

OCCUM PROJECT  
LIHI APPLICATION

ATTACHMENT B  
WATER QUALITY

## B. Water Quality

Questions:

- 1) 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?
- 2) 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?

Water quality in the Shetucket River in the vicinity of the project is identified as Class B by the CTDEEP Water Management Bureau. According to Connecticut Water Quality Standards, Class B waters have a minimum dissolved oxygen concentration of 5 mg/l and temperature can deviate above ambient conditions by 4 degrees F. Water quality should be suitable for recreational use, fish and wildlife habitat, agricultural, industrial supply and other legitimate uses including navigation.

In general, the CTDEEP's main water quality concern for the Shetucket River is the occurrence of seasonal algal blooms. The CTDEEP collected data in the 1991 and 1992 summer months for the purpose of creating an eutrophication control plan. These data show that the Shetucket River in the vicinity of Occum (one sample location approximately 2.5 miles upstream of the dam and one sample location less than 1,200 ft downstream of the dam) exceeds the established water quality standards for algae concentrations.

NPU has confirmed that the original water quality certifications remain current per communications with the CTDEEP. NPU has requested CTDEEP provide a formal letter to LIHI from to provide written confirmation that these provision remain valid. NPU has provided a copy of the CTDEEP email indicating a letter will be provided and that the CTDEEP will support the application. NPU has also provided a copy of the most recent FERC environmental review confirming current compliance. FERC has not issued the 2012 report but has verbally communicated that the project is in compliance.

The 2010 Integrated Water Quality Report (excerpt below) indicated that the river segment containing the project (CT3800-00\_02) has not been assessed for use support for Aquatic Life and for Recreation. This portion was not revised in the 2012 Integrated Water Quality Report.

## OCCUM HYDROELECTRIC PROJECT WATER QUALITY CERTIFICATE

Water Quality Certificate Conditions for the Occum Project Issued By the Connecticut Department of Environmental Protection on February 19, 1997.

Pursuant to Section 401 of the Federal Water Pollution Control Act, the Department hereby certifies that operation of the proposed project as described in the City of Norwich, Department of Public Utilities' application to the Federal Energy Regulatory Commission (FERC) dated February 9, 1996, will not violate Connecticut's Water Quality Standards provided that the following conditions are complied with:

- (1) The applicant shall, in a manner and on a schedule as approved by the Department of Environmental Protection, construct and maintain facilities for upstream fish passage.
- (2) The applicant shall begin construction of a downstream fishway/sluceway within two years and complete construction within four years of the issuance of a license for the project.
- (3) 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.
- (4) The applicant shall operate the project in a cycling mode based on flows from the upstream Scotland Project. The drawdown of the impoundment shall be limited to 2 feet from the top of the flashboards or two feet below the masonry dam crest when the flashboards are not in place.

Nothing contained herein shall relieve the applicant of other obligations under applicable federal, state, and local law.

## Al Nash

---

**From:** Gephard, Steve [Steve.Gephard@ct.gov]  
**Sent:** Friday, December 21, 2012 3:01 PM  
**To:** 'Al Nash'  
**Cc:** Mark Greene  
**Subject:** RE: Counter information and LIHI letter

I'm sorry to tell you that I just can't get to this until January. Too many last minute things and I'm am off next week. I will try to get to it promptly after the new year.

I will reassure Mark that I have decided to write the letter of support for LIHI. In most cases, I send that directly to LIHI. Should I do that (and copy you) or should I send it to one of you?

Merry Christmas.

Steve

---

**From:** Al Nash [<mailto:al.nash@renewablepowerconsulting.com>]  
**Sent:** Wednesday, December 19, 2012 11:42 AM  
**To:** Gephard, Steve  
**Subject:** Counter information and LIHI letter

Good morning Steve - when you get a chance would you please send me the Denil counter information we discussed and the LIHI letter for Norwich's Occum and Greenville stations?

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](mailto:AL.Nash@renewablepowerconsulting.com)

**ENVIRONMENTAL INSPECTION REPORT  
(ELECTRONICALLY SUBMITTED)  
FEDERAL ENERGY REGULATORY COMMISSION**

**New York Region**

**Date of Inspection – May 11, 2005**

**Name Occum Project No. 11574-CT**

**Licensee City of Norwich – Dept. of Public Utilities License Type Minor**

**License Issued September 29, 1999 License Expires August 31, 2039**

**Location Shetucket River None  
(Waterway) (Reservation)**

New London Connecticut  
(County) (State)

**Inspector Joseph Enrico**

**Licensee Representatives Mr. Roy Borque, Senior Watch Engineer**

**Other Participants None**

**Summary of Findings**

The licensee is currently installing upstream and downstream fish passage facilities at the project which were completed in July, 2005. The construction area was fenced for security and public safety. There were no environmental issues at the construction area with sufficient safeguards for soil erosion and runoff control. The recreation area was open for access and all public safety measures were in place. There were no follow-up actions as a result of this inspection.

**Submitted August 31, 2005**

**Joseph G. Enrico  
Environmental Protection Specialist**

**A. INSPECTION FINDINGS**

| Requirements*   | Date of Requirement  | Follow-up Needed | Photo Nos. |
|---|--|------------------|------------|
| <b>CULTURAL RESOURCES</b>   |  |                  |            |
| Article 408 requires the Licensee to implement the Programmatic Agreement on Cultural Resources. CMP filed on August 30, 2001. <b>C-185</b>   | <b>O:</b> 9-29-99<br><b>Ap:</b> 8-30-01                      | N                |            |
| <b>FISH AND WILDLIFE RESOURCES</b>  |  |                  |            |
| Article 401 requires the Licensee to limit drawdowns of the impoundment to 2 feet below crest or top of flashboards. <b>C-188</b>   | <b>O:</b> 9-29-99  | N                |            |
| Article 402 requires the Licensee to release a minimum flow of 30 cfs into the bypass reach from leakage or spillage and 100 cfs when the downstream fish passage facility becomes operational. <b>C-089.</b> | <b>O:</b> 9-29-99  | N                |            |
| Article 403 requires the Licensee to file a project operation monitoring plan for impoundment fluctuations and minimum flows. Filed 3-29-2000 & 12-18-2000. <b>C-211</b>                                      | <b>O:</b> 9-29-99<br><b>Ap:</b> 3-2-01                       | N                |            |
| Article 404 requires the Licensee to submit an erosion control plan prior to any future ground breaking activities at the project. Filed 9-29-00, 12-18-00 & 6-7-04 <b>C-120</b>                              | <b>O:</b> 9-29-99<br><b>Ap:</b> 3-23-01<br><b>Ap:</b> 8-3-04 | N                |            |
| Article 405 requires the Licensee to file a final plan for the installation, monitoring and operation of an upstream fish passage. Filed 9-29-00, 12-18-00 & 6-7-04 <b>C-026</b>                              | <b>O:</b> 9-29-99<br><b>Ap:</b> 8-3-04                       | N                | 1-3        |
| Article 406 requires the Licensee to file a final plan for the installation, operation and monitoring of downstream fish passage facilities. Filed 9-29-00, 12-18-00 & 6-7-04. <b>C-026.</b>                  | <b>O:</b> 9-29-99<br><b>Ap:</b> 3-23-01<br><b>Ap:</b> 8-3-04 | N                | 4-6        |
| Article 407 reserves authority to the Commission to prescribe the installation of fish passage facilities. <b>C-072</b>   | <b>O:</b> 9-29-99  | N                |            |
| <b>PUBLIC SAFETY</b>  |  |                  |            |
| Facilities and measures to assure public safety (18 CFR, Part 12). Plan submitted on April 13, 1994. <b>C-111</b>   | <b>O:</b> 9-29-99<br><b>Ap:</b> 11-1-94                      | N                | 7          |

| Requirements*   | Date of Requirement                     | Follow-up Needed | Photo Nos. |
|---|---|------------------|------------|
| <b>RECREATION RESOURCES</b>   |   |                  |            |
| Article 409 requires the Licensee to file a canoe portage plan. Filed 9-29-2000. NYRO letter dated August 31, 2001 confirming receipt and acceptance of as-builts. <b>C-113</b> | <b>O:</b> 9-29-99<br><b>Ap:</b> 11-8-00 | N                | 8          |
| Recreation signing and posting (18 CFR, Part 8) <b>C-118</b>  | <b>O:</b> 9-29-99                       | N                | 8          |
| Standard Article 13 requires the Licensee to allow public free access to project waters and adjacent lands <b>C-118</b>   | <b>O:</b> 9-29-99                       | N                |            |
| Submission of the Commission's Form 80 monitoring report <b>C-112.</b>  | <b>18CFR:</b><br>Filed 4-1-03           | N                |            |
| <b>OTHER ENVIRONMENTAL RESOURCES</b>  |   |                  |            |
| Article 410 allows the Licensee to grant conveyances for non project use of project lands and waters, for certain actions without prior Commission approval. <b>C-202</b>       | <b>O:</b> 9-29-99                       | N                |            |

**O**=Order **C**=OEP-IT Code **18CFR**=Title 18 Code of Federal Regulations, **Ap**=Approved

### Comments and Follow-Up Action

(1) **Fish Passage Facilities:** The Licensee requested and received an extension of time for facility installation so that the upstream and downstream facilities could be done at the same time for a significant cost savings. The facilities were near completion at the time of inspection.

(2) **Recreational Facilities:** The canoe portage and access facility was available for public use during construction as it is located on the opposite side of the river from the powerhouse/intake area.

### **B. EXHIBITS AND PHOTOGRAPHS**

The following are provided to show the location of the project and to illustrate project features: Eight photographs and photo location map.

**Cc: DHAC**  
**Enrico, J./di**

# STATE OF CONNECTICUT

## INTEGRATED WATER QUALITY REPORT

Final – May 31, 2011

This document has been established pursuant  
to the requirements of Sections 305(b) and 303(d)  
of the Federal Clean Water Act

/s/ Betsey Wingfield

5/31/2011

Betsey Wingfield, Chief  
Bureau of Water Protection and Land Reuse

Date



**STATE OF CONNECTICUT**  
**DEPARTMENT OF**  
**ENVIRONMENTAL PROTECTION**  
79 Elm Street  
Hartford, CT 06106-5127  
(860) 424-3704

**Daniel Esty, Commissioner**

| ID305B       | NAME                       | LOCATION  | MILES | AQUATIC LIFE | RECREATION | FISH CONSUMPTION |
|--------------|----------------------------|---|-------|--------------|------------|------------------|
| CT3713-00_01 | Mill Brook (Plainfield)-01 | From mouth at confluence with Quinebaug River (DS of Weston Road crossing), Canterbury, US to RailRoad crossing, Plainfield.  | 1.99  | U            | U          | FULL*            |
| CT3713-00_02 | Mill Brook (Plainfield)-02 | From RailRoad crossing (DS of Route 12 crossing), Plainfield, US to headwaters in large wetland area, north of Rhode Road (east of I395), Griswold.   | 3.1   | U            | U          | FULL*            |
| CT3716-00_01 | Broad Brook (Preston)-01   | From mouth at confluence with Quinebaug River (DS of Old Jewett City Road crossing), at the Preston/Lisbon/Griswold borders, US to Lewis Pond outlet dam (north side of Route 165, near intersection with Lewis Road), Preston. | 4.73  | NOT          | NOT        | FULL*            |
| CT3800-00_01 | Shetucket River-01         | From end of estuary, at Route 2 crossing, US to Greenville dam, Norwich.  | 1.56  | U            | NOT        | FULL*            |
| CT3800-00_02 | Shetucket River-02         | From Greenville Dam, Norwich, US through Greenville Dam impoundment, Taftville Pond, and Occum Pond to Sprague (Baltic) WPCF, Sprague.  | 6.09  | U            | U          | FULL*            |
| CT3800-00_03 | Shetucket River-03         | From Sprague WPCF (near head of Occum Pond), US to confluence with Merrick Brook at Sprague/Scotland town line (DS of Scotland Dam).  | 4.7   | FULL         | FULL       | FULL*            |
| CT3800-00_04 | Shetucket River-04         | From confluence with Merrick Brook (DS of Scotland Dam), US to confluence with Cold Brook just DS from Franklin Mushroom Farm STP (on unnamed tributary).   | 2.18  | U            | U          | FULL*            |
| CT3800-00_05 | Shetucket River-05         | From confluence with Cold Brook (DS of Franklin Mushroom Farm STP from unnamed tributary), US to headwaters at confluence of Natchaug River and Willimantic River.  | 4.99  | NOT          | NOT        | FULL*            |

**Use Support:**

**FULL**=Designated use Fully Supported    **NOT**=Designated use Not Supported, See 303d listing for details.    **U**=Not Assessed    **///**=Not applicable to Segment    **I**= Insufficient Information to assess use  
**FULL\***=Refer to Connecticut Department of Environmental Protection Angler's Guide, or online at [www.ct.gov/dep](http://www.ct.gov/dep) for more information about fish consumption advisories.

**FINAL  
ENVIRONMENTAL ASSESSMENT  
FOR HYDROPOWER LICENSE**

**Occum Hydroelectric Project**

**FERC Project No. 11574-000**

**Connecticut**

**Federal Energy Regulatory Commission  
Office of Hydropower Licensing  
Division of Licensing and Compliance  
888 First Street, NE  
Washington, DC 20426**

**August 1999**

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## ACRONYMS AND ABBREVIATIONS

|                    |  |
|--------------------|--|
| ac-ft              | acre-feet  |
| Advisory Council   | Advisory Council on Historic Preservation          |
| APE                | area of potential effect                           |
| Btu                | British thermal units                              |
| CDEP               | Connecticut Department of Environmental Protection |
| cfs                | cubic feet per second                              |
| CL&P               | Connecticut Light & Power Company                  |
| CRMP               | Cultural Resources Management Plan                 |
| CWA                | Clean Water Act                                    |
| DO                 | dissolved oxygen                                   |
| EA                 | Environmental Assessment                           |
| EPRI               | Electric Power Research Institute                  |
| ESA                | Endangered Species Act                             |
| Federal Commission | Federal Paper Board                                |
| FPA                | Federal Energy Regulatory Commission               |
| FPA                | Federal Power Act                                  |
| fps                | feet per second                                    |
| FWS                | U.S. Fish and Wildlife Service                     |
| Interior           | U.S. Department of the Interior                    |
| kV                 | kilovolt   |
| kW                 | kilowatt   |
| kWh                | kilowatt-hour                                      |
| MWh                | megawatt-hours                                     |
| National Register  | National Register of Historic Places               |
| NEPA               | National Environmental Policy Act                  |
| NEPOOL             | New England Power Pool                             |
| NERC               | North American Electric Reliability Council        |
| NGVD               | National Geodetic Vertical Datum                   |
| NHPA               | National Historic Preservation Act                 |
| NMFS               | National Marine Fisheries Service                  |
| Norwich            | city of Norwich, Department of Public Utilities    |
| NPCC               | Northeast Power Coordinating Council               |
| NU                 | Northeast Utilities                                |
| NWI                | National Wetland Inventory                         |
| PA                 | Programmatic Agreement                             |
| rm                 | river mile   |
| SCADA              | Supervisory Controls and Data Acquisition System   |
| SD1, SD2           | Scoping Document 1, Scoping Document 2             |
| SHPO               | State Historic Preservation Officer                |
| sq mi              | square mile  |
| USGS               | U.S. Geological Survey                             |
| WQC                | Water Quality Certification                        |
| YOY                | young-of-the-year                                  |

## SUMMARY

On February 23, 1996, the city of Norwich, Department of Public Utilities (Norwich) filed an application with the Federal Energy Regulatory Commission (FERC or Commission) for an original license under Part I of the Federal Power Act (FPA) to operate the 800-kilowatt (kW) Occum Hydroelectric Project No. 11574, located on the Shetucket River in New London County, Connecticut.

This final environmental assessment (final EA) analyzes the effects of the proposed action and various alternatives, including no-action. Our analysis shows that the best alternative for the Occum Project to reduce or avoid adverse effects on environmental resources is to issue an original license with the following measures: (1) operate the project in a cycling mode, limiting impoundment drawdown to 2 feet; (2) develop and implement soil and erosion control measures, including temporary cofferdams, as part of the final plans for construction of the downstream fish bypass and upstream fish ladder and the canoe portage; (3) release minimum flows of 30 cfs through a combination of leakage and spillage when the project is not operating, and, following installation of the downstream fish bypass, a total of 100 cfs through a combination of leakage, spillage, and the downstream fish bypass when the project is not operating and the impoundment elevation at the Taftville Project is below 48.9 feet; (4) develop and implement a plan to monitor impoundment and tailwater elevations and minimum flows; (5) develop and implement a final plan for the construction, operation, maintenance, and effectiveness monitoring of the upstream Denil fish ladder; (6) develop and implement a final plan for the construction, operation, maintenance, and effectiveness monitoring of downstream fish bypass; (7) implement a Programmatic Agreement among the Commission, the State Historic Preservation Officer, and the Advisory Council for Historic Preservation, that provides for the development and implementation of a Cultural Resources Management Plan; and (8) develop and implement a final plan for the installation of canoe portage around the dam, including signs and erosion control measures. We discuss these measures in section V and summarize them in section VII of this final EA.

Overall, these measures, along with the standard articles provided in any license issued for the project, would protect, mitigate, or enhance geology and soils, water quality, fisheries, terrestrial, cultural, and recreational resources.

Under the provision of Section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations of federal and state fish and wildlife agencies submitted to adequately and equitably protect, mitigate damages to, and enhance fish and wildlife (including spawning grounds and habitat) affected by the project. The Connecticut Department of Environmental Protection (CDEP) and the U.S. Department of Interior (Interior) filed recommendations for the protection, mitigation, and enhancement of such resources in response to the Notice of Application Ready for Environmental Analysis issued on April 28, 1998. All except one of our recommendations are consistent with those of the resource agencies. We did not adopt Interior's recommendation that Norwich should provide a minimum flow of 155 cubic feet per second when the tailwater elevation drops below 48.9 feet. Pursuant to Section 10(j), we contacted Interior by letter dated February 24, 1999, to attempt to resolve the inconsistency with the FPA. By letter dated March 23, 1999, Interior responded saying it could accept our recommended minimum flow of 100 cfs when the tailwater elevation drops below 48.9 feet. Consequently, we consider all inconsistencies between Interior's recommendations and the FPA to be resolved. We discuss these measures and our recommendations in sections V and VIII of this final EA.

The CDEP granted Norwich, pursuant to Section 401 of the Clean Water Act, a water quality certificate with conditions on February 11, 1997. In this final EA, we make recommendations consistent with the terms of the water quality certificate to ensure protection of water quality at the site.

On the basis of our independent analysis, we conclude that issuing an original license for the Occum Project, with our recommended measures, would not be a major federal action significantly affecting the quality of the human environment.

## FINAL ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission  
Office of Hydropower Licensing  
Division of Licensing and Compliance  
Washington, DC

OCCUM HYDROELECTRIC PROJECT  
FERC NO. 11574--CONNECTICUT  
August 1999

### INTRODUCTION

The Federal Energy Regulatory Commission (Commission) issued the Occum Hydroelectric Project Draft Environmental Assessment (draft EA) for comment on February 24, 1999. In response, we received three comment letters. The comment letters and staff responses to the comment letters are contained in Appendix A.

### I. APPLICATION

On February 23, 1996, the city of Norwich, Department of Public Utilities (Norwich or applicant) filed an application with the Commission for an original minor license under Part I of the Federal Power Act (FPA) to operate the 800-kilowatt (kW) Occum Hydroelectric Project. The Occum Project is located on the Shetucket River in the city of Norwich and the town of Sprague in New London County, Connecticut (figure 1). No new construction or installed capacity is proposed. The project does not occupy any federally owned lands.

### II. PURPOSE AND NEED FOR ACTION

#### A. Purpose of Action

The Commission must decide whether to license Norwich's proposed project, and what, if any, conditions should be placed on any license issued. In this final environmental assessment (final EA), we assess the environmental and economic effects of: (1) operating the project as proposed by Norwich; (2) operating the project as proposed by Norwich with additional staff-recommended measures; and (3) no-action.



## **B. Need for Power**

To assess the need for power, we reviewed the future use of the project's power, together with that of the operating region in which the project would be located. The Occum Hydroelectric Project would be located in the New England Power Pool (NEPOOL) subregion of the Northeast Power Coordinating Council (NPCC) region of the North American Electric Reliability Council (NERC). NEPOOL annually forecasts electrical supply and demand in the region for a 10 year period. NEPOOL's most recent report on annual supply and demand projections indicates that, for the period 1997-2007, loads in the NEPOOL area will increase slightly, less than 1 percent annually; however, the planned capacity retirements plus additions, will decrease supply slightly resulting in decreased reserve margins. These margins could fall below 15 percent for summer periods by 1998 for each year of the forecast.

The Occum Project would generate an annual average of about 3,750 megawatt-hours (MWh) of power for the region. The project would help meet Connecticut Light & Power Company's (CL&P) power requirements and reserve margin, resource diversity, and NEPOOL's capacity needs. Based on these estimates, current reserve margins will diminish in the long run, and the project would contribute to maintaining an adequate and resource-diverse capacity mix. We conclude that the future use of the project's power, displacement of nonrenewable fossil-fired generation, and contribution to a resource diversified generation mix support a finding that the power from the project would help meet the need for power in the NEPOOL area in the long term.

## **III. PROPOSED ACTIONS AND ALTERNATIVES**

### **A. Proposed Action**

#### **1. Project Description**

The Occum Project (figure 2) would consist of: (1) an existing dam consisting of two adjacent spillway sections, earth embankments, and an intake structure, from east to west described as follows: (a) a 185-foot-long east embankment having a stone and concrete core wall with a top elevation of 79.1 feet National Geodetic Vertical Datum (NGVD); (b) the eastern spillway section consisting of a 170-foot-long, 14-foot-high concrete ogee spillway, with a crest elevation of 66.1 NGVD; (c) the western

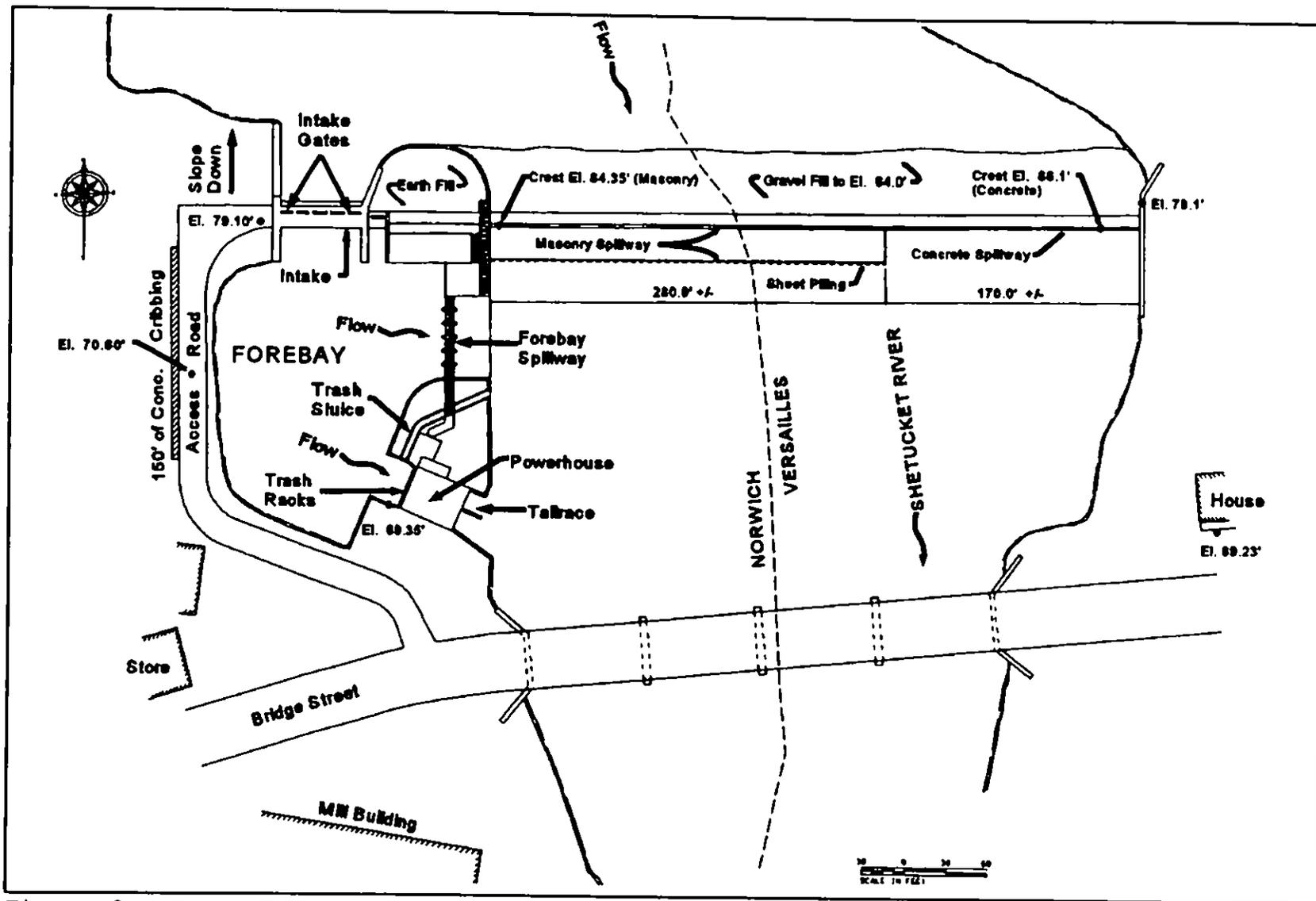


Figure 2. Occum Hydroelectric Project (Source: Norwich, 1996)

usable storage capacity of 155 acre-feet (ac-ft), and a gross storage of 600 ac-ft at normal pool elevation 66.1 feet NGVD; (3) a 225-foot-long, 160-foot-wide forebay area, equipped with a trash sluice gate and a 55-foot-long forebay spillway section with a crest elevation of 64.5 NGVD, topped with 1.60-foot-high flashboards; (4) an existing 40-foot-long, 32-foot-wide brick and masonry powerhouse containing one vertical shaft Kaplan turbine with a hydraulic capacity ranging from 250 to 900 cubic feet per second (cfs), which is directly connected to a generator rated at an installed capacity of 800 kW at 13 feet of head, and discharging at a tailwater elevation of about 51.2 feet NGVD; (5) an existing 4.8 kilovolt (kV) transmission line; and (6) appurtenant facilities.

## **2. Proposed Operation**

Norwich operates the Occum Project as a cycling facility. Inflow to the Occum Project fluctuates considerably as a result of the cycling operation of the upstream Scotland Project (FERC No. 2662). The Scotland Project, owned and operated by the CL&P, a subsidiary of Northeast Utilities (NU), uses one turbine that has a normal discharge of 1,200 cfs. During periods when river flow does not fully support the unit at the Scotland Project, it operates in a peaking mode, and the impoundment is drawn down 2 feet. The Scotland Project releases a minimum flow of 84 cfs at all times. The Occum Project operates during the time period when 1,200 cfs or more is released from the Scotland Project and continues to operate after the Scotland Project ceases operation until the Occum impoundment is drawn down approximately 2 feet. At that time, the project is shut down and does not begin to generate again until the next pulse of water is received from the Scotland Project. Travel time for water between the Scotland Project and the Occum Project is approximately 2 hours at river flows of 1,200 cfs.

Norwich proposes to continue operating the Occum Project as a cycling project but to provide a minimum flow of between 22 and 32 cfs to the bypassed reach whenever the Occum Project is not operating. This minimum flow would consist of 10 to 20 cfs from the forebay sluice gate, added to approximately 12 cfs of leakage flow that originates from the dam.

## **3. Proposed Environmental Measures**

Norwich proposes the following measures:

- (1) operate the Occum Project in a daily cycling mode, with up to a 2-foot drawdown, in accordance with the

schedule of pulsed flows released from the upstream Scotland Project;

- (2) install temporary cofferdams to isolate construction activities during installation of fish passage facilities;
- (3) release minimum flows of between 22 and 32 cfs into the project's bypassed reach when the project is not operating; and a total project minimum flow of 100 cfs or inflow, whichever is less, when the tailwater elevation is below 48.3 feet (referenced to Taftville impoundment gage) after installation of the downstream fish bypass;
- (4) monitor project operation, including the minimum flow releases and the tailrace levels;
- (5) work with the owner of the downstream Taftville Project to limit drawdowns of Taftville's impoundment to a maximum of 3.5 feet (48.3-foot elevation);
- (6) construct a minimum flow/downstream fish bypass on the downstream side of the powerhouse including perforated (1-inch holes) plate overlays on the existing trashracks within 2 to 4 years of licensing;
- (7) conduct an economic feasibility study for an upstream fish ladder, based on conceptual designs agreed to by the resource agencies; and
- (8) install a boat barrier at the project (completed) and provide a canoe portage around the project dam.

**B. Proposed Action with Additional Staff-recommended Measures**

In addition to, or in lieu of, Norwich's proposed measures, we recommend the following measures:

- (1) provide a minimum flow of 100 cfs or inflow, whichever is less, downstream of the project when the tailwater elevation is below 48.9 feet after installation of the downstream fish bypass;
- (2) develop and implement a plan to monitor impoundment and tailwater elevations and minimum flows;

- (3) develop and implement a final plan, including soil and erosion control measures for the construction, operation, and maintenance of a downstream fish bypass within 3 years of license issuance.
- (4) develop and implement a final plan, including soil and erosion control measures and temporary cofferdams, for the construction, operation, and maintenance of an upstream fish ladder within 4 years of the time that any future fish passage facilities at the downstream Taftville Project begin passing migrants;
- (5) develop and implement a plan to monitor the effectiveness of the downstream and upstream fish passage facilities;
- (6) execute a Programmatic Agreement (PA) among the Commission, the State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (Advisory Council) that provides for the development and implementation of a Cultural Resources Management Plan (CRMP); and
- (7) file a final plan for canoe portage around the project including signs and soil erosion and control measures.

#### **C. No-action**

Under the no-action alternative, the project would continue to operate, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

### **IV. CONSULTATION AND COMPLIANCE**

#### **A. Agency Consultation and Interventions**

The Commission's regulations require applicants to consult with appropriate state and federal environmental resource agencies and the public before filing a license application. This consultation is required to comply with the Fish and Wildlife Coordination Act, the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be complete and documented in accordance with the Commission's regulations.

The Commission issued a Public Notice on April 28, 1998, saying that the application for the Occum Project was ready for environmental analysis and that all comments should be filed within 60 days of the notice. The following entities commented:

| <u>Commenting Entities</u>                         | <u>Date of Letter</u> |
|--|-----------------------|
| Connecticut Department of Environmental Protection | June 22, 1998         |
| U.S. Department of the Interior                    | June 24, 1998         |

Organizations and individuals also may petition to intervene and become a party to subsequent proceedings. On May 8, 1996, the Commission issued a notice that Norwich had filed an application to license the Occum Project. This notice set July 7, 1996, as the deadline for filing protests and motions to intervene. In response to the public notice, the following entities filed motions to intervene, but not in opposition, in the proceeding:

| <u>Intervenors</u>              | <u>Date of Motion</u> |
|---------------------------------|-----------------------|
| U.S. Department of the Interior | June 25, 1996         |

We address intervenor concerns in the environmental analysis section (section V) of this final EA.

On February 24, 1999, we issued a public notice for the Occum Project stating that the draft EA was available for comment. The following entities provided comments on the Occum Project:

| <u>Entities</u>                                    | <u>Date of Letter</u> |
|--|-----------------------|
| U.S. Department of the Interior                    | March 23, 1999        |
| Norwich Department of Public Utilities             | April 7, 1999         |
| Connecticut Department of Environmental Protection | April 12, 1999        |

**B. Scoping**

Before preparing this final EA, we conducted scoping to determine what issues and alternatives should be addressed. A Scoping Document (SD1) was distributed to interested agencies and others on May 28, 1996. No comments were received in response to the SD1. We issued a revised Scoping Document (SD2), on January 6, 1997, which reflects the Commission's staff review of comments

included in the U.S. Department of the Interior's (Interior's) Motion to Intervene, dated June 25, 1996, and Interior's letter on upstream fish passage, dated August 7, 1996.

### **C. Mandatory Requirements**

#### **1. Water Quality Certification**

Under Section 401(a)(1) of the Clean Water Act (CWA), license applicants must obtain either state certification that any discharge from a project would comply with applicable provisions of the CWA or a waiver of certification by the appropriate state agency.

On February 22, 1996, Norwich applied to the Connecticut Department of Environmental Protection (CDEP) for Water Quality Certification (WQC) for the Occum Project, as required by Section 401 of the CWA. The CDEP issued a WQC for the Occum Project on February 11, 1997.

The WQC includes the following four conditions: (1) the applicant shall, in a manner and on a schedule as approved by the CDEP, construct and maintain facilities for upstream fish passage; (2) Norwich shall begin construction of a downstream fishway/sluiceway within 2 years and complete construction within 4 years of the issuance of a license for the project; (3) Norwich 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, and 4 years after the issuance of a license for the project, a minimum of 100 cfs will be maintained in the bypassed stream segment whenever the Taftville Pond elevation drops below 48.3 feet; and (4) Norwich shall operate the project in a cycling mode based on flows from the upstream Scotland Project. The drawdown of the impoundment shall be limited to 2 feet from the top of the flashboards or 2 feet below the masonry dam crest when the flashboards are not in place. We discuss our recommendations to ensure protection of water quality at the Occum Project in section V.C.2, Water Resources.

#### **2. Section 18 Fishway Prescription**

Section 18 of the FPA states that the Commission shall require the construction, maintenance, and operation by a licensee of such fishways as may be prescribed by the Secretary

of the Interior, or the Secretary of Commerce, as appropriate.<sup>1/</sup> The National Marine Fisheries Service (NMFS) indicated that it would not offer any comment on the project because there are currently no anadromous fish species present within the Shetucket River in the Occum Project vicinity (personal communication between Cory Collins, NMFS, and Jeff Murphy, Norwich, January 12, 1996).

Pursuant to Section 18, Interior filed with the Commission, by letter dated June 24, 1998, a request for the reservation of authority to prescribe the construction, operation, and maintenance of upstream and downstream fishways and to modify its Section 18 fishway prescription, as needed, to facilitate fish passage at the project.

### 3. Coastal Zone Management Act

The Occum Project is not in a state-designated coastal zone management area and therefore is not subject to Connecticut coastal zone program review (personal communication, Chris Orphanides, Recreation Planner, Louis Berger & Associates, Inc., and Brian J. Emerick, Supervising Environmental Analyst, CDEP, on August 12, 1998). Our assessment is that no coastal zone consistency certification is needed for this project.

## V. ENVIRONMENTAL ANALYSIS

In this section, we first describe the general environmental setting in the project area, including a discussion of environmental resources in the project area that may be subject to cumulative effects from the Occum Project when considered in combination with other actions affecting the resources. Then, we discuss each affected environmental resource. For each resource, we first describe the affected environment--which is the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions--and then the environmental effects of the project, including proposed mitigation, protection, and enhancement measures.

We include only resources that would be affected, or about which comments have been made by interested parties, in detail in this final EA.

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<sup>1/</sup>Section 18 of the FPA provides that "the Commission shall require construction, maintenance, and operation by a licensee at its own expense such fishways as may be prescribed by the Secretary of Commerce or the Secretary of Interior, as appropriate."

Unless mentioned otherwise, the source of our information is the license application (Norwich, 1996) and supplemental filings by the applicant (Norwich, 1998).

#### A. General Description of the Shetucket River Basin

The Occum Project is on the Shetucket River in southeastern Connecticut. The Shetucket River is a major tributary to the Thames River, which drains a significant part of southeastern Connecticut and a portion of northwestern Rhode Island (see figure 2). The Occum Project is located in the Occum section of the city of Norwich, which has a population of 37,391. The project is 6.4 river miles (rm) north of the confluence of the Shetucket and Yantic Rivers, which combine to form the Thames River. The drainage area above the project is approximately 465 square miles (sq mi).

Table 1 lists the hydroelectric projects on the Shetucket River. The Scotland Project (FERC No. 2662) is located approximately 8.1 miles upstream of the Occum Project. The Taftville Project is an unlicensed project located about 2 miles downstream of the Occum Project and its operations influence the tailwaters of the Occum Project. The Greenville Project (FERC No. 2441) is located at rm 1.3, or about 5.1 miles downstream of the Occum Project and is the first dam on the Shetucket River.

#### B. Scope of Cumulative Effects Analysis

According to the Council on Environmental Quality's Regulations for implementing the National Environmental Policy Act (NEPA) (§ 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the

Table 1. Hydropower development on the Shetucket River (Source: Staff)

| Project name                       | Location        | Installed capacity (kW) | Approx. river mile | Drainage area (sq mi) | Storage capacity (ac-ft) |
|------------------------------------|-----------------|-------------------------|--------------------|-----------------------|--------------------------|
| Scotland <sup>a</sup><br>(No.2662) | Scotland<br>CT  | 2,000                   | 14.5               | 429                   | 268                      |
| Occum<br>(No.11574)                | Norwich<br>CT   | 800                     | 6.4                | 465                   | 155                      |
| Taftville<br>(Unlicensed)          | Taftville<br>CT | 1,760                   | 4.4                | 511                   | 1,712                    |

| Project name                         | Location            | Installed capacity (kW) | Approx. river mile | Drainage area (sq mi) | Storage capacity (ac-ft) |
|--------------------------------------|---------------------|-------------------------|--------------------|-----------------------|--------------------------|
| Greenville <sup>b</sup><br>(No.2441) | New<br>London<br>CT | 2,200                   | 1.3                | 1,264                 | 453                      |

<sup>a</sup> The Scotland Project license expires on August 31, 2012.

<sup>b</sup> The Greenville Project license expires on December 31, 2043.

action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

We identify fisheries, cultural resources, and recreation as having the potential to be cumulatively affected by this project in combination with the other hydropower developments in the basin.

#### 1. Geographic Scope

The geographic scope of our cumulative effects analysis defines the physical limits or boundaries of the proposed actions' effects on fisheries, cultural, and recreation resources. The geographic scope of analysis for this final EA encompasses the Shetucket River from below the Scotland Project to the Long Island Sound. Included within this scope are the Occum Project, the upstream Scotland Project, and the downstream, unlicensed Taftville Project and the Greenville Project (figure 3).

Because the proposed actions affect the resources differently, the geographic scope for each resource area may

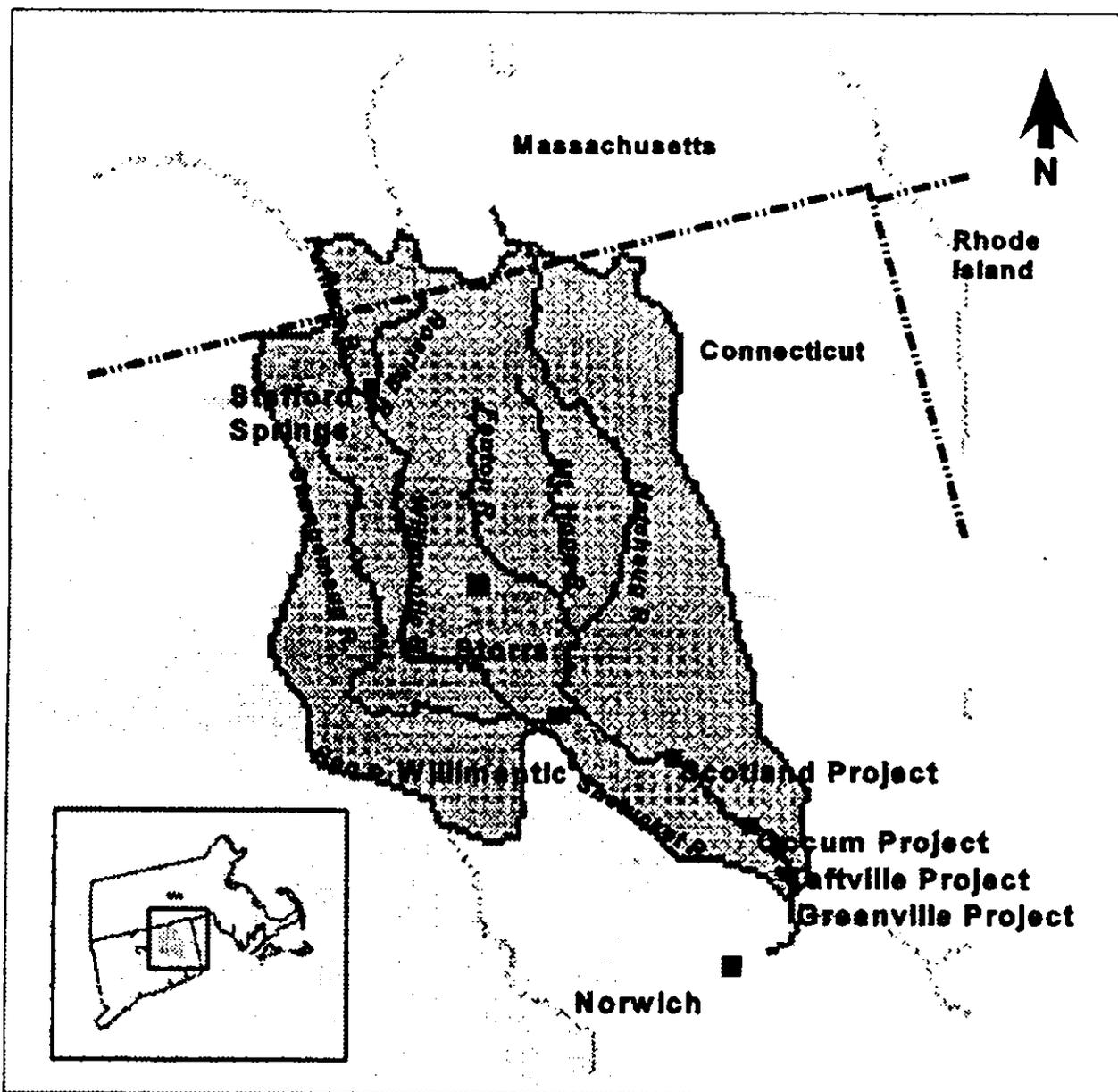


Figure 3. Shetucket River Basin Map (Source: EPA, 1998).

vary. In this case, for the main stem of the Shetucket River below the Scotland Project, we include resident and anadromous fisheries resources.

We choose this geographic scope because of: (1) concerns about the project's effects on anadromous fish restoration efforts in the Shetucket River, particularly American shad and

river herring; and (2) the aquatic habitat issues related to minimum flows in the project's tailrace.

For all other resources, we confine our analysis to the immediate project area.

## **2. Temporal Scope**

The temporal scope of analysis includes a discussion of the past, present, and future actions and their effects on fisheries resources, water quality and quantity, wildlife resources, recreation, and cultural resources. Based on the term of the proposed license, we looked 30 to 50 years into the future, concentrating on the effects on fisheries, recreation, and historic resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, comprehensive plans, and scoping comments received from agencies.

As we discuss in detail in sections V.C.3, Fisheries Resources; V.C.5, Cultural Resources; and V.C.6, Recreation and Land Use Resources, with our proposed environmental measures, the project would have beneficial cumulative effects on anadromous populations and recreation resources, and would have no adverse cumulative effects on historical resources in the Shetucket River Basin.

## **C. Proposed Action and Action Alternatives**

### **1. Geology and Soils**

a. Affected environment: Topography of the upper basin consists of generally lowland hills surrounding the wide floodplain of the Shetucket River. In the project vicinity, the land is characteristically low with rolling hills. Downstream of the project to the Thames River, the topography is steeper. The broad floodplain upstream is replaced by fairly steep embankments to the east, and by major roadways that have been built up along the industrially developed western bank. The impoundment shoreline is relatively undeveloped. There are no areas of erosion within the impoundment area, upstream or downstream of the project.

b. Environmental effects: Norwich indicates that continued operation of the project, along with the proposed operational changes, would not affect the existing geology or soils of the project area. The proposed release of minimum flows into the

bypassed and downstream reaches would result in increased water levels in the tailrace. Impoundment levels and fluctuation range would remain the same as under current operations.

### *Our Analysis*

The operational changes that Norwich proposes would not increase long-term erosion rates along the project shorelines. The future construction of fish passage facilities (see section V.C.3) and a canoe portage (see section V.C.6) would involve some incidental disturbance of soil during construction. However, this disturbance would be minimized through the use of best practices to control erosion. Therefore, we recommend that Norwich include soil and erosion control measures in the final plans for the upstream and downstream fish passage facilities and the canoe portage.

c. Unavoidable adverse effects: None.

## **2. Water Resources**

a. Affected environment:

### Water Quantity

Daily inflow of water at the project is controlled primarily by the upstream Scotland Project (FERC No. 2662), which is owned and operated by the CL&P, a subsidiary of NU. This project operates in a cycling mode using one turbine, which results in a normal discharge of 1,200 cfs at full generation and a minimum flow of 84 cfs when the project is not generating. The Occum Project operates when 1,200 cfs or more is released from the Scotland Project, and it continues to operate after the Scotland Project ceases operation until the Occum impoundment is drawn down approximately 2 feet. Travel time for water between the Scotland Project and the Occum Project is about 2 hours at river flows of 1,200 cfs.

Flows in the Shetucket River above the Occum Project fluctuate considerably because of the cycling operation of the Scotland Project. Average daily inflow to the Occum Project fluctuates from 100 cfs to more than 1,200 cfs. The estimated maximum and minimum mean daily flows at the site were 39,760 cfs (September 21, 1938) and 21 cfs (August 22, 1949), respectively. Occum has an estimated average annual flow of approximately 720 cfs. The annual flow duration data for the site indicate that, on average, flows exceeded 116 cfs 90 percent of the time, 517 cfs 50 percent of the time, and 1,747 cfs 10 percent of the

time.<sup>2/</sup> These are measurements of natural inflow; however, the natural inflow to the Occum Project is influenced by the operations of the upstream Scotland Project.

Norwich states that the cycling mode of Occum Project operation is likely to limit the available habitat in the bypassed reach and downstream from the powerhouse during ponding periods. The Occum tailrace is influenced by the operations of the Taftville Project located approximately 2 miles downstream. The Occum tailrace is backwatered when impoundment elevations at Taftville are above 48.3 feet. Below that level, an approximately 1,000-foot-long reach of river is exposed.

### Water Quality

The CDEP's Water Management Bureau classifies the Shetucket River within the Occum Project area as Class B. These waters should have a minimum dissolved oxygen (DO) concentration of 5 mg/l, and temperature can deviate above ambient conditions by 4°F, but is not to exceed 85°F. According to Connecticut Water Quality Standards, waters designated as Class B are intended for recreational use, fish and wildlife habitat, agricultural use, industrial supply, and other legitimate uses including navigation. There are no known consumptive uses or direct point source discharges to project waters.

During the summers of 1991 and 1992, the CDEP collected water samples in the project area as part of a eutrophication control plan. The data show that during this sampling period, the waters within the project area violated the established water quality standards for algae concentrations. The CDEP has since identified point and non-point sources of pollution as major contributors to water quality problems in the Shetucket River. However, none of these sources are associated with operation of the Occum Project.

Federal Paper Board (Federal), a paper company located in Versailles, previously discharged treated wastewater directly into the Little River, a tributary that flows into the Shetucket River approximately 1,200 feet downstream of the project dam.

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<sup>2/</sup>Flow regime data are prorated based on relative drainage areas from U.S. Geological Survey (USGS) records for gage #01122500, approximately 10.6 miles upstream near Willimantic, Connecticut, on the Shetucket River. This gage measures a drainage area of 404 square miles, and the Shetucket River drainage area above the project is 465 square miles.

The CDEP suspected that Federal's discharge contributed to algal blooms. During our July 24, 1998, site visit, Norwich staff stated that Federal has recently re-routed its discharge directly into the Norwich wastewater collection system, eliminating Federal discharges into the Little River, and subsequently into the Shetucket River. Norwich does not believe that continued project operations would have any negative effects on existing water quality conditions.

**b. Environmental effects:**

**Water Quantity**

Water levels in the Occum Project tailrace are influenced by the downstream Taftville Project. The Taftville project impoundment is typically fluctuated up to 6 feet during normal cycling operations. At full pond (52-foot elevation), it backwaters to the base of the Occum Project dam. However, below that level, a 1,000-foot-long reach of river is exposed.

**Minimum Flows in the Bypassed Reach**

Appropriate minimum flows to the bypassed reach of the project are needed to protect habitat for fish and other aquatic organisms. Therefore, we provide a discussion and our analysis of the minimum flows proposed by Norwich and recommended by the agencies in section V.C.3, Fisheries Resources.

**Monitoring Minimum Flows**

Norwich proposes to monitor project operations, including minimum flow releases and water surface levels in the tailrace. Norwich attempted to reach an agreement with NU, the owners of the downstream Taftville Project, to limit drawdowns of the Taftville impoundment to a maximum of 3.5 feet, which would have minimized exposed aquatic habitat below the Occum Project. As part of these negotiations, Norwich explored the feasibility of installing remote controls to allow Norwich to operate the Taftville Project via its Supervisory Controls and Data Acquisition System (SCADA). Norwich has determined that the costs of automation of Taftville would equal or exceed the cost to install a gate at the Occum Project (at least \$100,000) (letter from Jon M. Christensen, Project Manager, Kleinschmidt Associates, Pittsfield, ME, dated December 31, 1998).

To document compliance with the 2-foot drawdown limitation of the Occum Project impoundment and the recommended minimum flows, Interior recommends that, within 3 months from the

effective date of the license, Norwich file a plan for monitoring impoundment and tailwater levels and flow releases from the project with the Commission for approval. Interior recommends that this plan: (1) detail the mechanisms and structures that would be used, including any periodic maintenance and calibration necessary to ensure that the devices work properly; (2) specify how often impoundment and tailwater levels and flow releases would be recorded; and (3) be developed in consultation with Interior, the Environmental Protection Agency (EPA), and the CDEP (letter to David Boergers, Acting Secretary, Federal Energy Regulatory Commission, from Andrew Raddant, Regional Environmental Officer, U.S. Department of the Interior, dated June 24, 1998).

### *Our Analysis*

Monitoring of flow, impoundment elevation, and tailwater elevation at the Occum Project would document compliance with recommended drawdown and minimum flow requirements. We agree with Interior that Norwich's monitoring proposal should include these three parameters to ensure the protection of fisheries and aquatic resources.

### Water Quality

Norwich states that it does not expect any negative effects on water quality conditions from continued and proposed operation of the Occum Project. Some incidental enhancements to DO levels may occur in the project bypassed reach and tailwater areas under the proposed habitat-based minimum flow of 22 to 100 cfs (depending on the tailwater elevation; see section V.C.3.b). This flow would serve to circulate aerated water throughout the reach. Circulation reduces the potential for localized stagnation to occur during periods of non-spillage, thus reducing the likelihood of seasonal algal blooms. Norwich proposes no further measures to protect water quality resources in the project area.

The WQC for the Occum Project includes a condition allowing Norwich to operate the Occum Project in a cycling mode based on flows from the upstream Scotland Project. A minimum stream flow of 22 cfs, from a combination of leakage and releases from the forebay sluice gate, must be provided in the bypassed stream segment whenever the project is not generating. The WQC further requires, following the installation of the downstream fish bypass (sluiceway) at the Occum Project, a minimum flow of 100 cfs be provided to the bypassed stream segment whenever the Taftville Pond elevation drops below 48.3 feet. These conditions

would protect water resources within the Occum Project area and are consistent with Norwich's proposed flows.

In the letter of response to the Draft License Application, (letter from Michael J. Bartlett, Supervisor, Interior's New England Field Office, Concord, NH, to Jon Christensen, Project Manager, Kleinschmidt Associates, Pittsfield, ME, dated January 26, 1996), Interior expressed concern that the project operation could potentially exacerbate seasonal algal blooms in the project area by interrupting continuous river flow. No recommendations for mitigation were given.

### *Our Analysis*

Compliance with the WQC minimum flow requirements would enhance water quality within the project area and enhance downstream aquatic habitat. The proposed minimum flows would be adequate to provide circulation through the channel and avoid stagnant water conditions, and would increase DO concentrations in the project's tailwater. Increased flows promote aeration of project waters, which in turn increases assimilative capacity in downstream river reaches. The recent re-routing of Federal's discharge away from the Little River eliminates sources of nutrient loading to the Shetucket River, further improving river water quality. There is no evidence that the existing flows and continued operation of the project adversely influence the water quality within the project area. Presently, the project waters are suitable for recreational use, fish and wildlife habitat, agricultural uses, industrial supply, and other legitimate uses, as required under CDEP's Class B standards.

c. Unavoidable adverse effects: None.

### **3. Fisheries Resources**

a. Affected environment: The reaches of the Shetucket River upstream and downstream of the Occum Project are bounded by the Scotland Project, about 8.1 miles upstream of Occum, and the Taftville Project, about 2 miles downstream. The upstream reach, including Occum's 1.9-mile-long impoundment, is characterized by slow-water habitat with embedded cobble and boulder substrates. The downstream reach is dominated by cobble and boulder substrates with depths and flows that fluctuate considerably because of Scotland, Taftville, and Occum Projects' operations.

Both the upstream and downstream species assemblages are classified as warmwater fisheries. During a 1993 stream survey conducted about 2.5 miles upstream of Occum, the CDEP found

abundant smallmouth bass, sunfish species, rock bass, several coarse fish species, and the American eel. Other recreational fishes included largemouth bass, chain pickerel, and yellow perch. Norwich also identified common carp and white perch in the project vicinity.

The CDEP annually stocks post-spawned adult Atlantic salmon in the reach between Occum and Scotland. These stockings support a put-and-take fishery, but are not an attempt to restore anadromous runs of Atlantic salmon to the Shetucket River Basin. Adult salmon are released in late November, and most fish are removed by anglers by February of the following year.

Although there are several anadromous fish species in the lower reaches of the Shetucket River below the Taftville Project, none can reach the tailwaters of Occum because Taftville has no upstream passage facilities. As part of its anadromous fish restoration program, the CDEP stocks pre-spawned American shad and river herring between Taftville and Greenville. Greenville is the first project on the Shetucket River and the only project with upstream and downstream passage facilities. The CDEP indicates that it does not plan to stock pre-spawned shad and herring adults above Occum until downstream passage facilities have been installed for juvenile fish, which migrate to the ocean in the fall. Although Atlantic salmon fry and parr have been stocked (1988 through 1992), the CDEP currently has no plans to restore anadromous runs of salmon to the Shetucket River Basin.

#### b. Environmental effects:

##### Instream Flows

Flow releases from the Occum Project may affect upstream and downstream fisheries by altering daily headwater and tailwater levels when the project is cycling. The main areas of influence downstream include a 180-foot-long bypassed reach from the dam to the tailrace and a reach of the main stem of the river that extends 1,000 feet downstream to where the Little River enters the Shetucket River. Tailwater levels also are affected by Taftville Project operations, which backs up water into the Occum bypassed reach when impoundment elevation is greater than 48.3 feet. When Occum is not generating and the Taftville impoundment drops below this elevation, the bypassed reach and areas of the river bed downstream to the Little River confluence are exposed.

Under Norwich's proposal, maximum drawdown of the Occum impoundment would be 2 feet from the top of the flashboards, or 2 feet from the crest of the dam if the flashboards are not in place. Norwich states that its proposed cycling mode and maximum

drawdown levels would have little effect on fishery resources in the impoundment.

To reduce environmental effects associated with the de-watering of the Occum tailwater, Norwich proposes to release a minimum flow of 22 to 32 cfs to the bypassed reach during periods when the Taftville impoundment is at elevations greater than 48.3 feet, and to release a minimum flow of 100 cfs or inflow, whichever is less, when the Taftville impoundment drops below this elevation. These minimum flow releases would minimize fish stranding and eliminate stagnant water below Occum. The proposed minimum flow releases are based on extrapolated data from the instream flow study, which evaluated the extent of de-watering in the bypassed reach and the 1,000-foot section downstream. Instream flows were evaluated with the Taftville impoundment set at elevations ranging from 46.4 feet to 48.3 feet and with flow releases from Occum between 0 and 155 cfs.

The CDEP, whose staff participated in the field effort for the instream flow study, concurs with Norwich's proposed minimum flow releases. As part of the project's WQC, the CDEP requires that Norwich release a minimum flow of 22 cfs into the bypassed reach whenever the project is not generating (this may include leakage and releases from the forebay sluice gates), and, beginning 4 years after the issuance of a license, release a minimum flow of 100 cfs below the project whenever the Taftville impoundment elevation drops below 48.3 feet. The CDEP also agrees with the proposed maximum drawdown levels of 2 feet below the flashboards or the dam crest when the flashboards are not present, and includes this as a condition of the WQC.

Interior recommends a minimum flow release of 30 cfs in the bypassed reach during non-generation periods. At Taftville pond elevations below 48.9 feet, Interior recommends increasing the minimum flow to 155 cfs (based on actual data collected during the instream flow study). The Interior does not oppose operation of the project in a cycling mode, which is based on the releases from the upstream Scotland Project, nor does it disagree with the proposed maximum drawdown of the impoundment (i.e., 2 feet below the top of the flashboards or 2 feet below the crest of the dam when the flashboards are not present).

Both Norwich and Interior use data that were collected when the Taftville impoundment was at an elevation of 46.4 feet to support their recommended trigger elevations. Norwich concludes that the wetted area of the study reach was similar for releases of 53 cfs (112,590 square feet) and 155 cfs (132,830 square feet) when the Taftville elevation was 46.4 feet. Conversely, Interior characterizes the difference between releases of 53 cfs and 155

cfs at a Taftville elevation of 46.4 feet to be considerable, noting that there is an additional 20,240 square feet of wetted area at a flow release of 155 cfs than at 53 cfs. Interior states that it cannot support a minimum flow release of 100 cfs because there were no data collected for this flow level.

#### *Our Analysis*

The minimum flow releases proposed by Norwich and recommended by Interior are considerably different in two ways:

- (1) the Taftville impoundment elevation (48.9 feet versus 48.3 feet) that would trigger an increase in the minimum flow release; and
- (2) the minimum flow (155 cfs versus 100 cfs) that would be released when the Taftville impoundment drops below the trigger elevation (the CDEP agrees with the trigger elevation and release flows proposed by Norwich).

Norwich bases its proposed trigger elevation for increasing the minimum flow on observations made by the study team, including Norwich's consultants and the CDEP, that conducted the instream flow evaluation. The study team agreed that the Occum tailwater levels observed at a Taftville impoundment elevation of 48.3 feet were adequate to maintain a reasonable amount of wetted area and prevent stagnation of water in the bypassed reach. Interior selected a Taftville elevation of 48.9 feet based on observations from photographs that show the study reach at this elevation and at an elevation of 48.3 feet. Interior concludes that there was a considerable difference in the amount of exposed substrate in the bypassed reach and on a downstream shoal that warranted the higher trigger elevation for increases in the minimum flow.

To quantify the difference in wetted area, we developed a model to estimate the wetted area of the study reach at an additional elevation of 48.9 feet. We used the data that were collected at five known Taftville impoundment elevations between 46.4 feet and 48.3 feet and with a release of 12 cfs leakage flow (table 2). Wetted area for Taftville headpond levels at 48.9

Table 2. Estimated wetted area and percent bank full below the Occum Project (Source: Staff)<sup>a</sup>

| Taftville impoundment elevation | Wetted area in the study reach (sq ft) | Percent bank full in the study reach |
|---------------------------------|--|--------------------------------------|
| 46.4                            | 83,857                                 | 39.8                                 |
| 47.0                            | 91,627                                 | 67.7                                 |
| 47.5                            | 115,065                                | 43.5                                 |
| 47.8                            | 142,660                                | 54.6                                 |
| 48.3 (Norwich)                  | 152,670                                | 72.5                                 |
| 48.9 (Staff)                    | 199,710                                | 94.8                                 |

<sup>a</sup> Estimates are based on leakage flow (12 cfs) from Occum. Wetted area for elevation 48.9 feet was derived from channel cross sections provided in the instream flow report.

feet was measured by drawing a horizontal line at 48.9 feet on the channel cross sections provided in the instream flow report. Using this approach, we calculated the wetted area, at a Taftville elevation of 48.9 feet and with leakage flow (12 cfs), to be 199,710 square feet, which is about 30.8 percent more wetted area than was estimated when the Taftville impoundment elevation was 48.3 feet. This difference is most pronounced at Transects 2 and 3 because of a midstream shoal in this river segment. Along these two transects the wetted area increases dramatically when water surface elevation rises from 48.3 feet to 48.9 feet (figure 4). The 30.8 percent difference equates to a considerable difference in percent bank full. A percent bank full of 94.8 percent (see table 2) should be adequate for achieving the goals of minimizing fish stranding downstream, minimum water coverage for aquatic macroinvertebrate communities, and preventing the stagnation of water in the bypassed reach.

Table 2 provides the estimates of wetted area for a 12 cfs flow release at various Taftville impoundment elevations. Actual data for the proposed 22-30 cfs flow release were not available from the instream flow study; therefore, 12 cfs was used as a basis of comparison. At an elevation of 48.3 feet, a 12 cfs release would wet approximately 152,670 square feet resulting in a 72.5 percent bank full condition. At an elevation of 48.9 feet during leakage flow, there is a 94.8 percent bank full condition. We conclude that a release of 22 to 30 cfs, as proposed by Norwich, would minimize fish stranding downstream and prevent water from stagnating below the dam when Taftville elevation is

above 48.9 feet. We agree with Interior that a trigger elevation of 48.9 feet is an appropriate level to provide sufficient protection to aquatic resources, and possibly enhancing local aquatic productivity by improving water quality through higher DO and increased circulation.

Based on our independent review and evaluation of the instream flow data, wetted perimeter and available habitat are similar at releases of 53 cfs and 155 cfs when the Taftville impoundment elevation is 46.4 feet. To calculate the wetted perimeter and available habitat for a flow of 100 cfs at an elevation of 46.4 feet, we estimated a midpoint between 155 cfs and 53 cfs using channel cross sections provided in the instream flow study (figure 5). Using the available flow data at an elevation of 46.4 feet, our calculations show that a release of 100 cfs would produce about 4,265 square feet (3.3 percent) less wetted area in the study reach than would a release of 155 cfs (128,565 versus 132,830 square feet). Wetted area for 30 cfs is also calculated using the same technique.

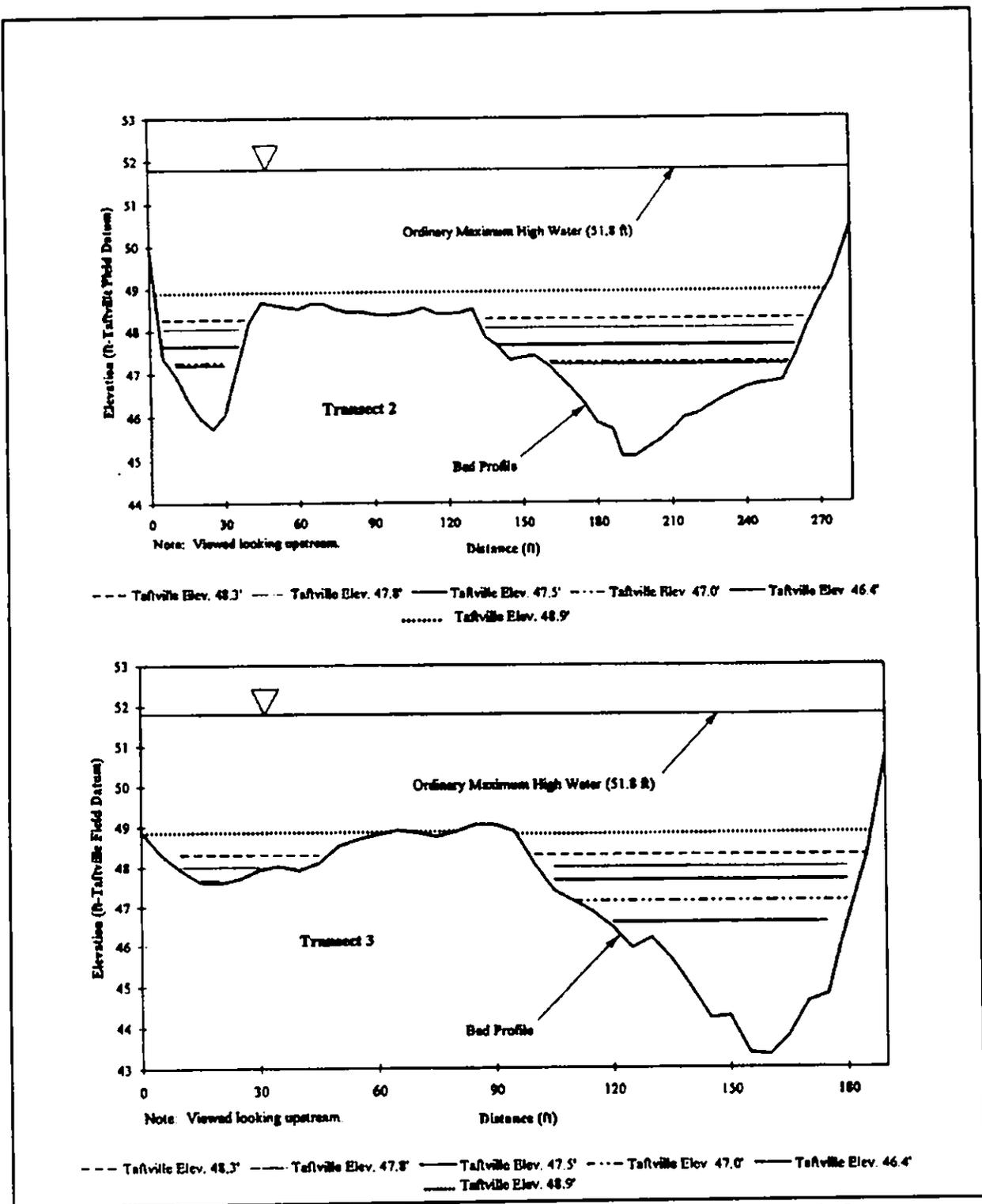


Figure 4. Water surface elevations at Transects 2 and 3 at alternative Taftville impoundment elevations when discharge from the Occum Project is leakage (12 cfs) (Source: Norwich, 1996).

To evaluate appropriate trigger elevations, we extrapolated

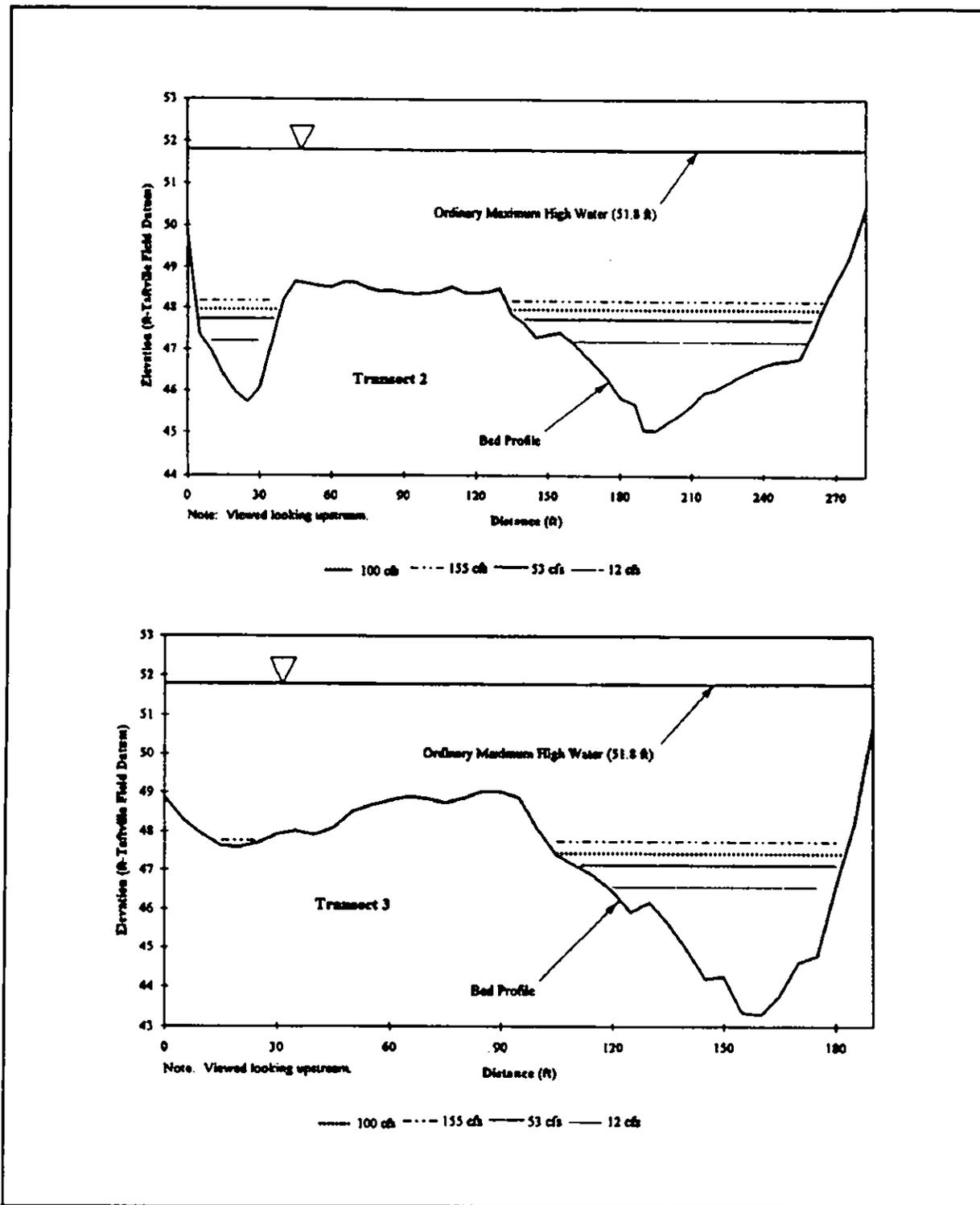


Figure 5. Water surface elevations at Transects 2 and 3 at alternative discharges from the Occum Project when Taftville impoundment elevation is 46.4 feet (Source: Norwich, 1996).

assuming a curvilinear relationship between flow and wetted area. Table 3 shows the estimates of wetted area for a 12, 30, 53, 100, and 155 cfs flow release at a Taftville impoundment elevation of 46.4 feet. Figure 6 shows the curvilinear relationship of our estimates of wetted areas and percent bank full at flows of 100 and 155 cfs.

Table 3. Estimates of wetted area and percent bank full for Occum flow release at Taftville impoundment elevation of 46.4 feet (Source: Staff)

| Flow release (cfs) | Wetted area (sq ft) | % Bank full |
|--------------------|---------------------|-------------|
| 12                 | 83,857              | 39.8        |
| 30                 | 101,560             | 48.2        |
| 53                 | 112,590             | 53.5        |
| 100                | 128,565             | 61.0        |
| 155                | 132,830             | 63.1        |

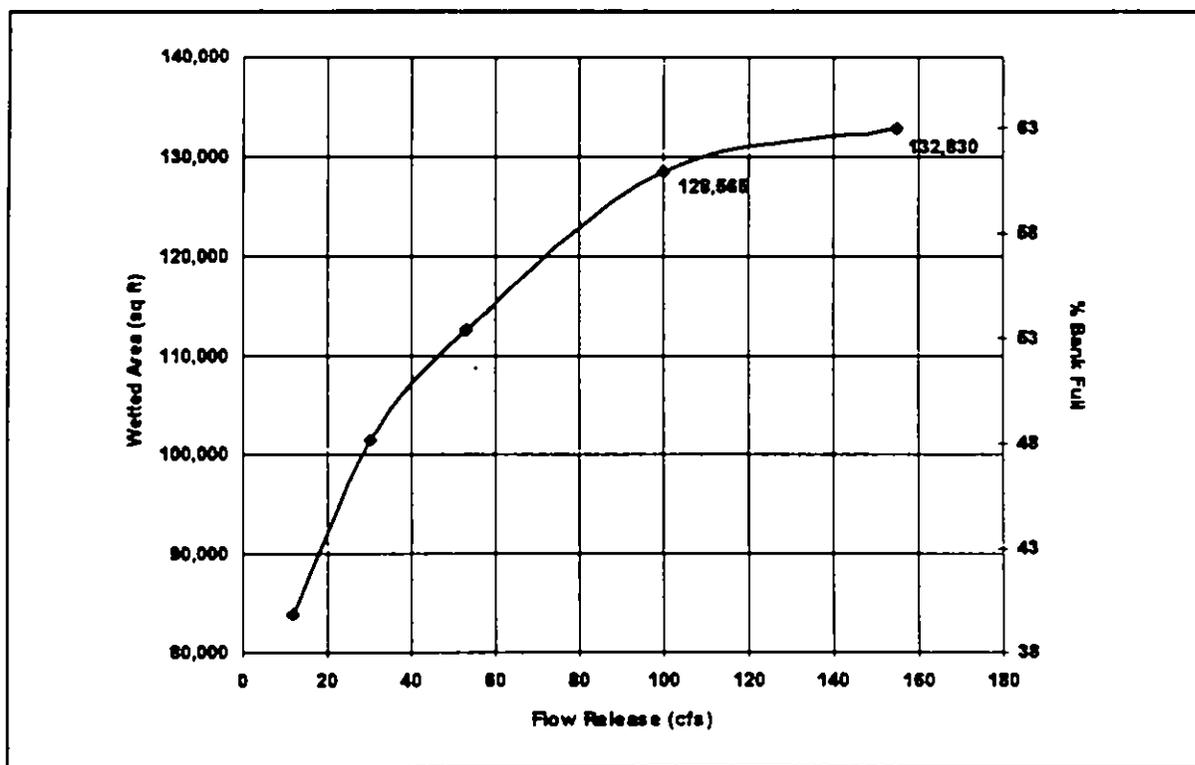


Figure 6. Wetted area and percent bank full as a function of flow release at a Taftville impoundment elevation of 46.4' (Source: Norwich, 1996).

The incremental gain between 100 cfs and 155 cfs does not justify a higher minimum flow requirement. In addition, the minimum flow from the Scotland Project (84 cfs plus inflow from tributaries between the projects) is likely to be closer to 100 cfs. Flow duration data indicate that 116 cfs is exceeded 90 percent of the time. A 100 cfs minimum flow requirement is more reasonable based on historical flows because with a minimum flow release of 155 cfs, the Occum impoundment could not be refilled under certain flow conditions and could frequently force Norwich into a situation of violating its 2-foot drawdown limitation or its minimum flow release at low Taftville impoundment levels (Interior does not specify that minimum flows could be reduced to inflow to the Occum Project, if inflow is less than 155 cfs).

When the Taftville impoundment is above 48.9 feet, a minimum release of 22 to 32 cfs would sufficiently protect aquatic resources in the downstream reach below the Occum powerhouse by providing water circulation through the channel and thereby avoiding stagnation. During periods of prolonged low flows and especially low pond levels at Taftville (below 48.9 feet), the Occum Project would release a minimum flow of 100 cfs or inflow, whichever is less, into the bypassed reach. We provide our recommendation for minimum flows when the tailwater elevation of the Occum Project is below 48.9 feet in section VIII.

Our recommendation for a minimum flow of 100 cfs when the tailwater elevation drops below 48.9 feet would not be implemented until after installation of the downstream fish passage. The downstream fish passage would be installed within 3 years after licensing, for reasons we discuss later in this section under "Fish Passage". Interior has indicated that it would consider lowering the trigger elevation to 48.3 feet if actual data were available to demonstrate that wetted area at 48.9 and 48.3 feet were similar. Interior also indicates that it cannot support 100 cfs because this flow was not assessed in the instream flow study (letter from Michael J. Bartlett, Supervisor, Interior's New England Field Office, Concord, NH, to Jon Christensen, Project Manager, Kleinschmidt Associates, Pittsfield, ME, dated February 6, 1996).

There is sufficient time, prior to implementation of the recommended 100 cfs minimum flow, when the tailwater elevation drops below 48.9 feet for Norwich to complete the instream flow study as it was intended to be conducted. Completion of the study, at least for comparison of the 100 cfs and 155 cfs flows at elevations of 48.3 and 48.9 feet, could provide data that would allow reconsideration of Interior's recommendations (through a post-licensing amendment). Reconsideration based on

real data could result in lowering the trigger elevation to 48.3 feet.

### Fish Entrainment

Fish moving downstream can be entrained into project intakes and suffer injury or death when passing through hydroelectric turbines (EPRI, 1987). Entrainment rates usually depend on biological, environmental, and project operation and design parameters (EPRI, 1992; FERC, 1995). Injury and mortality rates are influenced by several factors, including fish species and size, turbine type, and mode of operation (EPRI, 1987).

Norwich states that the entrainment of fish through the Occum turbine is not adversely affecting resident fish populations, based on calculated water velocities through the trashracks at two forebay elevations: 65.8 feet (full pond) and 63.8 feet (minimum level). At a forebay elevation of 65.8 feet, the estimated velocities at the trashracks for maximum and minimum generation flows (900 cfs and 300 cfs) are 1.82 feet per second (fps) and 0.73 fps, respectively. At a forebay elevation of 63.8 feet, the estimated velocities for maximum and minimum generation are 2.07 and 0.83 fps, respectively. Norwich concludes that these estimated intake velocities are within the criteria established by the fisheries agencies for minimizing involuntary impingement and entrainment of fish (i.e., 2 fps or less).

To reduce the potential for entrainment of anadromous species (i.e., juvenile American shad and river herring), once these species become established, Norwich proposes to install a perforated plate with 1-inch diameter holes at the intake as part of its downstream fish bypass plan. The perforated plate would be placed over the trashracks only during the shad and herring outmigration period, which typically occurs from September through November.

The CDEP and Interior agree with Norwich's conclusions on entrainment effects on riverine fish populations. Interior concludes that the maximum intake velocity for a worst case scenario (flashboards out, minimum impoundment, and maximum generation flow) would be 1.8 fps, which is below its design criteria of 2 fps or less (letter from Michael J. Bartlett, Supervisor, Interior's New England Field Office, Concord, NH, to Jon Christensen, Project Manager, Kleinschmidt Associates, Pittsfield, ME, dated January 26, 1996). Neither agency recommends mitigation measures for reducing entrainment or impingement of riverine fish at the project. The agencies request downstream passage for American shad and blueback

herring, but provide no specific comments on the acceptability of the perforated plate for reducing entrainment of juvenile outmigrants.

### *Our Analysis*

We reviewed available literature that discusses entrainment of riverine fish species to determine the potential effects of fish passing through the Occum powerhouse. We also considered the design of the project's intake (e.g., bar spacing), the location relative to river flow, and water velocities at the trashracks as factors that would influence entrainment rates. We used information that is available for the same or similar species as those that occur upstream of the Occum Project.

Entrainment of fish at hydroelectric projects usually occurs sporadically throughout the year. Although catchable-size gamefish and adult coarse fish also may be entrained at Occum because the trashracks at the intake have a clear spacing of 4 inches, peak entrainment events often are associated with seasonal movements of young-of-the-year (YOY) fish (EPRI, 1992; FERC, 1995). Consequently, most riverine fish entrained at hydroelectric projects are small (less than 8 inches long) (EPRI, 1992). In the Shetucket River, YOY riverine fish species (e.g., freshwater basses, sunfish, minnows, shiners, and suckers) most likely move downstream during the spring and summer months and, subsequently, would be subject to entrainment at Occum. Dispersal of these species would occur naturally whether or not the project existed.

Turbine mortality of small fish (less than 8 inches long) usually is low, depending on turbine design and operation, as well as fish species (EPRI, 1992). Occum has a single Kaplan unit, and fish mortality rates associated with passage through Kaplan turbines generally are lower than for other turbine types (e.g., Francis turbines), because of fewer blades and wider spacing between blades. The turbine mortality rate of resident fish at the Occum Project is likely to be low because most entrained fish are probably YOY (EPRI, 1992). Turbine mortality of adult game and coarse fish would be higher, but large resident fish tend to represent a small percentage of the fish entrained (EPRI, 1992). Also, the low intake velocities (less than 2 fps) would limit entrainment of larger fish, which tend to be stronger swimmers. Juvenile American shad and river herring entrained at Occum could suffer 10 to 20 percent mortality rates during their outmigration. Also, the effect of shad and herring mortality would be compounded by passage through the two projects downstream of Occum. There are no state or federally listed

endangered or threatened species upstream of the project that would be subject to entrainment and turbine mortality at the Occum Project.

We conclude that entrainment at Occum is not adversely affecting existing resident fish populations, and concur that protective measures are not needed at this time. However, anadromous populations of American shad and river herring, if these species become established upstream of the Occum Project, may suffer mortality rates that could have negative effects on the populations of these two species in the Shetucket River. Because the agencies plan to restore shad and herring runs upstream of Occum, and the potential for additional mortality of outmigrating fish at the two downstream projects is high, turbine mortality of these species at Occum should be minimized. Therefore, we recommend that the final plan for the downstream fish bypass as proposed by Norwich include a 1-inch diameter perforated plate over the intake during the fall period when juvenile shad and herring migrate to the ocean.

### Fish Passage

Norwich proposes to install downstream fish passage facilities for American shad and river herring. The design and installation schedule of these facilities has been developed in consultation with the resource agencies. Norwich proposes to install a fish bypass on the south side of the powerhouse, and place a perforated plate with 1-inch diameter holes over the trashracks to minimize entrainment of outmigrants through the turbine, as previously discussed in the section on fish entrainment. Norwich proposes to begin construction within 2 years of license issuance and complete construction within 4 years. The downstream fish passage facility also would provide the sluiceway for the proposed 100 cfs minimum flow release downstream of the project when tailwater elevations drop below the recommended trigger elevation of 48.9 feet.

Norwich also proposes to consult with the agencies on an appropriate design for an upstream ladder for shad and herring. However, based on cost estimates for the conceptual design of the fish ladder, Norwich indicates that the cost of the upstream fish ladder may render the Occum Project uneconomical. Therefore, Norwich proposes to conduct an economic feasibility study for providing upstream passage at Occum after license issuance. If the study reveals that installation of upstream passage facilities would make the project uneconomical, then Norwich proposes to consult with the Commission on the possibility of selling the project or surrendering the license. If an upstream fish ladder is economically feasible, then Norwich would begin

the design phase within 2 years of licensing, and begin construction after upstream passage facilities are installed at the Taftville Project.

The CDEP concurs with the general design and installation schedule proposed by Norwich for downstream and upstream fish passage facilities. The CDEP recommends, however, no delay in the development of conceptual designs for upstream fish passage facilities, despite the uncertainty of when the facilities would be needed, and requests that the design and schedule of such facilities be approved by its staff. The installation of downstream and upstream passage facilities, including CDEP approval of design and schedule, is a condition of the state's 401 WQC for the Occum Project. The CDEP also recommends effectiveness studies for upstream and downstream fish passage facilities and that the methods and techniques for these studies be developed in consultation with and approved by the CDEP.

Interior requests a reservation of authority to prescribe downstream and upstream fish passage facilities under Section 18 of the FPA. Interior did not prescribe fishways at this time because the downstream Taftville project, which does not have fish passage facilities, is unlicensed and negotiations for fish passage may take some time. However, Interior recommends that Norwich provide functional drawings for a downstream fish bypass and an upstream fish ladder within 6 months of license issuance (including an operations and maintenance schedule), and requests that it and the CDEP be consulted during the design phase for these facilities. Interior recommends that construction of the downstream fish bypass begin no later than 2 years from licensing and be completed within 3 years. Interior also recommends that construction of the upstream fish ladder at Occum begin within 2 years of when upstream migrants first pass over the downstream Taftville Project, and construction be completed within 4 years.

#### *Our Analysis*

Based on the state and federal management plans for the Shetucket River, we concur with Norwich and the agencies that downstream and upstream fish passage facilities for American shad and river herring would be consistent with state and federal management objectives to restore shad and herring to the Shetucket River. The CDEP indicates that it most likely will not stock pre-spawned shad and herring upstream of Occum until downstream facilities have been installed for outmigrating juveniles. Because the timeliness of downstream passage will help restore shad and herring populations, we concur with Interior and recommend that the downstream fish bypass be

completed within 3 years of license issuance. We also agree with Norwich and the agencies on the need for the upstream fish ladder when sufficient numbers of target species pass through any facilities installed at the Taftville Project.<sup>3/</sup> We consider the schedule recommended by the agencies (beginning the development of a functional design within 2 years and completing construction within 4 years of fish passing Taftville) to be reasonable. Finally, we recommend including in any license issued for this project an article reserving Interior's authority to prescribe fish passage facilities in the future.

c. Cumulative effects: We considered turbine entrainment mortality and instream flow fluctuations as having potential cumulative effects that may adversely affect Shetucket River fisheries. We selected the Shetucket River from the Scotland Project to Long Island Sound as the geographic scope for assessment of cumulative effects. Hydroelectric projects that are located within the selected geographic boundaries include, in upstream to downstream order, the Scotland, Occum, Taftville, and Greenville Projects.

Although turbine mortality most likely is occurring at each project, we conclude that the cumulative effects are minor because most entrainment probably consists of YOY, which usually suffer low mortality during turbine passage. Instream flow fluctuations produced by the projects within the defined geographic scope may be affecting habitats used by some species. However, the lower portion of the Shetucket River is not considered free-flowing due to the peaking operations of the four projects within this reach. The lower Shetucket River supports a warmwater fishery that does not appear to be adversely affected by Occum or the other projects.

Cumulative effects on anadromous (shad and herring) populations in the Shetucket River are associated with the ability of upstream migrants to reach spawning grounds and for outmigrating juveniles to safely move downstream through each project they encounter on their way to the ocean. A fish lift installed at the lower-most project (Greenville) has successfully passed American shad and river herring. The next upstream project (Taftville) is unlicensed. Consequently, it is uncertain when, or even if, fish passage facilities will be installed at this project. Occum is the next upstream project on the

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<sup>3/</sup>We assume that the CDEP and Interior intend that the installation of upstream fish passage facilities should occur within 2 years of the effective passage of target species at the Taftville Project.

Shetucket River. The CDEP is planning to stock pre-spawned adult shad and herring upstream of Occum, but has indicated that it will not stock fish until downstream facilities have been constructed or are near completion. There are no upstream or downstream fish passage facilities at the Scotland Project, which is upstream of Occum.

The installation of upstream and downstream fish passage facilities at projects on the Shetucket River would aid restoration efforts and reduce adverse effects of the project on anadromous fish populations.

d. Unavoidable adverse effects: Turbine injury and mortality of upstream YOY riverine fish would continue to occur at Occum, but should be minimal because most fish entrained are small (less than 8 inches long). Anadromous species (i.e., juvenile American shad and river herring) also would be exposed to entrainment after the CDEP initiated stocking of pre-spawned adults upstream of Occum. The proposed provision of a downstream fish bypass with perforated plate overlays on the intake during juvenile shad and herring outmigrations would reduce the environmental impacts of entrainment to anadromous fish.

#### **4. Terrestrial Resources**

##### a. Affected environment:

###### Upland Vegetation

Successional hardwood forest is the predominant vegetative cover type along the steep banks and upland areas of both shorelines of the project impoundment. These areas contain species that represent the Southeast Hills ecoregion of Connecticut, which is part of the oak, chestnut, and tulip poplar region of New England. These and other deciduous species, such as maple, beech, and sycamore, dominate the forested areas surrounding the project; white pine, eastern hemlock, and pitch pine are also found throughout this ecoregion. Many shrubs typical to this region of New England are also prevalent in the project vicinity.

###### Wetlands

Norwich reviewed the National Wetland Inventory (NWI) maps for the project area, up to and including the area approximately 1.2 miles upstream of the dam. There are several wetland areas along the portions of the river bank with shallower slopes. NWI mapping shows 39 acres of palustrine forested wetlands, and

another 3.0 acres of two palustrine emergent wetlands. The forested wetlands are deciduous floodplain forests that formed due to naturally occurring high spring river levels. During a site visit on July 24, 1998, Norwich verified that there are no wetland areas within the downstream reach of the project.

### Wildlife

Wildlife expected to occur in the project vicinity include species common to central Connecticut. Mammals include white-tailed deer, red and gray squirrel, opossum, beaver, raccoon, porcupine, and skunk. Common passerine bird species likely to occur in the area include warblers, finches, robins, and swallows. A variety of waterfowl and wading birds, such as Canada geese, mallards, black ducks, great blue heron, and egrets, may be attracted to the impoundment area. The project site also is likely to provide suitable habitat for a variety of reptiles and amphibians, such as snapping turtle, eastern painted turtle, northern water snake, green frog, and bullfrog.

### Threatened and Endangered Species

The CDEP Natural Resources Center conducted a search of its Natural Diversity Data Base maps and files for the project area. According to the CDEP, there are no terrestrial threatened or endangered species known to occur in the area (letter from Dawn M. McKay, Biologist, Connecticut Department of Environmental Protection, to Tina Jones, Licensing Coordinator, Kleinschmidt Associates, dated September 11, 1995).

Interior, Office of Environmental Policy and Compliance, indicates that no federally listed or proposed threatened or endangered species under the jurisdiction of Interior are known to occur within the project area, except for occasional transient bald eagles (*Haliaeetus leucocephalus*) or peregrine falcons (*Falco peregrinus*) (letter from Andrew L. Raddant, Regional Environmental Officer, U.S. Department of the Interior, to David P. Boergers, Acting Secretary, Federal Energy Regulatory Commission, dated June 24 1998).

### b. Environmental impacts:

#### Vegetation

Norwich's proposed operation would not have an impact on upland vegetation in the project area. The operational changes that Norwich proposes (minimum bypass flow of 22 to 32 cfs during periods of non-generation, and release of 100 cfs downstream when

tailwater elevation falls below 48.3 feet) would not alter existing upland vegetation. The future construction of fish passage facilities and a canoe portage may involve some incidental removal of vegetative cover during construction.

#### *Our Analysis*

We concur with Norwich's findings that continued operation of the project, along with the proposed operational changes, would not have a significant impact on upland vegetation in the project area.

#### Wetlands

Norwich proposes to continue operating the project in a cycling mode, such that the impoundment level is not drawn down more than 2 feet below the dam crest or the top of the flashboards. Additionally, Norwich proposes to implement a minimum bypass flow of 22 to 32 cfs during periods of non-generation to promote water circulation, and to release 100 cfs or inflow, whichever is less, downstream of the project when tailwater elevation falls below 48.3 feet (due to drawdown at the downstream Taftville Project) to prevent fish stranding and to protect aquatic habitat downstream. These activities may result in minimal changes to the current impoundment fluctuation levels in the Occum impoundment. Better coordination with the upstream and downstream hydroelectric facilities, as Norwich proposes, should help reduce the periods during which the project is in drawdown mode and thus limit any adverse impacts on upstream wetlands.

#### *Our Analysis*

Most wetlands in the project vicinity are forested floodplain wetlands that formed from naturally occurring high spring river levels and thus are minimally affected by project operation. The potential for desiccation of emergent wetlands around the impoundment area due to drawdown activity would not increase, because impoundment drawdown limitations would remain the same as for current operations. We concur with Interior (letter from Andrew L. Raddant, Regional Environmental Officer, U.S. Department of the Interior, to David P. Boergers, Acting Secretary, Federal Energy Regulatory Commission, dated June 24, 1998) that a final plan for monitoring and recording the impoundment level should be developed to ensure compliance with the drawdown limit of 2 feet set by the WQC. The enhancement of downstream aquatic habitats resulting from improved water flow

may also result in the incidental creation of shoreline emergent wetland habitats in the downstream reach.

Except for possible downstream enhancements, we concur with Norwich that continued operation of the project, along with the proposed operational changes, would not have a significant impact on wetlands in the project vicinity.

### Wildlife

Current project operation does not appear to affect resident wildlife or wildlife habitats. Norwich is presently negotiating with the owners of the downstream Taftville Project to better coordinate operations and thus improve riparian habitat availability in the section of river that lies between the two facilities.

### *Our Analysis*

We concur with Norwich that continued operation of the project, along with the proposed operational changes, would not have a significant impact on wildlife resources in the project area. We also agree that some incidental enhancements to wildlife habitat may occur as a result of future flow improvements and operational coordination with surrounding hydroelectric stations. In addition, the future restoration of anadromous fish runs (as discussed in section V.C.3) would benefit piscivorous birds and mammals by increasing the available prey base.

### Threatened and Endangered Species

Interior notes that two federally endangered bird species, the bald eagle and peregrine falcon, may occur as occasional transients through the project area. Interior stated that the preparation of a Biological Assessment or further consultation with Interior under Section 7 of the Endangered Species Act is not required (letter from Andrew L. Raddant, Regional Environmental Officer, U.S. Department of the Interior, to David P. Boergers, Acting Secretary, Federal Energy Regulatory Commission, dated June 24, 1998). Breeding habitat for these species is not present in the project vicinity.

### *Our Analysis*

Continued operation of the Occum Project, along with proposed operational changes, would have no effect on federally listed threatened or endangered species.

c. Unavoidable adverse effects: None.

## 5. Cultural Resources

a. Affected environment:

### Historical Resources

The Occum Project's area of potential effect (APE) includes the project facilities and the shorelines to the high water mark of the impoundment, which extends approximately 1.9 miles upstream from the project dam. The project facilities were listed in the National Register of Historic Places (National Register) in 1996 under the name Occum Hydroelectric Plant and Dam, and included the dam, headgate and forebay components, and powerhouse as contributing elements.

In 1865, the Occum Company constructed the stone portion of the dam, and the associated headgates, to provide water power for hydromechanically powered mills downstream. Although the company's plans for two power canals to supply a variety of industries were never realized, its dam did supply water in one canal to two woolen mills, which were later combined into a single manufacturing enterprise to produce cotton textiles. This firm, known as Totoket Mills, operated until the 1930s. In 1932, the Occum Company sold the dam and power privileges to the city of Norwich, which between 1934 and 1937 redeveloped the site for hydroelectric power production. The redevelopment effort included construction of a brick powerhouse, addition of a sixth gate to the intake structure, and burying the old power canal. The hurricane of 1938 damaged the dam, particularly the eastern end. The city of Norwich rebuilt this section of the dam in reinforced concrete, at the same time extending the structure an additional 170 feet. There have not been any major alterations to the project facilities since that time.

The project is located within the boundaries of the Quinebaug and Shetucket Rivers Valley National Heritage Corridor (NPS, 1998). The Heritage Corridor covers 850 square miles and stretches over 25 towns and several villages. Historical sites in the region in addition to the project facilities include numerous museums and historic buildings highlighting the region's small town agrarian history and textile production.

### Archeological Resources

Neither Norwich nor the Connecticut SHPO identified any archeological resources within the project's APE.

b. Environmental effects: In letters dated April 6, 1994, and December 4, 1995, the SHPO issued its opinion that continued operation of the project under its current mode would have no effect on the historic and engineering significance of the Occum Hydroelectric Plant and Dam. The SHPO did, however, request that Norwich consult with that office on the design of the proposed fish passage facilities, canoe portage improvements, or other recreational enhancements. In its application, Norwich proposes to consult with the SHPO, prior to any construction, about potential impacts of specific mitigation measures that may ultimately be included in the new license.

#### *Our Analysis*

Occum Dam has provided water power since 1865, and it has been used for generation of electric power since completion of the city of Norwich's hydroelectric plant in 1937. The Occum Hydroelectric Plant and Dam are significant in several respects. The dam is significant for its association with the textile industry, the major engine of economic growth in eastern Connecticut throughout the 19<sup>th</sup> century, and also as an example of dam engineering in that period. The hydroelectric plant is significant as a late example of the standardized hydroelectric engineering that came to dominate the industry in the 1910s and 1920s. Continued operation and maintenance of the Occum Project with staff-recommended measures would maintain its historic facilities for the purpose for which they were designed and built, and would therefore be beneficial to the National Register-listed Occum Hydroelectric Plant and Dam.

Construction of fish passage facilities could require alteration of the dam or powerhouse and the introduction of a new structure or structures within the National Register boundaries of the Occum Hydroelectric Plant and Dam that may constitute a visual intrusion. There could be adverse effects. Consultation with the SHPO on the design of fish passage facilities would ensure that adverse effects on the National Register property would be minimized or appropriately mitigated.

Improvements to canoe portages or other potential recreation enhancements may involve ground-disturbing activities that could affect as yet unknown archeological resources. Consultation with the SHPO on the need for and level of investigations to locate, identify, and evaluate archeological resources within the project's APE would ensure that adverse effects on significant archeological resources would be avoided or minimized.

To protect the historic property and any as yet unknown archeological resources, we recommend that a PA be developed and executed pursuant to Section 106 of the NHPA, and the regulations of the Advisory Council on Historic Preservation at 36 CFR Part 800. The PA would require Norwich to develop a CRMP for historic properties. The CRMP would require consultation with the SHPO prior to any change in mode of project operation, expansion of capacity, alteration to project facilities, or initiation of potentially ground-disturbing recreational enhancements or other activities. Norwich's implementation of the measures contained in the PA would ensure that project operation and maintenance would continue without loss of historical integrity of historic properties.

c. Cumulative effects: The continued operation of the Occum Project, the installation of fish passage facilities, and installation of canoe portage could have potential cumulative effects of the Occum Hydroelectric Plant and Dam, an Historic Property of statewide significance. Norwich's proposal to continue operating and maintaining the Occum Project with our recommended CRMP would maintain the historic character and use of the project facilities and would, therefore, provide beneficial cumulative effects by preserving resources of statewide significance over the next 30 to 50 years.

Norwich's proposal to add a downstream fish bypass and our recommended upstream fish ladder, and the canoe portage, with our recommended CRMP, would ensure that the fish passage and recreational facilities would be designed to be compatible with the historic character of the Occum Hydroelectric Plant and Dam.

We conclude that Norwich's proposed action, along with our recommendation would have no adverse cumulative effect on the physical characteristic of that qualify the Occum Hydroelectric Plant and Dam for listing in the National Register as a resource of statewide significance.

d. Unavoidable adverse effects: None.

## **6. Recreation and Land Use Resources**

a. Affected environment: The Occum Project is located in the transition area between the upper and lower Shetucket River Basins in eastern Connecticut. Land use in this region varies from a rural area containing small towns, light manufacturing, and agricultural land in the upper basin, to more developed urban land in the city of Norwich and the lower basin. Topography upstream of the project is relatively flat, and topography

downstream is gently sloping. Land use bordering the western shoreline of the impoundment is largely residential, and land use bordering the eastern shoreline contains a mix of residential and undeveloped land. Dwellings are set back from the water's edge and trees and other vegetation grow along both shorelines.

The project is situated within the boundaries of the Quinebaug and Shetucket Rivers Valley National Heritage Corridor (see section V.C.6), which offers numerous recreational opportunities. Several parks, forests, and preserves within the corridor offer hiking, biking, canoeing, fishing, picnicking, and equestrian opportunities. Parks include Mashamoquet Brook State Park, Mohegan Park, Pachaug State Forest, and Trail Wood, a Connecticut Audubon Society preserve.

Recreation activity in the project area is light and consists mainly of boating and fishing by local residents. Fishing pressure is light for most of the year, and species commonly caught are mainly warmwater species, although fishing pressure is moderate in the spring when the CDEP stocks the river with post-spawned Atlantic salmon. Boating activity on the impoundment is light, and it is limited by the shallowness of the impoundment. Boaters occasionally launch small motorless boats and canoes from an informal dirt boat launch, but boaters rarely use motor boats on the impoundment. Although no formal portage route exists, people also occasionally portage canoes around the dam at this informal launch. Additional access to the impoundment occurs via informal footpaths.

b. Environmental effects: Norwich recently installed a boat barrier and proposes to provide a canoe portage around the dam. The canoe portage would be located on the eastern shoreline and would use the existing upstream informal launch site as a put-in/take-out area. From this launch site, the portage would extend south over moderately sloped land to a point roughly 20 to 30 feet below the dam. In the area of the proposed downstream put-in/take-out, the trail would cross a river bank roughly 5 feet high and finish on rocks lining the shoreline.

The CDEP expressed interest in Norwich's proposal to provide a canoe portage by letter dated January 19, 1996 (letter from Brian Emerick, Supervisor Environmental Analyst, CDEP, Hartford, Connecticut, Jon Christensen, Kleinschmidt Associates, January 19, 1996)

### *Our Analysis*

The proposed canoe portage would enhance recreation opportunities in the project area. However, the downstream portage put-in/take-out area could prove difficult to use depending on its exact location. A moderately steep bank borders the river, and large rocks line the tailrace shoreline. The final design of the portage route and downstream put-in/take-out area should take advantage of existing flat rocks along the shoreline for easier entrance and exit to and from the river. The route also should follow a path of minimal slope over the bank adjacent to the river.

Currently, a moderately steep trail runs adjacent to the abutment on the east side of the dam. Depending on the exact location of the proposed portage put-in/take-out, directional signs may be beneficial to ensure that the safer proposed portage route is taken rather than the steeper existing trail. We recommend that Norwich consult with the CDEP on the final design of the canoe portage to ensure a safe and clearly marked put-in/take-out area downstream of the dam.

c. Cumulative effects: Norwich's proposed canoe portage would provide beneficial cumulative effects on recreational opportunities in the project area by facilitating canoe passage around one of several dams on the Shetucket River.

d. Unavoidable adverse effects: None.

#### D. No-action

Under the no-action alternative, Norwich would continue to operate the project and there would be no changes to the existing environment. No measures to protect, mitigate, or enhance existing environmental resources would be implemented.

## VI. DEVELOPMENTAL ANALYSIS

In this section, we analyze the project's use of the Shetucket River's available water resources to generate hydropower; estimate the economic benefits of the proposed project; and estimate the cost of various environmental protection, mitigation, and enhancement measures and the effects of these measures on project operations.

### A. Power and Economic Benefits of the Project

Our independent economic studies are based on existing electric power conditions, with no considerations for future

inflation, escalation, or deflation beyond the potential license issuance date.<sup>4/</sup>

We would typically base our estimate of the value of project-related capacity on a cost of alternative capacity of \$109/kW-year (at a fixed charge rate of 14 percent), which is based on a combined-cycle combustion turbine plant fueled by natural gas. We would typically base our estimate of the value of project-related energy on the 1998 cost of natural gas to electric generators in the New England Division of the United States. The 1998 cost of fuel would be based on information in Energy Information Administration (1996) and our estimate of the amount of fuel that would be displaced would be based on fuel consumption at a heat rate of 6,200 British thermal units per kilowatt-hour (Btu/kWh).<sup>5/</sup>

In this case, however, the project is treated as having no dependable capacity because there are significant periods during low flow when it is unable to generate, due in part to its dependence on releases from the upstream Scotland Project. Furthermore, the regional energy value (29.81 mills/kWh) is too low to represent the replacement cost for a small municipal utility such as Norwich. Therefore, in this analysis, we use the current energy replacement cost of 55 mills/kWh stated by Norwich.

For our economic analysis of the alternatives, we use the assumptions, values, and sources shown in table 4. The proposed action consists of the operation of the Occum Project with Norwich's proposed environmental and safety measures as shown in table 5.

Based on the assumptions in table 4 and the costs of enhancements shown in table 5, we estimate that the annual cost of the Occum Project would be \$201,913, or about \$8,439 (2.4 mills/kWh) more than the annual power value of \$193,474. The estimated average annual output of the project would be 3,518 MWh.

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<sup>4/</sup>See Mead Corporation, Publishing Paper Division, 72 FERC ¶61,027 (July 13, 1995).

<sup>5/</sup>This fuel consumption rate is for a new plant designed for maximum efficiency.

Table 4. Staff's assumptions for economic analyses of the Occum Project (Source: Staff)

| Assumption  | Value        | Source       |
|---|--------------|--------------|
| Energy value (1998) <sup>a</sup>                  | 55 mills/kWh | Norwich      |
| Capacity value (1998) <sup>b</sup>                | \$109/kW-yr  | Staff        |
| Operation & maintenance costs (1998) <sup>c</sup> | \$124,025    | Norwich      |
| Period of analysis                                | 30 years     | Staff (Mead) |
| Discount rate                                     | 10%          | Staff        |
| Net investment <sup>d</sup>                       | \$18,934     | Norwich      |

- <sup>a</sup> Energy-only, based on Norwich's 1998 replacement cost (Norwich's #7 response to AIR, Jon M. Christensen, Kleinschmidt Associates, March 16, 1998 [NDPU, 1998]).
- <sup>b</sup> Assigned to dependable capacity. The Occum Project has no dependable capacity, so entire value of generation is reflected in 55 mills/kWh energy-only figure.
- <sup>c</sup> Based on figure of \$121,000 presented by Norwich in its 1997 AIR response. Adjusted by the staff to 1998\$ by inflating 2.5% annually for one year.
- <sup>d</sup> Based on figure of \$20,534 presented by Norwich in 1997 AIR response. Adjusted by the staff to 1998\$ by depreciating \$1,600 annually for one year, as also presented by Norwich in 1997 AIR response.

Table 5. Summary of annual costs of Norwich's proposed enhancements for the Occum Project (Source: Staff)

| Protection, mitigation, or enhancement measure                         | Capital cost (1998\$) | O&M cost (1998\$) | Annual cost (1998\$)  |
|--|-----------------------|-------------------|-----------------------|
| Downstream fish bypass   | \$230,000             | \$3,285           | \$35,973 <sup>a</sup> |
| Minimum flow releases of 22-32 cfs and 100 cfs, or inflow <sup>b</sup> | 0                     | 0                 | \$5,060               |
| Canoe portage <sup>c</sup>   | 0                     | 0                 | 0                     |
| Review of plans with SHPO <sup>d</sup>                                 | 0                     | 0                 | 0                     |

- <sup>a</sup> Includes \$7,715 in lost energy (140.3 MWh at 55 mills/kWh).
- <sup>b</sup> Assume capital and O&M cost accounted for elsewhere because flow would be released through new downstream fish bypass. Annual cost consists of \$5,060 in lost energy (92 MWh at 55 mills/kWh).
- <sup>c</sup> We assume landowners would bear cost of removing sheds and that maintenance and the filing of final design with erosion control measures would be a minor part of normal O&M.
- <sup>d</sup> We assume these costs to be minor and part of normal O&M.

## B. Proposed Action with Additional Staff-recommended Measures

In this section, we present the annual costs of the proposed action with the staff's recommended measures. Table 6 shows the annual costs of enhancements for staff-recommended measures.

Based on these assumptions, we estimate that the annual cost of the proposed action with the staff's recommended measures would be about \$354,791, or about \$162,616 (46.5 mills/kWh) more than the annual power value of \$192,176. The estimated average annual output of the project would be 3,494 MWh.

Table 6. Summary of annual costs of enhancements of the staff and agency-recommended measures for Norwich's proposed Occum Project (Source: Staff)

| Protection, mitigation, or enhancement measure                            | Capital cost<br>(1998\$) | O&M cost<br>(1998\$) | Annual cost<br>(1998\$) |
|---|--------------------------|----------------------|-------------------------|
| Minimum flow of 155 cfs when tailwater drops below 48.9 feet <sup>a</sup> | 0                        | 0                    | \$1,815 <sup>a</sup>    |
| Operations monitoring plan  | \$5,000                  | -                    | \$530                   |
| Upstream fish ladder <sup>b,c</sup>                                       | \$1,322,000              | \$8,700              | \$153,542               |
| Execute PA  | \$1,000                  | -                    | \$106                   |

<sup>a</sup> The staff is not recommending this measure and the cost of this measure is not included in the proposed action with additional staff-recommended measures shown in table 7.

<sup>b</sup> The upstream fish ladder would be installed within 4 years of passing migrant fish at the Taftville Project.

<sup>c</sup> Annual cost includes \$1,300 in lost energy (23.6 MWh at 55 mills/kWh).

## C. No-action

Under the no-action alternative, the project would continue to operate as it does now, with no change in existing environmental conditions.

The annual cost of the existing project, including carrying charges on the net investment, necessary future capital, and licensing costs, is about \$173,655 (46.3 mills/kWh) for the existing generation of about 3,750 MWh annually. As stated above, we assume that the cost of alternative power is 55 mills/kWh. Therefore, the existing project would produce power

at a cost of about \$32,595 (8.7 mills/kWh) less than the currently available alternative.

#### D. Economic Comparison of the Alternatives

Table 7 presents a summary of the current net annual power benefits for no action, the proposed action, and the proposed action with additional staff-recommended measures.

Table 7. Summary of the net annual benefits of alternatives for Norwich's proposed Occum Project (Source: Staff)

|                                  | Proposed<br>action | Proposed<br>action with<br>additional<br>staff-<br>recommended<br>measures | No action |
|----------------------------------|--------------------|--|-----------|
| Annual generation (MWh)          | 3,518              | 3,494  | 3,750     |
| Annual power benefit<br>(\$)     | 193,474            | 192,176  | 206,250   |
| (mills/kWh)                      | 55.0               | 55.0   | 55.0      |
| Annual cost <sup>a</sup><br>(\$) | 201,913            | 354,791  | 173,655   |
| (mills/kWh)                      | 57.4               | 101.5  | 46.3      |
| Annual net benefit<br>(\$)       | -8,439             | -162,616   | 32,595    |
| (mills/kWh)                      | -2.4               | -46.5  | 8.7       |

<sup>a</sup> Annual cost of no action consists of \$12,709 for net investment, \$19,105 for future capital (trash booms, SCADA control equipment, and forebay intake gates), \$14,946 for licensing, \$124,025 for operation and maintenance, \$1,230 for Commission fees, and \$1,640 for miscellaneous.

Our evaluation of the economics of the proposed action and the proposed action with additional staff-recommended measures shows that the project appears to cost more than alternative power costs.

Project economics is only one of the many public interest factors that is considered in determining whether or not to issue a license. The construction and operation of a project may be desirable for other reasons, such as to diversify the mix of energy sources in the area, to promote local employment, to provide a fixed-cost source of power and reduce contract needs, and to conserve fossil fuels and reduce atmospheric pollution.

## **E. Pollution Abatement**

The Occum Project annually generates about 3,750 MWh of electricity. This amount of hydropower generation, when contrasted with the generation of an equal amount of energy by fossil-fueled facilities, avoids the unnecessary emission of atmospheric pollutants. Assuming that the 3,750 MWh of hydropower generation would be replaced by an equal amount of natural gas-fired generation, generating electrical power equivalent to that produced by the Occum Project would require combustion of about 38.7 million cubic feet of natural gas annually. Removal of pollutants from the emissions to levels presently achievable by state-of-the-art technology would cost about \$2,083 (1998 \$) annually.

## **VII. COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE**

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to all uses of the waterway on which the project is located. When we review a hydropower project, we consider the water quality, fish and wildlife, recreational, cultural and other nondevelopmental values of the involved waterway equally with its electric energy and other developmental values. In determining whether, and under what conditions, to license a project, the Commission must weigh the various economic and environmental tradeoffs involved in the decision.

This section contains the basis for, and a summary of, our recommendations to the Commission for the licensing of the Occum Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

### **A. Recommended Alternative**

Based on our independent review and evaluation of the proposed project, the proposed action with the additional staff-recommended measures, and no-action, we select the proposed action with our additional staff-recommended measures as the preferred alternative.

We recommend this alternative because: (1) issuance of a license would allow Norwich to continue to operate the project as a dependable source of electric energy; (2) the 800-kW project would avoid the need for an equivalent amount of fossil-fuel fired electric generation and capacity, continuing to help conserve these nonrenewable energy resources and reduce atmospheric pollution; and (3) the recommended environmental protection, mitigation, and enhancement measures would improve

water quality, protect fish and terrestrial resources, improve public use of recreation facilities and resources, improve multiple use and management of project lands, and maintain and protect historic and archeological resources within the area affected by project operations.

We recommend including the following environmental measures in any license issued by the Commission for the Occum Project:

- (1) operate the project in a cycling mode limiting impoundment drawdown to 2 feet;
- (2) develop and implement soil and erosion control measures, including temporary cofferdams, as part of the final plans for construction of the upstream and downstream fish passage and the canoe portage;
- (3) release minimum flows of 30 cfs through a combination of leakage and spillage when the project is not operating, and, following installation of the downstream fish bypass, a total of 100 cfs or inflow, whichever is less, through a combination of leakage, spillage, and the downstream sluiceway when the project is not operating and the impoundment elevation at the Taftville Project is below 48.9 feet;
- (4) develop and implement a plan to monitor impoundment and tailwater elevations and minimum flows;
- (5) develop and implement a final plan for the construction, operation, maintenance, and effectiveness monitoring of the upstream Denil fish ladder within 4 years of effective upstream passage at Taftville;
- (6) develop and implement a final plan for the construction, operation, maintenance, and effectiveness monitoring of downstream fish bypass within 3 years of license issuance;
- (7) execute a PA among the Commission, the SHPO, and the Advisory Council, that provides for the development and implementation of a CRMP; and
- (8) develop and implement a final plan for the installation of canoe portage around the dam, including signs and erosion control measures.

Because our recommendations for the operations monitoring plan, upstream fish ladder, and programmatic agreement represent tradeoffs between developmental and non-developmental resources,

we present our justification for these measures and a comparison of the alternatives in the following section.

Implementation of these measures would protect and enhance fisheries, cultural and recreational resources in the project areas and provide for the best use of the waterway.

The costs of some of these measures would reduce the net benefit of the project. As discussed in section VI, we estimate that the project as proposed by Norwich would cost more than currently available alternative power. Specifically, three of our additional recommended measures would further reduce the economic benefits of the project. These include: (1) development of a plan to monitor project operations and minimum flows; (2) development and implementation of a plan for the construction, operation, maintenance, and effectiveness monitoring of an upstream fish ladder; and (3) execution of a PA. We summarize these recommendations briefly in the following section.

#### **1. Project Operations and Minimum Flow Monitoring Plan**

Norwich proposes to monitor minimum flows and tailwater elevations. Interior recommends that Norwich develop a plan to monitor project operations including impoundment and tailwater elevations and minimum flows. Because habitat suitability and fish passage could be adversely affected by inconsistent flow releases and water surface elevations, compliance with our recommended flow releases and water surface management regime should be monitored.

We recommend that Norwich develop a monitoring plan that would provide for measuring and reporting impoundment and tailwater elevations and minimum flows released into the bypassed and downstream reaches. The plan also should indicate specific methods that would be used to verify impoundment and tailwater elevations and minimum flows. We estimate that the current net annual cost of this monitoring and documentation of compliance with our recommended flows and water surface elevation regimes would be about \$530.

#### **2. Upstream Fish Ladder**

Norwich proposes to conduct a feasibility study for the installation, operation, and maintenance of an upstream fish ladder. Norwich states that the costs associated with the upstream fish ladder may render the continued operation of the project infeasible. Interior and CDEP recommend the

installation, operation, maintenance, and effectiveness monitoring of an upstream fish ladder to allow the passage of American shad and river herring. Installation of an upstream fish ladder would be consistent with both state and federal management plans for the Shetucket River.

We recommend that Norwich develop a final plan for the construction, operation, maintenance, and effectiveness monitoring of an upstream fish ladder, to be installed within 4 years of effective passage of fish through facilities at the Taftville Project. We estimate that the current net annual cost of the upstream fish ladder would be \$153,542, a major cost relative to the overall project economics. We conclude that the environmental benefits of providing upstream fish passage are worth the cost.

### **3. Execute a Programmatic Agreement and CRMP**

Norwich proposes to review plans for fish passage and canoe portage with the SHPO. The SHPO states that continued use and maintenance of the facilities would have no effect on the historic characteristics of the property, provided that the SHPO is given the opportunity to review and comment on the fish passage and canoe portage designs. A PA and CRMP are necessary to ensure that the historic character of the Occum Project is protected during the license period. We estimate that the current net annual cost of preparation of the CRMP would be \$106.

## **B. Conclusion**

Based on our independent analysis of the Occum Project, we conclude that operation of the project with our recommended protection, mitigation, and enhancement measures would improve environmental conditions in the project area and would be a beneficial use of the resources.

## **VIII. RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES**

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or

other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

**Section 10(j) Inconsistency**

Pursuant to Section 10(j) of the FPA, we are making a preliminary determination that one of the recommendations of the fish and wildlife agencies may be inconsistent with the purposes and requirements of Part I of the FPA or other applicable laws. Recommendations, or parts of recommendations that are inconsistent with Section 10(j) conflict with the comprehensive planning and public interest standards of Section 4(e) and 10(a) of the FPA. This is because the recommendation would cost more to implement than the value of its potential benefits.

For the Occum Project, both CDEP and Interior have had the opportunity to make comments and recommendations. Both agencies have provided recommendations, and all recommendations are evaluated and discussed in the water, fisheries, and recreation resource sections of this final EA.

In table 8 we summarize CDEP's and Interior's recommendations, show if they are within the scope of Section 10(j) and indicate whether we recommend adopting the measures under the proposed action with additional staff-recommended measures.

Table 8. Analysis of fish and wildlife agency recommendations for the Occum Project (Source: Staff).

| Recommendation   | Agency           | Within scope of Section 10(j)? | Annual cost | Recommend adopting? |
|--|------------------|--------------------------------|-------------|---------------------|
| 1. Maintain impoundment to within 2 feet of the top of the flashboards or crest of the dam when flashboards are not in place | CDEP<br>Interior | Yes                            | \$0         | Yes                 |
| 2. Provide minimum flow of 30 cfs to the bypassed reach when the project is not generating                                   | Interior         | Yes                            | \$5,060*    | Yes                 |

| Recommendation   | Agency   | Within<br>scope of<br>Section<br>10(j)?            | Annual<br>cost        | Recommend<br>adopting?   |
|--|----------|--|-----------------------|--|
| 3. Provide minimum flow of 155 cfs when the tailwater elevation drops below 48.9 feet  | Interior | Yes  | \$1,815 <sup>b</sup>  | No. 155 cfs provides only inconsequential benefit at more cost |
| 4. Provide minimum flow of 22 cfs to the bypassed reach when the project is not generating and, 4 years after licensing, 100 cfs when the Taftville impoundment elevation drops below 48.3 feet <sup>c</sup> | CDEP     | Yes  | \$5,060 <sup>a</sup>  | Yes  |
| 5. Develop and implement a plan for monitoring impoundment and tailwater levels, and minimum flow releases   | Interior | Yes  | \$530                 | Yes  |
| 6. File monitoring plan with the Commission within 3 months of license issuance  | Interior | No. Not a specific measure to protect and wildlife | \$0                   | Yes, considered under Section 10(a)                            |
| 7. Develop and implement functional design drawings for a downstream fish bypass and commence construction within 2 years and complete construction within 3 years of license issuance                       | Interior | Yes  | \$35,973              | Yes  |
| 8. Develop and implement functional designs for a downstream fishway/sluiceway (bypass) and commence construction within 2 years and complete construction within 4 years of license issuance                | CDEP     | Yes  | \$35,973 <sup>d</sup> | Yes  |

| Recommendation  | Agency           | Within scope of Section 10(j)?                          | Annual cost            | Recommend adopting?                 |
|---|------------------|---|------------------------|-------------------------------------|
| 9. Develop and implement functional design drawings for an upstream fish ladder and commence construction within 2 years and complete construction within 4 years of the time Taftville facilities begin passing migrants | Interior<br>CDEP | Yes   | \$153,542 <sup>d</sup> | Yes                                 |
| 10. File functional design drawings for downstream and upstream fish bypass and fish ladder with the Commission for approval within 6 months of license issuance  | Interior         | No. Not a specific measure to protect fish and wildlife | \$0                    | Yes, considered under Section 10(a) |
| 11. Develop and implement a plan for monitoring the effectiveness of upstream and downstream fish passage facilities  | CDEP             | Yes   | \$0 <sup>e</sup>       | Yes                                 |
| 12. Provide boat barrier and canoe portage facilities within 4 years of license issuance  | CDEP             | No. Not a specific measure to protect fish and wildlife | \$0                    | Yes, considered under Section 10(a) |

- <sup>a</sup> Norwich provided cost data that combined the costs associated with providing 22 to 32 cfs and 100 cfs minimum flows. We assume the \$5,060 cost estimate primarily results from the 22 to 32 cfs because of the anticipated agreement with owners of the downstream Taftville Project to eliminate drawdown below the 48.3 foot elevation thereby eliminating the need for the 100 cfs flow.
- <sup>b</sup> This cost represents the incremental difference between providing 100 cfs at trigger elevation 48.3 feet and 155 cfs at the trigger elevation of 48.9 feet.
- <sup>c</sup> Although CDEP does not specify 100 cfs "or inflow, whichever is less", there is nothing in the record of this proceeding to indicate that CDEP is in disagreement with Norwich's proposal to release 100 cfs or inflow, whichever is less, when the tailwater elevation is below 48.3 feet.

- Conceptual drawings of the fish passage facilities were submitted to the agencies; we assume that costs associated with final design drawings are included in annual O&M costs.
- We assume these costs are included in the final plans for upstream and downstream fish passage.

As shown in table 8, we determined that 3 recommendations are not within the scope of Section 10(j) because they are not specific measures for the protection of fish and wildlife. We do not recommend adopting Interior's recommendation to release a minimum flow of 155 cfs when the tailwater elevation drops below 48.9 feet. Based on our analysis, the wetted area increases only 3.3 percent over the amount wetted with Norwich's proposed 100 cfs release when the tailwater elevations drops below our recommended trigger elevation of 48.9 feet. This minor increase would afford inconsequential benefits to fish and aquatic resources.

By letter dated February 24, 1999, we requested that Interior consider other options that would be agreeable to Interior and would adequately protect fish and aquatic resources consistent with other project purposes.

Interior, in its response by letter dated March 23, 1999, indicated that it could accept that a 100 cfs release (or inflow) would adequately protect instream resources when tailwater elevations fall below 48.9 feet, based on our analysis and acceptance of Interior's recommended headpond elevation trigger of 48.9 feet.

#### **IX. CONSISTENCY WITH COMPREHENSIVE PLANS**

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal and state comprehensive plans for improving, developing, and conserving waterways affected by the project. Under Section 10(a)(2), federal and state agencies filed 10 plans that address various resources in Connecticut. Eight plans address resources

relevant to the Occum Project.<sup>6/</sup> No conflicts were found with the plans.

#### X. FINDING OF NO SIGNIFICANT IMPACT

With the staff's additional recommended measures, the Occum hydroelectric facilities would continue to operate, fish passage facilities and minimum flows would facilitate passage of anadromous fish (shad and herring), and recreational access would be enhanced and maintained. With our recommended consultation with the SHPO, execution of the PA, and development of a revised CRMP, no significant impacts on cultural resources are expected.

Based on our independent analysis, issuance of a license for the project with additional staff-recommended measures would not constitute a major federal action significantly affecting the quality of the human environment.

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Appendix A: Comments on the Draft Environmental Assessment

Comment letters on the Draft EA issued February 14, 1999,  
appear in the following order:

| <u>Entity</u>   | <u>Date of Letter</u> |
|---|-----------------------|
| U.S. Fish and Wildlife Service                        | March 23, 1999        |
| Norwich Department of<br>Public Utilities             | April 7, 1999         |
| Connecticut Department of<br>Environmental Protection | April 12, 1999        |



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
New England Field Office  
22 Bridge Street, Unit #1  
Concord, New Hampshire 03301-4996

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MARCH 23 1999

REF: FERC No. 11574-000  
City of Norwich, Department of Public Utilities

David P. Boergers, Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, D.C. 20426

Dear Mr. Boergers:

Interior-1

This is in response to the Commission's Notice of Availability of draft Environmental Assessment (dEA) for the Occum Project, and the Commission's letter to the Department of Interior's Regional Environmental Officer regarding 10(j) dispute resolution proceedings, both dated February 24, 1999.

Interior-1 No response required.

Interior-2

We are pleased that the dEA concurs with the following 10(j) recommendations specified in our June 24, 1998 letter to the Commission:

- Limit drawdowns to within 2 feet of the top of the flashboards or the dam crest when the boards are not in place
- Release a minimum flow of 30 cfs whenever Occum is not generating
- Implement downstream fish passage within 3 years of license issuance
- Implement upstream fish passage within 4 years of fish habitat passing the downstream Taftville Project
- Develop a plan to monitor headpond and effluent elevations, and minimum flow releases

Interior-2 No response required.

Interior-3

While determining that our recommendations regarding schedules for filing the monitoring plan and functional design drawings for upstream and downstream fishways were outside the scope of Section 10(j), the dEA does recommend adopting them under Section 10(a). Given that the applicant proposes to utilize the downstream bypass discharge as attraction flow for the upstream fishway, coordinating the development of their designs is very important (even though the timing of the actual construction of each facility will differ).

Interior-3 No response required.

Interior-4

Minimum Flows

The Commission does not recommend adopting our 10(j) measure of releasing 155 cfs whenever the Taftville headpond falls below 48.9 feet. Instead, the dEA recommends releasing 100 cfs at our suggested trigger elevation of 48.9 feet versus the applicant's proposed trigger elevation of 48.3 feet.

Interior-4 No response required.

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Interior-4 Cont. This recommendation is based on information contained in the applicant's flow study, as well as supplemental analyses performed by Commission staff.

Interior-5 The dEA supports our trigger elevation because their analysis showed that at 48.9 feet, wetted area is 30% greater than at 48.3 feet (at a leakage flow of 12 cfs).

-6 In the analysis of flow release versus wetted area (at the minimum tailwater elevation of 46.4 feet), we based our recommendation for a 153 cfs flow on the fact that there was no information on habitat conditions at the applicant's proposed 100 cfs discharge. In the dEA, the Commission concluded that the additional 53 cfs between 100 and 153 cfs resulted in a gain in wetted area of only 3.3%. We have reviewed this analysis and have conducted our own. Our calculations differ slightly. We plotted the three discharges and wetted areas actually calculated during the flow study, then fit a curvilinear (logarithmic) line through them. We then used this graph to extrapolate the wetted areas for the two releases not actually evaluated (30 and 100 cfs). At 100 cfs we obtained a wetted area of 124,290 sq. ft. (vs. the dEA's 122,565 sq. ft.). This results in a gain of almost 7% between 100 and 153 cfs, not 3.3% as stated in the dEA.

-7 Nonetheless, based upon the Commission's analysis and acceptance of our recommended headpond elevation trigger, and in view of the 100 cfs release analysis, we can accept that a 100 cfs release (or inflow) will adequately protect instream resources when tailwater elevations fall below 48.9 feet.

-8 Lastly, flow study results indicate that Taftville's headpond level has a greater influence on wetted area than any of the discharges evaluated. Therefore, we continue to support the development of an agreement between Norwich and the owners of Taftville that would maintain Taftville's impoundment drawdowns to within 3 feet (while Occum releases a 30 cfs recirculating flow during non-generation periods).

#### Downstream Fish Passage

-9 Because the applicant has proposed to pass a portion of the minimum flow through the downstream bypass, it is imperative that the facility be built within the time frame specified in the dEA (within 3 years of license issuance). Until the bypass is built, only 30 cfs will be released downstream of Occum during periods of non-generation, regardless of tailwater elevation. Hastening the pace of construction will quicken the anticipated habitat enhancements.

-10 Thank you for this opportunity to comment. If you have any questions, please contact Melissa Gruber of this office at (413) 863-9473, ext. 30.

Sincerely yours,



Michael J. Bardett  
Supervisor  
New England Field Office

Interior-5 No response required.

Interior-6 Variations in estimates, on which these calculations are based, could account for this small difference.

Interior-7 No response required.

Interior-8 We agree; however, we note that Norwich indicates that attempts to gain agreement on Taftville headpond elevation are stymied pending sale of the Taftville facility.

Interior-9 We agree and will recommend inclusion of such a condition in any license issued for the Occum Project.

Interior-10 No response required.

**KA** KLENSCHMIDT ASSOCIATES  
Consulting Engineers & Scientists

78 Mohr Street PO Box 516 • Philadelphia, PA 19107 • Phone: 215-487-3328 • Fax: 215-487-3128 • [www.kleas.com](http://www.kleas.com)

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U.S. DEPARTMENT OF ENERGY  
REGULATORY COMMISSION

April 7, 1999

VIA Federal Express

Mr. David P. Bourgen, Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

Occum Hydroelectric Project (FERC No. 11574)  
Response to Draft Environmental Assessment

Dear Secretary Bourgen:

Norwich-1

On behalf of the City of Norwich, Department of Public Utilities (Norwich), owner and operator of the referenced project, this letter responds to the request for comments on the Draft Environmental Assessment (DEA) dated February 24, 1999.

Norwich-1 No response required.

Norwich-2

Norwich agrees with the conclusions drawn by the Commission staff in the DEA that the issuance of an original license for the Occum Hydroelectric Project (Occum) "would not be a major Federal action significantly affecting the quality of the human environment". The DEA recommends the adoption of measures proposed by Norwich to protect the existing environmental resources of the project, with a modification to the proposed minimum flow plan, the addition of specific upstream fish passage requirements, requirements for upstream and downstream passage effectiveness studies, and measures to provide for the protection of historic and cultural resources. For the most part, Norwich finds these recommended measures to be acceptable, but wishes to make comments on the Staff-recommended minimum flow measure:

Norwich-2 No response required.

"Provide a minimum flow of 100 cfs or below, whichever is less, downstream of the project when the tailwater elevation is below 48.5' after installation of the downstream fish bypass" (DEA, Pg. 6)

Norwich-3

With regard to the Commission's analysis and recommendations concerning minimum flows for the Project, we appreciate the Commission's additional analysis that constructed potential habitat gains associated with alternative minimum flows of 100 and 175 cfs. The Commission found that, below a certain Tail-Rise headpond elevation, a minimum flow of 100 cfs from Occum provided only 1.3 percent less wetted area than a minimum flow of 175 cfs. Based on that analysis, the DEA recommended that Occum provide a minimum flow of 100 cfs or below when the Tail-Rise headpond level was below that trigger elevation. Norwich agrees with this flow recommendation. In its comment letter dated March 23, 1999, the USFWS has also agreed that 100 cfs or below provides an adequate minimum flow when the Tail-Rise headpond is below a certain trigger elevation.

Norwich-3 No response required.

New Columbia, SC  
803-682-9177

Shrewsbury, PA  
717-487-7211

Fairfax Station, VA  
703-496-4597

Cheshire, CT  
860-656-2800

East Syracuse, NY  
315-484-8913

APPROVED  
DATE: APR 7 1999  
BY: [Signature]

A3

Mr. David P. Bourque, Secretary  
April 7, 1999

2

Norwich-4

Although we agree that a minimum flow of 100 cfs or inflow is reasonable when the Taftville headpond is substantially drawn down, the elevation at which the 100 cfs flow is triggered remains a concern to Norwich. As discussed in the Instream Flow Report (KA, 1995) the relatively short, 1,000 ft reach between the Occum tailwater and the Little River is inundated when the Taftville headpond is full, and free flowing when the Taftville headpond is drawn down. This reach provides marginal habitat for most aquatic organisms. Six ft pond fluctuations (between elevation 51.5' and 46.6', approximately) of the downstream Taftville headpond render this area neither lotic nor lacustrine habitat, instead it is an artificial, freshwater "tidal" area. The Instream Flow Study (1995) conclusions indicated that the primary impact to the reach below the Occum tailwater is a result of the minimum intake at the Taftville Project. Minimum flows from Occum were proposed by Norwich to maintain flows in the bypassed reach, and to provide circulation flows for the downstream reach while the Taftville headpond was drawn down.

Norwich-5

The analysis contained in the DEA recognizes that a large shoal located in the middle of the reach below the Occum tailwater is almost fully submerged when the Taftville headpond elevation is 48.9' or higher. Study data indicates that as the Taftville headpond is drawn down further to elevation 48.3' the Occum tailwater and bypass reach become dewatered, and this downstream shoal is exposed. The shoal becomes dewatered as the Taftville headpond is drawn down to its minimum level, regardless of whether a minimum flow of 100 or 155 cfs is maintained, as shown in Figure 5 of the DEA. Indeed, during the fieldwork study team observed that even at 250 cfs much of that shoal remained dewatered while the Taftville headpond was at elev. 46.4' (9.4 feet higher than the lowest anticipated Taftville headpond level). Thus, the proposed intent of protecting the shoal with a minimum flow is not met by the proposed trigger elevation of 48.3'. When the Taftville pond drops to elevation 48.3' or lower, the minimum flow will largely pass down the right channel (looking upstream) and the shoal area will be dewatered and have substantially reduced biological production. Norwich and CDEP, whose staff participated in the study, chose the 48.3' elevation as the trigger for the higher minimum flows because this would prevent the dewatering of the Occum bypassed reach, while providing circulation flows in the main channel of the downstream reach. Minimum flows from the Occum Project can provide little mitigation to the downstream reach when the impact is due to a six foot pond level fluctuation caused by the downstream project.

Norwich-6

Based on the fact that flows from the Occum Project have no significant influence on the shoal exposed by the Taftville draw-down, Norwich requests the Commission to reconsider the trigger level for Norwich's minimum flow release. Norwich still maintains that a trigger level of 48.3' will protect and enhance aquatic resources that are impacted by the Occum Project.

Norwich-7

Thank you for the opportunity to comment on the EA. If you have any questions about these comments, please feel free to contact me at (207) 487-3122, or Peter Polubinski at (207) 823-4153.

Sincerely,

KLEINBENNETT ASSOCIATES



Paul M. Carver  
Project Manager

JMC:gh

cc: Peter Polubinski  
Service List

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Norwich-4 Please note that the instream flow study did not include flows of 100 cfs and 155 cfs at 48.9 or 48.3 feet. Through extrapolation of the available data, we conclude that at trigger elevation of 48.9 feet, with flows of 100 cfs would provide enhanced aquatic habitat throughout the bypassed reach below the dam by increasing wetted habitat.

Norwich-5 Our trigger elevation is not designed to protect the shoal area, but to provide enhanced aquatic habitat throughout the bypassed reach. We note that there are gaps in the available data and that you would have 3 years to install the downstream conduit through which the 100 cfs minimum flow would be provided. You have the opportunity to complete the instream flow study during this time period. If your field data makes a compelling case for adjusting the trigger elevation, the Commission could consider lowering the trigger elevation in a license amendment.

Norwich-6 Please see our response to Norwich-5.

Norwich-7 No response required.

AA

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2044-00000000-0000 Rev. 02



Arthur J. Ragoza, Jr.  
Commissioner

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70 BLISS STREET HARTFORD, CONNECTICUT 06106

PHONE (603) 486-3000

UNITED STATES OF AMERICA  
FEDERAL ENERGY REGULATORY COMMISSION



REC'D  
1 DEPT. ENVIRONMENTAL PROTECTION  
59 APR 12 PM 4:01  
ACT OF THE SECRETARY

In the matter of

Occum Hydro Project  
City of Norwich  
Department of Public Utilities

Project No. 11574-000

CDEP-1 | This responds to the Commission's Notice of Availability of Draft Environmental Assessment for the subject project that was issued on February 24, 1999.

CDEP-2 | The assessment is a thorough evaluation of the project, and the recommended mitigation measures will ensure the long-term acceptability of this project. Two of the recommendations are based upon values larger than the requirements contained in the project's 401 Water Quality Certificate (WQC) issued by this Department. Specifically, these differences are related to the initial minimum stream flow requirement of 30 cfs vs. 22 cfs and the Taffville Pond elevation trigger of 48.9 feet vs. 48.3 feet. Since both of these recommendations are more protective of water quality, they are consistent with the WQC.

CDEP-3 | The coordinated operation of the Taffville and Occum projects remains a preferential method of addressing aquatic habitat concerns, which hopefully the subject project applicant will continue to pursue. The proposed sale of the Taffville facility, which is required under Connecticut's electric deregulation process, may provide a new opportunity in this regard.

CDEP-4 | If the Department can be of further assistance in this matter, please contact Brian J. Emerick or my staff at 60424-4169. Thank you.

Arthur J. Ragoza, Jr.  
Commissioner

cc: M. Grader, USF&WS  
AJR/bje

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Response to Comments  
of the State of Connecticut  
Department of Environmental Protection  
on the Draft Environmental Assessment  
for the  
Occum Project  
April 12, 1999

CDEP-1 No response required.

CDEP-2 We agree.

CDEP-3 Please see our response to Interior-8.

CDEP-4 No response required.

A6