous fish (American shad and river herring) and catadromous American eel. Unlike anadromous-fish passage, the eel facilities are not based on a license article or subsequent formal resource-agency prescription. Given that, I recommend a condition requiring the Applicant to continue to cooperate with the resource agencies with respect to assuring effective eel passage.

Regarding listed threatened and endangered species, none have been identified as present in the Facility area.

Regarding cultural resources, the Project facilities are listed on the National Register of Historic Places. The Project is subject to a Programmatic Agreement and a Cultural Resources Management Plan with which it must comply. Consultation with the State Historic Preservation Office is required for maintenance and repair activities.

Regarding other LIHI criteria, the Project does not qualify for extension of the certification term by three years under the watershed protection criteria, and there is no shoreland management plan with which the Applicant must comply. The Applicant maintains recreational improvements consistent with the license-approved recreation plan.

Issue 1. While the Project provides upstream and downstream passage for American eel, the measures are voluntary on the Applicant's part.

Recommended Condition No. 1. The City of Norwich shall continue to cooperate with CTDEEP and the USFWS on efforts to provide safe, timely, and effective American eel passage at Occum Dam. The City shall implement reasonable improvements to passage facilities or operating protocols when requested by the resource agencies. Should the City disagree with an agency request, it shall so notify LIHI within 30 days of the request and provide an explanation for the disagreement. LIHI may suspend or revoke this certification should it determine that its passage criteria are not being met.

A. Flows

The Shetucket River drains an area of 465 square miles at the dam site. The Project operates in tandem with the upstream Scotland Project (FERC No. 2662), which has a single unit with a capacity of 1,200 cfs. The Scotland Project is a peaking facility with a maximum drawdown of two feet; during periods of storage, it only releases a minimum flow of 84 cfs. The Occum Project, with a lower hydraulic capacity (900 cfs), utilizes a maximum drawdown of 2.0 cfs to optimize operations given the capacity differential. The intervening drainage area between the two projects is only 36 square miles.

With the downstream Taftville Project at full pond (elevation 51.8 feet msl¹), the backwater extends up to the Occum tailrace. Taftville, an unlicensed project, can cycle its headpond several feet. When the Taftville headpond is at or above elevation 48.9 feet msl, the Project is required to release a minimum flow of 30 cfs into the 180-foot-long bypassed reach. When the Taftville headpond is drawn below that elevation, the required minimum flow into the bypassed reach increases to 100 cfs to protect aquatic habitat in the reach downstream to the head of the Taftville impoundment; the Taftville drawdown can affect up to about 1,000 feet of the river downstream as far as the Little River confluence. Minimum flows are normally provided via leakage (8-9 cfs measured in August 2000, ref. Article 403 plan) and the downstream fish bypass pipe.² Subsequent to licensing of Occum, the owner of Taftville informally agreed to curtail drawdowns such that the higher minimum flow of 100 cfs is no longer commonly triggered (email from Al Nash, Renewable Power Consulting, PA, May 4, 2013, appended).

Article 401 requires the licensee to limit the drawdown in the impoundment to two feet from the top of the flashboards or two feet below the masonry dam crest when the flashboards are not in place (no lower than elevation 64.1 feet NGVD). Article 402 requires the licensee to release minimum flows of 30 cfs and 100 cfs, or inflow if less, as described above. The minimum flow releases are based on extrapolated data from an instream flow study, which evaluated the extent of dewatering in the bypassed reach and the 1,000-foot section downstream at alternate Taftville impoundment levels.

Under Article 403, the licensee was required to develop for FERC approval a monitoring and record-keeping plan to demonstrate compliance with articles 401 and 402. FERC approved the

¹ FERC EA, p. 6.

² Since the fish bypass pipe discharges downstream of the station tailrace and not at the upstream end of the bypassed reach, use of this facility for maintenance of minimum flows technically does not comply with the article as worded. The Applicant's consultant, Al Nash, Renewable Power Consulting, PA, explained in an email of May 4, 2013 (appended) that the circumstances have been accepted by FERC and the resource agencies for two reasons: 1) enhanced effectiveness of upstream fish passage facilities, and 2) the fact that the bypass is primarily a pool and the reach can receive flows from other sources, such as spillage. The explanation seems consistent with the intent of the article, especially given that the article only requires the release of a minimum flow when the station is off line.

plan by order dated March 2, 2001. The licensee is to report incidences of non-compliance to FERC within 30 days; according to the LIHI application, the last report of non-compliance was in 2004 and related to drawdowns in excess of 2.0 feet related to fish ladder construction.

The Scotland Project license expired in 2012. The Applicant is competing for the new federal license. When relicensed, the operation of the Scotland Project is likely to change significantly, which in turn will affect operations at Occum. (email from Al Nash, Renewable Power Consulting, PA, May 4, 2013, appended)

LIHI Questionnaire: Flows	
A.1	Is the Facility in <i>Compliance with Resource Agency Recommendations</i> issued after December 31, 1986 regarding flow conditions for fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow variations) for both the reach below the tailrace and all bypassed reaches?
	Reviewer Analysis/Conclusions: The post-1986 license incorporates Resource Agency Recommendations addressing bypass flows and impoundment drawdown limits. There are no incidences of non-compliance in the recent record. YES = PASS

B. Water Quality

As discussed in Section III above, CTDEEP certified the Project in 1997 as compliant with state water quality standards subject to four conditions related to flow management and fish passage. Condition #3 addresses minimum flows in the bypassed reach:

The applicant shall maintain a minimum stream flow of 22 cfs from a combination of leakage and releases from the forebay sluice gate in the bypassed stream segment whenever the project is not generating. Four years after the issuance of the FERC license for the project, a minimum stream flow of 100 cfs will be maintained in the bypassed stream segment whenever the Taftville Pond elevation drops below 48.3 feet.

As mentioned above under *Flows*, Footnote 2, except for dam leakage, the minimum flow release is actually discharged into the tailrace reach via the downstream fish passage pipe, and not into the “bypassed stream segment.” Consistent with license Article 402, the water quality certification does not require the release of a minimum flow when the station is on line.

I was unable to receive confirmation from CTDEEP that the Facility is in compliance with the water quality certification. Nonetheless, there is no recent record in FERC eLibrary of flow or fish passage violations, and the appended letter of March 8, 2013 from CTDEEP-Inland Fisheries Division does not indicate any compliance issues.

The water quality assessment segment that includes the Project (Segment CT3800-00_02) extends from Greenville Dam upstream to approximately the head of the Occum impoundment. This segment has not been assessed for use support for Aquatic Life and for Recreation. Consequently, it is not 303(d) listed.

LIHI Questionnaire: Water Quality	
B.1	<p>Is the Facility either: a) In Compliance with all conditions issued pursuant to a Clean Water Act Section 401 water quality certification issued for the Facility after December 31, 1986? Or b) In Compliance with the quantitative water quality standards established by the state that support designated uses pursuant to the federal Clean Water Act in the Facility area and in the downstream reach?</p> <p><i>Reviewer Analysis/Conclusions:</i> The Project water quality certification was issued after 1986, and the record does not contain incidences of non-compliance. YES to (a) = Go to B.2</p>
B.2	<p>Is the Facility area or the downstream reach currently identified by the state as not meeting water quality standards (including narrative and numeric criteria and designated uses) pursuant to Section 303(d) of the Clean Water Act?</p> <p><i>Reviewer Analysis/Conclusions:</i> The river segment that includes the Project impoundment and tailrace reach has not been assessed for use support. NO = PASS</p>

C. Fish Passage and Protection

Restoration of diadromous fish to the Shetucket River Basin follows *The Plan to Restore Diadromous Fishes to the Shetucket River Watershed* (DEP, Inland Fisheries Division, December 2009). Historically, Atlantic salmon, alewife and blueback herring (collectively, “river herring”), American shad, sea lamprey, American eel, and sea-run trout accessed spawning and nursery habitat in the basin; however, access was eliminated due to the construction of dams in the mid- to late-1800s. The Applicant has operated a fish lift at its Greeneville project since 1996. Due to ineffective upstream passage facilities at Taftville dam, shad are trucked around that dam and have access to the Occum reach and upstream.

The Occum license required the licensee to install an upstream Denil fish ladder within four years of effective upstream passage at Taftville (Article 405) and to install a downstream fish bypass within three years of license issuance (Article 406). Both articles also require evaluation of the effectiveness of the facilities. By order dated August 3, 2004, FERC modified and approved the licensee’s passage plan under both articles. The Denil fish ladder was installed in 2004, and the downstream fish passage pipe was installed in 2006. Effectiveness study reports have been completed annually and filed with FERC and the resource agencies since the facilities were installed; after study year 2012, report will be suspended pending resolution of the problems at Taftville.



Figure 6. Denil fish ladder for anadromous fish.



Figure 7. Eel pass is located between the dam abutment on left and the Denil ladder on right.

Atlantic salmon is not targeted for restoration at this time.

Although not a license requirement, upstream passage facilities for American eel were also installed at the dam in 2006 as shown in Figure 7, and the 2004 FERC order requires evaluation of the eel passage effectiveness. The Applicant has also voluntarily assisted in recent downstream eel passage testing throughout the river system under a study being conducted by the USFWS, the U.S. Geological Survey, and CTDEEP. Eel pass downstream via the same fish pipe used by anadromous fish, or via spillage if occurring.

Stephen Gephard, who manages the Diadromous Fish Program for CTDEEP, commented on the LIHI application by letter dated March 8, 2013, copy appended. Mr. Gephard cites passage problems at Taftville and problems at Occum due to uncontrollable spillage caused by the Scotland Dam releases; however, he mentions no problems attributable to the Occum facilities or operations. CTDEEP meets regularly with the Applicant to review passage activities and insure compliance. The tone of the letter suggests that cooperation has been excellent.

The Applicant originally proposed to install a perforated plate across the trashrack during the fall period in order to reduce the risk of entrainment; the bar spacing of the trashrack is four inches. The proposal was incorporated in Article 406; however, FERC deferred the requirement pending a determination of its need based on the evaluation of downstream passage effectiveness. According to an email of May 5, 2013 from Al Nash, representing the Applicant, a decision has been made not to use the perforated plate as part of anadromous downstream passage, although potential use for eels is continuing to be evaluated. During periods when the impoundment level is below 64.6 feet NGVD, the approach velocity at the rack exceeds 2.0 feet per second when the station is at full generation. Consequently, the risk of impingement is increased; the wicket gate opening is automatically reduced to 82 percent to lower the flow through the unit under those conditions and avoid impingement (Order Modifying and Approving Fish Passage Plan under Articles 405 and 406, FERC, August 3, 2004).



Figure 8. Power station with downstream migrant sluice pipe on left below tailrace; Denil ladder entrance on right.

LIHI Questionnaire: Fish Passage and Protection	
C.1	<p>Is the Facility in Compliance with <i>Mandatory Fish Passage Prescriptions</i> for upstream and downstream passage of anadromous and catadromous fish issued by Resource Agencies after December 31, 1986?</p> <p><i>Reviewer Analysis/Conclusions:</i> The 1999 federal license prescribed upstream and downstream passage for anadromous fish; the facilities have been constructed and operated consistent with the license terms. The resource agencies are not currently pursuing restoration of Atlantic salmon. Beyond the license requirements, the Applicant installed an upstream passage facility for American eel, a catadromous species. Effectiveness studies continue, having been extended due to passage problems at the next downstream dam. The facilities and operations are acceptable to the agencies.</p> <p>Yes with respect to anadromous fish = Go to C.5 N/A with respect to catadromous fish = Go to C.2</p>
C.2	<p>Are there historic records of anadromous and/or catadromous fish movement through the Facility area, but anadromous and/or catadromous fish do not presently move through the Facility area (e.g., because passage is blocked at a downstream dam or the fish run is extinct)?</p> <p><i>Reviewer Analysis/Conclusions:</i> American eel continue to move through the Facility area using the existing upstream passage eelway. Eel are passed downstream via the same fish sluice used by anadromous and riverine fish, or pass over the dam during spillage events.</p> <p>No with respect to catadromous fish = Go to C.3</p>
C.3	<p>If, since December 31, 1986:</p> <p>a) Resource Agencies have had the opportunity to issue, and considered issuing, a Mandatory Fish Passage Prescription for upstream and/or downstream passage of anadromous or catadromous fish (including delayed installation as described in C2a above), and</p> <p>b) The Resource Agencies declined to issue a Mandatory Fish Passage Prescription,</p> <p>c) Was a reason for the Resource Agencies' declining to issue a Mandatory Fish Passage Prescription one of the following: (1) the technological infeasibility of passage, (2) the absence of habitat upstream of the Facility due at least in part to inundation by the Facility impoundment, or (3) the anadromous or catadromous fish are no longer present in the Facility area and/or downstream reach due in whole or part to the presence of the Facility?</p> <p><i>Reviewer Analysis/Conclusions:</i> The agencies have not formally prescribed passage for American eel; however, facilities are in place and being operated by the Applicant to accommodate upstream and downstream movement.</p> <p>N/A for catadromous fish = Go to C.4</p>
C.4	<p>If C3 was not applicable:</p>

	<p>a) are upstream and downstream fish passage survival rates for anadromous and catadromous fish at the dam each documented at greater than 95% over 80% of the run using a generally accepted monitoring methodology? OR</p> <p>b) If the Facility is unable to meet the fish passage standards in 4.a, has the Applicant either i) demonstrated, and obtained a letter from the U.S. Fish and Wildlife Service or National Marine Fisheries Service confirming that demonstration, that the upstream and downstream fish passage measures (if any) at the Facility are appropriately protective of the fishery resource, or ii) committed to the provision of fish passage measures in the future and obtained a letter from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service indicating that passage measures are not currently warranted?</p>
	<p><i>Reviewer Analysis/Conclusions:</i> The Applicant has not attempted to demonstrate effective eel passage, but has agreed to continue to provide both upstream and downstream eel passage in voluntary cooperation with the resource agencies and as a condition of LIHI certification. YES to (b) for catadromous fish (so long as Recommended Conditions #1 is attached to the certification) = Go to C.5</p>
C.5	<p>Is the Facility in Compliance with Mandatory Fish Passage Prescriptions for upstream and/or downstream passage of <i>Riverine</i> fish?</p> <p><i>Reviewer Analysis/Conclusions:</i> There are no prescriptions for riverine fish. N/A = Go to C.6</p>
C.6	<p>Is the Facility in Compliance with Resource Agency Recommendations for Riverine, anadromous and catadromous fish entrainment protection, such as tailrace barriers?</p> <p><i>Reviewer Analysis/Conclusions:</i> Downstream passage measures in place divert fish from the forebay area for passage through a sluice pipe. YES = PASS</p>

D. Watershed Protection

No protected buffer zones have been created along the riverine impoundment through a settlement agreement or the federal exemption. Further, there is no shoreland protection plan.

LIHI Questionnaire: Watershed Protection	
D.1	Is there a buffer zone dedicated for conservation purposes (to protect fish and wildlife habitat, water quality, aesthetics and/or low-impact recreation) extending 200 feet from the high water mark in an average water year around 50 - 100% of the impoundment, and for all of the undeveloped shoreline?
	<i>Reviewer Analysis/Conclusions:</i> There are no buffer zones at this project. NO = Go to D.2
D.2	Has the facility owner/operator established an approved watershed enhancement fund that: 1) could achieve within the project's watershed the ecological and recreational equivalent of land protection in D.1.,and 2) has the agreement of appropriate stakeholders and state and federal resource agencies?
	<i>Reviewer Analysis/Conclusions:</i> There is no watershed enhancement fund. The facility does not qualify for an extension of the LIHI certification term by three years. NO = Go to D.3
D.3	Has the facility owner/operator established through a settlement agreement with appropriate stakeholders and that has state and federal resource agencies agreement an appropriate shoreland buffer or equivalent watershed land protection plan for conservation purposes (to protect fish and wildlife habitat, water quality, aesthetics and/or low impact recreation).
	<i>Reviewer Analysis/Conclusions:</i> There is no settlement agreement. NO = Go to D.4
D.4	Is the facility in compliance with both state and federal resource agencies recommendations in a license approved shoreland management plan regarding protection, mitigation or enhancement of shorelands surrounding the project?
	<i>Reviewer Analysis/Conclusions:</i> There are neither recommendations nor a shorelands management plan related to the Facility. N/A = PASS

E. Threatened and Endangered Species Protection

There are no federally listed species known to be present in Norwich according to the USFWS website.³ Connecticut has a fairly extensive list of threatened and endangered species and species of concern for New London County. The list includes shortnose sturgeon (endangered) and Atlantic sturgeon (threatened); however, they are not known to be present in the Shetucket watershed (email from Steve Gephard, CTDEEP, May 2, 2013, appended).

Efforts by state and federal agencies to protect and enhance the depleted coastwise stock of American eel are ongoing. The USFWS is currently reviewing eel status for possible protection under the Endangered Species Act. An eelway is in place at the dam and is operated by CTDEEP.

LIHI Questionnaire: Threatened and Endangered Species Protection	
E.1	Are threatened or endangered species listed under state or federal Endangered Species Acts present in the Facility area and/or downstream reach?
	Reviewer Analysis/Conclusions: No federally or state listed threatened or endangered species have been identified as present in the Facility area. Yes = Go to E.2

³ <http://www.fws.gov/newengland/pdfs/CT%20species%20by%20town.pdf>

F. Cultural Resource Protection

The Occum Project facilities were placed on the National Register of Historic Places on February 7, 1996, as the Occum Hydroelectric Plant and Dam. On September 16, 1999, FERC, the licensee, the Connecticut State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation entered into a Programmatic Agreement to ensure protection of the sites archeological and historic resources. Article 408 of the license requires implementation of the Programmatic Agreement, including preparation of a Cultural Resources Management Plan (CRMP). The licensee must consult with the SHPO prior to any change in the mode of operation, expansion of capacity, alteration to project facilities, or initiation of ground-disturbing activities. By order dated August 30, 2001, FERC approved the CRMP. The licensee also reports annually to FERC and the SHPO on activities at the Project site.

LIHI Questionnaire: Cultural Resource Protection	
F.1	If FERC-regulated, is the Facility in Compliance with all requirements regarding Cultural Resource protection, mitigation or enhancement included in the FERC license or exemption?
	<i>Reviewer Analysis/Conclusions:</i> No conflicts were identified in the record. Future construction is subject to consultation with the SHPO under Articles 408. YES = PASS

G. Recreation

Article 409 of the FERC license required the installation of a canoe portage and directional signage. The portage plan was to be developed in consultation with the USFWS, CTDEEP, and the SHPO. FERC approved the plan on November 8, 2000. The recreational improvements were completed in 2002.

Access to the western impoundment shoreline is not available through lands owned or controlled by the Applicant, and security fencing prevents public access to the intake and powerhouse area due to public safety and security concerns. All public access to the impoundment and immediate downstream reach is along the eastern shoreline as shown in Figure 9 below. Parking is provided at the east dam abutment area. The portage ramp is Americans with Disabilities Act compliant. Downstream ownership is limited and ends at the portage put-in. Some access is provided to the western shoreline below Bridge Street at a public park.

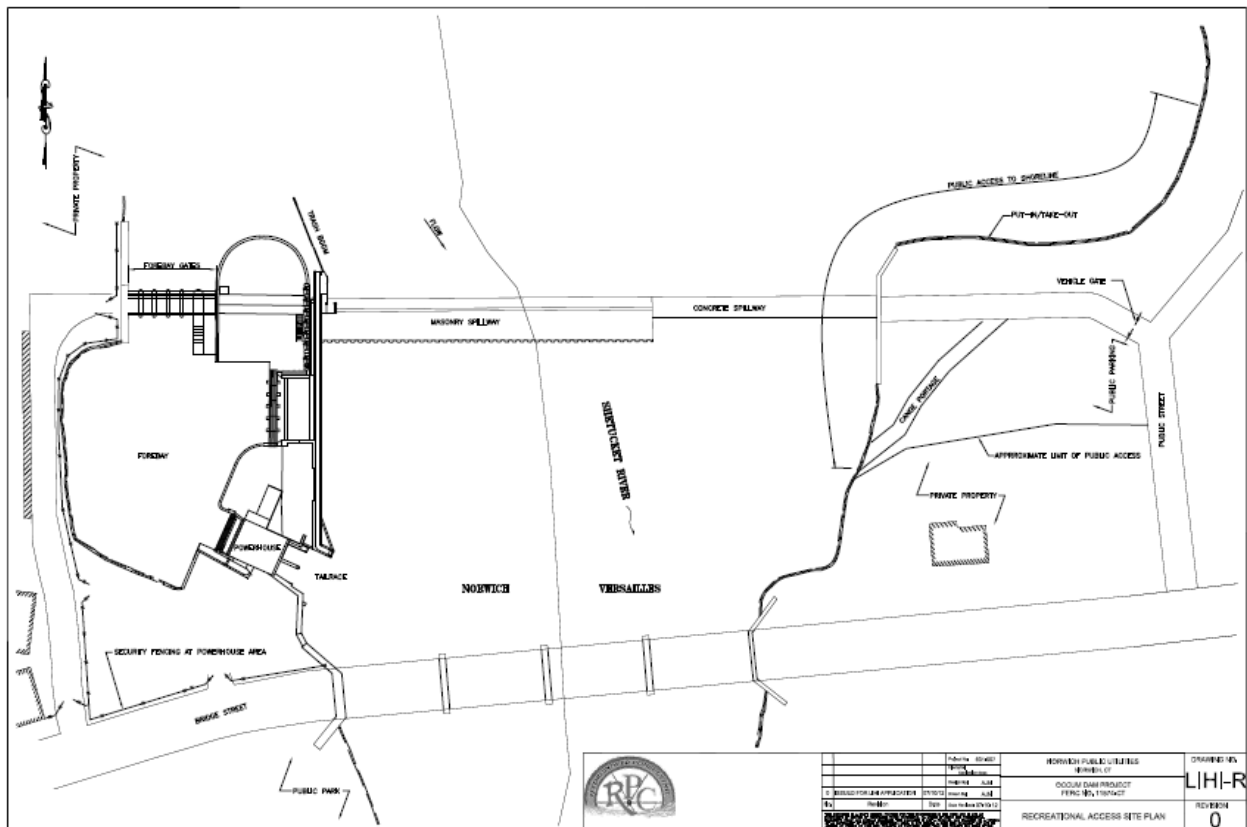


Figure 9. Layout showing recreational access and the portage.



Figure 6. Recreation area on opposite side of river from station. The canoe portage takeout is located to the right.

LIHI Questionnaire: Recreation	
G.1	<p>If FERC-regulated, is the Facility in Compliance with the recreational access, accommodation (including recreational flow releases) and facilities conditions in its FERC license or exemption?</p> <p><i>Reviewer Analysis/Conclusions:</i> The Article 409 recreational improvements were completed in 2002. Yes = Go to G.3</p>
G.3	<p>Does the Facility allow access to the reservoir and downstream reaches without fees or charges?</p> <p><i>Reviewer Analysis/Conclusions:</i> The Applicant provides access to the shoreline directly upstream and downstream of the dam. There are no fees or charges. YES = PASS</p>

H. Facilities Recommended for Removal

The record does not indicate an interest on the part of resource agencies in removing the dam.

LIHI Questionnaire: Facilities Recommended for Removal	
H.1	Is there a Resource Agency Recommendation for removal of the dam associated with the Facility?
	<i>Reviewer Analysis/Conclusions:</i> No. NO = PASS

APPENDIX

Contents

Correspondence.....	A-1 to A-10
Contacts	A-11

[NOTE: THE FOLLOWING EMAIL HAS GREENEVILLE AS THE SUBJECT, BUT ALSO APPLIES TO OCCUM AS THE OCCUM PROJECT REACH AND THE GREENEVILLE IMPOUNDMENT ARE IN THE SAME WATER QUALITY ASSESSMENT SEGMENT]

From: Thomas, Eric [mailto:Eric.Thomas@ct.gov]
Sent: Tuesday, April 30, 2013 3:06 PM
To: 'Jeffrey Cueto'
Cc: Hannon, Robert; Chase, Cheryl; Thomas, Eric
Subject: RE: LIHI application for Greenville Hydro

Hello Jeff,

I have reviewed our Department's statewide water quality assessment reports going back to the 2006 reporting cycle; documents as you know are posted online [here](#). The Shetucket River segment that you are referring to (CT3800_00_02) has not been assessed for either Aquatic Life (Habitat for Fish and other aquatic life and wildlife) or for Recreation use support since at least 2006.

- The Department's current wadeable stream monitoring and assessment methodologies are not favorable for assessing the physical and hydrological features of this particular segment. It has not been practical to monitor the river segment's benthic macroinvertebrate community as our primary indicator of biological integrity.
- Recreational use assessment (covering both "primary" and "secondary" contact) is based on sanitary/safety considerations and aesthetic/practical usability. Sanitary condition is determined from indicator bacteria data provided by DEEP and other sources, along with sanitary surveys where appropriate. There are no designated bathing beach areas in this Shetucket River segment. Furthermore, water quality bacteria sampling is not generally taken when monitoring crews are not on the river collecting data for the aquatic life support use assessment. I don't recall seeing records for other factors recorded for that river segment, such as excessive, non-native aquatic plant species present that would be assessed for impacts to water-based recreational uses.

If I understand your second query, I do not have information on compliance with regulatory matters such as Connecticut's 401 water quality certification program (that would reside in our Department's Inland Water Resources Division). I have copied Cheryl Chase, director of that division, as well as Robert Hannon of our Commissioner's Office of Planning and Program Development, in case they can provide that information to you.

Thank you for forwarding the comments submitted by our Department's Inland Fisheries Division in support of the LIHI designation.

Eric

Eric Thomas
Watershed/NPS Management Program
Planning and Standards Division
Water Protection and Land Reuse Bureau



CONNECTICUT DEPARTMENT OF
ENERGY & ENVIRONMENTAL PROTECTION



March 8, 2013

Low Impact Hydropower Institute
P.O. Box 194
Harrington Park, NJ 07640

RE: Greenville and Occum Hydroelectric Projects- LIHI Certification

To the LIHI,

Both of the referenced projects are FERC-licensed projects on the Shetucket River in Connecticut, operated by the City of Norwich- Norwich Public Utilities (NPU). I supervise the Diadromous Fish Program for the CTDEEP and have been involved NPU projects for over 20 years. As Greenville underwent relicensing and Occum underwent licensing, I have been involved in those processes, recommending license conditions, reviewing and approving fish passage facility plans and construction, and engaged with NPU as it carried out both required evaluation studies and all fish passage activities. I am very familiar with these projects and am writing a letter to support LIHI certification. The paragraphs below will explain my position.

The license for the Greenville project required effective upstream fish passage, effective downstream fish passage, an evaluation study, the provision of minimum flows down the bypass reach, and other procedural requirements relative to our agency. All have been achieved on an ongoing basis. The fishlift at Greenville has proven quite effective and has passed thousands of American shad (principal target species) annually. NPU has allowed our staff to maintain fish counting capability in the counting house so that we may monitor the run. NPU has also allowed us to install and operate an upstream eel pass, which was not required by its mid-1990s license. Our staff meets regularly with NPU to review fish passage activities and ensure compliance with all required activities.

The license for the Occum project also required effective upstream fish passage including an eel pass, effective downstream fish passage, an evaluation study, the provision of minimum flows down the bypass reach, and other procedural requirements relative to our agency. A Denil fishway has been built and operated for seven years. The evaluation study has been hampered by the fact that there is one other dam between Greenville and Occum that is owned by another party, non-jurisdictional in respect to FERC, and its fishway has not been effective in passing American shad. Therefore, few shad have passed up the Occum fishway (although in 2012, Occum passed all of the seven shad passed at the next downstream fishway). NPU's evaluation study has documented the passage of many non-diadromous species, suggesting that the fishway works well. The study of the downstream fish passage facility show that it passes many young-of-the-year shad. The study has also highlighted trends in fish passage and suggested what could be done to improve fish passage. One obstacle to effective fish passage at Occum

is the peaking operational mode of the Scotland Dam, the next project upstream. This results in substantial spill and false attraction at the Occum spillway. After accepting the NPU reports, our agency has supported the suspension of further evaluation studies at Occum until which time Scotland is re-licensed and becomes run-of-river. Our staff meets regularly with NPU to review fish passage activities and ensure compliance with all required activities and NPU submits an annual report to FERC which we review and sign off on for accuracy.

NPU has voluntarily begun trucking live shad from its Greenville Dam Fishlift to spawning habitat upstream of its Occum Dam to compensate for the fact that few shad are passing through its Occum Dam fishway. This is a significant contribution and will accelerate the pace of restoration of shad to the river. We hope that this will be an interim measure as the owner of the second dam/fishway improves passage and more shad reach and pass Occum. NPU has also voluntarily cooperated with the U.S. Fish & Wildlife Service, the U.S. Geological Survey (Conte Anadromous Fish Research Center), and our agency on a cooperative research project that released 60 tagged silver-phase American eels above Occum and studied their migratory path and behavior as they moved downstream past the three hydroelectric dams. It is hoped that the results of this ongoing study will give clues to how best design downstream eel passage facilities at these and other hydroelectric projects.

In summary, I feel that NPU is operating these two projects in a manner that qualifies them for certification by the LIHI and I endorse such certification.

Sincerely,



Stephen Gephard
Supervising Fisheries Biologist
Inland Fisheries Division
steve.gephard@ct.gov

From: Al Nash [mailto:al.nash@renewablepowerconsulting.com]
Sent: Monday, May 06, 2013 6:06 AM
To: 'Jeffrey Cueto'
Cc: markgreene@npumail.com
Subject: RE: Occum entrainment/impingement

PLEASE SEE MY RESPONSES BELOW AND THE ATTACHED FILES.

Alfred Nash, P.E.
Renewable Power Consulting, PA
43 Spaulding Road
P.O. Box 195
Palmyra, ME 04965
(207) 992-3926
email: AL.Nash@renewablepowerconsulting.com

From: Jeffrey Cueto [mailto:ompompanoo@aol.com]
Sent: Sunday, May 5, 2013 6:40 PM
To: 'Al Nash'
Cc: markgreene@npumail.com
Subject: Occum entrainment/impingement

Al –

1. Is it correct that passage effectiveness was not evaluated in 2012? You gave LIHI the 2011 report, and I think I read somewhere (CTDEEP's letter) that the agencies postponed further evaluation until Taftville gets squared away.

SUBSEQUENT TO THE APPLICATION SUBMISSION THE 2012 FISH PASSAGE REPORT WAS ISSUED. ATTACHED IS A COPY FOR YOUR USE. CTDEEP HAS SUSPENDED FISH PASSAGE TESTING AT OCCUM UNTIL THE DOWNSTREAM TAFTVILLE STATION IS EFFECTIVE (REFER TO SECTIONS 2.4, 3.4 & 4.4 OF THE REPORT). VIDEO RECORDING WAS AND WILL BE MAINTAINED (REFER TO 2/9/13 LETTER ATTACHED). THE FIRST USE OF THE LADDER BY SHAD AND PASSAGE OF SHAD AT THE TAFTVILLE STATION WAS NOTED IN 2012 (REPORT SECTION 4.3). THE CTDEEP IS CONTINUING TO PIT TAG AND NPU IS ASSISTING BOTH FIRST LIGHT (TAFTVILLE OWNER) AND CTDEEP WITH THIS EFFORT.

2. Has the decision been made yet as to whether the perforated plate, or some other measure, is needed to prevent entrainment?

THE PERFORATED PLATE OR OTHER MEASURES ARE NOT REQUIRED FOR THE ANADROMOUS PASSAGE. THE ONGOING STUDY FOR CATADROMOUS MAY REQUIRE MODIFICATION IN THE FUTURE.

3. The rack still has a 4-inch bar spacing?

CORRECT

From: Al Nash [mailto:al.nash@renewablepowerconsulting.com]
Sent: Saturday, May 04, 2013 7:11 PM
To: 'Jeffrey Cueto'
Cc: markgreene@npumail.com
Subject: RE: Occum tailrace

PLEASE SEE MY COMMENTS BELOW

Alfred Nash, P.E.
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43 Spaulding Road
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From: Jeffrey Cueto [mailto:ompompanoo@aol.com]
Sent: Saturday, May 4, 2013 5:23 PM
To: 'Al Nash'
Cc: markgreene@npumail.com
Subject: FW: Occum tailrace

Al – One other related question. Article 402 requires the Occum minimum flows to be released into the bypassed reach and immediately downstream of the dam. Since most of the minimum flows, as I understand it, are released through the fish pipe and since the fish pipe discharges downstream of the powerhouse tailrace, how did this arrangement get approved?

Regards,
Jeff

THE BYPASS REACH THAT THIS IS REFERENCING IS THE REACH BETWEEN OCCUM AND TAFTVILLE. THIS REACH BECOMES PARTICULARLY VULNERABLE WHEN TAFTVILLE WAS DRAWN DOWN TO ITS LOWEST POINT. HENCE THE REASON FOR MORE FLOW IF TAFTVILLE WAS DRAWN BELOW 48.9. WHILE THE LICENSE INDICATES THE DAM THE INTENT AND NEED WAS BELOW THE PROJECT. SINCE THIS WAS UNDERSTOOD BY THE VARIOUS PARTIES NPU DID NOT REQUEST A CHANGE IN THE LANGUAGE.

THERE ARE A FEW REASON WHY THE AGENCIES AGREED TO THE FLOW BEING INTRODUCED AT THE TAILRACE AREA VERSUS THE ACTUAL DAM TOE.

ONE OF THE REASONS WAS FOR IMPROVED UPSTREAM FISH PASSAGE EFFECTIVENESS. THE AGENCIES WERE CONCERNED THAT HAD A FLOW BEEN INTRODUCED AT THE DAM TOE FISH MAY MOVE TO THE DAM TOE AND BYPASS THE FISH LADDER ENTRANCE. THEY ALSO REASONED THAT WITH NO REAL FLOW ALONG THE TOE, FISH TRAVELING THE FAR BANK WOULD MORE READILY MOVE ACROSS TO THE LADDER SIDE AND ENHANCE PASSAGE EFFECTIVENESS.

ANOTHER REASON WAS THE ACKNOWLEDGEMENT THAT THE SECTION BETWEEN THE DAM AND POWERHOUSE IS RELATIVELY SMALL AND GENERALLY CONSISTED OF A POOL VERSUS RIFFLE TYPE AREA. ON PG 129 OF APPLICATION IN PHOTOS 12A AND 12B YOU WILL NOTICE THAT THE AREA BETWEEN THE DAM AND TAILRACE IS BASICALLY A POOL. FLOW FROM THE UNIT CAUSES A SLIGHT BACK EDDY EFFECT WITH FLOW GOING ACROSS THE RIVER AND INTO THIS POOL OF WATER. THE TAILRACE FLOW CAN MOVE ACROSS THE RIVER AND CIRCLE UPSTREAM BEFORE MOVING ACROSS THE TOE AND BACK DOWNSTREAM. THIS EDDY WAS A CONCERN DURING THE FISH PASSAGE DESIGN AND IN THE DISCUSSIONS ABOUT WHERE THE LADDER ENTRANCE SHOULD BE.

WE ALSO KNEW DURING LICENSING THAT NPU WOULD INTRODUCE A SMALL FLOW FOR THE UPSTEAM EEL LADDER AND ADD A SPILL GATE. BETWEEN THE EEL LADDER FLOW, THE EXPECTED LEAKAGE FROM THE SPILL GATE, THE SCOTLAND PULSES CAUSING SPILLS AND THE BACK EDDY THE SHORT SECTION OF BYPASS BETWEEN THE TOE AND TAILRACE RECEIVES ADQUATE FLOW MOVEMENT THROUGH THE POOL.

From: Jeffrey Cueto [<mailto:ompompanoo@aol.com>]
Sent: Saturday, May 04, 2013 1:50 PM
To: 'Al Nash'
Cc: 'markgreene@npumail.com'
Subject: Occum tailrace

Al – Your description of project operation on p. 126 of the application references elevation 48.3 feet msl as the trigger for increasing the minimum flow release. That was the original proposal. As licensed, the trigger is 48.9 feet. Please confirm that this is the trigger that is being used by Norwich. **THE 48.9 IS CORRENT AND WHAT NPU USES. THE 48.3 WAS FROM AN INITIAL DRAFT THAT WAS LATER UPDATED.**

On p. 6 of the FERC EA, there is mention of Norwich approaching the Taftville owner about reducing the magnitudes of drawdowns at Taftville. Did that happen? **YES THEY DID. TAFTVILLE NO LONGER DRAWS THE POND DOWN THIS FAR. THEIR MAIN REASON IS DUE TO THEIR FISH PASSAGE WHICH REQUIRES A HIGHER POND TO OPERATE. TAFTVILLE ELECTED TO KEEP THE POND HIGH RATHER THAN SPEND CONSIDERABLY MORE MONEY TO INSTALL FISH PASSAGE FACILITIES THAT WOULD ACCOMODATE THE FORMER OPERATING RANGE. IN ADDITION THERE IS AN INFORMAL AGREEMENT IN PLACE WITH NPU WHEREBY TAFTVILLE DOES NOT DRAW THE POND DOWN. THIS WAS ACTUALLY IN PLACE BEFORE NPU DESIGNED AND INSTALLED THEIR FISH PASSAGE FACILITIES. NPU USES A STAFF GAGE TO CONFIRM THAT THE TAILRACE LEVEL IS HIGH ENOUGH.**

Is it correct that Occum is drawn down primarily due to its lower hydraulic capacity compared to Scotland? The use of storage would avoid spillage and loss of production. At least that is what I was assuming. **THAT IS CORRECT. HISTORICALLY THE INFLOW WENT FROM 84 CFS (SCOTLAND'S MIN FLOW) TO AROUND 1,200 CFS WHEN SCOTLAND'S ONE UNIT**

From: Gephard, Steve [mailto:Steve.Gephard@ct.gov]
Sent: Thursday, May 02, 2013 1:25 PM
To: 'Jeffrey Cueto'
Cc: Melissa_Grader@fws.gov
Subject: RE: Greenville and Occum - sturgeon

Hi Jeff,

We have no evidence of sturgeon in this watershed. We have previously looked for them downstream of Greenville and never found them and gave up. The Occum reach is landlocked and if there were fish there, some angler would have stumbled across them. I can say with confidence there are no sturgeon there and no native sturgeon below Greenville. That's not to say that some Hudson River fish might not wander into the estuary some day but there no evidence of a natal population.

Steve

Stephen Gephard
Supervisor
Diadromous Fish Program *and* Habitat and Conservation Enhancement Program
Inland Fisheries Division
Dept. Energy and Environmental Protection
P.O. Box 719, Old Lyme, CT 06371
860-447-4316



From: Jeffrey Cueto [mailto:ompompanoo@aol.com]
Sent: Thursday, May 02, 2013 9:44 AM
To: Gephard, Steve
Cc: Melissa_Grader@fws.gov
Subject: Greenville and Occum - sturgeon

Hi, Steve. I thought I sent you an email previously, but I couldn't find any trace of it. So maybe not. The state T&E list includes shortnose sturgeon (endangered) and Atlantic sturgeon (threatened). Do you know whether they are present at either dam reach and, if so, whether the projects have any significant adverse impact on these fish?

Thanks.

Jeff

CONTACTS

Entity	Authorized Representatives	Contact Information
Norwich Public Utilities (applicant)	Chris LaRose	16 South Golden St Norwich, Connecticut 06360 Telephone: (860) 823-7300 Email: Chrislarose@npumail.com
United States Fish and Wildlife Service	Melissa Grader Fish & Wildlife Biologist	US FWS/New England Field Office c/o CT River Coordinator's Office 103 East Plumtree Road Sunderland, MA 01375 Telephone: (413) 548-8002, x124 Email: melissa_grader@fws.gov
National Marine Fisheries Service	Marjorie Mooney	Northeast Fisheries Science Center 166 Water Street Woods Hole, MA 02543-1026 Telephone: (508) 495-2000 Email: Marjorie.Mooney-Seus@noaa.gov
CT Department of Energy & Environmental Protection Office of Planning and Program Development	Robert Hannon (water quality certification)	79 Elm Street Hartford, CT 06106 Telephone: (860) 424-3245 Email: robert.hannon@ct.gov
CT Department of Energy & Environmental Protection Bureau of Water Management	Eric Thomas Watershed Manager	79 Elm Street Hartford, CT 06106 Telephone: (860) 424-3548 Email: eric.thomas@ct.gov
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