UNITED STATES OF AMERICA 69 FERC _ 62, 197
FEDERAL ENERGY REGULATORY COMMISSION

Central Vermont Public Service Corporation — Project No. 2400-001 - VT

ORDER ISSUING SUBSEQUENT LICENSE
(MINOR PROJECT)
(ISSUED DECEMBER 8, 1994)

INTRODUCTION

On December 31, 1991, Central Vermont Public Service Corporation (CVPSC or applicant) filed an application under Part I of the Federal Power Act (FPA) for a subsequent license to continue to operate and maintain the 0.7-megawatt (MW) Passumpsic Hydroelectric Project, located on the Passumpsic River near the Town of St. Johnsbury, Caledonia County, Vermont. 1/

BACKGROUND

Notice of the application has been published. Timely motions to intervene were filed by the Vermont Agency of Natural Resources (VANR), the U.S. Department of Interior, and American Rivers. None of the entities opposes relicensing of the project. Comments received from interested agencies and individuals have been fully considered in determining whether, or under what conditions, to issue this license.

On May 23, 1994, the Federal Energy Regulatory Commission's (Commission) staff issued a draft environmental assessment (DEA) for this project. Comments on the DEA have been addressed in the final environmental assessment (EA), which is attached to this license. The staff also prepared a safety and design assessment (S&DA) for this project, which is available in the Commission's public file.

PROJECT DESCRIPTION

The existing Passumpsic Project consists of: (1) a concrete gravity dam consisting of (a) a south section, 122 feet long by a maximum height of 10 feet, with a crest elevation of 519.98 feet mean sea level (msl), and topped with 1-foot-high flashboards and

1/ The Passumpsic River is a tributary of the Connecticut River, a navigable waterway of the United States. Power produced from the project is fed directly into CVPSC's existing power grid to offset baseload. However, because the project was constructed and placed in operation in 1929, and there has been no project construction since 1935, the project is not required to be licensed pursuant to Section 23(b)(1) of the FPA. A license is authorized under Section 4(e) of the FPA, and the project was originally licensed under this section. See 43 FPC 168 (1970).

(b) a north section, 126 feet long by a maximum height of 10 feet, with a crest elevation of 519.98 feet msl, topped with 1-foot-high flashboards; (2) a 27-foot-wide headgate structure with two gates; (3) a power canal 19 to 22 feet wide and 87 feet long, with a sluice and a 24-foot-long overflow spillway; (4) an integral intake powerhouse with an inclined trashrack; (5) a powerhouse, 24 feet square, housing a vertical shaft turbine rated at 708 kilowatts (kW) and a generator rated at 700 kW; (6) a substation adjacent to the power canal; (7) an 18.3-acre impoundment extending 4,600 feet upstream with a water surface elevation of 521.0 feet msl and a usable storage of 18.4 acre-feet; and (8) appurtenant facilities.

The bypassed reach at Passumpsic is about 350 feet long. The project has a hydraulic range of 195 to 460 cfs and an average annual generation of about 3,868 megawatt-hours (MWh). A more detailed project description can be found in ordering paragraph (B)(2).

The project's original license permits the licensee to use daily pondage to generate hydropower, and it does not include any requirement to provide spillage over the dam crest to protect area aesthetics and aquatic resources in the project's bypass reach. CVPSC proposes to operate Passumpsic as a run-of-river project with a minimum spillage of 26 cfs or inflow, whichever is less.

APPLICANT'S PLANS AND CAPABILITIES

Need for Power and Action

The CVPSC application for relicensing establishes 1929 as the year during which the Passumpsic Project was constructed as it exists today. Therefore, for approximately 67 years, CVPSC and its customers have benefitted from low-cost, non-polluting hydropower from the Passumpsic Project. The 67-year operating history of the project fully demonstrates a past and continuing need for the amount of power generated by the project.

Conservation Efforts and Load Management Programs

In August 1993, CVPSC submitted to the Vermont Public Service Board a report, Conservation and Load Management, which includes quantitative information regarding CVPSC's specific conservation and load management goals and accomplishments for the first 6 months of 1993. Its programs affect residential, commercial, and industrial consumers.

My staff, after reviewing this document, concludes that CVPSC has made a satisfactory good faith effort to comply with Section 10(a)(2)(C) of the FPA and to support the objectives of the Electric Consumers Protection Act of 1986. I concur.

Compliance History

We have reviewed CVPSC's compliance with the terms and conditions of the existing license. We find that CVPSC's overall record of making timely filings and compliance with its license is satisfactory.

WATER QUALITY CERTIFICATION

Section 401(a)(1) of the Clean Water Act (CWA) 2/ requires an applicant for a federal license or permit for any activity that may result in a discharge into navigable waters of the United States to provide to the licensing or permitting agency a certification from the state in which the discharge originates that such discharge will comply with certain sections of the CWA. If a state fails to act on a request for certification within 1 year, the certification requirement is waived. 3/ Section 401(d) of the CWA 4/ provides that state certifications shall set forth conditions necessary to ensure that applicants comply with specific portions of the CWA and with appropriate requirements of state law.

On December 27, 1991, CVPSC filed a request with the Vermont Agency of Natural Resources, Water Quality Division (Vermont WQD), for CWA water quality certification for the Passumpsic Project. CVPSC subsequently withdrew its request and refiled it on October 8, 1992, and again on June 21, 1993. Vermont WQD issued the project certification on June 16, 1994.

The certification includes 16 conditions, labeled A through P. As stated in Tunbridge Mill Corporation, 68 FERC _ 61,078 (1994), under Section 401(d), states may lawfully impose only conditions related to water quality. In examining the conditions proposed here, I follow the principles laid out and discussed in Tunbridge.

Condition A requires CVPSC to operate and maintain the project pursuant to the conditions of the certificate. Because some of these conditions are beyond the scope of Section 401 and will not be included in the license, Condition A will become a part of the license only to the extent that it requires compliance with conditions within the scope of Section 401.

2/ 33 U.S.C. _ 1341.

3/ 33 U.S.C. _ 1341(a)(1).

4/ 33 U.S.C. _ 1341(d).

Condition B requires operation in a run-of-river mode, with all flows spilled at the dam when the facility is not operating. An exception is made for the replacement of flashboards and special maintenance draw-downs. This condition will become a part of the license. Article 402 of the license ensures such operation.

Condition C requires an instantaneous minimum flow of 86 cfs. It also specifies that, if instantaneous inflow falls below the minimum hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam. Condition C will become part of the license as Article 403. Article 403 of the license requires a continuous minimum flow of 86 cfs or inflow, whichever is less.

Condition D requires that, following reinstallation of flashboards or special maintenance draw-down, the impoundment shall be refilled by reducing downstream flows, but to no less than 214 cfs or 90 percent of inflow from June 1 to September 30, and 428 cfs or 90 percent of inflow from October 1 to May 31. Condition D adds that, from April 1 to May 31 or if project inflow is insufficient to permit passage of these flows and refilling, the impoundment will be refilled while releasing 90 percent of inflow below the project. Condition D will become a part of the license as Article 402. Article 402 requires the aforementioned flows following replacement of flashboards.

Condition E requires CVPSC to file for state review and approval a plan for monitoring impoundment levels and instantaneous flow releases at the project. This condition will become part of the license. Article 404 of the license requires the licensee to develop, in consultation with the state, a plan for monitoring reservoir elevation, outflow, and minimum flows in the project's bypass reach. The plan must be filed with the Commission, for approval.

Condition F requires that the licensee file a plan for downstream fish passage and operate the facility to be constructed from April 1 to June 15 and from September 15 to November 15. In light of the State's efforts to manage for fish habitat in the Passumpsic River, I will accept the State's provision and include it in the license. I recognize that there could be future conflict between the fishways included in the Water Quality Certificate by the state and those prescribed by the Secretary of the Interior. I see no need to resolve these issues here, but may do so when the licensee seeks our approval before constructing the fishway. Article 405 of the license requires a plan for downstream fish passage.

Condition G requires the licensee to provide for upstream fish passage upon written request by the State. Article 407 reserves to the Commission the authority to require the licensee

to construct, operate, and maintain such upstream fish passage facilities as may be required by the Secretary of the Interior, pursuant to Section 18 of the FPA. In light of the State's program designating fish habitat as a use of the Passumpsic River, I accept the State's provision and will include it in the license. There is potential for conflict between the facilities prescribed by the State and by the Secretary of the Interior, but, as in the case of Condition F, there is no need to resolve these issues until the licensee seeks approval to construct the fish passage facilities. However, the requirement in Condition G that the licensee provide for the upstream passage within 2 years of the State's request appears to be beyond the scope of Section 401, and will not become a part of the license, because this requirement would give the State the ability to control the timing of activities under a federal license.

Condition H requires CVPSC to provide VANR with a copy of the project's turbine rating curves. This condition will become part of the license. This requirement is included in Article 404.

Condition I requires the licensee to provide a canoe portage at the project. Since recreation is a regulated use of the river, the condition appears to be within the scope of Section 401. Also, staff has determined that the portage is warranted. Therefore, Article 412 includes a requirement for a canoe portage at the Passumpsic Project.

Condition J requires the licensee to allow continued public access to the river subject to reasonable safety and liability limitations. Any limitations are subject to state approval. Article 412 of the license ensures adequate public access to project recreational opportunities, and standard license Article 13 addresses public access to recreation in more general terms. Therefore, Condition J will become part of the license.

Condition K requires CVPSC to submit for the state's review and approval a plan for the proper disposal of debris associated with project operation, including trashrack debris. This condition will become part of the license. Article 410 of the license incorporates this requirement.

Condition L requires CVPSC to file for the state's prior review and approval, any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment draw-downs to facilitate repair or maintenance work, and tailrace dredging. The state has no authority to halt or order maintenance and repair of the Passumpsic Project. Section 401 provides that a state may issue its certification, at which point the federal licensing or permitting agency is responsible for making the certification a part of the license or permit. Section 401 gives the state no

further role in the federal process. Condition L, which would give the state the ability to control the timing of activities under a federal license, is thus beyond the scope of Section 401 and will not become part of the license. 5/

Condition M requires access for state personnel to inspect facilities to determine compliance with the terms of the water quality certification. Condition N requires that a copy of this certification be prominently posted within the facility. These conditions will become part of the license.

Condition O requires any changes to the project, including project operation, that would have a significant or material effect on the certificate to be submitted to VANR for prior review and approval. This condition in effect gives the State the opportunity to revisit its certification. Section 401(a)(3) of the CWA sets out the exclusive manner in which state certifications may be modified and makes clear that that process is to be initiated by the federal licensing or permitting agency, not the state. 6/ Thus, the Commission determines whether proposed license amendments require new water quality certification. 7/ Condition O, which gives the state authority beyond that provided for in the CWA, is beyond the scope of Section 401 and thus will not be included in the license.

Condition P states that VANR may request, at any time, that the Commission reopen the license to consider modifications to the license necessary to assure compliance with Vermont water quality standards. Although this condition will not be included in the license, VANR may make such a request at any time.

COASTAL ZONE MANAGEMENT PROGRAM

The project is not located in a state-designated coastal

5/ See Tunbridge, supra at p. 61,389.

6/ See Tunbridge, supra at p. 61,389.

7/ Our regulations, 18 C.F.R. _ 4.38(7)(iii) (1993), provide that, if an applicant seeks to amend its application or license, it must make a new request for water quality certification if the amendment would have a material adverse impact in the discharge from the project. We make the determination as to whether a material adverse impact will result from the amendment and, thus, whether a new certification is necessary. See, e.g., Joseph M. Keating, 57 FERC _ 61,261 (1991), reh'g denied, 61 FERC _ 61,215 (1992).

zone management area.

SECTION 18 OF THE FPA

Section 18 of the FPA provides the Secretary of the Interior the authority to prescribe fish ways at Commission-licensed projects. Interior, by letter dated December 23, 1993, filed the following measures pursuant to Section 18 for the Passumpsic Project:

(i) develop functional design drawings for a permanent downstream fish passage facility, in consultation with the U.S. Fish and Wildlife Service (FWS); construct the downstream passage facility as depicted in the approved final designs; and provide as-built drawings to FWS after construction;

(ii) submit plans for permanent downstream passage facility within 6 months from the issuance date of the FERC project license;

(iii) release flows for operation of, and attraction to, the passage facility, as required by the final approved facility design;

(iv) operate the downstream passage facility from April 1 through June 15 and from September 15 through November 15; the time period may be modified in the future in accordance with new information on downstream migration;

(v) prior to the completion of the permanent downstream fishway at the project, design, construct, and operate an interim downstream fishway, developed in consultation with and approved by FWS;

(vi) submit functional design drawings of the interim fishway to FWS within 4 months of issuance of the FERC project license; and

(vii) construct the interim fishway by April 1, 1995, and operate it from April 1 through June 15, and from September 15 through November 15, annually until construction of the permanent downstream passage facility is completed; the time period may be modified in the future in accordance with new information on downstream migration.

Items (i), (iii), (iv), and (v) appear to qualify as Section 18 measures. We also consider item (vii) as an appropriate Section 18 measure to the extent that it specifies annual operation schedules, but it is excluded to the extent that it specifies the construction schedule. We do not consider items (ii) and (vi) as appropriate Section 18 measures, because the

requirement to submit plans for interim and final fish ways within a specified time frame is the responsibility of the Commission, and the plans themselves are not considered to be fish ways. Therefore, we consider these items under Sections 10(a) and 10(j) of the FPA.

Article 405 requires the design and implementation of downstream fish ways. The permanent downstream fishway will enhance both the resident and migratory fisheries resources of the river. The interim facility is warranted as upstream stocking of migratory Atlantic salmon has already taken place, and outmigration will occur before permanent passage facilities could be put in place. Article 406 requires a plan to monitor the facilities' effectiveness.

Interior also reserves the authority to prescribe the construction, operation, and maintenance of upstream fish ways under Section 18, and the right to modify its Section 18 fishway prescription as needed to facilitate fish passage.

Future fish passage needs and management objectives cannot always be predicted at the time of license issuance. Although fish ways may not be recommended by Interior at the time of project licensing, upon receiving a specific request from Interior, it is appropriate for the Commission to include a license article that reserves authority to require construction, operation, and maintenance of fishway in the future. Therefore, Article 407 reserves the Commission's authority to require fish ways that Interior may prescribe.

RECOMMENDATIONS OF FEDERAL AND STATE FISH AND WILDLIFE AGENCIES

Section 10(j) of the FPA requires the Commission to include license conditions, based on recommendations of federal and state fish and wildlife agencies for the protection, mitigation of adverse impacts to, and enhancement of fish and wildlife resources. The various recommendations for this project and the actions taken are summarized in Section VIII of the EA. Pursuant to Section 10(j) of the FPA, staff determined that the recommendations of the federal and state fish and wildlife agencies which are appropriate for consideration under 10(j) are consistent with the purposes and requirements of Part I of the FPA and applicable law. Staff has addressed the concerns of the federal and state fish and wildlife agencies in the EA, and the license includes conditions consistent with the current recommendations of the agencies.

COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or

conserving a waterway or waterways affected by the project.

Under Section 10(a)(2), federal and state agencies filed a total of 28 comprehensive plans that apply to Vermont of which staff identified 15 plans that are applicable. 8/ No conflicts were found.

COMPREHENSIVE DEVELOPMENT

Sections 4(e) and 10(a)(1) of the FPA require the Commission, in acting on applications for license, to give equal consideration to the power and development purposes and to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway for all beneficial public uses.

A. Recommended Alternative

Staff considered several environmental enhancement measures including: run-of-river operation; spillage flows; recreational, historical, and archeological enhancements; landscaping; and fish passage.

From staff's independent analysis of the environmental and economic effects of the alternatives, I have selected the applicant's proposed operational procedures and environmental enhancement measures plus staff-recommended enhancement measures as the preferred alternative. I have selected this alternative because implementation of these measures will: enhance aesthetics, water quality, fisheries, and recreational resources; increase public access to the river in the project area; and will provide for fish passage.

The required enhancement measures will include:

- ù developing a soil erosion and sediment control plan for all land-disturbing activities;
- ù operating in an instantaneous run-of-river mode;
- ù providing a minimum flow of 74 cfs or inflow at the dam;
- ù designing and implementing a plan to monitor the required run-of-river operation and minimum flows;

8/ For a list of these plans, see Section XI of the attached EA.

- providing designated minimum flows downstream of the project during refilling of the impoundment;

- constructing and operating interim and permanent downstream fish passage facilities;

- conducting a study to ensure that the downstream fish passage facilities are operating effectively;

- installing "Danger Dam" signs and signs directing paddlers to the portage from the impoundment;

- implementing a Programmatic Agreement to carry out the Cultural Resources Management Plan among the Commission, Advisory Council on Historic Preservation, and the Vermont Division of Historic Preservation with CVPSC as a concurring party;

- developing and implementing a landscaping plan to enhance views of the station from Town Highway 11;

- installing at least one interpretive sign at the project, after consulting with the Vermont Department of Forests, Parks and Recreation on the design and location;

- working with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation; the Town of St. Johnsbury; the Passumpsic River Watch; and other interested groups and individuals to develop a Passumpsic River recreation guide to be distributed free of charge throughout the local area and region;

- developing and implementing a plan to conduct a professional recreational-use survey 10 and 20 years after the issuance of this license, in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury; submitting the plan to the Commission, for approval; conducting the study to determine the adequacy of the project's recreational facilities; and providing additional recreational enhancements, as needed;

- ensuring that the proposed and our recommended recreational facilities conform to the national standards established by the Architectural and Transportation Barriers Compliance Board; and

- revising the recreation plan for the project to include our recommendations, in consultation with the

Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury; and filing the revised recreation plan with the Commission, for approval.

B. Developmental and Nondevelopmental Uses of the Waterway

The project will generate an estimated 3.2 gigawatt-hours (GWh) annually of relatively low-cost electricity from a renewable energy resource for use by CVPSC customers. Positive, long-term benefits to water quality, aquatic habitat, area aesthetics, recreational resources, and cultural resources also will result from operating the project with the required enhancement measures. Though the cost of these measures will reduce the existing power benefits of the project, the measures are worth their costs, and the project will still have positive net benefits over the new license term compared to the least-cost alternative.

The primary costs associated with the required enhancements will be: (1) operating the project in a run-of-river mode at an annual levelized cost of $4,000; (2) providing and monitoring spillage flows at an annual levelized cost of $64,300; (3) constructing, operating, and studying downstream fish passage facilities at a yearly levelized cost of $16,400; (4) developing and implementing a landscaping plan at a yearly levelized cost of $600; and (5) providing additional recreational enhancements at an annual levelized cost of $2,100.

In total, the required enhancement measures will reduce the project's levelized annual net benefits from $304,000 to $216,600 or by $87,400.

C. Economic Costs of Additional Water Quality Certificate Conditions

One condition included in VANR's WQC for the Passumpsic Project that will affect project economics was considered unwarranted by my staff. This condition, which will be included in the license for the project, requires the provision of a continuous minimum flow of 86 cfs rather than 74 cfs, at a yearly incremental levelized cost of about $9,600. This required measure, therefore, will result in yearly net benefits of $207,000.

Based on review of the agency comments filed on this project, and on staff's independent analysis and assessment of the project pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, I find that the Passumpsic Project with the required environmental enhancement measures is economically beneficial and best adapted to a comprehensive plan for the proper use, conservation, and development of the Passumpsic River and other

project-related resources.

PROJECT RETIREMENT

The Commission has issued a Notice of Inquiry (NOI), dated September 15, 1993, requesting comments that address numerous issues involving the potential decommissioning of licensed hydropower projects at some future time, based on project-specific circumstances. 9/ The NOI states that the Commission is not proposing new regulations at this time, but is inviting comments on whether new regulations may be appropriate. Alternatively, the Commission may consider issuing a statement of policy addressing the decommissioning of licensed hydropower projects or take other measures.

The Passumpsic Project may be affected by future actions that the Commission takes with respect to issues raised in the NOI. Therefore, the license includes Article 202, which reserves authority to the Commission to require the licensee to conduct studies, make financial provisions, or otherwise make reasonable provisions for decommissioning of the project in appropriate circumstances.

By including Article 202, I do not intend to prejudge the outcome of the NOI. I am simply including the article so that the Commission will be in a position to make any lawful and appropriate changes in the terms and conditions of this license, which is being issued during the pendency of the NOI, based on the final outcome of that proceeding.

TERM OF LICENSE

In 1986, the Electric Consumers Protection Act modified Section 15 of the FPA to specify that any license issued under Section 15 shall be for a term which the Commission determines to be in the public interest, but not less than 30 years, nor more then 50 years. We are following the same guidelines in issuing subsequent licenses. 10/ Generally, we issue 30-year relicenses for projects that include no substantial new construction or power-generating expansion. We issue relicenses for 40 years or more for projects that include substantial new construction or capacity increases. We issue licenses of longer duration to ease the economic impact of the new costs and to encourage better comprehensive development of the renewable

9/ Notice of Inquiry, Project Decommissioning at Relicensing, Docket No. RM93-23-000, September 15, 1993, 58 FR 48,991 (1993).

10/ A subsequent license is issued for a minor project whenever Sections 14 and 15 of the FPA were waived in the project's original license.

power-generating resource. For the same reason, we may issue longer duration licenses for projects that include substantial or costly environmental mitigation and enhancement measures. Licenses of longer duration in these instances encourage license applicants (1) to be better environmental stewards, and (2) to propose more balanced and comprehensive development of our river basins.

Although the license does not authorize construction of new capacity for or redevelopment of the Passumpsic Hydroelectric Project, the recreational and environmental enhancements authorized and mandated in the license entail substantial costs to CVPSC that are comparable to the costs of moderate redevelopment or new construction. Accordingly, we conclude that issuance of a new license for a term of 40 years is appropriate.

SUMMARY OF FINDINGS

The EA issued for this project includes background information, analysis of impacts, support for related license articles, and the basis for a finding of no significant impact on the environment. Issuance of this license is not a major federal action significantly affecting the quality of the human environment.

The design of this project is consistent with engineering safety standards. The project will be safe if operated and maintained in accordance with the requirements of this license. Analysis of related issues is provided in the S&DA prepared for the Passumpsic Project and available in the Commission's public file for this project.

I conclude that the Passumpsic Project does not conflict with any planned or authorized development, and it is best adapted to the comprehensive development of the Passumpsic River for beneficial public uses.

THE DIRECTOR ORDERS:

(A) This license is issued to the Central Vermont Public Service Corporation (CVPSC) for a period of 40 years, effective the first day of the month in which it is issued to operate and maintain the Passumpsic Hydroelectric Project. This license is subject to the terms and conditions of the FPA, which is incorporated by reference as part of this license, and subject to the regulations the Commission issues under the provisions of the FPA.

(B) The project consists of:

(1) All lands, to the extent of the Licensee's interests in those lands, shown by Exhibit G:

Exhibit G-	FERC No.	Showing
1	2400-6	Project map
2	2400-7	Project map

(2) Project works consisting of: (1) a concrete gravity dam consisting of (a) a south section, 122 feet long by maximum height of 10 feet, with a crest elevation of 519.98 feet msl and topped with 1-foot-high flashboards and (b) a north section, 126 feet long by maximum height of 10 feet, with a crest elevation of 519.98 feet msl topped with 1-foot-high flashboards; (2) a 27-foot-wide headgate structure with two gates; (3) a power canal 19 to 22 feet wide and 87 feet long, with a sluice and a 24-foot-long overflow spillway; (4) an integral intake powerhouse with an inclined trashrack; (5) a powerhouse, 24 feet square, housing a vertical shaft turbine rated at 708 kW and a generator rated at 700 kW; (6) a substation adjacent to the power canal; (7) an 18.3-acre impoundment extending 4,600 feet upstream with a water surface elevation of 521.0 feet msl and a usable storage of 18.4 acre-feet; and (8) appurtenant facilities.

The project works generally described above are more specifically shown and described by those portions of exhibits A and F shown below:

Exhibit A: The following sections of Exhibit A filed December 31, 1991:

The generator description on page A-1; the turbine description on page A-1; and the additional mechanical and electrical equipment described elsewhere on page A-4 of Exhibit A.

Exhibit F Drawings	FERC No.	Showing
1	2400-3	Existing conditions
2	2400-4	Existing conditions
3	2400-5	Existing conditions

(3) All of the structures, fixtures, equipment or facilities used to operate or maintain the project, all portable property that may be employed in connection with the project, and all riparian or other rights that are necessary or appropriate in the operation or maintenance of the project.

(C) The Exhibits A, F, and G described above are approved and made part of the license.

(D) The following sections of the FPA are waived and excluded from the license for this minor project:

4(b), except the second sentence; 4(e), insofar as it relates to approval of plans by the Chief of Engineers and the Secretary of the Army; 6, insofar as it relates to public notice and to the acceptance and expression in the license of terms and conditions of the FPA that are waived here; 10(c), insofar as it relates to depreciation reserves; 10(d); 10(f); 14, except insofar as the power of condemnation is reserved; 15; 16; 19; 20; and 22.

(E) This license is subject to Conditions M, N, and P of the Water Quality Certificate issued for the Passumpsic Project dated June 16, 1994.

(F) This license is subject to the articles set forth in Form L-12 (October 1975), entitled "Terms and Conditions of License for Constructed Minor Project Affecting the Interests of Interstate or Foreign Commerce", and the following additional articles:

Article 201. The Licensee shall pay the United States an annual charge, effective the first day of the month in which this license is issued, for the purpose of reimbursing the United States for the cost of administration of Part I of the FPA, as determined by the Commission. The authorized installed capacity for that purpose is 933 horsepower.

Article 202. The Commission reserves authority, in the context of a rulemaking proceeding or a proceeding specific to this license, to require the Licensee at any time to conduct studies, make financial provisions, or otherwise make reasonable provisions for decommissioning of the project. The terms of this article shall be effective unless the Commission, in Docket No. RM93-23, finds that the Commission lacks statutory authority to require such actions or otherwise determines that the article should be rescinded.

Article 401. At least 90 days before the start of any land-disturbing activities associated with the construction of recreation facilities, fish ways, or other features required by this license, the Licensee shall file with the Commission, for approval, a plan to control erosion, to control slope instability, and to minimize the quantity of sediment resulting from project construction and operation.

The plan shall be based on actual-site geological, soil, and groundwater conditions and on project design, and shall include at a minimum, the following four items:

(1) a description of actual site conditions;

(2) measures proposed to control erosion, to prevent slope instability, and to minimize the quantity of sediment resulting from project construction and operation;

(3) detailed descriptions, design drawings, and specific topographic locations of all control measures; and

(4) a specific implementation schedule and details for monitoring and maintenance programs for project construction and operation.

The Licensee shall prepare the plan after consultation with the Soil Conservation Service and the Vermont Agency of Natural Resources.

The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on geological, soil, and groundwater conditions at the site.

The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 402. The Licensee shall operate the project in a run-of-river mode (outflow equals inflow) to preserve water quality, aquatic and riparian habitats, and aesthetic and recreational flows in the Passumpsic River, except as allowed in the following two paragraphs. The Licensee shall at all times act to minimize fluctuation of the reservoir surface elevation by maintaining a discharge from the project so that, at any point in time, flows, as measured immediately downstream from the project tailrace, approximate the sum of the inflows to the project reservoir.

During the repair or replacement of flashboards, or maintenance that requires lowering of the impoundment water level, the water surface level shall be drawn to the dam crest, and the project operated continuously in a true run-of-river mode by passing all flows through the turbines. Scheduled draw-downs below the crest of the dam shall be made only after consultation with the Vermont Agency of Natural Resources (VANR) and approval by the Commission. After the installation or maintenance is complete, the following instantaneous minimum flows shall be

released downstream of the project as the impoundment is refilled: 214 cubic feet per second (cfs) from June 1 to September 30; and 428 cfs from October 1 to May 31. From April 1 to May 31 or at any time when natural inflow to the project is insufficient to meet these flow passage requirements and fill the impoundment, the impoundment shall be refilled while releasing 90 percent of the instantaneous inflow downstream.

Run-of-river operation may be temporarily modified, if required by operating emergencies beyond the control of the Licensee, or for short periods upon mutual agreement between the Licensee and VANR. If the flow is so modified, the Licensee shall notify the Commission as soon as possible, but no later than 10 days after each such occurrence.

Article 403. The Licensee shall release into the bypassed reach of the Passumpsic River a minimum instantaneous flow of 86 cubic feet per second (cfs), or inflow, whichever is less, to enhance aesthetics and aquatic habitat. If the instantaneous inflow falls below the minimum hydraulic capacity of the turbine unit plus the bypassed flow requirement, all flows (except those needed for fish passage) shall be spilled at the dam.

The flow may be temporarily modified if required by operating emergencies beyond the control of the Licensee, and for short periods upon agreement between the Licensee and Vermont Agency of Natural Resources. If the flow is so modified, the Licensee shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 404. Within 6 months of license issuance, the Licensee shall file with the Commission, for approval, a plan to monitor impoundment levels and outflow from the project both below the tailrace and in the bypassed reach to document compliance with the run-of-river operation and provision of downstream flows during impoundment refilling, required by Article 402, and the 86 cubic feet per second minimum instantaneous flow in the bypassed reach, required by Article 403.

The plan shall include, at a minimum, the following items:

(1) the specific methods to pass the specified minimum flows;

(2) a schedule for installing all flow measuring devices;

(3) the planned locations of the flow measuring devices;

(4) the design of the devices, including any pertinent hydraulic calculations;

(5) operating measures that will minimize the effects of lag time and deviations from true run-of-river conditions below the project;

(6) the method of flow data collection, and provisions for providing data to the regulatory agencies in a timely manner; and

(7) a copy of the project's turbine rating curves.

The Licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service, the U.S. Geological Survey, and the Vermont Agency of Natural Resources. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 405. Within 6 months of license issuance, the Licensee shall file with the Commission, for approval, detailed design drawings of interim downstream fish passage facilities as prescribed by the Secretary of the Interior (Interior).

Within 1 year of license issuance, the Licensee shall file with the Commission, for approval, detailed design drawings of permanent downstream fish passage facilities as prescribed by Interior.

The interim and permanent downstream passage facilities shall be operated from April 1 through June 15 and from September 15 through November 15. This period may be modified in the future, after Commission approval, based on additional information on the appropriate timing for downstream passage.

These filings shall include, but not be limited to: (1) specifications of the passage facilities; (2) the locations of the bypass sluice and discharge; (3) a description of the flows required to safely convey fish through the sluice; (4) a description of the methods and schedules for installing the passage facilities; and (5) operating and maintenance plans.

The Licensee shall prepare the aforementioned drawings, schedules, and plans after consultation with the U.S. Fish and

Wildlife Service and the Vermont Agency of Natural Resources. The Licensee shall include with the filings documentation of consultation, copies of comments and recommendations on the drawings and schedules after they have been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the Licensee's facilities. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the drawings, plans, and schedules with the Commission. If the Licensee does not adopt a recommendation, the filings shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the drawings, plans, and schedules. Construction of downstream fish passage facilities shall not begin until the Licensee is notified by the Commission that the filings are approved. Upon Commission approval, the Licensee shall implement the proposals, including any changes required by the Commission.

Article 406. At least 90 days before starting to operate the permanent downstream passage facilities, the Licensee shall file with the Commission, for approval, a plan for a post-construction study during the first year of operation to monitor the effectiveness of the permanent downstream fish passage facilities in facilitating the efficient and safe passage of downstream migrating Atlantic salmon. The monitoring plan shall include the following:

(1) an assessment of the effectiveness of the downstream fish passage facilities, including documentation of any observed fish mortality associated with the fish passage facility;

(2) an assessment of the use of the passage facility by Atlantic salmon from September 15 through November 15; and

(3) a schedule for implementing the plan and for filing the results of monitoring, agency comments, and the Licensee's response to agency comments with the Commission.

The Licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service and Vermont Agency of Natural Resources. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the Licensee's plan. The Licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Operation of the permanent downstream passage facilities shall not begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

If the results of the monitoring indicate that changes in project structures or operations, including alternative flow releases, are necessary to protect fish resources, the Commission may direct the Licensee to modify structures or operations.

Article 407. Authority is reserved by the Commission to require the Licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of, such upstream fish passage facilities as may be prescribed by the Secretary of the Interior under Section 18 of the Federal Power Act.

Article 408. The Licensee shall implement the provisions of the "Programmatic Agreement Among the Federal Energy Regulatory Commission, the Advisory Council on Historic Preservation, and the Vermont State Historic Preservation Officer; for Managing Historic Properties that May Be Affected by a License Issuing to Central Vermont Public Service Corporation for the Continued Operation of Four Hydroelectric Projects on the Passumpsic River in Vermont." The Commission reserves the right to require changes to the Cultural Resources Management Plan incorporated as part of the Programmatic Agreement at any time during the term of the license.

Article 409. Within 6 months of license issuance, the Licensee shall file with the Commission, for approval, a landscaping plan to enhance the visual attractiveness of the project by screening views of the project substation. The plan shall include diagrams indicating the locations of proposed landscaping and a schedule for implementing the plan.

The Licensee shall prepare the plan after consultation with the Vermont Agency of Natural Resources. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agency, and specific descriptions of how the agency's comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agency to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin

until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 410. Within 6 months of license issuance, the Licensee shall file with the Commission, for approval, a plan for sealing the flashboards and disposing of trashrack debris at the Project. The plan shall include a schedule for its implementation.

The Licensee shall prepare the plan after consultation with the Vermont Agency of Natural Resources. The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agency, and specific descriptions of how the agency's comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agency to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons based on project-specific information.

The Commission reserves the right to require changes to the proposed plan. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 411. At least 90 days before the start of related work, the Licensee shall file with the Commission, for approval, a plan for any project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment draw-downs to facilitate repair/maintenance work, and tailrace dredging.

The Licensee shall prepare the plan after consultation with the Vermont Agency of Natural Resources (VANR). The Licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agency, and specific descriptions of how the agency's comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the agency to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No project maintenance or repair work involving the river shall begin until the Licensee is notified by the Commission that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 412. Within 6 months of license issuance, the Licensee shall file with the Commission, for approval, a detailed plan for constructing, operating, and maintaining its proposed recreational facilities at the Passumpsic Project, specified on pages E-29 and E-30 of the Licensee's "Application for a Subsequent License for a Minor Water Power Project," December 1991 and in item No. 6 of the Licensee's "Additional Information," filed in September 1993. These recreational facilities shall consist of: (1) a picnic area, (2) improvements to the existing parking area, and (3) an impoundment access site for boats.

The Licensee, in addition to its proposed recreational facilities, shall include plans for the construction, operation, and maintenance of the following improvements at the Passumpsic Project: (1) a canoe portage trail and canoe put-in, (2) "Danger Dam" signs and signs directing boaters to the portage trail; (3) an interpretative sign; and (4) reconfiguration of the proposed picnic area to accommodate the needs of the disabled. The plan also shall discuss the entity or entities responsible for the operation and maintenance of the facilities.

The Licensee shall acquire land or an easement for a safe canoe portage route and canoe put-in through the property adjacent to the Passumpsic powerhouse or along the Canadian-Pacific Railroad right-of-way. The Licensee shall provide documentation to prove they possess the property rights for the canoe portage facilities or provide plans for alternative portage facilities.

The plan shall include a discussion of how the needs of the disabled were considered in the planning and design of each recreation facility, and an identification of all facilities that are available for use by the disabled. The Licensee's design of recreational facilities shall conform to the national standards established by the Architectural and Transportation Barriers Compliance Board pursuant to the Americans with Disabilities Act of 1990.

The plan shall also include erosion and sediment control measures, designed in consultation with the Soil Conservation Service, which shall be implemented during construction. A schedule shall be provided for constructing the facilities after the plan's approval.

The Licensee shall prepare the plan after consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation, the Soil Conservation Service, and the Town of St. Johnsbury. The Licensee shall include in the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared

and provided to the entities, and specific descriptions of how the entities' comments are accommodated by the plan. The Licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No land-disturbing or land-clearing activities shall begin until the Licensee is notified that the plan is approved. Upon Commission approval, the Licensee shall implement the plan, including any changes required by the Commission.

Article 413. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article.

If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and water for which the Licensee may grant permission without prior Commission approval are:

(1) landscape plantings;

(2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 watercraft at a time and where said facility is intended to serve single-family type dwellings;

(3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and

(4) food plots and other wildlife enhancement.

To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall:

(1) inspect the site of the proposed construction;

(2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site; and

(3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline.

To implement this paragraph (b), the Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for:

(1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained;

(2) storm drains and water mains;

(3) sewers that do not discharge into project waters;

(4) minor access roads;

(5) telephone, gas, and electric utility distribution lines;

(6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary;

(7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and

(8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir.

No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed. If no conveyance was made during the prior calendar year, the Licensee shall so inform the Commission and the Regional Director in writing no later than January 31 of each year.

(d) The Licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for:

(1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained;

(2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained;

(3) other pipelines that cross project lands or waters but do not discharge into project waters;

(4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained;

(5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina;

(6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and

(7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year.

At least 60 days before conveying any interest in project lands under this paragraph (d), the Licensee must submit a letter to the Director, Office of Hydropower Licensing, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked exhibit G or K map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the Licensee shall consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved exhibit R or approved report on recreational resources of an exhibit E; or, if the project does not have an approved exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee shall take all reasonable precautions to insure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values

of the project; and (iii) the grantee shall not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised exhibit G or K drawings would be filed for approval for other purposes.

(g) The authority granted to the Licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.

(G) The Licensee shall serve copies of any Commission filing required by this order on any entity specified in this order to be consulted on matters related to that filing. Proof of service on these entities must accompany the filing with the Commission.

(H) This order is issued under authority delegated to the Director and constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. section 385.713. The filing of a request to rehearing does not operate as a stay of the effective date of this order or of any other date specified in this order, except as specifically ordered by the Commission. The Licensee's failure to file a request for rehearing shall constitute acceptance of this order.

Fred E. Springer
Director, Office of
Hydropower Licensing

ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE

Passumpsic River Projects:
PIERCE MILLS (FERC NO. 2396)
ARNOLD FALLS (FERC NO. 2399)
GAGE (FERC NO. 2397)
PASSUMPSIC (FERC NO. 2400)
Vermont

Federal Energy Regulatory Commission
Office of Hydropower Licensing
Division of Project Review
825 North Capitol Street, N.E.
Washington, DC 20426

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SUMMARY

On December 31, 1991, Central Vermont Public Service Corporation, Inc. (CVPSC or applicant) filed applications with the Federal Energy Regulatory Commission (Commission) for subsequent licenses for the following existing projects: the 250-kilowatt (kW) Pierce Mills Project, the 350-kW Arnold Falls Project, the 700-kW Gage Project, and the 700-kW Passumpsic Project. All four projects are located on the mainstem of the Passumpsic River in or near St. Johnsbury, Caledonia County, Vermont. CVPSC supplemented its applications with additional information filed on September 15, 1993. The current licenses for each of the projects expired at the end of 1993. No new capacity is proposed at any of the four projects.

This environmental assessment (EA) prepared for the four Passumpsic River projects analyzes and evaluates the effects associated with the issuance of subsequent licenses for the existing hydropower developments and recommends terms and conditions to become a part of any licenses issued. For any licenses issued, the Commission must determine that the project adopted will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and development purposes for which licenses are issued, the Commission must give equal consideration to the following purposes: energy conservation; the protection and enhancement of fish and wildlife; aesthetics; cultural resources; and the protection of recreational opportunities. This EA for the four Passumpsic River projects reflects the Commission's consideration of these factors.

Based on our consideration of all developmental and nondevelopmental resource interests related to the four projects, the following measures to protect and enhance environmental resource values should be included in any licenses issued for the Pierce Mills, Arnold Falls, Gage, and Passumpsic projects.

The licensee should: (1) develop and implement soil erosion and sediment control plans for all land-disturbing activities associated with recommended recreational enhancements; (2) operate all four projects in an instantaneous run-of-river mode (inflows to the project impoundment instantaneously equal flows below the confluence of the bypass reach and the project tailrace); (3) construct and operate interim and permanent downstream fish passage facilities; (4) release recommended instantaneous minimum flows to the bypassed reaches; (5) release an instantaneous minimum flow of 33 cubic feet per second (cfs) to the Arnold Falls south channel when the project is not generating; (6) release recommended instantaneous minimum flows downstream of the projects when the reservoirs are refilling; (7) reset the flashboards at Gage before the impoundment water level decreases 2 feet below the normal pool elevation of

539.15 feet; (8) develop and implement landscaping plans at Pierce Mills and Passumpsic; (9) develop and implement a Programmatic Agreement among the Commission, Advisory Council on Historic Preservation, and the Vermont Division of Historic Preservation, with CVPSC as a concurring party; and (10) revise its proposed recreation plan to include our recreation enhancement recommendations.

These environmental measures are recommended to protect or enhance fishery resources, water quality, recreational and aesthetic resources, and undiscovered properties listed on or eligible for listing on the National Register of Historic Places. In addition, the electricity generated from the projects would be beneficial because it would: continue to reduce the use of fossil-fueled, electric generating plants; conserve nonrenewable energy resources; and continue to reduce atmospheric pollution.

No reasonable action alternatives to the project have been identified for assessment. The no-action and decommissioning alternatives were considered and are addressed in the environmental analysis and the comprehensive development sections of this EA. Denial of all four of the licenses would mean that about 9,824 megawatt-hours (MWh) of electric energy generation per year would be lost, and no measures would be implemented to protect and enhance existing environmental resources.

CVPSC filed applications for water quality certification from the Vermont Agency of Natural Resources for each of the four Passumpsic River projects. The applications were withdrawn and refiled on October 8, 1992, and again on June 21, 1993. The water quality certifications for all four projects were issued on June 16, 1994.

Pursuant to Section 10(j) of the Federal Power Act (FPA), we make a determination that the recommendations of the Federal and state fish and wildlife agencies are consistent with the purposes and requirements of Part I of the FPA and applicable law. Section 10(j) of the FPA requires the Commission to include license conditions, based on recommendations of Federal and state fish and wildlife agencies, for the protection and enhancement of fish and wildlife resources. We address the concerns of the Federal and state fish and wildlife agencies and make recommendations consistent with those of the agencies.

Under Section 18 of the FPA, the U.S. Department of the Interior has prescribed the construction, operation, and maintenance of downstream fish ways at each of the four projects.

Based on our independent analysis of the projects, including our consideration of all relevant economic and environmental concerns, we conclude in this EA that: (1) the Pierce Mills, Arnold Falls, Gage, and Passumpsic hydroelectric projects, with

our recommended environmental measures and other special license conditions, would be best adapted to a comprehensive plan for the proper use, conservation, and development of the Passumpsic River and other project-related resources; and (2) issuance of subsequent licenses for the four projects would not constitute a major Federal action significantly affecting the quality of the human environment.

ENVIRONMENTAL ASSESSMENT

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF HYDROPOWER LICENSING
DIVISION OF PROJECT REVIEW

Passumpsic River Projects:
PIERCE MILLS (FERC NO. 2396)
ARNOLD FALLS (FERC NO. 2399)
GAGE (FERC NO. 2397)
PASSUMPSIC (FERC NO. 2400)
Vermont

INTRODUCTION

The Federal Energy Regulatory Commission (Commission or FERC) issued the Passumpsic River Projects Draft Environmental Assessment (DEA) for comment on May 23, 1994. In response, we received two comment letters. Those commenters are listed in Section IV.C., Comments on the Draft EA. All timely-filed comment letters were reviewed by the staff. The sections of the DEA that have been modified as a result of comments received are identified in the staff responses to the right of the letters of comments, in Appendix B.

I. APPLICATION

On December 31, 1991, Central Vermont Public Service Corporation, Inc. (CVPSC or applicant) filed applications with FERC for subsequent licenses for the Passumpsic River hydroelectric projects. These four projects -- Pierce Mills (FERC No. 2396), Arnold Falls (FERC No. 2399), Gage (FERC No. 2397), and Passumpsic (FERC No. 2400) -- are located on the Passumpsic River in northern Vermont, in or near St. Johnsbury (see Figure 1). The projects do not occupy any United States lands.

II. PURPOSE AND NEED FOR ACTION

A. Purpose of Action

This environmental assessment (EA) analyzes the impacts associated with continued operation of the four constructed projects, evaluates alternatives to the proposed projects, and makes recommendations to the Commission on whether to issue licenses, and if so, recommends terms and conditions to become part of any licenses issued. The Federal Power Act (FPA) provides the Commission with the exclusive authority to license nonfederal water power projects located on navigable waterways or on Federal lands.

Figure 1

In deciding whether to issue any license, the Commission must determine that the projects adopted will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued, the Commission must give equal consideration to the following purposes: energy conservation; the protection and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

B. Need for Power

CVPSC is a domestic corporation. To consider the need for power we evaluated the regional need for power.

The four Passumpsic River projects are located in the New England Power Pool (NEPOOL) area of the Northeast Power Coordinating Council (NPCC) Regional Electric Reliability Council region. As reported in the June 1993 Electricity Supply and Demand report issued by the North American Electric Reliability Council (NERC), NEPOOL is forecasting an average annual increase in peak energy demand of 2.4 percent during summer months and 2.1 percent during winter months for the 1993 to 2002 planning period. During the same time period, NEPOOL is forecasting an annual decrease in planned capacities of 0.6 percent during the summer and 0.3 percent during the winter. The decrease in planned capacities is primarily due to the retirement of facilities offsetting planned facilities.

The continued operation of the four Passumpsic River projects would be useful in meeting a small part of the need for power projected by the NPCC. These projects annually generate the following average amounts of energy: Pierce Mills -- 1,610 megawatt-hours (MWh); Arnold Falls -- 1,580 MWh; Gage -- 2,766 MWh; and Passumpsic -- 3,868 MWh.

III. PROPOSED ACTION AND ALTERNATIVES

A. Proposed Action

1. Project Descriptions

The four Passumpsic River projects affect a total of about 13 river miles (RMs). The four project reservoirs, which are generally within the river's banks, impound a total of almost 3.5 miles. Bypassed reaches are short; the longest, 350 feet, is at the Passumpsic Project. About 9.4 miles of downstream reaches are affected by existing peaking operations. The four Passumpsic River projects, together with the three other hydroelectric facilities on the mainstem of the Passumpsic River, control all but 4 to 5 miles of the river's 22.6-mile length. There are no

fish passage facilities at any of the seven projects on the mainstem of the Passumpsic River.

The Passumpsic Project is located at RM 5.5. The Gage Project is located upstream at RM 7.2. The Arnold Falls Project is located at RM 9.5 just upstream of the confluence of the Passumpsic and Moose rivers. Pierce Mills is the most upstream project at RM 14.9.

Pierce Mills Project

The Pierce Mills Project began operation in 1928. The project's site plan is shown in Figure 2. Principal features include: (1) a concrete gravity dam, 93 feet long by 18 feet high, with a crest elevation of 603.5 feet mean sea level (msl) and topped with 18-inch flashboards; (2) a 37-foot-long intake structure forming the left abutment, with a manually operated bulkhead gate and trashrack; (3) a 6-foot-diameter, 246-foot-long penstock; (4) a powerhouse, 22 feet wide by 22 feet long, housing a vertical shaft turbine rated at 271 kilowatts (kW) and a generator rated at 250 kW; (5) a substation; (6) a 24.7-acre impoundment extending 1.25 miles upstream to the Great Falls Dam with a water surface elevation at 605.0 feet msl and 24.7 acre-feet of usable storage; and (7) appurtenant equipment and facilities. The bypassed reach at this project is about 330 feet long. The existing project has a hydraulic range of 90 to 200 cubic feet per second (cfs) and an average annual generation of about 1,610 MWh.

Arnold Falls Project

The Arnold Falls Project began operation in 1928. The project's site plan is shown in Figure 3. Principal features include: (1) two timber crib dams consisting of (a) a North Dam, 189 feet long by 18 feet high, with a dam crest elevation of 572.72 feet msl and topped with 18-inch flashboards and (b) a South Dam, 66 feet long by 15 feet high, with a crest elevation of 572.8 feet msl and topped with 18-inch flashboards; (2) a 20-foot-wide intake with trashracks and a manually operated bulkhead gate; (3) a powerhouse, 21 feet wide by 18 feet long, housing a vertical shaft turbine rated at 335 kW and a generator rated at 350 kW; (4) a substation adjacent to the intake; (5) a 7.2-acre impoundment extending about 2,200 feet upstream with a water surface elevation of 574.3 feet msl and about 10.8 acre-feet of usable storage; and (6) appurtenant facilities. The bypassed reach is about 300 feet long. The project has a hydraulic range of 150 to 262 cfs and an average annual generation of about 1,580 MWh.

Figure 2

Figure 3

Gage Project

The Gage Project began operation in 1921, was rebuilt after the flood of 1927, and returned to service in 1929. The project's site plan is shown in Figure 4. Principal features include: (1) a concrete gravity dam consisting of: (a) a north section, 176-feet long by maximum height of 13 feet, with a crest elevation of 534.2 feet msl and topped with 6-foot-high flashboards, (b) a center section, 30 feet long, with a crest elevation of 542.1 feet msl, and (c) a south section, 43 feet long by 18 feet high, with a crest elevation of 538.9 feet msl and a 6-foot-wide sluice and topped with 1-foot-high flashboards; (2) a 51-foot-wide headgate structure with four headgates; (3) a power canal 90 feet long by 44 feet wide by 16 feet deep; (4) an integral intake with an inclined trashrack; (5) a powerhouse, 27 feet wide by 60 feet long housing (a) two vertical shaft turbines rated at 365 kW (Unit 1) and 522 kW (Unit 2) and (b) generators rated at 300 kW and 400 kW; (6) a substation adjacent to the power canal; (7) a 15.2-acre impoundment extending 3,400 feet upstream with a water surface elevation of 539.9 feet msl and 13.8 acre-feet of usable storage; and (8) appurtenant facilities. The bypassed reach at Gage includes a 2-acre plunge pool and about 120 feet of riffle habitat. The project has a hydraulic range of 170 to 700 cfs and an average annual generation of about 2,766 MWh.

Passumpsic Project

The Passumpsic Project began operation in 1929. The project's site plan is shown in Figure 5. Principal features include: (1) a concrete gravity dam consisting of: (a) a south section, 122 feet long by maximum height of 10 feet, with a crest elevation of 519.98 feet msl and topped with 1-foot-high flashboards and (b) a north section, 126 feet long by maximum height of 10 feet, with a crest elevation of 519.98 feet msl topped with 1-foot-high flashboards; (2) a 27-foot-wide headgate structure with two gates; (3) a power canal 19 to 22 feet wide and 87 feet long, with a sluice and a 24-foot-long overflow spillway; (4) an integral intake powerhouse with an inclined trashrack; (5) a powerhouse, 24 feet square, housing a vertical shaft turbine rated at 708 kW and a generator rated at 700 kW; (6) a substation adjacent to the power canal; (7) an 18.3-acre impoundment extending 4,600 feet upstream with a water surface elevation of 521.0 feet msl and a usable storage of 18.4 acre-feet; and (8) appurtenant facilities. The bypassed reach is about 350 feet long. The project has a hydraulic range of 195 to 460 cfs and an average annual generation of about 3,868 MWh.

Figure 4

Figure 5

2. Proposed Environmental Measures

Pierce Mills Project

CVPSC proposes to implement the following measures:

- ù enhance water quality, vegetation, fisheries, and aesthetics by operating in a run-of-river mode with a minimum bypass flow of 13 cfs or inflow, whichever is less, passed over the crest of the dam at all times;
- ù install Supervisory Control and Data Acquisition (SCADA) equipment to record unit output and impoundment water level;
- ù enhance recreational opportunities by constructing a multiple use recreation area with parking, picnic tables, and access to the river; and
- ù develop and implement a landscaping plan to improve the visual character of the project area by screening the penstock and substation.

Arnold Falls Project

The applicant proposes to implement the following measures:

- ù enhance water quality, vegetation, fisheries, and aesthetics by operating in a run-of-river mode with a minimum bypass flow of 20 cfs or inflow, whichever is less, passed over the northern dam crest at all times; and
- ù enhance recreational opportunities by developing a canoe portage trail, public river access area, and a public parking area.

Gage Project

The applicant proposes to implement the following measures:

- ù enhance water quality and fisheries by operating in a run-of-river mode with a minimum bypass flow of 32 cfs or inflow, whichever is less, from October 1 to May 1 and 17 cfs or inflow, whichever is less, the remainder of the year; and
- ù enhance recreational opportunities by developing a day-use picnic area associated with the existing canoe portage trail.

Passumpsic Project

The applicant proposes to implement the following measures:

- ù enhance water quality and fisheries by operating in a run-of-river mode with a minimum bypass flow of 26 cfs or inflow, whichever is less, over the dam crest at all times; and

- ù enhance recreational opportunities by developing a canoe access site and picnic area, making parking improvements, and landscaping.

B. Alternatives to the Proposed Project

1. Staff's Alternatives

After evaluating CVPSC's proposals and reviewing recommendations from resource agencies, we considered what, if any, additional enhancement measures would be necessary and appropriate to include in the subsequent license for each of the four projects. Our alternatives consist of CVPSC's proposals with the additions or modifications presented below. These items do not include conditions included in the water quality certifications with which staff disagrees.

All Projects

The applicant should:

- ù develop and implement soil erosion and sediment control plans for sites that would be affected by the construction of new recreational facilities;

- ù install interim and permanent downstream fish passage facilities;

- ù design and implement studies to determine the effectiveness of the downstream fish passage facilities;

- ù install "Danger Dam" signs as well as signs directing paddlers to the portage from the impoundment;

- ù develop and implement a Programmatic Agreement among the Commission, Advisory Council on Historic Preservation, and the Vermont Division of Historic Preservation (VDHP), with CVPSC as a concurring party;

- ù design and install an interpretive sign at each project after consulting with the Vermont Department of Forests, Parks, and Recreation on each sign's design and location;

- ù work with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation; the Town of St. Johnsbury; the Passumpsic River Watch; and other interested groups and individuals to develop a Passumpsic River canoeing guide that would be distributed free throughout the local area and region;

- ù implement a professional recreational use survey once every 10 years after the issuance of any license, in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury; if needed, develop and implement a plan to provide additional recreational enhancements;

- ù construct recreational facilities that conform to the national standards established by the Architectural and Transportation Barriers Compliance Board; and

- ù revise the recreation plan for each of the four projects to include our recommendations, in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury.

Pierce Mills Project

The applicant should:

- ù enhance aquatic habitat in the bypassed reach and area aesthetic value by releasing an instantaneous minimum flow of 88 cfs or inflow, whichever is less, over the crest of the dam at all times;

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling: 118 cfs from June l to September 30; 237 cfs from October 1 to March 31; and 948 cfs from April 1 to May 31; when natural inflow to the project is insufficient to meet these release requirements and refill the impoundment, release 90 percent of the instantaneous inflow at all times; and

- ù construct two overnight camping sites for canoeists in the vicinity of the project.

Arnold Falls Project

The applicant should:

- ù provide a year-round minimum instantaneous spillage of 78 cfs or inflow, whichever is less, to the north channel bypassed reach for aquatic habitat enhancement;

- ù provide a minimum spillage of 17 cfs over the South Dam from April 1 to November 30 for aesthetic enhancement when inflow to the project exceeds 95 cfs (the sum of our recommended minimum flows to the north and south bypassed reaches);

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling: 127 cfs from June 1 to September 30; 254 cfs from October 1 to March 31; and 1,016 cfs from April 1 to May 31; when natural inflow to the project is insufficient to meet these release requirements and refill the impoundment, release 90 percent of the instantaneous inflow at all times; and

- ù provide an instantaneous minimum flow of 21 cfs to the tailrace channel when the project is not generating.

Gage Project

The applicant should:

- ù provide a minimum instantaneous spillage of 32 cfs or inflow, whichever is less, from October 1 to May 31 and 17 cfs or inflow, whichever is less, from June 1 to September 31 for aquatic enhancement;

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling: 207 cfs from June 1 to September 30; 413 cfs from October 1 to March 31; and 1,652 cfs from April 1 to May 31; when natural inflow to the project is insufficient to meet these release requirements and refill the impoundment, release 90 percent of the instantaneous inflow at all times; and

- ù reset the hinged flashboards following lowering before the impoundment water surface elevation decreases 2 feet below the normal pool elevation of 539.15 feet msl.

Passumpsic Project

The applicant should:

- ù provide a year-round instantaneous spillage of 74 cfs or inflow, whichever is less, for aquatic and aesthetic enhancement;

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling: 214 cfs from June 1 to September 30; 428 cfs from October 1 to March 31; and 1,712 cfs from April 1 to May 31; when natural inflow to the project is insufficient to meet these release requirements and refill the impoundment, release 90 percent of the instantaneous inflow at all times;

- ù develop and implement a landscaping plan;

- ù reconfigure current plans for the proposed picnic area to accommodate the needs of the disabled and file the changes as part of a revised recreation plan; and

- ù acquire an easement for the construction, operation, and maintenance of a canoe portage trail and put-in.

2. Dam Removal Alternative

VANR requested that FERC consider removing one or more of the four dams. The request was made in response to CVPSC's concern that releasing recommended flows to the bypassed reaches could affect project economic feasibility. VANR notes dam removal could increase coldwater fish habitat by converting currently impounded segments to free-flowing status and return bypassed reaches to a natural flow regime. Consequently, we evaluated the dam removal alternative described below.

We evaluated the potential impacts of removing the Pierce Mills Dam and the Gage Dam. We selected the Pierce Mills Dam because it has the lowest generating capacity of the four projects. Retirement of this plant would represent the least impact to installed capacity and would minimize the cost of replacement energy. The current net annual benefit of the Pierce Mills Project is estimated as $84,000. The next larger project, Arnold Falls, has a current net annual benefit of $101,300. We assumed that the lower these values, the greater the potential that environmental benefits might outweigh the benefits of power generation.

Initially we considered only current conditions. Subsequently, we considered the projects in terms of staff's recommended alternative. We note that Pierce Mills with staff's

proposed enhancement measures continues to have the lowest net annual benefit ($18,900) and also has the lowest annual average generation.

After selecting the Pierce Mills Project for consideration, we looked at the Passumpsic River Projects from a different perspective. We looked for the project with the greatest potential environmental benefit, regardless of capacity or net benefit. Since cold-water fisheries, and salmon in particular, are important resources ecologically and to the public, the focus was on potential gains in salmon habitat. We selected the Gage Project for evaluation because it is downstream of the confluence of the Moose River, which is now stocked with Atlantic salmon fry and parr, and has the potential for enhanced salmon habitat from the Moose River to the Passumpsic impoundment. Removal of the Passumpsic Dam, also downstream of the Moose River confluence, would leave a natural falls as a barrier to downstream and potential upstream fish passage. Removal of Arnold Falls Dam would leave a similar barrier; moreover, the project is upstream of the confluence of the Moose River. Only if removal of the Pierce Mills and Gage dams proved reasonable would we consider removal of the Arnold Falls and Passumpsic dams.

Our dam removal alternative would affect the Pierce Mills and Gage projects by removing the existing dams and returning the river to a free-flowing condition at these sites. This alternative would eliminate the electrical energy produced by these projects and would require other power generation or conservation resources to replace the lost energy.

To prevent sediment from flowing downstream during removal of the projects, each reservoir would be gradually lowered (about 1 foot per week) during a 5-month period. We assumed that sediment would not be contaminated and would not require excavation.

Removal of each dam would begin during the reservoir draining period. However, the power plants, penstocks, and canal structures would not be demolished. We assumed that concrete would be blasted and hauled to a site within 5 miles of each project, and that excavated embankment material would be used to fill the power canal at the Gage Project.

Restoration costs would include revegetating all disturbed areas at the demolition site with native plant species to restore each site as closely as possible to its preconstruction condition. Costs of stabilizing and restoring previously inundated reservoir shorelines were not estimated because they are dependent on site-specific conditions.

We discuss the impacts of the dam removal alternative in the individual resource sections in Section V of this EA.

3. No-Action Alternative

Under the no-action alternative, the projects would continue to operate under the terms and conditions of their existing licenses, with no change in existing environmental conditions. Because no participant advocates continuing the status quo, we use this alternative to establish baseline environmental conditions for comparison with other alternatives. The alternative of license denial and project decommissioning is discussed below in Section III.B.4.

4. Alternatives Considered but Eliminated From Detailed Study

We considered decommissioning without dam removal as an alternative to the applicant's relicensing proposal but eliminated it from detailed study because it is not reasonable in the circumstances of this case. Project decommissioning could be accomplished without dam removal (see Section III.B.2 for discussion of the dam removal alternative). This decommissioning alternative would involve retaining the existing dams and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency willing and able to assume regulatory control and supervision of the remaining facilities.

While VANR did suggest that the Commission consider decommissioning if warranted by project economics during evaluation of relicensing, decommissioning was not a recommended term or condition. Furthermore, no agency has stepped forward to assume regulatory control; no participant has advocated this project decommissioning alternative; nor do we have any basis for recommending it. Because the power supplied by the projects is needed, a source of replacement power would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment to be a reasonable alternative. Therefore, a decommissioning alternative without dam removal was not considered further.

IV. CONSULTATION AND COMPLIANCE

A. Agency Consultation

The following entities commented on the applications subsequent to the public notice, which was issued on October 25, 1993. All comments become part of the Commission's record and are considered in our analysis of the projects.

Commenting Agencies and Other Entities	Date of Letter
U.S. Department of the Interior	December 23, 1993

Vermont Agency of Natural Resources (re: Pierce Mills)	December 22, 1993
Vermont Agency of Natural Resources (re: Arnold Falls)	December 23, 1993
Vermont Agency of Natural Resources (re: Gage)	December 23, 1993
Vermont Agency of Natural Resources	December 23, 1993

B. Interventions

In addition to providing comments, organizations and individuals may petition to intervene and become a party to any subsequent proceedings. The following entities filed for and were granted intervenor status for the Passumpsic River projects. None of these intervenors opposed relicensing the projects.

Name of Organization	Date of Motion
Vermont Agency of Natural Resources	August 31, 1992
U.S. Department of the Interior	October 2, 1992
American Rivers	October 5, 1992

C. Comments on the Draft Environmental Assessment

The respondents commenting on the DEA are as follows:

U.S. Fish & Wildlife Service	June 24, 1994
Vermont Agency of Natural Resources	July 6, 1994
Central Vermont Public Service Corp.	July 7, 1994

D. Water Quality Certification Conditions

CVPSC filed applications for water quality certification from the Vermont Agency of Natural Resources (VANR) for each of the four Passumpsic River projects. The applications were withdrawn and refiled on October 8, 1992, and again on June 21, 1993. The water quality certifications for the four Passumpsic River Projects were issued on June 16, 1994.

Our past experience with Section 401 water quality conditions indicates that some states routinely include measures that, in our opinion, do not relate to water quality and, therefore, are outside the scope of Section 401. Based on the Commission's Order Issuing License issued July 15, 1994, for the Tunbridge Mills Project, only those measures included in a water quality certificate considered to be within the scope of Section 401 become part of any license issued.11/ The State of

11/ Tunbridge Mill Corporation, 68 FERC _ 61,078 (1994).

Vermont's water quality certificates for the Passumpsic Projects list numerous terms and conditions as noted below.

Pierce Mills Project

The water quality certification for the Pierce Mills Project lists 16 terms and conditions as follows:

Condition A. The applicant shall operate and maintain this project as set forth in the findings of fact and conclusions above and these conditions.

Condition B. Except as allowed in Condition D below, the facility shall be operated in a true run-of-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

The applicant shall, within 90 days of issuance of this certification, furnish a description, hydraulic design calculations, and plans for the measure to be used to maintain run-of-river flows below the project tailrace.

Condition C. When available from inflow, a minimum instantaneous flow of 88 cfs shall be released at the dam at all times. If the instantaneous inflow falls below the hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam. Within 90 days of the issuance of this certification, the applicant shall furnish a description, hydraulic design calculations, and plans for the measure to be used to pass this minimum flow. The filing shall address conditions with and without flashboards in place, including conditions when the impoundment is drawn for flashboard replacement and subsequent refilling.

Condition D. Following the reinstallation of flashboards or an approved special maintenance operation necessitating a drawdown, the impoundment shall be refilled by reducing downstream flows, but to no less than 118 cfs from June 1 to September 30. During the periods October 1 to March 31 and April 1 to May 31 or under circumstances during the summer period when the natural inflow to the project is insufficient to permit both passage of 118 cfs and refilling of the impoundment, the impoundment shall be refilled while releasing 90

percent of instantaneous inflow downstream at all times.

Condition E. The applicant shall file for review and approval, within 90 days of the issuance of this certification, a plan for monitoring instantaneous flow releases at the project, both in the bypass and below the tailrace. Following approval of the monitoring plan, the applicant shall then measure instantaneous flows and provide records of discharges at the project on a regular basis as per specifications of the Department. Upon receiving a written request from the applicant, the Department may waive, all or in part, this requirement for flow monitoring at this project provided the applicant satisfactorily demonstrates that the required flow will be discharged at all times.

Condition F. Within six months of the issuance date of the license, the applicant shall submit a plan for downstream fish passage to the Department of Fish and Wildlife for review and written approval. Downstream passage shall be provided April 1 to June 15 and September 15 to November 15 and shall be functional with and without flashboards in place, with the period subject to adjustment by the Department based on knowledge gained about migration periods for migratory salmonids. The approved plan shall be fully implemented within 2 years of license issuance and shall include provisions to:

1. minimize passage of fish into the generating unit(s);

2. minimize impingement of fish on trashracks or on devices or structures used to prevent entrainment; and

3. convey fish safely and effectively downstream of the project, including flows as necessary to operate conveyance facilities.

The plan shall include an implementation/ construction schedule and a proposal for an interim fish bypass method for use until permanent facilities are completed; the interim method shall be utilized beginning with the spring 1995 passage period. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall

include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition G. Within 2 years of a written request by the Agency, the applicant shall provide for upstream fish passage, subject to plan approval by the Department of Fish and Wildlife. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition H. The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within 1 year of the issuance of this certification.

Condition I. Within 90 days of the issuance of this certification, the applicant shall submit a plan for proper disposal of debris associated with project operation, including trashrack debris, for written approval by the Department. The plan shall include the method used for flashboard construction, including materials used and means of sealing to prevent leakage. The plan shall be designed to prevent or minimize the discharge of debris or trash downstream.

Condition J. Any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval.

Condition K. The applicant shall maintain the portage in good, usable condition.

Condition L. The applicant shall allow continued public access to the river for utilization of the public resources, subject to reasonable safety and liability limitations. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department.

Condition M. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with certification conditions.

Condition N. A copy of this certificate shall be prominently posted within the facility.

Condition O. Any change to the project that would have significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval.

Condition P. The Department may request, at any time, the FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.

We are of the opinion that Conditions B-F, H, I, and K-N should become part of any license issued for the project. Conditions A and G should be included in part since it appears that they are partially within the scope of Section 401. Conditions J, O, and P are considered beyond the scope of Section 401. The technical merits of these conditions are discussed in Section V.C.

Arnold Falls Project

The water quality certification for the Arnold Falls Project lists 16 terms and conditions as follows:

Condition A. The applicant shall operate and maintain this project as set forth in the findings of fact and conclusions above and these conditions.

Condition B. Except as allowed in Condition D below, the facility shall be operated in a true run-of-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

The applicant shall, within 90 days of issuance of this certification, furnish a description, hydraulic design calculations, and plans for the measure to be used to maintain run-of-river flows below the project tailrace.

Condition C. Whenever the project is operating, a minimum instantaneous flow of 78 cfs shall be spilled over

the left-section crest at the dam at all times. If the instantaneous inflow falls below the hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam. This spillage requirement, when combined with leakage, is intended to provide a total flow of 103 cfs in the north (left) channel; should leakage diminish substantially from 25 cfs, spillage will have to be adjusted accordingly.

When the project is not generating, a minimum flow of 33 cfs shall be released into the south (right) channel at the dam, unless inflows have declined below 139 cfs, in which case 26 percent of inflow shall be maintained in the south channel and the remainder maintained in the north channel.

Within 90 days of the issuance of this certification, the applicant shall furnish a description, hydraulic design calculations, and plans for the measure to be used to pass these minimum flows. The filing shall address conditions with and without flashboards in place, including conditions when the impoundment is being drawn for flashboard replacement and subsequent refilling.

Condition D. Following the reinstallation of flashboards or an approved special maintenance operation necessitating a drawdown, the impoundment shall be refilled by reducing downstream flows, but to no less than 127 cfs from June 1 to September 30 and 254 cfs from October 1 to May 31. During the period April 1 to May 31 or under circumstances during the other periods when the natural inflow to the project is insufficient to permit both passage of these minimum flows and refilling of the impoundment, the impoundment shall be refilled while releasing 90 percent of instantaneous inflow downstream at all times.

Condition E. The applicant shall file for review and approval, within 90 days of the issuance of this certification, a plan for monitoring instantaneous flow releases at the project, both in the bypass and below the tailrace. Following approval of the monitoring plan, the applicant shall then measure instantaneous flows and provide records of discharges at the project on a regular basis as per specifications of the Department. Upon receiving a written request from the applicant, the Department may waive the requirement for flow

monitoring at this project provided the applicant satisfactorily demonstrates that the required flow will be discharged at all times.

Condition F. Within six months of the issuance date of the license, the applicant shall submit a plan for downstream fish passage to the Department of Fish and Wildlife for review and written approval. Downstream passage shall be provided April 1 to June 15 and September 15 to November 15 and shall be functional with and without flashboards in place, with the period subject to adjustment by the Department based on knowledge gained about migration periods for migratory salmonids. The approved plan shall be fully implemented within 2 years of license issuance and shall include provisions to:

1. minimize passage of fish into the generating unit(s);

2. minimize impingement of fish on trashracks or on devices or structures used to prevent entrainment; and

3. convey fish safely and effectively downstream of the project, including flows as necessary to operate conveyance facilities.

The plan shall include an implementation/ construction schedule and a proposal for an interim fish bypass method for use until permanent facilities are completed; the interim method shall be utilized beginning with the spring 1995 passage period. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition G. Within 2 years of a written request by the Agency, the applicant shall provide for upstream fish passage, subject to plan approval by the Department of Fish and Wildlife. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition H. The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within 1 year of the issuance of this certification.

Condition I. Within 90 days of the issuance of this certification, the applicant shall submit a plan for proper disposal of debris associated with project operation, including trashrack debris, for written approval by the Department. The plan shall include the method used for flashboard construction, including materials used and means of sealing to prevent leakage. The plan shall be designed to prevent or minimize the discharge of debris or trash downstream.

Condition J. Any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval.

Condition K. The applicant shall provide a canoe portage around Arnold Falls dam by October 1, 1995. The applicant shall consult with the Recreation Section of the Department of Forests, Parks and Recreation and the Department of Environmental Conservation in the planning, siting, and design of the portage. Design and maintenance plans for the portage shall be filed with the Department of Environmental Conservation and the Department of Forests, Parks and Recreation for review and approval before construction of the portage.

Condition L. The applicant shall allow continued public access to the river for utilization of the public resources, subject to reasonable safety and liability limitations. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department.

Condition M. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with certification conditions.

Condition N. A copy of this certificate shall be prominently posted within the facility.

Condition O. Any change to the project that would have a significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval.

Condition P. The Department may request, at any time, that FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.

We are of the opinion that Conditions B-F, H, I, and K-N should become part of any license issued for the project. Conditions A and G should be included in part since it appears that they are partially within the scope of Section 401. Conditions J, O, and P are considered beyond the scope of Section 401. The technical merits of these conditions are discussed in Section V.C.

Gage Project

The water quality certification for the Gage Project lists 19 terms and conditions as follows:

Condition A. The applicant shall operate and maintain this project as set forth in the findings of fact and conclusions above and these conditions.

Condition B. Except as allowed in Condition E below, the facility shall be operated in a true run-of-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

The applicant shall, within 90 days of issuance of this certification, furnish a description, hydraulic design calculations, and plans for the measure to be used to maintain run-of-river flows below the project tailrace.

Condition C. When available from inflow, a minimum instantaneous flow of 142 cfs from October 1 through May 31 and 82 cfs from June 1 through September 30 shall be released at the dam at all times. If the instantaneous inflow falls below the hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam.

Within 90 days of the issuance of this certification, the applicant shall furnish a description, hydraulic design calculations, and plans for the measure to be used to pass this minimum flow. The filing shall address conditions during flashboard replacement and impoundment refilling. If technically feasible, the measure shall include spillage of a portion of the flow over the main spillway.

Condition D. The applicant shall fully investigate alternatives that would enable it to manage impoundment levels such that drawdowns in excess of 2.0 feet, as caused by flashboard management, from the normal operating level are eliminated or significantly reduced. An investigation report shall be filed with the Department within six months of issuance of this certification and shall include an implementation schedule for construction of a feasible alternative, subject to Department review and approval.

Condition E. Following the reinstallation of flashboards or an approved special maintenance operation necessitating a drawdown, the impoundment shall be refilled by reducing downstream flows, but to no less than 206 cfs from June 1 to September 30 and 413 from October 1 to May 31. During the period April 1 to May 31 or under circumstances during the summer and fall/winter periods when the natural inflow to the project is insufficient to permit both passage of these minimum flows and refilling of the impoundment, the impoundment shall be refilled while releasing 90 percent of instantaneous inflow downstream at all times.

Condition F. The applicant shall file for review and approval, within 90 days of the issuance of this certification, a plan for monitoring instantaneous flow releases at the project, both in the bypass and below the tailrace. Following approval of the monitoring plan, the applicant shall then measure instantaneous flows and provide records of discharges at the project on a regular basis as per specifications of the Department. Upon receiving a written request from the applicant, the Department may waive, all or in part, this requirement for flow monitoring at this project provided the applicant satisfactorily demonstrates that the required flow will be discharged at all times.

Condition G. The applicant shall file for review and approval, within 180 days of the issuance of this certification, a remediation plan and schedule for correcting erosion that has been attributed to past project operation (ref. Finding 78). The Department may waive this requirement if the applicant files an updated geotechnical analysis of the reach showing that such remediation is unnecessary due to the existence of bedrock.

Condition H. Unless a means of controlling major drawdowns is implemented, the applicant shall monitor shoreline erosion during the life of the project. The applicant shall report to the Department the results of a survey of erosion every 3 years during the life of the project. If problems arise measures shall be taken by the applicant, subject to Department approval, to stabilize shorelines so as to prevent discharge of sediment to State waters.

Condition I. Within six months of the issuance date of the license, the applicant shall submit a plan for downstream fish passage to the Department of Fish and Wildlife for review and written approval. Downstream passage shall be provided April 1 to June 15 and September 15 to November 15 and shall be functional with and without flashboards in place, with the period subject to adjustment by the Department based on knowledge gained about migration periods for migratory salmonids. The approved plan shall be fully implemented within 2 years of license issuance and shall include provisions to:

1. minimize passage of fish into the generating unit(s);

2. minimize impingement of fish on trashracks or on devices or structures used to prevent entrainment; and

3. convey fish safely and effectively downstream of the project, including flows as necessary to operate conveyance facilities.

The plan shall include an implementation/ construction schedule and a proposal for an interim fish bypass method for use until permanent facilities are completed; the interim method shall be utilized no later than 6 months from license issuance. The U.S. Fish and Wildlife Service and

the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition J. Within 2 years of a written request by the Agency, the applicant shall provide for upstream fish passage, subject to plan approval by the Department of Fish and Wildlife. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition K. The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within 1 year of the issuance of this certificate.

Condition L. Within 90 days of the issuance of this certification, the applicant shall submit a plan for proper disposal of debris associated with project operation, including trashrack debris, for written approval by the Department. The plan shall include the method used for flashboard construction, including materials used and means of sealing to prevent leakage. The plan shall be designed to prevent or minimize the discharge of debris or trash downstream. The applicant shall cease using plastic sheeting for control of flashboard leakage and utilize an alternative that meets standards.

Condition M. Any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval.

Condition N. By October 1, 1994, the applicant shall file maintenance plans for the existing portage with the Department of Environmental Conservation and the Department of Forests, Parks and Recreation for review and approval. The Department may require reasonable modifications to the portage at any time and as necessary to facilitate use or protect wildlife use of nearby wetlands.

Condition O. The applicant shall allow public access to the river for utilization of the public resources, subject to reasonable safety and liability limitations. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department.

Condition P. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with certification conditions.

Condition Q. A copy of this certification shall be prominently posted within the facility.

Condition R. Any change to the project that would have a significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval.

Condition S. The Department may request, at any time, that FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.

We are of the opinion that Conditions B-I, K, L, and N-Q should become part of any license issued for the project. Conditions A and J should be included in part since it appears that they are partially within the scope of Section 401. Conditions M, R, and S are considered beyond the scope of Section 401. The technical merits of these conditions are discussed in Section V.C.

Passumpsic Project

The water quality certification for the Passumpsic Project lists 16 terms and conditions as follows:

Condition A. The applicant shall operate and maintain this project as set forth in the findings of fact and conclusions above and these conditions.

Condition B. Except as allowed in Condition D below, the facility shall be operated in a true run-of-river mode where instantaneous flows below the tailrace shall equal instantaneous inflow to the impoundment at all times. When the facility is not operating, all flows shall be spilled at the dam.

The applicant shall, within 90 days of issuance of this certification, furnish a description, hydraulic design calculations, and plans for the measure to be used to maintain run-of-river flows below the project tailrace.

Condition C. When available from inflow, a minimum instantaneous flow of 86 cfs shall be released at the dam at all times. If the instantaneous inflow falls below the hydraulic capacity of the turbine unit plus this spillage requirement, all flows shall be spilled at the dam.

The applicant shall file for review and approval, within 90 days of the issuance of this certificate, a description, hydraulic design calculations, and plans for the measure to be used to pass this minimum flow. The filing shall address conditions with and without the flashboards in place, including conditions when the impoundment is being drawn for flashboard replacement and subsequent refilling.

Condition D. Following the reinstallation of flashboards or an approved special maintenance operation necessitating a drawdown, the impoundment shall be refilled by reducing downstream flows, but to no less than 214 cfs from June 1 to September 30 and 428 from October 1 to May 31. During the period April 1 to May 31 or under circumstances during the summer and fall/winter periods when the natural inflow to the project is insufficient to permit both passage of these minimum flows and refilling of the impoundment, the impoundment shall be refilled while releasing 90 percent of instantaneous inflow downstream at all times.

Condition E. The applicant shall file for review and approval, within 90 days of the issuance of this certificate, a plan for monitoring impoundment levels and instantaneous flow releases at the project, both in the bypass and below the tailrace. Following approval of the monitoring plan, the applicant shall then measure impoundment levels and instantaneous flows and provide records of discharges at the project on a regular basis as per specifications of the Department. Upon receiving a written request from the applicant, the Department may waive, all or in part, this requirement for flow monitoring at this project provided the applicant satisfactorily demonstrates

that the required flow will be discharged at all times.

Condition F. Within six months of the issuance date of the license, the applicant shall submit a plan for downstream fish passage to the Department of Fish and Wildlife for review and written approval. Downstream passage shall be provided April 1 to June 15 and September 15 to November 15 and shall be functional with and without flashboards in place, with the period subject to adjustment by the Department based on knowledge gained about migration periods for migratory salmonids. The approved plan shall be fully implemented within 2 years of license issuance and shall include provisions to:

1. minimize passage of fish into the generating unit(s);

2. minimize impingement of fish on trashracks or on devices or structures used to prevent entrainment; and

3. convey fish safely and effectively downstream of the project, including flows as necessary to operate conveyance facilities.

The plan shall include an implementation/ construction schedule and a proposal for an interim fish bypass method for use until permanent facilities are completed; the interim method shall be utilized no later than 6 months from license issuance. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition G. Within 2 years of a written request by the Agency, the applicant shall provide for upstream fish passage, subject to plan approval by the Department of Fish and Wildlife. The U.S. Fish and Wildlife Service and the Department of Fish and Wildlife shall be consulted during plan development. The plan shall include an erosion control and water management plan designed to assure compliance with water quality standards during construction.

Condition H. The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within 1 year of the issuance of this certificate.

Condition I. The applicant shall provide a canoe portage around Passumpsic Dam by October 1, 1995. The applicant shall consult with the Recreation Section of the Department of Forests, Parks and Recreation and the Department of Environmental Conservation in the planning, siting, and design of the portage. Design and maintenance plans for the portage shall be filed with the Department of Environmental Conservation and the Department of Forests, Parks and Recreation for review and approval before construction of the portage.

Condition J. The applicant shall allow continued public access to the project area for utilization of public resources, subject to reasonable safety and liability limitations. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department.

Condition K. Within 90 days of the issuance of this certification, the applicant shall submit a plan for proper disposal of debris associated with project operation, including trashrack debris, for written approval by the Department. The plan shall include the method used for flashboard construction, including materials used and means of sealing to prevent leakage. The plan shall be designed to prevent or minimize the discharge of debris or trash downstream.

Condition L. Any proposals for project maintenance or repair work involving the river, including desilting of the dam impoundment, impoundment drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval.

Condition M. The applicant shall allow the Department to inspect the project area at any time to monitor compliance with conditions of this certification.

Condition N. A copy of this certification shall be prominently posted within the facility.

Condition O. Any change to the project that would have a significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval.

Condition P. The Department may request, at any time, that FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.

We are of the opinion that Conditions B-F, H-K, M, and N should become part of any license issued for the project. Conditions A and G should be included in part since it appears that they are partially within the scope of Section 401. Conditions L, O, and P are considered beyond the scope of Section 401. The technical merits of these conditions are discussed in Section V.C.

E. Section 18 Fishway Prescriptions

Section 18 of the FPA provides the Secretary of the U.S. Department of the Interior (Interior) the authority to prescribe fishways.12/ Interior (December 23, 1993) filed the following measures pursuant to Section 18 for the Pierce Mills, Arnold Falls, Gage, and Passumpsic projects:

(i) develop functional design drawings for a permanent downstream fish passage facility, in consultation with the U.S. Fish and Wildlife Service (FWS); construct the downstream passage facility as depicted in the approved final designs; and provide as-built drawings to FWS after construction;

(ii) submit plans for permanent downstream passage facility within 6 months from the issuance date of the FERC project license;

(iii) release flows for operation of, and attraction to, the passage facility, as required by the final approved facility design;

(iv) operate the downstream passage facility from April 1 through June 15 and from September 15 through November 15;

12/ Section 18 of the FPA provides: "The Commission shall require the construction, maintenance, and operation by a licensee at its own expense of ... such fish ways as may be prescribed by the Secretary of Commerce or the Secretary of Interior, as appropriate."

the time period may be modified in the future in accordance with new information on downstream migration;

(v) prior to the completion of the permanent downstream fishway at the project, design, construct, and operate an interim downstream fishway, developed in consultation with and approved by FWS;

(vi) submit functional design drawings of the interim fishway to FWS within 4 months of issuance of the FERC project license; and

(vii) construct the interim fishway by April 1, 1995, and operate it from April 1 through June 15, and from September 15 through November 15, annually until construction of the permanent downstream passage facility is completed; the time period may be modified in the future in accordance with new information on downstream migration.

Interior also reserves the authority to prescribe the construction, operation, and maintenance of upstream fish ways under Section 18, and the right to modify its Section 18 fishway prescription as needed to facilitate fish passage.

Items (i), (iii), (iv), and (v) appear to qualify as Section 18 measures. We also consider item (vii) as an appropriate Section 18 measure to the extent that it specifies annual operation schedules, but it is excluded to the extent that it specifies the construction schedule. We do not consider items (ii) and (vi) as appropriate Section 18 measures, because the requirement to submit plans for interim and final fish ways within a specified time frame is the responsibility of the Commission, and the plans themselves are not considered to be fish ways. Therefore, we consider these items under Sections 10(a) and 10(j) of the FPA. Disposition of 10(a) and 10(j) measures is discussed in Section VIII of this EA.

F. Dredge and Fill Permit Conditions

Pursuant to Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers issues dredge and fill permits for specified types of construction in wetlands. These permits generally include conditions applicable to project construction activities. Since relicensing of the Passumpsic projects would not involve any construction activities that would affect wetlands, a Section 404 Permit would not be required.

G. Coastal Zone Management Program

The Passumpsic projects are not located in the state-designated coastal zone management area (personal communication between Ginny Garrison, Supervisor, Lakes and Ponds Management

and Protection, the Agency Water Quality Division, Waterbury, and J. H. Rumpp, Jr., Stone & Webster Environmental Services, on December 17, 1993).

H. Scoping

On November 1, 1993, we issued a Scoping Document 1 (SD1) describing the environmental issues that we would and would not subject to detailed analysis in this EA. Our preliminary conclusions were based on information provided in the applications for relicense and comment letters.

On November 9, 1993, we held a public meeting in St. Johnsbury, Vermont, to discuss the SD1 and other pertinent information concerning the projects. CVPSC, VANR, Passumpsic River Watch, and members of the public attended. We established a 30-day comment period to receive additional comments after the meeting.

On November 10, 1993, we conducted a site visit with representatives of CVPSC, VANR, and the Passumpsic River Watch. The purpose of the site visit was to acquaint FERC staff with each of the projects and to obtain additional site-specific information.

The following entities filed comments on the SD1:

Commenting Entity	Date of Letter
U.S. Department of the Interior	November 18, 1993
National Park Service	November 19, 1993
Passumpsic River Watch	December 4, 1993
Vermont Agency of Natural Resources	December 8, 1993

On February 1, 1994, we issued a second Scoping Document (SD2) describing the environmental issues to be analyzed in the EA. The SD2 incorporated those new or modified issues that reflected public comments on the SD1.

V. ENVIRONMENTAL ANALYSIS13/

This chapter presents a general description of the river basin, describes existing and proposed hydropower projects in the basin, and summarizes the potential for cumulative impacts on environmental resources.

13/ Unless otherwise indicated, the source of our information is CVPSC's applications (1991 a-d).

We begin our detailed assessment of the potential environmental impacts on area resources resulting from relicensing the four Passumpsic River projects by first describing the affected environment. Then we use the existing state of each resource as the baseline for measuring and comparing the effects of the proposed relicensing actions and any alternative actions. Next we describe the potential effects on each environmental resource resulting from the implementation of new operational procedures and environmental enhancement measures, as well as the development of additional recreational facilities.

We do not discuss land use and socioeconomics because those resources would be largely unaffected by the relicensing of the projects.

A. General Description of the Locale

1. General Setting

The Passumpsic River is located in the Connecticut River Basin. The Connecticut River, the largest river in New England, extends about 400 miles from its origin in Fourth Connecticut Lake, New Hampshire, at an elevation of 2,625 feet, to Saybrook, Connecticut, where it empties into Long Island Sound (FWS 1989). The tidal portion of the river extends from Long Island Sound 60 miles upstream to Enfield Rapids.

The English first settled in the Connecticut River watershed in 1635. They used small boats, as Native Americans did before them, for transportation on the extensive river system. Numerous falls and cascades limited travel, however, and settlers started to develop dams and canals to aid navigation in the late 1700s. The wing dam and canal to bypass South Hadley Falls were constructed in 1795, the first dam across the Connecticut was built in 1800 at Turners Falls, and the dam at Enfield Rapids was completed in 1829. Development based on use of the river for cheap transportation continued until about 1850 when railroad development began to have an impact.

About the same time, the Connecticut River began to be developed for industry. The first large industrial dam was built at Holyoke in 1849. The basin's first hydroelectric dam was constructed on the Farmington River near Hartford, Connecticut. As industries were attracted to the water power, towns grew. Their prosperity increased with the growth of the New England textile industry and waned as economic conditions drove this industry from New England. With development also came industrial pollution, which has been ameliorated by Federal and state air and water pollution control measures implemented since the early 1970s.

Until the end of the eighteenth century, the Connecticut River supported large runs of Atlantic salmon and American shad. With the development of high dams, however, the fish could no longer reach spawning and nursery areas, and the runs ceased to exist. As long as pollutants made conditions unsuitable for the fish, no restoration was warranted.

Increased pollution controls and steadily increasing water quality beginning in the 1970s brought about efforts to restore anadromous fish runs, which are now beginning to show results. Fish that return to the Connecticut River have fewer barriers to upstream movement because of upstream passage facilities at Holyoke, Turners Falls, Vernon, Bellows Falls, and Wilder on the river's mainstem (Figure 6). Ryegate and McIndoes dams do not

Figure 6

have upstream passage facilities and are located on the mainstem, below the confluence with the Passumpsic River. The first dam on the Connecticut (Enfield) has been breached and, therefore, presents no obstacle.

The Connecticut River is a highly developed hydropower resource with many projects located on tributaries in northern Massachusetts, Vermont, and New Hampshire. Appendix A lists the 109 existing hydroelectric developments in the Connecticut River Basin. Table 1 lists those projects in the Connecticut River Basin that have license applications pending before the Commission as of October 5, 1993.

2. Passumpsic River Basin

The Passumpsic River originates near Lyndonville, Vermont, where the East and West branches of the Passumpsic converge. The river drains a total area of 507 square miles in Caledonia, Essex, Orleans, and Washington counties. The mainstem is 22.6 miles long, from its source to its confluence with the Connecticut River. The topography of the basin is most rugged in the area of the eastern headwaters. The Kirby Mountains, the highest of which is Burke Mountain at 3,267 feet, are located in this area. The western portion of the basin has a less rugged topography; the highest elevation is 2,783 feet at the summit of Wheelock Mountain.

The Passumpsic River Basin is largely forested and supports a wide range of recreational activities that are important to the local economy. St. Johnsbury has historically been a manufacturing community; some of the mill buildings that remain continue in industrial uses. Approximately 8,000 people now live in St. Johnsbury. Lyndonville, located upstream of the four projects, has a population of approximately 1,400.

As shown in Table 2, there are currently 10 hydroelectric projects in the Passumpsic River Basin. Three (West Danville 15, Emerson Falls, and Fairbanks Mill) are located on tributaries of the Passumpsic and seven are located on the mainstem (see Figure 7), including the four projects evaluated in this EA. All 10 projects are small; the largest is East Barnet, which has 2,200-kilowatts (kW) capacity. One mainstem project, East Barnet, also owned and operated by CVPSC, is located downstream at RM 0.5, 5 miles below the Passumpsic Project.

Two other projects currently operate on the mainstem above the four projects. The Lyndon Municipal Light Company owns the Great Falls Project, about 1.25 miles above Pierce Mills, and the Vail Project, about 1 mile above Great Falls. This company operates both projects in a strict run-of-river mode. Consequently, inflows to the Pierce Mills reservoir are not influenced by releases from the upstream projects.

Figure 7

Table 1. Pending License Applications in the Connecticut River Basin - October 5, 1993(Source: Staff)

FERC No.	Project Name	State	River	Application Type14/
2608	West Springfield	Massachusetts	Westfield	A
2490	Taftsville	Vermont	Ottauquechee	A
2489	Cavendish	Vermont	Black	A
2396	Pierce Mills	Vermont	Passumpsic	A
2397	Gage	Vermont	Passumpsic	A
2399	Arnold Falls	Vermont	Passumpsic	A
2400	Passumpsic	Vermont	Passumpsic	A
2323	Deerfield River	Vermont, Massachusetts	Deerfield	A
2334	Gardners Falls	Massachusetts	Deerfield	A
11090	Turnbridge Mill	Vermont	First Branch of the White River	B
2392	Gilman	Vermont, Massachusetts	Mainstem Connecticut River	A
11313	Apthorp	New Hampshire	Ammonoosuc	C
10729	Murphy Dam	New Hampshire	Mainstem Connecticut River	B

14/ A = Constructed operating project with a pending application for a new or subsequent license.
B = License application for a proposed new hydropower facility at an existing dam.
C = License application for an unlicensed constructed project.

Table 2. Hydroelectric Projects in the Passumpsic River Basin

Name	FERC No.	License Type	Installed Capacity (kW)	Head (ft)	River
East Barnet	3051	Exemption	2,200	29	Passumpsic
West Danville 15	2540	Non-Jurisdictional	1,000	180	Joes Brook
Passumpsic	2400	Minor	700	24	Passumpsic
Emerson Falls	7809	Exemption	250	47	Sleepers
Gage	2397	Minor	700	15	Passumpsic
Arnold Falls	2399	Minor	335	18	Passumpsic
Pierce Mills	2396	Minor	250	17	Passumpsic
Fairbanks Mill	6649	Exemption	18	15	Sleepers
Great Falls	2839	Major	2,050	61	Passumpsic
Vail Station	3090	Minor	400	20	Passumpsic

There are five wastewater discharges, licensed by the Vermont Department of Water Resources and Environmental Engineering (VDWR) (now Department of Environmental Conservation), in the Passumpsic River Basin. The largest discharge comes from the Town of St. Johnsbury, which is licensed to discharge up to 1.9 million gallons per day (MGD) and has a design capacity of 1.6 MGD. The secondary treatment facility has a combined stormwater and sanitary sewer collection system. The outfall is located on the Passumpsic River upstream of the confluence with the Sleepers River. The combined sewer overflows discharge into the Passumpsic, Sleepers, and Moose rivers.

The second largest discharge (0.75 MGD) is from the Town of Lyndon upstream of the four Passumpsic River projects. The third largest discharge (0.35 MGD) is from EHV Weidman, an industrial treatment plant, which discharges into the Passumpsic River below the Pierce Mills Dam. The fourth largest discharge (0.06 MGD) comes from the Town of Danville. Danville discharges into Joes Pond which eventually drains (via Joes Brook) to the Passumpsic River in Barnet, well downstream of the projects. The smallest licensed discharge (0.015 MGD) comes from the Town of East Haven, which discharges into the East branch of the Passumpsic, upstream of the four projects.

B. Cumulative Impact Summary

An action may cause cumulative impacts on the environment if it overlaps in space and/or time with the impacts of other past, present, and reasonably foreseeable future actions. The individually minor impacts of multiple actions, when added together, may amount to collectively significant cumulative impacts. The existing environment shows the effects of past and present actions and provides the context for determining the cumulative impacts of future actions.

We reviewed the four projects' potential to cause cumulative impacts. Given the projects' location and the nature of the area's resources, we conclude that the four Passumpsic River projects affect water quality, salmonid fisheries, and canoeing. Individual resource sections (Section V.C) include discussions of cumulative impacts on these resources.

C. Proposed Action and Action Alternatives

In each of the following resource sections, first we describe the environmental setting. Next we present the applicant's proposed operational procedures and environmental enhancement measures. Then we discuss recommendations of the resource agencies and other entities. Next we provide our independent analysis and conclusions regarding measures to include in the licenses issued for the four projects.

Lastly, we discuss any unavoidable adverse impacts that would occur to each environmental resource as a consequence of relicensing the four projects with our recommended enhancement measures.

1. Geological Resources

a. Affected environment: The Passumpsic River from the Pierce Mills Dam downstream to the Passumpsic Project shows some active lateral erosion at bends in the river and active down-cutting as a result of flows over steeper terrain. Historically, the Passumpsic River valley has been subject to similar stream processes, and seasonal flooding has lead to floodplain development (Morrison 1991a-c). The Passumpsic River valley contains predominantly material deposited in shallow, slow-moving water with small areas of material deposited by running water. To the west are deposits left as glaciers melted, and the bordering highlands on the east and west side of the valley are mixed deposits of clay, sand, gravel, and boulders (till). These soils can be easily eroded, especially when vegetative cover is missing.

Pierce Mills Project

The Pierce Mills Project is located between two river bends. Route 5 and the Canadian Pacific Railroad border the river on the west. In the impoundment, there is one area of erosion located at a bend in the river 0.73 mile above the dam. At this bend, the stream bank is steep with gently rolling fields extending away from the top of the bank. The banks at this location are not vegetated. There is no evidence of erosion below the dam.

Arnold Falls Project

The Arnold Falls Project influences an area with the same general geology as the rest of the Passumpsic Valley. Areas along Route 5 and the Canadian Pacific Railroad that might erode are protected with riprap and retaining walls. There is no evidence of erosion related to the operation of the project above or below this dam.

Gage Project

The Gage Project is located between two river bends. To the east and south, the terrain rises to foothills. Route 5 borders the river on the west bank for the length of the impoundment, and the Canadian Pacific Railroad is on the east bank before crossing to the west bank 2,000 feet above the dam. Route 5 is close to the river for about 1,000 feet on the west bank above the dam. Attempts to stabilize the high, steep bank have been only partially successful, and soil, rocks, and trees continue to slide into the Passumpsic (Morrison 1991b). Releases of water during flashboard removal or failure may also be adding to the natural erosion of the east side of the river below the dam and within the impoundment area. The banks around the impoundment and dam area are wooded with wetland plant species along the shoreline.

Passumpsic Project

The Passumpsic Project impoundment starts just below Gage Dam and continues along the west flank of a broad, flat floodplain for about 0.5 mile, passes through a 0.14-mile-long gorge, and then flows through more floodplain. The river curves just above the Passumpsic Dam. The river is actively eroding its banks in the Passumpsic impoundment. There are many locations where the river banks show fresh, unvegetated scars (Morrison 1991c). The banks are vegetated with willow and other similar species. The floodplains are in agricultural use.

b. Environmental impacts:

Shoreline Erosion

VANR is concerned that operation of the four Passumpsic River projects may be causing shoreline erosion in the impoundments and in the river reaches downstream of the dams where water elevations are variable.

VANR also contends that peaking by hydroelectric projects on the Passumpsic River could have exacerbated the slumping and erosion on the banks of the impoundments (VANR 1993). Rapid lowering of the water level in an impoundment reach reduces hydrologic support on the saturated bank soils which, in combination with bank undercutting, could cause the observed erosion and slumping. VANR (1989) indicated that a 1.5- to 2-foot average drawdown associated with peaking operation would not affect erosion significantly. Subsequently, VANR modified its position and requested the applicant to conduct studies to determine the impact of various impoundment levels on shoreline stability (VANR 1990). VANR also requested that CVPSC assess erosion upstream and downstream of the Gage Dam and upstream of the Passumpsic Dam, as described above.

More specifically, VANR indicates that the 6-foot drawdown associated with dropping the flashboards at the Gage Project could be causing bank erosion above the dam by reducing the hydrologic support on the banks. VANR also indicates that flows related to flashboard release could be directly contributing to shoreline erosion below the dam. VANR requests mitigation of existing erosion problems that can be attributed to operation of the project and development of plans to prevent future impacts.

CVPSC states that: (1) existing erosion and bank slumping within the impoundment reaches of each dam are primarily natural phenomena consistent with normal river migration; and (2) the dams may reduce erosional processes by increasing the base level of the river (Morrison 1991 a-c). Therefore, CVPSC concludes that it is not responsible for controlling erosion in the impoundment reaches.

CVPSC indicates that: (1) below Gage Dam, the railroad grade has proper riprap protection; and (2) the area between the railroad grade and the north end of the dam is not protected. This north shoreline is most affected by water passing over the spillway crest; the flow is further channelized by bedrock outcrops below the dam. The shoreline will continue to slowly erode at two levels: at the lower level during normal flows, and at the higher during high flows. Morrison (1993) recommends using riprap or gabions to protect both erosional levels.

Contrary to its engineer's findings, CVPSC states . . . "that the north bank along the plunge pool is tiered as a result of decades of spring run conditions; however, it is well vegetated and stable. To attempt modification would result in unnecessary environmental impacts when an unstable condition does not presently exist" (CVPSC 1994).

Our Analysis

Based on available reports and our observations, we conclude that existing erosion along the Passumpsic, and, to a certain extent, Gage impoundments is a natural phenomenon, consistent with normal river migration and independent of the operation of these projects. As a result, we do not recommend that CVPSC undertake mitigative measures.

Erosion and slumping on the north bank above the Gage Dam is consistent with scour that usually occurs on the outside river bank of a bend in the river. Over the more than 70 years of project operation, we expect that equilibrium developed between all dam-related flows (including flows associated with dropping of the 6-foot flashboards) and shoreline stability. Mature tree growth at the water's edge above the dam indicates a stable slope environment with only minor, natural erosion. There is no evidence (Morrison 1991 a-d) nor have we observed conditions at the site that indicate soil movement because of project operation.

Factors other than river flows have caused substantial erosion upstream of Gage Dam. Morrison (1991b) states that the condition of the river bank adjacent to Route 5 is impacted by highway drainage from a corrugated metal pipe near the top. Some riprap below the pipe controls erosion; however, it is in disarray and is ineffective. We conclude that Morrison did not properly emphasize the extent of erosion from Route 5 discharge. Photos in Morrison (1991b) show two distinct, large washouts on this slope due to improper or ineffectual stormwater discharge from Route 5. These washouts are devoid of vegetation and are beginning to propagate laterally. We conclude that the erosion in the Gage impoundment is either associated with normal river migration or caused by improper stormwater discharge from Route 5 and, therefore, is not the responsibility of CVPSC.

Downstream erosion on the east bank of the river at Gage is confined to the stretch of bank between the north end of the dam and the railroad riprapping. We agree with CVPSC's conclusion that the area is well vegetated and stable. A bedrock outcrop was observed at the center of this bank. Impacts associated with clearing and excavating to install riprap or gabions, as suggested by VANR, would be an unnecessary approach to such a minor, natural erosion problem.

Desilting Protocol

VANR requests that CVPSC develop a desilting protocol at each of the four projects. CVPSC indicates that, if sediment deposition in project reservoirs becomes a problem, it would develop a desilting protocol to allow removal of accumulated material without degrading water quality and damaging wildlife (VANR 1990).

This conclusion is based on CVPSC's experience at the Passumpsic projects' dams. The dams have been in place and the projects have been operating for about 65 years. During much of the time, the projects operated in a peaking mode, and any erosion of impoundment shoreline due to water level fluctuation could have resulted in silt accumulation behind the dams. Such accumulation has not occurred or has been below acceptable levels, and desilting has not been warranted.

After reviewing the available information, we conclude that, if after 65 years of operation there is no evidence of a sedimentation problem at these four dams, CVPSC should not now be required to develop a desilting protocol. Changing from a peaking to a run-of-river mode is less likely to result in erosion and sedimentation. The impoundment shorelines would be subject to less erosion, and there are no other significant upstream or tributary sources of sediment. It should be sufficient to observe conditions behind each dam and develop a desilting protocol only when a need is established.

Construction-Related Erosion and Sedimentation

Vegetation removal, earth disturbance, and construction activities associated with installation of proposed and recommended recreational facilities and fish ways could cause some short-term erosion and sedimentation. To avoid water quality impacts, erosion and the movement of sediments must be controlled during the construction process and until site restoration is completed. Control measures, which are inexpensive to plan and implement, would yield significant water quality benefits. Therefore, we recommend that CVPSC develop and implement a plan to control erosion and sedimentation at each construction site. The plan should include site-specific measures and an implementation schedule.

c. Unavoidable adverse impacts: There may be some minor, short-term increases in erosion and sedimentation associated with the construction of downstream fish passage and recreational facilities.

2. Water Resources

a. Affected environment:

Water Quality

The mainstem of the Passumpsic River in project-affected reaches is classified as Class B water. The impoundment of the Pierce Mills Project and the downstream reach to the St. Johnsbury Village limit is designated Class B water. A waste management zone extends 4.8 miles from this point to Passumpsic Dam. Downstream of the Passumpsic Dam is Class B water.

The State of Vermont considers the Passumpsic River a coldwater stream, capable of supporting salmonid fisheries. The dissolved oxygen (DO) standard for such streams, regardless of water quality class, is 6 milligrams per liter (mg/l) or 70 percent saturation unless the area is a designated spawning area, in which case the standard is 7 mg/l or 75 percent saturation.

The applicant conducted a comprehensive DO survey (273 samples) at stations upstream, in the bypassed reaches, and downstream of all four projects (Aquatec, Inc. 1991a) to support an assessment of whether additional spillage was warranted to improve DO conditions in the Passumpsic River. The survey was conducted during extremely low-flow conditions (100 to 120 cfs during the majority of the study) in July with the projects operating in run-of-river mode, as CVPSC proposes to operate them in the future. The lowest DO measured was 7.20 mg/l (85 percent saturation) and the maximum DO was 12.45 mg/l (152 percent saturation). This indicates that the treatment plants on the Passumpsic River are discharging nutrients, which stimulate algal growth. Water temperature during the survey ranged from 67.6èF in the Pierce Mills tailrace to 81.0èF in the Passumpsic impoundment just upstream of the flashboards. Most temperatures were in the low- to mid-70s.

Water Quantity

Table 3 presents the estimated mean, maximum, and minimum flows in the Passumpsic River at the four projects. Lowest flows typically occur during August, and highest flows occur during April and May. The lack of flow at certain times presumably results from artificial flow regulation due to hydroelectric project operation.

Since 1828, at least 16 damaging floods have occurred in St. Johnsbury. The November 1927 flood is the event of record. Both heavy rainfall (with and without snowmelt) and ice jams (FEMA 1986) have caused flooding on the Passumpsic River. The principal flood-prone areas are St. Johnsbury Center (between Pierce Mills and Arnold Falls), the Village of St. Johnsbury

Table 3. Estimated Annual Flow Characteristics of Passumpsic River Projects

	Mean (cfs)	Maximum (cfs)	Minimum (cfs)
Pierce Mills	403	10,347	0
Arnold Falls	432	11,090	0
Gage	704	14,584	12
Passumpsic	704	14,584	12

*Period of record: 1928 to 1984.

(near Arnold Falls), and the area surrounding the confluence of the Sleepers and the Passumpsic rivers (between Arnold Falls and Gage)(FEMA 1986).

Water Rights

In the application's initial statement, CVPSC indicates that, according to its best knowledge, all Pierce Mills, Arnold Falls, Gage, and Passumpsic project's property and rights (including water rights) are owned by the applicant. CVPSC also states that it has fully complied with all state laws that affect the projects as proposed with respect to bed and banks and to the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power, and in any other business necessary to accomplish the purposes of the licenses under the FPA.

There are no water diversions between any of four project dams and tailraces, and operation of the projects does not require any consumptive water use. Consequently, the projects would not affect any existing water rights.

b. Environmental impacts:

Water Quality

Run-of-River Operations

The conversion of all four projects to run-of-river operation (instantaneous inflow to each project is equal to instantaneous outflow from each project), as proposed by CVPSC, would return the unimpounded portions of the river to their natural flow regime.

VANR states that the conversion of each project to run-of-river operation "is expected to improve water quality below the project(s), as downstream flows will no longer be subject to

artificial drought conditions and concomitant poor water quality." Interior agrees that the "proposed run-of-river operation mode for the four projects minimizes impacts associated with reservoir fluctuations and fluctuating flows downstream from the project during normal operations."

Our Analysis

We agree that conversion of the four projects to run-of-river operation would benefit downstream water quality. During present peaking operations, there are extended periods of low flow downstream of each project because water is stored in the impoundment. Isolated pools of water in the stream channel may be warmed under these circumstances, especially during the summer, and the temperature tolerances of coldwater and even warmwater fish may be exceeded. The shallower downstream water caused by storage is also more subject to solar warming. Such warming may lower the DO regime and result in water quality standard violations. Artificially low streamflow also magnifies the influence of toxic chemicals that may be in the stream because they are less diluted.

Run-of-river operations also would improve the water quality in all four impoundments. Storage of water associated with peaking causes short-term stagnation of water in the impoundments. Uncirculated surface water is warmed by solar radiation for a longer period than with run-of-river operations. Oxygen-demanding properties of bottom sediments are increased by stagnant water. These factors can result in marginal DO in the cooler bottom water, which is where coldwater fish would most likely seek refuge from warmer surface water. When stored water is released for generation during peaking operations, downstream water quality (DO and temperature) can suddenly diminish to stressful levels for aquatic biota.

We recommend the conversion of all four projects to run-of-river operation, because this mode would improve water quality in the Passumpsic River.

Dam Spillage

Water quality may be adversely affected by hydroelectric plant operation, particularly in rivers that receive discharges from wastewater treatment plants. Some of these organically enriched rivers may experience low DO concentrations which violate water quality standards and adversely influence aquatic biota.

Water quality in most rivers, however, is enhanced by the natural reaeration that occurs when water flows over cascades or spills over dams. When low DO is identified as a problem in a

river, controlled spillage over dams is sometimes used to improve the problem.

Dam spillage, however, tends to skim warm surface water from the impoundment, which may have a negative impact on downstream water quality. Water released through turbines is often cooler than water spilled over the dam because typically the turbine intake draws in cooler, deeper water. This is an important consideration in a river that is managed for coldwater fisheries, such as the Passumpsic.

According to the water quality study performed by the applicant (1991a), there is significant reaeration potential at each of the four dams. VANR indicates that the algal influence on the Passumpsic River's DO regime would be exacerbated as the St. Johnsbury wastewater plant loading increases. Consequently, dam spillage as a point source of reaeration may sometimes be necessary to maintain DO standards. However, VANR indicates that their recommended bypass flows and impoundment refilling would result in the projects meeting DO and temperature standards and the anti-degradation provisions of the water quality regulations.

Our Analysis

We conclude that water quality is presently not a problem in the mainstem of the Passumpsic River, and that controlled spillage is not necessary to improve water quality. VANR suggests that controlled spillage may be required in the future if additional nutrient loading creates a low DO problem, but we consider this is speculation. Controlled spillage may not be an effective means to improve water quality. Water temperature, which is presently marginal for coldwater fisheries, could be increased. We agree that the present high DO conditions (often supersaturated) indicate high organic enrichment from the water treatment plants in the Passumpsic River Basin. We are concerned that additional bypass spillage may be requested to correct DO problems before corrective actions are taken with pertinent wastewater dischargers in the Passumpsic River Basin. By addressing the high nutrient load problems now, VANR would avoid unwarranted loss of additional generating capacity caused by controlled spillage.

Bypass Flows

Although water quality is a consideration when setting minimum flows in the bypassed reaches, the primary factors for setting flows are related to aquatic habitat. Therefore, bypass flows are discussed in detail in Section V.C.3, Fishery Resources.

Flooding Resulting from the Project's Impoundment Elevation

The sequence of dams on the Passumpsic River provides a backwater upstream of each dam. The length is dictated by local topography, dam height, and flashboard deployment. These dams were constructed in the 1920s so their backwater impacts have been in place for more than 70 years, and development in and adjacent to the floodplain has had to contend with these impacts. The flashboards of all four dams wash out prior to the onset of the 10-year and greater flood events; consequently they have no effect on floods greater than the 10-year event.

VANR expresses concern about the effects of the Passumpsic, Gage, Arnold Falls, and Pierce Mills dams on floodstages due to backwater. In particular, they cite the effects of the Passumpsic Dam on Town Highway 11, and the impacts of Gage Dam on the St. Johnsbury wastewater treatment plant.

Detailed descriptions for each of the dams are presented below.

Pierce Mills Project

CVPSC's operational procedures at the Pierce Mills Project maintain the pond level at +/- 1 inch above the 1.5-foot-high flashboards, at elevation 605.0 feet msl. Flashboards are designed to fail when the water surface elevation is 1.5- to 2.0-foot over their crest (606.5 to 607.0 feet msl). Their replacement is scheduled for mid-May since the flashboards are always taken out by winter ice. Non-scheduled replacement occurs at most once per year as a result of a summer storm event.

Review of the Federal Emergency Management Agency (FEMA) flood profiles shows that the backwater effect of the dam ends 2,500 feet upstream. Field observations show that the affected area is undeveloped.

Arnold Falls Project

The Arnold Falls Dam has north and south spillway sections that are topped with wooden flashboards 1.5 feet high. These boards raise the water surface elevation to 574.3 feet msl. Flashboards are designed to fail when the water surface elevation is 1.0- to 1.5-foot over their crest (575.3 feet to 575.8 feet msl). This stage corresponds to a discharge of 1,820 cfs. Flashboards are scheduled for replacement in mid-May since they are always taken out by winter ice. Non-scheduled replacement seldom occurs.

Because reservoir inflows equal to or greater than 1,820 cfs cause the flashboards to fail, project flashboards do not increase upstream flood stages for flood events that produce this

inflow. The 10-year discharge equals 7,700 cfs with a corresponding stage of 578.6 feet, which exceeds the flashboard failure elevation. As observed on the FEMA flood profiles, the dam's backwater influence appears to end 2,500 feet upstream of the dam. At this point the water surface profiles parallel the stream bed.

For storm events that produce inflows under 1,820 cfs, some incremental increase in upstream water levels results from the flashboards. The magnitude of this incremental increase is less than or equal to the height of the flashboards and, as observed on the FEMA Flood Insurance Rate Map, is well contained within the narrow, steep banks.

Gage Project

The Gage Project flashboard system currently consists of two sections, a 42-foot spillway with 1-foot-high boards and the 176-foot main dam comprised of 6-foot-high by 4-foot-long panels. CVPSC's operational procedure currently calls for maintaining the pond level at elevation 539.9 feet msl with the flashboards in place. CVPSC proposes to operate without the 1-foot boards and with a target flow of 0.25 feet over the spillway; this proposed action provides 0.75 feet of freeboard and reduces the pond level to elevation 539.15 feet msl.

The hinged flashboards are designed to fail naturally when the water surface elevation is 3.0 feet over their crest (elevation 542.3 feet msl); this stage corresponds to a discharge of 4,535 cfs. Typically, flashboards are voluntarily dropped three times in March, three times in April, and once in May. CVPSC operators begin dropping the boards with between 1 and 2 feet of flow over the crest. This manipulation is intended to reduce potential upstream flooding. Flashboard replacement is scheduled for mid-May, since the flashboards are always taken out by winter ice. Non-scheduled replacement seldom occurs from June through December.

Because reservoir inflows equal to or greater than 4,535 cfs cause the flashboards to fail, project flashboards do not increase upstream flood stages for flood events that produce this inflow. The 10-year discharge equals 11,830 cfs with a corresponding stage of 545.8 feet msl, which exceeds the flashboard failure elevation. Review of the FEMA flood profiles shows that the dam's backwater effect ends approximately 2,000 feet upstream at Interstate 91. At that point the flood profile starts to parallel the stream bottom. This change in profile slope is indicative of normal flow depth which is unaffected by the dam.

For storm events that produce inflows under 4,535 cfs, some incremental increase in upstream water levels would result from

the flashboards if they are not manually lowered. The magnitude of this incremental increase is less than or equal to the height of the flashboards. Under normal conditions, operational procedures prevent this increase.

As noted by CVPSC, the St. Johnsbury wastewater treatment plant outfall has been placed at an elevation less prone to backwater effects. We have seen no evidence to indicate that backwater is a problem at the treatment plant.

Passumpsic Project

CVPSC's operational procedures for the Passumpsic Project call for maintaining the pond level at elevation 520.98 feet msl using the flashboards. The flashboards are 1 foot high and placed along the north and south spillways. They are designed to fail when the water surface elevation is 1.0 to 1.5 foot over their crest (elevation 521.98 feet to 522.48 feet msl); this stage corresponds to a discharge of 1,970 cfs. Their replacement is scheduled for mid-May, since the flashboards are always taken out by winter ice. Non-scheduled replacement seldom occurs.

Because reservoir inflows equal to or greater than 1,970 cfs cause the flashboards to fail, project flashboards do not increase upstream flood stages for flood events that produce this inflow. The 10-year discharge equals 12,100 cfs with a corresponding stage of elevation 526.8 feet msl, which exceeds the flashboard failure elevation.

For storm events that produce inflows under 1,970 cfs, some incremental increase in upstream water levels results from the flashboards. The magnitude of this incremental increase is less than or equal to the height of the flashboards. Since existing freeboard under Town Highway 11 is on the order of 2 feet, the flashboards do not adversely affect Town Highway 11 for any flood event.

Our Analysis

We reviewed the FEMA Flood Insurance Studies for the Town of Barnet, Vermont (FEMA 1988) and Town of St. Johnsbury (FEMA 1986). The applicant's data and FEMA flood studies provide adequate information to estimate the effects of flooding from the projects. FEMA studies are concerned with floods of 10-year and greater frequency.

Our review of project hydraulics and hydrology demonstrates that the projects do not increase flood stages for 10 year and greater frequency events. For events of smaller frequency, there are some incremental increases in flood stages because of flashboards at Pierce Mills, Arnold Falls, and Passumpsic. This incremental increase in flood stages is minor: at Pierce Mills

the upstream area is undeveloped; at Arnold Falls the upstream area has steep banks that contain the increase; and at Passumpsic the increase is less than the freeboard under Town Highway 11. Therefore, we conclude that CVPSC does not need to implement additional protective measures to control flooding.

Dam Removal

Dam removal at either the Pierce Mills or Gage projects would return the river to its natural state upstream and in the project bypass channels. Natural aeration of the river near these two projects would increase at the cascades that would be exposed in the currently impounded reaches. However, the present DO regime meets Vermont's water quality standards.

Without the impoundments, streamflow velocity would increase. Consequently, impacts from solar heating of surface water and reduced DO associated with bottom water would diminish. This would create more favorable habitat for coldwater fish. If the dams were removed, there would be short-term increased turbidity and sedimentation, as fine particles were flushed from the bottom of the former reservoirs. If a large amount of sediment was present in the reservoirs (as determined by dam removal studies), it would be dredged as part of the dam removal process. Therefore, the quantity of any remaining sediment would be small.

The dams currently provide some regulation of variable flows, including periodic high flows that would otherwise overtop the river banks and spread across the adjacent floodplain. Primarily, however, the dams are not built or operated for flood control because their storage capacity is limited to daily peaking. Thus, larger flooding events are not precluded, but they are somewhat modified by operations at the dams.

If the Pierce Mills Dam were removed, there would be no regulation above Arnold Falls Dam, and more frequent and extensive flooding would occur. Similarly, if the Gage Dam were removed, the Arnold Falls Dam would provide some flow regulation, but only as far downstream as the confluence of the Moose River. The river reach from the Moose River to the Passumpsic Dam would be subject to some additional flooding. Given the amount of flood control currently available from these dams and the flooding that now takes place, dam removal would result in a minor increase in periodic flooding.

c. Unavoidable adverse impacts: Minor, periodic flooding from high flows less than the 10-year flood event would occur at some locations along the Pierce Mills, Arnold Falls, and Passumpsic projects' impoundments. The water surface elevation would be limited to the height of the flashboards at each project (i.e., no more than 1.5 feet).

3. Fishery Resources

a. Affected environment:

Game Species

The Passumpsic River, managed by the Vermont Department of Fish and Wildlife (VDFW) as a coldwater fishery, supports both wild and stocked populations of brook, brown, and rainbow trout (Interior 1993). Brown trout and rainbow trout are stocked from the Vail Dam, upstream of Pierce Mills, to the Gage Dam. From the Passumpsic Dam to the East Barnet Dam, only rainbow trout are stocked.

VDFW studies indicate that the Passumpsic River drainage basin contains a higher percentage of brook trout (relative to brown and rainbow trout) than any other drainage basin studied throughout the state (VANR 1993). This is evidently due to successful natural reproduction in suitable habitats (most often coldwater tributaries with gravel substrate and pool/riffle flow characteristics). FWS, in a letter dated April 10, 1989, indicates that high summer stream temperatures limit salmonid habitat in the mainstem of the Passumpsic River.

The only other game fish species known to occur in the Passumpsic River are sunfish, yellow perch, and brown bullhead (VANR 1993). Trout anglers often consider sunfish and yellow perch to be a nuisance because they readily take the same bait as trout. However, sunfish, yellow perch, and brown bullhead have sport value for younger anglers. Smallmouth bass and largemouth bass are reported to exist in the Passumpsic River only below the East Barnet Project (VAEC 1986), which is downstream of the four projects discussed in this EA.

Non-Game Species

Non-game fishes that occur in the Passumpsic Basin are typical of coldwater streams and include white sucker, longnose dace, creek chub, fallfish, and slimy sculpin.

Atlantic Salmon

Historically, the Passumpsic River probably supported anadromous Atlantic salmon. Efforts are underway to restore anadromous Atlantic salmon to the Connecticut River Basin. The Strategic Plan for the Restoration of Atlantic Salmon in the Connecticut River Basin includes the Passumpsic River drainage as a component of the program (PCMMCR 1982). This plan identifies the Passumpsic River as potential non-natal smolt production habitat.

FWS (letter from Gordon Beckett, Supervisor of New England Field Offices, dated September 25, 1991) indicates that the 6,000 Atlantic salmon nursery units (one unit=100 square yards) in the Passumpsic Basin are upstream of the Pierce Mills Project. In its comment letter dated July 6, 1994, however, VANR indicates that VDFW revised the estimate of available Atlantic salmon nursery habitat in the Passumpsic Basin to about 20,000 units, with 8,200 units upstream of Pierce Mills. CVPSC estimates that in the mainstem of the Passumpsic River from the Pierce Mills Dam to the end of the free-flowing river downstream of the Passumpsic Project there are 1,835 units, 105 of which are in the bypassed reaches of the four projects (Ritzi 1991).

Although spawning adult salmon are not expected to return to the Passumpsic River (the East Barnet Dam is a barrier to adults moving up the Connecticut River), Atlantic salmon fry and parr have been stocked in the Passumpsic River since 1991 to produce smolts for the Connecticut River restoration program (Table 4). Smolts originating from these stockings should begin their downstream migration 1 to 3 years from the date of stocking (most migrate at 2 years). Presently, the only downstream passage route at the Passumpsic River projects is spillage over the dams or entrainment through the turbines.

Table 4. Atlantic Salmon Stocking in the Passumpsic River Basin (Source: Interior 1993)

Stocking Site	Year	Life Stage	Number
Passumpsic River (location not specified)	1991	Parr	6,100
	1994	Fry	77,589
Moose River	1991	Parr	8,900
	1993	Parr	50,000
	1994	Fry	152,355
Lower Moose River	1992	Parr	50,000
	1993	Fry	25,000
East Branch Passumpsic	1993 (spring)	Fry	25,000
	1994	Fry	91,387
Sleepers River	1994	Fry	23,965

Pierce Mills Project

The Pierce Mills Dam creates a 25-acre, 1.25-mile-long impoundment that backs up to the tailwaters of the Great Falls Project. The shallow impoundment has no tributaries entering it, and the substrate is predominantly sand and silt. An electrofishing survey conducted in 1989 collected only chubs,

longnose dace, white suckers, and tesselated darters. VANR (1993) considers this impoundment to have marginal value as lacustrine habitat.

The bypassed reach between the dam and the tailrace, which is about 240 feet long, has three habitat types. Directly below the dam is a 100-foot-long, 40- to 80-foot-wide section of deep run. Abutting the project tailrace is a 100-foot-long, 75- to 140-foot-wide section of shallow riffle. These two habitats are connected by a 40-foot-long, 45-foot-wide section of shallow run.

The predominant substrate throughout the bypass is ledge, but the deep run section has some sand and gravel areas. The substrate in the shallow run is ledge, boulder, and cobble. The riffle section has a moderate gradient and is characterized by small, shallow pocket pools in ledge with scattered boulder and cobble (Ritzi and MRM 1993a). There are an estimated 22 salmon nursery units in this bypassed reach (Ritzi 1991). VANR (1993) considers portions of the bypassed reach quality habitat for resident trout species and salmon rearing.

There are about 2 miles of free-flowing river between the tailrace and the Arnold Falls impoundment. There is a mixture of pool, run, and riffle habitats within this reach and an estimated 550 salmon nursery units (Ritzi 1991). Macroinvertebrate sampling in a riffle area about 100 yards downstream of the tailrace produced about 1,100 organisms in each of two samples. Forty-seven taxa were identified (indicating good species richness) and 29 taxa were mayflies, stoneflies, or caddisflies (taxa generally considered to be indicative of good water quality) (Aquatec, Inc. 1991b).

Arnold Falls Project

The Arnold Falls impoundment encompasses an area of about 7 acres, and is about 2,200 feet long. No tributaries known to have salmonid spawning habitat enter this impoundment. The impoundment has abrupt banks and lacks shallow embayments. There is no information regarding fish in the impoundment (and downstream of it), but VANR (1993) considers this impoundment to have marginal value as lacustrine habitat.

The Arnold Falls bypassed reach below the North Dam is about 250 feet long. The upper section of this north channel is shallow pocket pools in ledge, the middle section is moderate- to steep-gradient runs through ledge, and the lower section is shallow riffle with ledge and boulder substrate (Ritzi and MRM 1993b). VANR (1993) considers that portions of the north channel offer excellent habitat for salmonids, especially juvenile Atlantic salmon and other river fishes of all life stages. There are an estimated 30 salmon nursery units in this bypassed reach (Ritzi 1991).

The bypassed reach below the South Dam extends about 40 feet across ledge cascades before its confluence with the tailrace. The tailrace channel is about 150 feet long, with predominantly cobble substrate and riffle habitat, although scattered pockets of gravel may also exist (Ritzi and MRM 1993b). The tailrace and north channel converge in a large pool that, according to VANR, is a popular fishing spot (1993). VANR indicates that this large pool may hold adult brown trout that could move into the tailrace to spawn during project operation.

There is about 1 mile of free-flowing river between the tailrace and the Gage impoundment, which includes the confluence of the Moose River with the Passumpsic River. The Moose River is the major stocking site for Atlantic salmon fry and parr in the Passumpsic Basin. Most of this reach is riffle, although there is some run and pool habitat; there is an estimated 767 salmon nursery units (Ritzi 1991). Macroinvertebrate sampling in a riffle area about 250 yards downstream of the tailrace produced about 1,200 organisms in each of two samples. Forty-one taxa were identified, 22 of which were mayflies, stoneflies, or caddisflies (Aquatec, Inc. 1991b).

Gage Project

The Gage Dam creates a 15-acre, 1-mile-long impoundment. VANR (1993) considers the impoundment to have marginal value as lacustrine habitat.

At the base of the dam, in the beginning of the bypassed reach, is a large (about 2 acres), deep (up to 27 feet) plunge pool. This pool provides important adult salmonid holding habitat and is a popular fishing hole (Ritzi and MRM 1993c). Downstream of the pool is a 90-foot-long, 100-foot-wide, deep-to-moderate depth riffle habitat. Upstream of the confluence with the tailrace is a 160-foot-long, 100-foot-wide, shallow run habitat. Substrate in the bypassed reach downstream of the pool is cobble and gravel embedded with sand and silt.

There may be brown trout spawning and incubation in the riffle section. In June 1989, an electrofishing and seining survey collected three young-of-year brown trout, which indicates some successful spawning in this segment. A typical assemblage of suckers, minnows, and darters also were collected. No trout were collected in this reach during follow-up collections in August (Ritzi and MRM 1993c). An estimated 12 salmon nursery units are located within this bypassed reach (Ritzi 1991). Flow through the powerhouse causes "backwatering effects" that can influence this entire reach (Ritzi and MRM 1993c).

The 0.5 mile of free-flowing river between the Gage tailrace and the Passumpsic impoundment is mostly riffle or run habitat. There are an estimated 101 salmon nursery units in this reach

(Ritzi 1991). Macroinvertebrate sampling in a riffle area about 600 yards downstream of the tailrace produced about 1,500 organisms in each of two samples. Thirty-four taxa were identified, 18 of which were mayflies, stoneflies, or caddisflies (Aquatec, Inc. 1991b).

Passumpsic Project

The Passumpsic impoundment is about 18 acres and extends 4,600 feet. VANR (1993) considers its habitat value as marginal.

The bypassed reach between the dam and the tailrace is about 320 feet long. The upper 130 feet of this reach is a steep ledge with a few isolated pools that the resource agencies do not consider productive salmonid habitat. Downstream of this reach is a wide, deep pool followed by a narrow run before the confluence with the tailrace. The predominant substrate in this reach is ledge, although there are also numerous boulders (Ritzi and MRM 1993d). VANR (1993) indicates that there is a gravel bar on the north side of the bypass at the base of the falls and that the reach contains excellent habitat (pocket water) for adult salmonids. There are an estimated 41 salmon nursery units in this reach (Ritzi 1991).

There are roughly 2 miles of free-flowing river between the tailrace and the head of the East Barnet Project impoundment. Most of this reach is riffle and run habitat with an estimated 314 salmon nursery units (Ritzi 1991). Macroinvertebrate sampling in a riffle area 150 yards downstream of the tailrace produced about 1,650 organisms in each of two samples. Twenty-eight taxa were identified (the lowest of the four projects examined), 15 of which were mayflies, stoneflies, or caddisflies. Unlike the other three sites, where the dominant taxa were caddisflies, this sample was dominated by midge larvae (chironomids) (Aquatec, Inc. 1991b). These results suggest that water quality in this part of the Passumpsic River, due to organic enrichment, is not as good as it is further upstream.

b. Environmental impacts:

Run-of-River Operations

Fluctuations in the four impoundments under the applicant's proposed and our recommended run-of-river operating regimes would be minimal, thereby benefitting fish that spawn in near-shore habitats, because nests would not be dewatered during the late spring/summer spawning and nursery season. Run-of-river operation also would minimize flow fluctuations in unimpounded river reaches downstream of the project tailwaters (except during periods when the impoundments are refilled after flashboard installation), thereby enhancing salmonid habitat conditions in

these river reaches, including the estimated 1,730 Atlantic salmon nursery units.

Downstream Flows During Impoundment Refilling

Ice breakup and high flows during the spring usually cause the flashboards to fail. CVPSC subsequently replaces the boards. Flashboards at Pierce Mills, Arnold Falls, and Passumpsic usually are replaced during mid-May.

At Gage, the 6-foot-high flashboards are hinged, and a cable system is in place that facilitates repositioning of the flashboards. This enables the flashboards at this project to be voluntarily lowered during spring run-off to protect against upstream flooding. Normally, the flashboards at Gage are lowered three times in March, three times in April, and once in May.

When flashboards are replaced and impoundments are refilled, river flows downstream of the projects are significantly reduced. Although this flow reduction is only temporary, it can cause raised water temperatures and reduced DO levels, particularly in river segments that receive wastewater discharges.

VANR indicates that their "Interim Procedure for Determining Acceptable Minimum Stream Flows" and the FWS's "Flow Recommendation Policy for the New England Area" specify certain aquatic base flows (ABFs) that are designed to perpetuate indigenous fish species. These ABFs are based on the size of the drainage basin at the specific site and are calculated as cubic feet per square mile of drainage basin (csm). The ABFs are 4.0 csm for spring spawning and incubation, 1.0 csm for fall/winter spawning and incubation, and 0.5 csm for the remaining period and in cases where there is no spawning and incubation.

Reducing flow substantially below these minimum levels to refill the impoundment may imperil fish below the project. VANR believes that during the occasional refill periods, CVPSC should provide a continuous release of the FWS ABFs (or 90 percent of the inflow to the project when the natural inflow is insufficient to provide the appropriate ABF flows). Table 5 presents VANR's proposed downstream flows during reservoir refilling. Interior generally agrees with VANR, and their recommended flows are also indicated in Table 5.

CVPSC agrees conceptually with the VANR recommendation. However, they propose to release 0.67 csm if the reservoir requires refilling from October 1 to March 31, rather than the 1.0 csm recommended by the resource agencies (see Table 5). CVPSC offers no justification for this proposed fall/winter ABF. The applicant proposes to measure the flow below the stations in terms of generator output, and has converted downstream flows to equivalent kilowatts of generation.

Table 5. Proposed Downstream Flows* During Impoundment Refilling

	VANR	Interior	CVPSC
Pierce Mills			
June 1-September 30	>118 cfs	>119 cfs	>118 cfs (80 kW)
October 1-March 31	90% Inflow	>237 cfs	
April 1-May 31	90% Inflow	>948 cfs	>159 cfs (180 kW)
			90% Inflow
Arnold Falls			
June 1-September 30	>127 cfs	>127 cfs	>127 cfs (90 kW)
October 1-March 31	>254 cfs	>254 cfs	
April 1-May 31	90% Inflow	>1,016 cfs	>170 cfs (120 kW)
			90% Inflow
Gage			
June 1-September 30	>206 cfs	>207 cfs	>206 cfs (160 kW)
October 1-March 31	>413 cfs	>413 cfs	
April 1-May 31	90% Inflow	>1,652 cfs	>277 cfs (210 kW)
			90% Inflow
Passumpsic			
June 1-September 30	>214 cfs	>214 cfs	>214 cfs (310 kW)
October 1-March 31	>428 cfs	>428 cfs	
April 1-May 31	>1,712 cfs	>1,712 cfs	>287 cfs (410 kW)
			90% Inflow

* When natural inflow to the project is insufficient to meet the specified flow, 90 percent of instantaneous inflow would be released.

Our Analysis

The three flow release proposals presented in Table 5 are relatively similar. All three proposed downstream flows during the summer are the same (with the exception of Pierce Mills). During April and May, VANR and CVPSC both propose a release equivalent to 90 percent of project inflow at Pierce Mills, Arnold Falls, and Gage. Interior always specifies a proposed release flow in conjunction with the 90 percent default value.

Downstream aquatic habitats should be protected during flashboard replacement (or after other necessary impoundment water level lowering) by providing downstream flows that are sufficient to prevent lowered water levels and resultant impacts

to aquatic biota inhabiting shallow water areas. Concurrently, the reservoirs should be refilled as quickly as possible to minimize the period of near-shore aquatic habitat dewatering and associated impacts to aquatic biota. Potential impacts to shoreline-dwelling wildlife, especially during the nesting season, also would be reduced by prompt reservoir refilling. Therefore, we support Interior's recommended flows during impoundment refilling (except as modified below) because they would reduce refilling time when inflow to the projects is greater than 10 percent over the ABF flows.

We also note that at Pierce Mills, summer ABF is listed by Interior as 119 cfs, whereas VANR and CVPSC list it as 118 cfs. We calculate the summer ABF flow to be 118.5 cfs. We believe this difference to be inconsequential and not at odds with Interior's recommendation because it represents the summer ABF.

We do not accept CVPSC's proposed flows for the fall/winter period. The values selected are unsupported. In particular, no biological basis has been provided for the selections. This is in contrast with the use of ABF by both VANR and FWS to define habitat needs.

CVPSC's suggestion to monitor generator output in lieu of directly measuring flow is reasonable. We recommend that CVPSC develop a flow monitoring plan (including downstream flows during reservoir refilling, bypass flows, and run-of-river operation) in consultation with VANR and FWS.

Bypass Flows

Each of the four projects has a bypassed reach that currently receives only a small amount of leakage and local drainage when inflow to the project is greater than the minimum operating range of its turbines but less than the maximum hydraulic capacity of the project's turbines. This low flow has a detrimental effect on aquatic habitat. Riffles and shallow pools can be dewatered, exposing the eggs of trout and stressing aquatic invertebrates. Dewatering also limits the amount of space available for fish to search for food and escape from predators. Fish can become stranded in isolated pools and subjected to excessive water temperature from solar radiation.

CVPSC originally proposed to provide bypass flows of less than 7Q10 and ABF at all four projects. FWS and VANR indicated that the proposed flows would be inadequate, and that habitat-based studies or demonstration flows were necessary to establish appropriate bypass flows at each project. CVPSC subsequently conducted habitat-based studies in each bypassed reach. Analysis of the bypass flows at each project is presented below.

Pierce Mills Project

The species and life stages of concern are juvenile Atlantic salmon and adult rainbow trout. Figure 8 shows changes in weighted usable area (WUA) at five study flows ranging from 13 cfs to 171 cfs. CVPSC concluded that, based on its study, the best minimum flow for the targeted species and life stages was 49 cfs. However, CVPSC concluded that the economic cost of providing this bypass flow was not justified and, consequently, proposed a bypass flow of only 13 cfs or inflow, whichever is less.

VANR indicates that, although the area represented by the bypassed reach is relatively small, it represents a disproportionate amount of the high quality habitat for salmonids in the river's mainstem. A flow of 13 cfs would not support fisheries habitat or VANR management goals for this reach. VANR, in contrast, recommends an instantaneous minimum flow of 88 cfs or inflow, whichever is less.

Interior agrees that a flow of 13 cfs is far too low to adequately protect fish and other aquatic life, especially since Interior considers that the Pierce Mills bypassed reach is one of the most important of the four bypassed reaches. This agency also recommends an instantaneous minimum flow of 88 cfs, because this flow would provide 94 percent of the maximum salmon habitat and 92 percent of the maximum adult rainbow trout habitat.

CVPSC (letter from John Mullen dated February 8, 1994) reiterates that its proposed 13 cfs minimum flow or inflow, whichever is less, coupled with the conversion of the project to run-of-river operation, represents an equitable balance between environmental enhancement and lost generation.

Our Analysis

Our review of the bypass flow study leads us to conclude the CVPSC's proposed minimum flow of 13 cfs or inflow, whichever is less, is clearly inferior to the 88 cfs or inflow, whichever is less, recommended by the resource agencies. A minimum flow of 88 cfs or inflow, whichever is less, would provide: significant gains in salmonid habitat, and more than twice the WUA available for juvenile salmon (13,445 square feet compared to 6,257 square feet) and adult rainbow trout (11,919 square feet compared to 4,421 square feet) relative to the lower flow.

The importance of the bypassed reaches for production of Atlantic salmon smolts (the Pierce Mills bypass has an estimated 22 salmon nursery units) is downplayed by CVPSC, because of the presence of about 550 nursery units downstream of the Pierce Mills tailrace. However, because of the degree of impounding by

Figure 8

hydroelectric projects, the availability of high quality salmonid habitat in the mainstem Passumpsic River is extremely limited. Support for the uniqueness of the habitat in the bypassed reaches is also provided by CVPSC's own consultant. Its survey to identify potential salmon nursery habitat along 13 miles of river influenced by all four projects indicates that: "the best Atlantic salmon nursery habitat is in the occasional, short, shallow riffle drops and in the Pierce Mills, Arnold Falls, and Passumpsic bypass channels . . ."(Ritzi 1991).

We present our recommendations on minimum flows in the bypassed reach in Section VII.C. We conclude that a minimum flow of 88 cfs or inflow, whichever is less, would represent a significant enhancement of fish habitat in this bypassed reach.

Arnold Falls Project

The species and life stages of concern are juvenile Atlantic salmon and adult rainbow trout. CVPSC proposes to release 20 cfs or inflow, whichever is less, to the north channel to enhance this habitat. Figure 9 illustrates the changes in WUA at four study flows ranging from 20 cfs to 106 cfs over both the North and South dams. (A fifth study flow, 145 cfs, was proposed, but conditions during the studies were not suitable to achieve this flow.) Although study flows were released to both the north and south bypassed channels, habitat in the 40-foot-long south channel is cascade and ledge and, therefore, does not represent significant fish habitat. Consequently, total study flows must be apportioned to obtain estimated flows into the north channel, where habitat is considered good. This flow is estimated to be 74 percent of the total study flow.

When the project is not generating, flows to the tailrace through the south channel would be limited to leakage if all flows are provided to the north channel. The agencies, therefore, requested that CVPSC assess the tailrace channel for brown trout spawning and incubation. Figure 10 presents the results of this assessment. (Tailrace flows are CVPSC's best estimate based on deducting the north channel flow from the total river flow.)

VANR concludes 20 cfs or inflow, whichever is less, through the north channel would not support fisheries habitat in the bypass or VANR's management goals for this reach. VANR recommends providing an instantaneous minimum flow of 78 cfs or inflow, whichever is less, to the north channel. VANR states that because site-specific data are not available to establish the minimum flow in the tailrace (downstream of the South Dam) when the project is not generating, an appropriate flow for this reach would be 26 percent of ABF (that portion of the ABF that would spill over the South Dam to the tailrace) or 33 cfs when

Figure 9

Figure 10

the plant is not generating. Interior agrees with VANR's recommendations.

CVPSC responds that its proposed minimum flow of 20 cfs or inflow, whichever is less, to the north channel, coupled with the conversion of the project to run-of-river operation, represents an equitable balance between environmental enhancement and lost generation. Its consultants, Ritzi and MRM (1993b), indicate that ensuring flow to the tailrace when the project is not generating would require construction of a mechanism to deliver the recommended flow, although they did not speculate about the nature of the mechanism.

Our Analysis

CVPSC's proposed minimum flow to the north channel is inferior to the 78 cfs recommended by the resource agencies. However, the incremental differences in habitat gained by increasing flow from the level proposed by the applicant to that recommended by the resource agencies are much less pronounced at Arnold Falls than at the Pierce Mills bypass.

We assume that the actual flow to the north channel at the 20 cfs study flow (which provided flow to both the north and south channel) was about 15 cfs. Therefore, a release of 20 cfs only to the north channel would result in somewhat more than the WUA of 7,849 square feet for Atlantic salmon and 5,793 square feet for rainbow trout quantified during the study.

The increase in WUA measured between study flows of 44 and 67 cfs (north channel flows of 33 and 50 cfs, respectively) was 1,261 square feet for salmon and 1,104 square feet for rainbow trout. The WUA increase when the north channel flow was increased to the resource-agency recommended 78 cfs was 1,584 square feet for salmon and 959 square feet for rainbow trout.

The Arnold Falls north channel bypassed reach is uniquely important habitat relative to most of the rest of mainstem Passumpsic River for the same reasons presented in the discussion of the Pierce Mills bypassed reach. It is appropriate to enhance this habitat to the extent proposed by the agencies, and we conclude that a flow of 78 cfs or inflow, whichever is less, would substantially enhance fish habitat. This conclusion is conservative, because the applicant did not evaluate the proposed 145 cfs flow; consequently, there are no available data supporting habitat changes at study flows over 106 cfs. We assume that there would not be significant increases in habitat at total flows over 106 cfs. Because there are no data to substantiate this assumption, we cannot recommend north channel bypass flows of less than 78 cfs.

We do not agree with the resource agencies' recommended flow of 33 cfs (based on apportioned ABF) to the south channel when the project is not generating. Habitat data pertaining to the tailrace are available from CVPSC's study, although the format makes it difficult to apply the data to the concerns addressed by the resource agencies for spawning and incubating brown trout. We developed Figure 10 from data presented but not plotted in Ritzi and MRM (1993b). WUA for spawning and incubation is maximized at a flow of 21 cfs, not 33 cfs. However, we must point out that much of the tailrace is rendered unsuitable for spawning and incubation when the project is generating. The effects of high flows on spawning and incubation are apparent in Figure 10. Extrapolating to the maximum hydraulic capacity of the plant, 262 cfs, it is evident that WUA is likely to be very small (although not necessarily eliminated) when the plant is generating. High velocities (greater than 2.9 feet/second according to the suitability index for velocity) would wash out eggs deposited in gravel nests. Therefore, we conclude that a tailrace flow of 21 cfs provided when the plant is not generating would protect any spawning and incubation habitat not rendered unsuitable by high flows as well as ensure that aquatic macroinvertebrate habitat is not totally dewatered.

We conclude that flows to the tailrace would be provided with no incremental cost to CVPSC by using the downstream fish passage sluice (downstream fish passage is discussed later in this section). However, CVPSC would need to develop a plan to ensure this minimum flow was released if the plant stops generating when the fishway is not operating.

Gage Project

The species and life stages of concern are brown trout spawning and incubation, and brown trout juveniles. Figure 11 presents changes in WUA at seven study flows ranging from 14 cfs to 210 cfs. This bypassed reach is affected by backwater from turbine releases; consequently, the wicket gate settings provide a measure of flow through the turbines at the different study flows (greater gate settings indicate higher through-turbine flows).

CVPSC proposes to release 17 cfs or inflow, whichever is less, from May 2 to September 30, to enhance juvenile brown trout habitat. From October 1 to May 1, it would release 32 cfs or inflow, whichever is less, to enhance brown trout spawning and incubation.

VANR concludes that CVPSC's proposed flow regime would not support fisheries habitat in the project bypass or VANR management goals for this reach. VANR recommends that CVPSC provide an instantaneous minimum flow of: 82 cfs (the 7Q10 flow) or inflow, whichever is less, from June 1 through September 30 to

Figure 11

maintain water quality and circulation within the large pool at the base of the dam; and 142 cfs or inflow, whichever is less, from October 1 through May 31 to enhance brown trout spawning and incubation. Interior now agrees with VANR. (Interior, by letter dated July 1, 1994, accepted the flows specified in VANR's water quality certificates.)

Our Analysis

CVPSC's proposed minimum flow regime would protect brown trout spawning and incubation as well as brown trout juveniles. Incremental gains in WUA for spawning and incubation at flows above 32 cfs are relatively small. WUA associated with the resource agencies' 142 cfs recommended minimum flow is only slightly higher than at lower flows.

During the instream flow study, the wicket gates were 95 percent open at the 142 cfs study flow, indicating that a backwater effect influenced the results. We expect that backwatering reduces the velocity of flow through the bypassed reach. As we noted in the discussion of tailrace flows at Arnold Falls, water velocity equal to or greater than 2.9 feet per second has a suitability index of zero, most likely because eggs are scoured from their nests. Thus, at reduced turbine discharges, the velocity of a 142 cfs minimum flow release would be greater than at high turbine discharge; high-velocity bypass flows could have an adverse impact on incubating eggs. We recommend, therefore, CVPSC's proposed spawning and incubation flow of 32 cfs or inflow, whichever is less, because it represents a reasonably protective minimum flow for spawning and incubating brown trout eggs.

Bypass flows must be timed to ensure maintenance of suitable incubation of brown trout eggs, because reduction in the minimum bypass flow to 17 cfs would eliminate nearly all WUA for spawning and incubation (Figure 11) and could have a substantial adverse impact on brown trout larvae that have not yet emerged from the gravel (they could not escape from unsuitable conditions).

The length of time required for brown trout to hatch decreases at higher water temperatures. At 1.9oC brown trout eggs take about 5 months to hatch (Raleigh et al. 1986; Smith 1985). Because brown trout can spawn as late as November or early December (Smith 1985), we reviewed water temperature data near the Gage Project during February (0.0oC) and April (2.0oC), 1972 (USGS 1974). Based on these temperature data, we conclude that brown trout eggs spawned in the Passumpsic River could take up to 5 months to hatch, and eggs spawned at the end of November may not hatch until the end of April. However, the larvae do not emerge from the gravel until their yolk sac has been absorbed, which may not occur before sometime in May. Therefore, we agree

with VANR that the 32 cfs minimum bypass flows to protect incubation of brown trout eggs should continue through May 31.

Based on this analysis, we would support the following minimum flows at the Gage Project: 32 cfs or inflow, whichever is less, from October 1 through May 31; and 17 cfs or inflow, whichever is less, for the remainder of the year. However, the VANR's recommended values were made a condition of the WQC and will be included as part of any license issued for this project.

Passumpsic Project

The species and life stage of concern is rainbow trout adults. CVPSC proposes to release a minimum flow of 26 cfs or inflow, whichever is less, to enhance rainbow trout habitat.

Habitat estimates are based on the percentage of area represented by transects in the bypassed reach judged to be "good" rainbow trout habitat. Determination of "good" habitat is based on a Habitat Suitability Index that takes into account depth, velocity, and substrate suitability curves developed elsewhere for adult rainbow trout. This approach was developed with resource agencies and used at other projects in Vermont and Massachusetts (Ritzi and MRM 1993d). Figure 12 presents the results of this survey.

VANR concludes that the applicant's proposed minimum flow of 26 cfs or inflow, whichever is less, would not support fisheries habitat or VANR management goals for this reach. Although a flow of 165 cfs provides the best habitat conditions, VANR originally considered 110 cfs or inflow, whichever is less, to provide acceptable habitat given the relatively short length of suitable habitat (only 190 feet is not ledge cascades). When the WQC was issued for the Passumpsic Project, VANR conditioned a flow of 86 cfs, instead of 110 cfs. The VANR's letter dated July 6, 1994, commenting on the staff's DEA formally modified the agency's flow recommendation to 86 cfs or inflow, whichever is less.

Interior considers habitat in this reach to be limited by substrate and reach length. They believe that water quality and aesthetic considerations in this reach are likely to be as important as habitat concerns. Their current recommended minimum flow also is 86 cfs (the 7Q10 flow) or inflow, whichever is less.

CVPSC responds that its proposed minimum flow of 26 cfs or inflow, whichever is less, coupled with the conversion of the project to run-of-river operation, represents an equitable balance between environmental enhancement and lost generation.

Figure 12

Our Analysis

We reviewed the bypass flow study results as well as CVPSC's video of target flows and conclude that VANR's proposed 110 cfs minimum flow provides a reasonable amount of habitat (78 percent "good") in this bypassed reach. However, we consider a flow of 74 cfs to be comparable from a biological perspective because this flow would provide 73 percent "good" habitat (1993d). We also do not agree that the 7Q10 bypass flow of 88 cfs or inflow whichever is less, recommended by Interior is appropriate, because it is not a habitat-based flow, and there is no evidence that water quality below the Passumpsic Dam does not meet applicable water quality standards. We conclude that a year-round minimum flow of 74 cfs or inflow, whichever is less, would provide similar enhancements for rainbow trout adults. We present our recommendations for bypass flow in Section VII.B. Nonetheless, because the 86 cfs minimum bypass flow is a condition of VANR's WQC, this condition will become part of any license for this project.

Downstream Passage

Passage of anadromous and resident fish past hydroelectric projects includes entrainment of fish through turbines. Mortality of juvenile salmonids passing through Francis-type turbines (which are present at Pierce Mills, Gage, and Passumpsic) is about 10 percent, although site-specific conditions and sampling methods influence mortality estimates at each project (Stone & Webster 1992). Turbine mortality through Kaplan/propeller type turbines (Arnold Falls has a propeller type turbine) is somewhat less (estimated mortality: 7.6 percent) than through Francis turbines (Stone & Webster 1992).

Lack of downstream fish passage facilities at any one dam does not block passage, because some fish will always survive entrainment or spillage over the dam. However, if more dams have effective downstream passage facilities in place when downstream migration occurs, the cumulative adverse impact to the resource would be minimized.

Interior (using its Section 18 FPA authority to prescribe fish ways) and VANR indicate that downstream passage facilities are needed immediately at the Passumpsic and Gage projects and will be needed by April 1, 1995, at the Pierce Mills and Arnold Falls projects. These recommendations are based on the dates and location of fry and parr stocking upstream of these projects (see Table 5). Components of the facilities that are normally required include: 1-inch, angled trashracks; a bypass weir; and a sluice, adjacent to the downstream end of the trashracks, which conveys smolts to a safe discharge location.

CVPSC objects to the mandated fishway installation, because it questions the validity of continuing to spend large sums of money when only a limited number of adult salmon have returned to the Connecticut River (252 between 1989 and 1993). They assert that lack of long-term stocking schedules and uncertainty regarding the causes of the limited adult returns are valid reasons for not requiring additional ratepayer burdens to develop fish ways on the Connecticut and Passumpsic rivers. CVPSC, further states that: (1) it would be more prudent to increase the stocking density in higher priority streams (wild production rivers) where fewer obstructions exist and/or passage facilities are already in place; and (2) there is insufficient evidence to require the operation of downstream passage facilities during the fall period.

Our Analysis

There is compelling evidence that Atlantic salmon fry and parr will continue to be stocked in the Passumpsic River Basin. Interior states in its December 23, 1993, comment letter:

> "The stocking of fry into the Passumpsic River is expected to continue at increased levels in 1994 with additional future increases when expanded fry production capacity currently being sought by the VDFW and other cooperators of the Connecticut River Atlantic Salmon Commission is realized. When increased fry numbers are available, the habitat in the Passumpsic drainage may be stocked with over 500,000 fry at stocking densities of up to 50 per unit."

The Passumpsic River Basin recently has begun to serve as a nursery for Atlantic salmon. When the salmon are ready to migrate downstream to Long Island Sound, the presence of numerous dams on the Passumpsic River and the Connecticut River may substantially reduce the number of successfully outmigrating salmon if safe downstream passage is not provided.

We conclude that CVPSC should provide for the safe downstream passage of Atlantic salmon smolts. Smolts may currently be outmigrating past the Gage and Passumpsic projects, and will be outmigrating past Pierce Mills and Arnold Falls by spring 1995. Given the expected time frame for the order issuing the licenses for the four Passumpsic River projects, it is unlikely that plans for permanent downstream passage at each project can be finalized and implemented by spring 1995. Conceptual plans must be developed, resource agencies must be consulted, detailed final design plans must be developed, the Commission must review and approve the plans, and contractors must be solicited to construct the facilities. It is more realistic to construct interim downstream passage facilities to enable smolts to effectively outmigrate while plans for permanent measures are being finalized. Interim passage facilities should

include components that can be incorporated into the final designs, such as weirs and sluiceways, that enable safe passage of smolts past each of the four projects. Interim passage facilities should be designed in consultation with the resource agencies.

Although subject to change during design consultation, we assumed that a bypass flow of 20 cfs (the median between the resource agencies high-flow estimate and CVPSC's low-flow estimate) would provide for reasonable passage of bypassed fish. Our estimates of lost generation costs are based on this 20 cfs flow.

We also agree with the resource agencies' proposed downstream passage operational time frames. We acknowledge that the majority of smolts usually outmigrate between April and June (Ruggles 1980). However, there is evidence that some populations of Atlantic salmon, including pre-smolts, also outmigrate during September through November, albeit in lesser numbers (Ruggles 1980; Warner and Havey 1985). Until the outmigration characteristics of the Passumpsic River Atlantic salmon become clearly established, it is prudent to operate the downstream fish ways during both the fall and the spring. This schedule should be adjusted, if needed, based on future population-specific outmigration data.

In conclusion, we recommend that CVPSC design and install interim downstream fish passage facilities at all four Passumpsic projects by April 1, 1995, and permanent downstream fish passage facilities as soon as possible thereafter. The interim fishway should operate until the permanent fishway is installed. Unless notified otherwise by the Commission, the interim and permanent facilities should be operated from April through June 15 and from September 15 through November 15.

Monitoring

Studies should be required to determine if the downstream passage facilities are operating effectively. These studies should be designed to: (1) determine whether the permanent downstream fish passage facilities at all four projects efficiently divert Atlantic salmon smolts away from the power plant intake, through the sluice, and to safety downstream of each project; and (2) address whether continued operation of the facilities during the fall is warranted. The second component of the effectiveness study should not be implemented until there is evidence that smolt outmigration is occurring. Structural or operational changes to the fish ways to improve the effectiveness of the fishway, if any, should be discussed in the study reports. Plans for these studies should be developed in consultation with FWS and VDFW and approved by the Commission. The Commission

would consider approving structural or operational changes in the four fish ways upon receipt of sufficient documentation.

Dam Removal

Pierce Mills Project

The dam was built on top of a 3-foot-high sill (FEMA 1986) (which from photographic evidence is ledge and would remain if the dam were removed). A relatively small pool (about 500 feet long and 3 feet deep) would still exist behind the sill.

Upstream of this pool, the gradient would be steep, about 17 feet of vertical change over about 2,000 feet of stream reach. However, upstream of this riffle or cascade segment, the water surface would be approximately where it is with the dam in place.

By removing the dam, approximately 0.5 mile of riverine habitat would be created upstream of the dam site that could be suitable for salmonids. However, most of the remaining 0.75 mile of the former impoundment would remain as low-gradient stream habitat, not unlike its present condition, and not well suited for salmonids.

If the Pierce Mills Dam were removed, flows in what is now a bypassed reach would be unregulated. Presumably, this would allow the potential 22 salmon nursery units there (Ritzi 1991) to be realized. Assuming an annual production of five smolts per unit, this reach would produce an estimated 110 smolts per year. In contrast, using data presented in Figure 8, CVPSC's proposed bypass flow of 13 cfs would provide about 44 percent of the maximum WUA in the bypassed reach. These data suggest that about 48 smolts would be produced per year with the dam and a 13 cfs minimum flow. With the 88 cfs minimum bypass flow recommended by the resource agencies and supported by our analysis, 94 percent of the maximum WUA would be available. Annual smolt production with 88 cfs would be about 103, which is a negligible difference from the number of smolts that would be produced in this segment after dam removal.

The biological gains in habitat resulting from removal of the Pierce Mills Dam would be relatively small. Although potential entrainment or impingement mortality of fish would be eliminated with dam removal, the existing technology to protect fish from these impacts at hydroelectric plants would adequately protect fish populations. We conclude, therefore, that removal of this dam for biological reasons is not warranted.

Gage Project

The Gage impoundment is relatively small, extending less than 1 mile upstream of the dam. If the dam were removed, the

stream in this reach would consist of pool/riffle habitat with a moderate gradient (about 11 feet per mile) based on our review of FEMA (1986). We suspect that flow would be sufficient to flush at least some of the silt and sand that has accumulated due to sediment load deposition in the impoundment. Thus, this stream segment could become restored salmonid habitat.

The deep pool below the dam in the bypassed reach would remain if the dam were removed, but the circulation of water through the pool would be much more rapid because there would be no flow diversion through the powerhouse. Habitat in the bypassed reach below the pool would most likely remain similar to its present suitability for brown trout juveniles. However, the bypass reach could be less suitable for brown trout spawning and incubation if spring high flows pass through what is now the bypassed reach and create unacceptably high velocity conditions that would scour eggs from their nests. Actual impacts would depend on the timing of trout reproduction and spring flows.

The overall biological gains that would be realized from the removal of the Gage Dam would be greater than at Pierce Mills. This is primarily due to the anticipated conversion of about 0.65-mile of marginal lacustrine habitat to what we hypothesize would be productive salmonid habitat. Although such a conversion would be consistent with resource agency goals for the Passumpsic River, such gains should be weighed against other impacts, including increased reliance on fossil fuels necessitated by the elimination of generation from this project.

c. Unavoidable adverse impacts: None.

4. Terrestrial Resources

a. Affected environment: The topography of the Passumpsic River Basin is hilly, with the most steep slopes in the area of the eastern headwaters. In the early to late eighteenth century, before construction of dams in the basin, much of the land area in the vicinity of the projects was mixed deciduous forest. Since settlement of the area, a large proportion of the level land near the river has been cleared for agriculture. Vegetation types in the vicinity of the projects currently include mixed deciduous forests, croplands, and occasional silvicultural farms.

Wildlife is characterized by species representative of the transitional zone between the mountain regions of central Vermont and the lowlands of the Connecticut River Valley. Although no known state-listed threatened, endangered, or special concern species exist within the area, three species of mammals -- the lynx, marten, and small-footed myotis -- and two species of birds -- the common loon and loggerhead shrike -- have ranges that

include the project areas. The area west of the Passumpsic from the Village of Passumpsic to the Village of East Barnet is designated as a unique habitat area by the VDFW. Both the Arnold Falls and Gage projects border this unique habitat area (evergreen forests providing habitat for deer wintering). This area, however, is not affected by the operation of the projects.

Interior (1993) states that, except for occasional transient individuals, no federally listed or proposed endangered or threatened species are known to exist in the projects' area. Other than specific plants discussed under individual projects, no plants are considered uncommon, rare, threatened, or endangered by the Vermont Heritage Program or FWS.

Pierce Mills Project

Most land in the vicinity of the Pierce Mills Project is mixed deciduous forest. Coniferous forests dominated by eastern hemlock are found on steep slopes above the river and along tributary streams. Because of the relatively small size and steep gradient of the Passumpsic River, there are few opportunities for the development of floodplain wetlands (some are found in small, discrete patches at a few locations). There are no VANR Class I or Class II15/ wetlands within the influence of the projects' impoundments (VANR 1993).

Upstream of the Pierce Mills powerhouse, along the east bank, is a small (0.7 acre) floodplain forest dominated by maple and ash with an understory of shrubs and ferns. To date, erosion and bank slumping has filled much of the floodplain forest,

15/ Class I Wetlands are those wetlands that in and of themselves, based on an evaluation of the functions in Section 5 of the Vermont wetland regulations, are exceptional or irreplaceable in their contribution to Vermont's natural heritage and are therefore so significant that they merit the highest level of protection.

Class II Wetlands are those wetlands, other than Class I wetlands that, based on an evaluation of the functions in Section 5 of the Vermont wetland regulations, are found to be so significant, either taken alone or in conjunction with other wetlands, that they merit protection.

Class III Wetlands are those wetlands that have not been determined to be so significant that they merit protection under these rules either because they have not been evaluated or because when last evaluated were determined not to be sufficiently significant to merit protection.

allowing weedy plants to invade and limiting the historical extent of flooding from the river (VANR 1993).

A riverbank seep wetlands community, comprising herbaceous species, is located on the right bank of the river opposite the powerhouse. This habitat is calcareous and supports plant associations unique to this condition. Some of the predominant plants in this seep community include grass-of-parnassus, golden sedge, variegated horsetail, and Kalm's lobelia. Two less common plants found in the seep community are spikemoss and shining lady's tresses. The lady's tresses are included on the Vermont Natural Heritage Program Watch List, and the spikemoss is not known to exist at any other locations in Caledonia County.

Low outcrops at the project support ledge communities that are subject to regular flooding and ice scouring. Principal plants in these communities are wild columbine, round-leaved harebell, and saxifrage.

Arnold Falls Project

The Arnold Falls Project is in a densely developed area of St. Johnsbury; consequently, existing vegetation is generally characterized by scattered trees intermixed with weedy and adventive plants. No wetlands have been identified at the project (VANR 1993). Principal trees include American elm, boxelder, and willows. Common shrubs are willows, dogwoods, and escaped landscape species, such as privet and forsythia.

CVPSC's botanical consultant noted one plant, hare figwort (Scrophularia lanceolata), listed by the Vermont Natural Heritage Program as rare, at the top of the river bank near a parking lot on Concord Avenue (Countryman 1991). The principal threat to the hare figwort is from pedestrians going to or from the river along a path from Concord Avenue. Project operation, however, does not affect this plant.

Gage Project

Vegetation in the area is characterized by hardwoods, mixed forests, agricultural fields, and occasional pine plantations. Wetlands are small and occur infrequently because the small size and relatively steep gradient of the Passumpsic River provides little opportunity for the development of floodplain wetland habitats. The few marsh and emergent plant communities are limited to narrow fringes along the banks of the river. No VANR Class I or Class II wetlands exist within the influence of the impoundment water elevations.

Two small Class III wetlands are situated along the east bank, approximately 0.25-mile upstream of the dam. Both wetlands are influenced by water level fluctuations in the impoundment.

The more northern wetland, which is a backwater marsh (0.8 acres), provides forested, emergent and open water habitats; the southern wetland is primarily emergent and open water. The northern wetland contains maples, shrubs and ferns; the southern wetland consists primarily of cattail, arrowhead, and other common emergent aquatics.

VANR states that two potentially significant habitats are found at Gage: the backwater marsh described above and a ledge and sand community to the east of the powerhouse (VANR 1993). The ledge community is overhung by northern white cedar. A field survey did not reveal any unusual herbaceous species there.

Passumpsic Project

Vegetation in the area of the Passumpsic Project is characterized by hardwoods, mixed forests, agricultural fields, and occasional pine plantations. Wetlands are small and occur infrequently, because the small size and relatively steep gradient of the Passumpsic River provides little opportunity for the development of floodplain wetland habitats. The few marsh and emergent plant communities are limited to narrow fringes along the banks of the river. No VANR Class I or Class II wetlands exist within the influence of the impoundment water elevations (VANR 1993).

Ledge communities exist on outcrops at the Passumpsic Project. Inaccessibility and height above floodwaters leave the area largely unaffected by agricultural and industrial impacts. Typical species include carpenter's square, rusty woodsia, spike-grass, shadbush, wild columbine, and roundleaved harebell.

b. Environmental impacts:

Impacts from Construction Activities

The construction of new recreational facilities at all four projects, as discussed in Section III.C.6, Recreational Resources, would require clearing small amounts of vegetation. Moreover, public use of these areas would disturb or displace area wildlife. The impacts resulting from clearing, construction, and use of the facilities would be minor. Therefore, we do not recommend any protection or enhancement measures for lost vegetation or displaced wildlife.

VANR expressed concern over potential adverse impacts on wildlife that use the wetland adjacent to the access road to the proposed picnic area at the Gage Project. Increased disturbance could occur as a result of allowing visitors to use the access road to the picnic area.

This was an important factor in our decision to recommend that CVPSC develop this picnic area for recreational boaters only (see Section III.C.6), thereby avoiding public use of this access road and wetland wildlife disturbance.

Impacts Resulting from Run-of-River Operation

All four projects historically were operated in a store-and-release mode, which caused daily fluctuations in the water surface elevation of the impoundments. These fluctuations helped create an unstable environment for plants and wildlife.

VANR comments that a constant year-round impoundment water level at each project would enhance dependent wetlands and wildlife. Interior states that limiting water level fluctuations would benefit wetlands and wildlife habitat both in the impoundment area and downstream of the projects.

We concur that run-of-river operation would benefit wetlands and wildlife and, therefore, recommend that CVPSC operate the four projects in an instantaneous run-of-river mode.

Controlling the Impoundment Level at the Gage Project Using Crest Gates

VANR states that, although the run-of-river operation would eliminate several concerns associated with impoundment water level fluctuations, the loss of the 6-foot-high flashboards at the Gage Project and their expected lowering prior to flood events remain a concern. VANR indicates that lowering the pond elevation has detrimental effects on wildlife residing in the pond or using the upstream wetland during critical times of the year such as: dewatering of root stocks, "freeze-outs" of amphibian and furbearers, and increased predation of waterfowl broods.

VANR indicates that reducing the frequency of flashboard collapse or lowering would increase the functional value of the impoundment and associated habitat. VANR would like to eliminate the present 6 foot change in water level associated with flashboard raising or lowering, and they propose limiting the water level change to 2 feet. This could be achieved by using crest gates to control the water level.

CVPSC performed a prefeasibility study on the installation of a rubber dam as a crest gate at Gage. Results of the study indicate that the cost to install the dam is about $600,000, which CVPSC considered to be prohibitive.

CVPSC states that they voluntarily lower the hinged flashboards about three times in March and April and once in May to pass ice and floodwater but that during June through December

the boards are seldom manipulated. Therefore, during critical times of the year (spawning and nesting) impacts are minimal. They typically reset the boards when the water recedes to a 2- to 4-foot crest over the downed boards (water surface elevation 536.2 to 538.2 feet msl).

Our Analysis

We agree with VANR that reducing the frequency of flashboard lowering would help stabilize habitat associated with the Gage impoundment. However, voluntary lowerings help minimize potential flood damage during high flows and, therefore, should be continued as a flood control measure. CVPSC would normally keep voluntary flashboard lowerings to a minimum because of the cost of lost generation associated with reduced head at the project. Therefore, we conclude that wildlife habitat would be protected during the critical summer nesting and rearing period and that it is not appropriate to restrict the frequency of flashboard lowering by CVPSC.

It is appropriate for CVPSC to operate this project so that the extent of impoundment lowering associated with downed flashboards is minimal. This should reduce impacts to root-stocks and hibernating wildlife. VANR's request to limit impoundment water level deviations to 2 feet below the normal operating level is reasonable. CVPSC proposes to maintain the normal pool elevation 9 inches below the top of the flashboards which is equal to a water surface elevation of 539.15 feet msl. VANR's request, therefore, means that the boards must be reset before the water surface drops below 537.15 feet msl.

Because the boards are presently reset when the water is 2 to 4 feet over the crest of the dam (536.2 to 538.2 feet), we conclude that the existing plant operational mode can already accommodate VANR's request much of the time.

We do not consider that the installation of rubber crest gates or other new water level control devices is necessary. Therefore, we recommend that CVPSC modify their operational procedures to ensure that the flashboards are reset before the impoundment water surface elevation decreases 2 feet below the normal pool elevation of 539.15 feet msl.

Unique Habitats

VANR indicates that the continued operation of the four projects would not adversely affect populations of species inhabiting unique habitat at any of the projects (VANR 1993a-d). We concur with this opinion and, therefore, do not require any protection or enhancement measures.

Dam Removal

Removal of the Pierce Mills Dam or Gage Dam would eliminate small riparian wetlands at existing impoundments. These riparian wetlands rely on water from the impoundment to sustain wetlands. Without the impoundments, there would no longer be a source of water for these wetlands. However, new wetlands would eventually become established along the banks of the stream at some locations where fine sediments and hydrology are sufficient to support wetland vegetation. This would compensate, to some extent, for the loss of any riparian wetlands.

c. Unavoidable adverse impacts: Construction of recreational facilities would result in the permanent removal of small amounts of vegetation. During both the construction and operation of these facilities, wildlife could be disturbed or displaced. We consider these impacts to be minor.

5. Aesthetic Resources

a. Affected environment:

Pierce Mills Project

The Pierce Mills Project is located in a secluded natural setting typical of the Passumpsic River Basin. The forested surroundings, a mixture of hard and softwoods, screen project features from Route 5 on the west side of the river and Town Highway 15 on the east side. There are a few houses along Route 5, approximately 600 to 700 feet away from the powerhouse. Project facilities, however, cannot be viewed clearly from these houses.

The Pierce Mills site originally was developed in 1918 to 1919 by the Twin State Gas & Electric Company. Prior to 1918, the Passumpsic River flowed unimpeded through the project area.

The Pierce Mills Project is accessed via an approximately 500-foot-long drive off Town Highway 15 or via canoe. Visitors to the site include anglers, canoeists, and occasional picnickers. Picnickers who use the site generally view the project's civil works and the river from a grassy area on the east shore adjacent to the powerhouse. Anglers generally fish along the bypassed reach. Access to the site is limited to daylight hours. Most users of the area come during the recreation season, which runs from mid April through late October.

The project's primary landscape features include a small, brick powerhouse (built in 1928), the substation (located adjacent to the powerhouse), penstock (which is 6 feet in diameter and 246-feet long), and the dam (see Figure 2). The

powerhouse and dam blend well with the natural setting. In contrast, the more recently constructed substation and penstock detract from the attractiveness of the site. The large, black penstock rests at ground level between the station's primary viewing areas and the river. The modern substation clashes with the historic powerhouse.

Water flowing over the dam contributes to the site's overall attractiveness because it screens the concrete face of the dam, creating a more natural waterfall-type appearance. In addition, the bypassed reach appears more natural with water flowing over its ledge, boulder, and rubble substrate.

Arnold Falls Project

Located in downtown St. Johnsbury, the Arnold Falls Project is surrounded by industrial buildings along Mill Street to the south and west, the Concord Avenue Bridge to the north, and industrial/commercial buildings and a small parking lot to the east and south.

The dam is built in two sections divided by Arnold Island. The North Dam is approximately 189 feet long, and the South Dam is 66 feet long. The small, brick powerhouse is integrated into the south spillway (see Figure 3).

The river in the vicinity of the project is approximately 200 feet wide. The banks, where not developed, are vegetated with a mix of hard and softwoods and scrub. The west river bank is steep the east side bank is relatively flat.

The dam and powerhouse were built in 1928. However, before 1928, the site contained facilities for water-powered manufacturing, including mills and pattern shops. Before these, a natural waterfall existed at the site.

Despite the project's location in town, it is not easily seen from off-site. Buildings along Mill Street block the views of persons on Mill Street. From Concord Avenue bridge, just upstream of the dam, views are primarily of the headpond and the North Dam. The South Dam is obstructed from view somewhat by Arnold Island, but can be seen by patrons of a restaurant in one of the mill buildings on the south shore. The powerhouse, while visible, does not stand out very prominently from the backdrop of the buildings along Mill Street. Views of the project from the southeast are available from homes and businesses along the river bank as well as from the privately owned parking lot off Concord Avenue.

Currently, recreationists view the project from Fred Mold Park, a municipal facility located approximately 500 feet south of the Arnold Falls Dam, on the east side of the river at its

confluence with the Moose River. The park provides parking, picnic tables, and benches for visitors and access to the river for anglers.

Flow over the dam and in the bypassed reaches is not visible at night. During the winter, a sheet of ice usually forms over the face of the dams. During other times, the amount of water flowing over the project dam to the bypassed reaches affects the overall attractiveness of the project area. When enough water is flowing over the north spillway, it has a natural waterfall appearance. The quality of the bypassed reach below the North Dam also improves when a sufficient flow is released over the rocky bottom.

Similarly, the appearance of the South Dam is improved when water spills over to screen it. Water flowing over this dam gives it a historical mill-like appearance, more in keeping with the site's history and character.

Gage Project

The Gage Project is located in a secluded natural setting east of Route 5, approximately 1.5 miles south of downtown St. Johnsbury. Because of the steep drop from Route 5 to the river, the project site is not visible from Route 5 or from any buildings along it.

The existing concrete dam and powerhouse were built in 1929. Prior to then, there was a timber crib dam at the site.

Access to the Gage Project is difficult because the main driveway from Route 5 is steep and has poor sight distances. Although, there is an informal maintenance road that leads to the project's east side, its use is restricted to CVPSC personnel. Use of this road requires vehicles to cross an uncontrolled, unsignalled track of the Canadian Pacific Railroad located between the town road and the project facilities. Thus, for safety reasons, CVPSC prevents public entry with a locked gate. Because of the limited road access to the site, relatively few people view the project features.

The project's primary features include the three sections of concrete dam, the headgate structure and canal, and the powerhouse (see Figure 4). A historic foundation at the east end of the dam and the tramway, which extends over the dam, are also prominent. The powerhouse adds to the historic character of the site. The remaining civil works (e.g., substation, headgate and canal) are more modern in appearance.

Some water flows over the short, southern spillway and descends to the river pool below via a rocky channel running almost parallel to the north section of the dam. The water

flowing over the southern spillway largely obscures the dam. In contrast, the north section with 6-foot flashboards is fully visible much of the time. Some leakage is apparent between flashboards.

Passumpsic Project

The Passumpsic Project is located in the Village of Passumpsic within the Town of Barnet. Passumpsic Village consists of approximately 20 homes and a few small businesses. The main features of the Passumpsic Project are the dam, headgate, power canal, and powerhouse (see Figure 5).

The dam consists of two spillway sections. These are arranged in a broad V with the apex pointing upstream. The north section is 126 feet long; the south section is 122 feet long. The station's historic powerhouse adds to the overall character of the site. In contrast, the substation, which is modern in design and appearance, clashes with the powerhouse and detracts from the overall appearance of the site.

The river banks near the station and around its impoundment are wooded and interspersed with residential clearings. The Canadian Pacific Railroad right-of-way comes very close to the Passumpsic Project and the river along the west bank.

The first hydroelectric station at this location was constructed in 1905 or 1906. Prior to then, the river flowed freely through the site and cascaded over ledges. In 1927, this hydropower project was destroyed by a flood. In 1929, the powerhouse was rebuilt and the timber crib dam replaced with a concrete gravity structure.

From Route 11, persons in vehicles have views of the gravel parking area, substation, powerhouse, and warehouse adjacent to the powerhouse. However, the face of the dam and the bypassed reach are blocked from view by the crest of the dam and the headpond.

Trees block much of the view of the project from the town road on the east side of the river. To see the face of the dam, the bypassed reach, and the tailrace, one has to either hike down to the river from the road on the east bank, or hike along the west bank, parallel to the railroad right-of-way.

The amount of water flowing over the dam has a great effect on the overall appearance of the project. The 320-foot-long bypassed reach drops over a series of ledges creating a scenic cascade when at least 110 cfs spills over the dam. The bypassed reach is not visible at night, and recreation in the area is largely confined to the April through October period.

b. Environmental impacts: There are two major issues that affect aesthetic resources at the four Passumpsic River projects: (1) the need for additional landscaping/ screening around project facilities and (2) the desirability of providing minimum flows over the dams to enhance aesthetic qualities.

VANR also raised two minor issues: (1) CVPSC's use of plastic sheeting to seal flashboards at the four projects and (2) the method in which trashrack debris is disposed of. VANR finds the appearance of the plastic sheeting and other debris objectionable, and CVPSC has agreed to investigate possible alternatives to the use of plastic sheeting and methods of trashrack debris disposal.

Landscaping

VANR made the following general comment in regard to landscaping:

> "The Agency does not believe that the principal goal of a landscaping plan should be to completely screen or block views of facilities. Rather, it should be planned and executed to break up or soften views and provide contrast in a naturally appearing way. Visual barriers of vegetation can appear as artificial as structures. Carefully planned landscaping to provide attractive viewscapes at each of the sites for the purpose of promoting public use should be considered."

CVPSC proposes additional landscaping at the Pierce Mills and Passumpsic projects. Its landscaping plan, developed by a professional landscape architect, would soften and screen views of the unattractive project features.

Pierce Mills Project

VANR comments that: "the substation needs landscaping to soften its visual impact, but with care taken not to reduce or eliminate available views of the powerhouse."

CVPSC proposes to implement a planting program that would screen the existing substation and penstock from the proposed picnic area. Plantings would include lilac, privet, and forsythia.

Since most persons who visit the site would use the picnic area, CVPSC's plan would meet the goal identified in VANR's comment. Therefore, we recommend that CVPSC consult with VANR to finalize its landscaping plan and file the plan with the Commission, for approval.

Arnold Falls Project

VANR indicates that landscaping is not needed at this project, and CVPSC has not proposed any landscaping there. Due to the industrial setting of the station and the small number of persons who view the project's features, we also conclude that there is no need for landscaping at Arnold Falls.

Gage Project

VANR did not recommend specific landscaping measures for this project, and CVPSC has not proposed to implement any. Due to the site's limited access, and because primary views are from the opposite side of the river away from the station's civil works, we conclude that there is no need for landscaping at the Gage Project.

Passumpsic Project

CVPSC proposes to implement a planting plan designed to enhance views of the station from Town Highway 11. Plantings would consist of crabapple trees around the parking area and lilac bushes around the substation.

VANR is concerned that the proposed plantings could diminish views of the powerhouse.

We concur with the need for landscaping at the Passumpsic Project and find VANR's comment reasonable. Therefore, we recommend that CVPSC consult with VANR to finalize its landscaping plan and then file the plan with the Commission, for approval.

Bypass Flows

Flow releases over each of the four dams would enhance the attractiveness and the aesthetic quality of their settings. Since water splashing at the base of the dams and flowing through the bypassed reaches would provide a more natural and pleasing appearance, CVPSC proposes to provide minimum flows at all four sites.

We evaluated a range of flows at each of the four sites to determine a flow that would enhance area aesthetic quality. However, our conclusions regarding spillage must include considerations of the economic effects of the resultant lost generation (see Section VII).

Pierce Mills Project

CVPSC proposes to release 13 cfs or inflow, whichever is less, over the dam at all times for aesthetic purposes. VANR concurs with this proposal.

We viewed flows on video of 13, 49, 88, 135, and 171 cfs and, at the site visit, we viewed flows of 78 cfs. All flows were released in an even veil over the entire face of the dam. At 13 cfs, the face of the dam is thinly veiled, and the bypassed reach appears dewatered. When flow is increased to 49 cfs, the dam becomes screened, and the bypassed channel appears more natural.

As flows are increased from 49 to 88 cfs, the channel's appearance improves slightly, but aesthetic enhancement of the dam is negligible. Flows were most pleasing and impressive at 135 cfs. At this flow, water rushes over the dam and splashes at the base, creating a pleasing waterfall. When flow is increased from 135 to 171 cfs, the dam appears similar to the 135 cfs release. However, the bypassed reach becomes smoother as water completely covers most of the rocks. We find this a less appealing view than that provided by a 135 cfs flow.

Without considering other resources or lost generation costs, we determine that an aesthetic flow of 135 cfs would provide maximum aesthetic enhancement.

Arnold Falls Project

VANR concurs with CVPSC's proposed release of 20 cfs or inflow, whichever is less, over the north spillway for aesthetics.

We viewed flows on video of leakage, 20, 44, 67 and 106 cfs. We also viewed flows of 20 and 44 cfs during our site visit. These flows were apportioned as follows: 26 percent over the South Dam; 74 percent over the North Dam.

A flow of 20 cfs divided over the two dams appears about the same as leakage; the dams are not effectively screened, and the north bypass remains virtually dewatered. At 44 cfs (32 cfs over the North Dam and 12 cfs over the South Dam) the dams begin to look more like a natural waterfall. However, the north bypass is still quite dry.

When flow is increased from 44 to 67 cfs (50 cfs over the North Dam and 17 cfs over the South Dam), the incremental enhancement is significant. At 67 cfs, water screens the North Dam and creates a fine mist at the base of the dam. The bypassed reach also improves in appearance. The South Dam is also effectively screened at this flow.

A bypass flow of 106 cfs provides the best overall aesthetic enhancement of any of the flows studied. The dams are screened most effectively at this flow and the flow in the bypass looks impressive.

Without considering the needs of other resources or the cost of lost generation, we determine that a flow of 106 cfs apportioned over both dams (78 cfs over the North Dam and 28 cfs over the South Dam) would provide maximum aesthetic enhancement. The flow selected for aesthetic enhancement would be maintained only during the time of year when viewing is most likely to occur. In St. Johnsbury, this would be from April 1 to November 30 when recreational use is greatest.

Gage Project

CVPSC has proposed a minimum flow over the south spillway of 32 cfs from October 1 through May 1 and 17 cfs or inflow, whichever is less, the remainder of the year. VANR comments:

> "The Agency landscape architect has advised that the minimum flow proposal by the applicant is acceptable for aesthetics; however, that a means of providing sheet flow of water over the north spillway is needed in order to mask the unappealing appearance of the dry dam."

We viewed photographs showing releases of 14, 32, 55, 76, 116, 142, and 210 cfs. We also viewed bypass flows of 17 and 32 cfs during our site visit. All these flows were released over the south spillway only.

Our analysis indicates that the appearance of the dam and bypass reach improves as flows increases over the south spillway. The largest incremental increases occur in the jumps from 14 to 32 cfs and from 32 to 55 cfs. Of these two increases, the latter was more dramatic. At 55 cfs, flows over the channel begin to screen the south spillway more effectively and cover ledges in the small island.

Flows above 55 cfs produce further improvement. Flows over the dam and island ledges are most interesting and impressive at 210 cfs, the highest of the flows studied. Without considering other resources or the costs of lost generation, we determine that a bypass flow of 210 cfs appears the best.

Our analysis also indicates that providing a minimum flow over the north spillway is unnecessary. Because the site area is restricted, few visitors would be in a position to see this part of the dam. Obtaining a close view would involve parking offsite, entering the controlled access road, and passing through

other project facilities. Other views are at a considerable distance across the river bend and the railroad.

It also is physically difficult to provide an aesthetic flow over the flashboards because they represent a long stretch of spillway (176 feet) which is at a different elevation than the southern spillway. These factors make controlling the spillage difficult and would require devising some mechanism to release and control a divided flow.

Passumpsic Project

CVPSC proposes a minimum flow of 26 cfs or inflow, whichever is less, to be released evenly over the entire spillway year-round. VANR comments that the applicant's spillage proposal is satisfactory for aesthetics; however, there is substantial improvement at the agency-recommended flow." The agency recommends a flow of 110 cfs or inflow, whichever is less to improve bypassed reach habitat.

We viewed flows on video of 26, 74, 110, 165 and 210 cfs. We also viewed bypass flows of 26 and 74 cfs during our site visit.

At a flow of 26 cfs, the bypass appears dewatered. At 74 cfs, there is some improvement, but the bypass still appears somewhat dewatered. The increase from 74 to 110 cfs provides the greatest incremental benefit for aesthetics. At 110 cfs, the river appears to come alive as water fills the bypass, cascading over the ledges below the dam, creating an attractive waterfall. As flows increase further, the appearance of the site improves. Thus, 211 cfs provides the most aesthetic qualities of all the observed flows. Without considering other resources or the cost of lost generation, we determine that a flow of 211 cfs appears the best for aesthetic enhancement.

c. Unavoidable adverse impacts: None.

6. Cultural Resources

a. Affected environment:

Pierce Mills Project

The Pierce Mills hydroelectric site (also known as Saint Johnsbury #0) was originally developed in 1918 to 1919 by the Twin State Gas & Electric Company. The original powerhouse was destroyed by a flood in November 1927. However, the concrete dam, which was built just 2 years previously, was largely undamaged. The plant was rebuilt in 1928. The existing powerhouse uses portions of the earlier substructure. The unused

portion is a concrete foundation beneath the wood and steel bridge leading to the powerhouse entrance (CVPSC 1993a).

The project has not been substantially altered since its construction in 1928. The present flashboard system and float control were installed about 1970. In 1983, the generator was rewound, and the turbine was overhauled a few years later. The steel penstock, installed in 1990, replaced the wood stave conduit built during the 1928 reconstruction (CVPSC 1993a).

The Pierce Mills Project meets Criterion C of the National Register of Historic Places as a contributing element in the nominated Twin State Gas & Electric Company Hydroelectric Station Historic District. The Pierce Mills Project possesses overall integrity of design because the historic spatial and functional relationships among its principal elements remain as built in 1928. Integrity of materials and workmanship has diminished somewhat by the replacement of the original wood stave penstock with the existing steel conduit. Elements contributing to the significance of the station are the powerhouse and the dam with its integral intake. Because the penstock is a modern structure constructed of materials unlike the original, it is a noncontributing element. The outdoor substation, which has been upgraded over the years and now contains typical, modern electrical transmission equipment (CVPSC 1993a), is also a noncontributing element.

No prehistoric or historic archaeological sites eligible for the National Register have been recorded within the Pierce Mills Project boundaries. A Phase IA archaeological survey of the project was done in 1990 at two locations specified by the Vermont Division for Historic Preservation (VDHP). This investigation determined that the two locations, designated Survey Units E-1 and E-2, possess only low potential for prehistoric or historic archeological resources. Survey Unit E-1 shows no evidence of active erosion or other impact. Survey Unit E-2 appears to be experiencing moderate impacts not attributable to project operations or recreational use (CVPSC 1993a).

Arnold Falls Project

The Arnold Falls Project (also known as Saint Johnsbury #1-1/2) is located just below the Concord Street bridge in Saint Johnsbury. This old site was once intensively used. The remains of a number of water-powered factories are present on both banks of the river on property not owned by CVPSC. The station as it presently exists dates to 1928 (CVPSC 1993b).

The original dam sections, built at the same time as the powerhouse, were rock-filled timber crib structures that were substantially reconstructed in the 1940s. In the mid-1970s, both sections were completely rebuilt from bedrock; however, these

present structures replicate the originals in terms of basic form and materials. The existing headgate is the third to be installed due to normal wear. The original governor was replaced in the 1970s with one salvaged from another of CVPSC's stations. The generator was rewound and the turbine was overhauled during the 1980s (CVPSC 1993b).

The Arnold Falls Project meets Criterion C 16/ of the National Register of Historic Places as a contributing element in the nominated Twin State Gas & Electric Company Hydroelectric Station Historic District. The Arnold Falls Project possesses integrity of design, workmanship, and materials. Those structures that contribute to the significance of the resource are the powerhouse (including integral intake, generating unit, and governor) and two dams. The modern design substation does not contribute to the significance of the station (CVPSC 1993b).

No prehistoric or historic archaeological sites eligible for the National Register have been recorded within the Arnold Falls Project boundaries. Two historic archaeological sites -- VT-Ca-31 (a historic stone retaining wall) and VT-Ca-32 (a historic foundation) -- have been identified on land owned by CVPSC, but these sites have not been evaluated for National Register eligibility. A Phase IA archaeological investigation was undertaken in 1990 at locations specified by the VDHP. This investigation determined that Phase IA Survey Units F-1 (containing Site VT-Ca-31) and F-2 (containing VT-Ca-32) appear to have high potential for historic archaeological resources (CVPSC 1993b).

Gage Project

The Gage Project (also known as Saint Johnsbury #3) was originally built with, or used, a previously existing, timber crib dam. This dam was replaced in about 1929 with the existing concrete gravity structure. The cableway and hoist would also have been installed at that time. Because the original concrete was improperly set, the south section of the dam was replaced in the 1970s. In the late 1970s the garage adjacent to the cableway's winch house was enlarged to include shop space, and the building was covered with asphalt wall shingling. At the powerhouse, the foundations on the west side were repoured, and the wheel pits and draft tubes were refaced in 1982. The original trash gate was also reconstructed with a replacement

16/ Criterion C deals with elements that: (1) embody the distinctive characteristics of a type, period, or method of construction; (2) represent the work of a master; (3) possess high artistic value; or (4) represent a significant and distinguishable entity whose components may lack individual distinction.

pipe. In 1986, the windows and main door were replaced. In 1990, the existing steel flashboard units were installed along the crest of the north section. The original switchboard was also replaced in 1990 (CVPSC 1993c).

The Gage Project meets Criterion C of the National Register of Historic Places. The project as a whole possesses integrity of design, workmanship, and materials. Neither the arrangement of its primary elements nor the basic manner in which the project functions has been altered. The south section of the dam was reconstructed using forms and materials consistent with those of the original 1929 concrete gravity section. As a result, the dam also possesses integrity of design, workmanship, and materials. These integrities have been diminished at the cable hoist house, because of the expansion of the adjacent garage; however, the machinery remains intact and operational within. The canal/headgate structure remains essentially unaltered from its original construction, thus possessing integrity of design, workmanship, and materials. The powerhouse retains its engineering integrity too because the foundation reconstruction was consistent with the original design. The present window elements are unlike those originally present, but the dimensions and pattern of wall openings remain unaltered (CVPSC 1993c).

No prehistoric or historic archaeological sites eligible for the National Register have been recorded on land owned by CVPSC. A Phase IA archaeological survey of the Gage Project was completed in 1990 at five locations specified by VDHP. Survey units D-1, D-2, and D-3 were located on the right bank of the impoundment upstream of the railroad bridge. Survey units D-4 and D-5 were canoe landing sites, located on the left bank immediately below and above the dam, respectively (CVPSC 1993c).

In addition, one known archaeological resource at the Gage Project was designated for Phase IA survey by VDHP. It is located downstream of and adjacent to unit D-4. The resource consists of above-ground structural features from a likely nineteenth or early twentieth century site and components of an overhead cable trolley facility. This trolley facility was designed to allow maintenance of the flashboards along the dam crest. The overhead cables of the flashboard trolley facility run from the power station on the right bank, above the crest of the Gage Dam, to the opposite shore. Fifty feet north of the dam, the cables are suspended by two cable towers, which rest in turn on a concrete support structure. Above-ground historic resources at this location include elements of a previous structure that are incorporated into the concrete support for the cable towers, and to the northeast, a circular historic brick feature. VDHP designates these features as historic site VT-Ca-33.

Based on the results of the Phase IA survey, a Phase IB survey was carried out at Survey Unit D-3 in 1992. This unit is

located on the shoreline of the impoundment upstream of the railroad bridge. The cultural materials recovered during the Phase IB survey consisted of a portion of a leather harness strap (Berger 1993).

Passumpsic Project

The first hydroelectric station at this location (originally known as Saint Johnsbury #4) was constructed in 1905 or 1906 for the St. Johnsbury Electric Company and conveyed with the rest of that utility's holdings to the Twin State Gas & Electric Company in 1913. The November 1927 flood destroyed the original powerhouse. Portions of its foundations, and those of its associated power canal, remain buried beneath mounds of stone and concrete debris adjacent to the present facility (CVPSC 1993d).

Before the 1927 flood, the Chase leatherboard mill also used waterpower at the site and from the same end of the dam. In 1929 the powerhouse was rebuilt where Chase's water wheel had been, and the factory's power canal was reworked to serve Twin State's new station. At the same time, the timber crib dam was replaced with a concrete gravity structure. There has been no additional, new construction at the Passumpsic Project since that time (CVPSC 1993d).

The Passumpsic Project underwent substantial work during the 1980s, but still possesses integrity of design, workmanship, and materials. Repairs and reconstruction efforts have, to a significant extent, relied on like or compatible materials consistent with the original character and fabric of the station. The shorter of the two dam sections was chipped out and completely rebuilt in the early 1980s. The present structure is consistent with the original in terms of general design and materials. Also during the 1980s the intake structure was rebuilt; the original wooden headgates were replaced with steel elements; the face of the intake was stripped and resurfaced; the outer wall of the canal was reconstructed; and the inner wall of the canal was refaced (CVPSC 1993d).

The Passumpsic Project meets Criterion C of the National Register of Historic Places as a contributing element in the nominated Twin State Gas & Electric Company Hydroelectric Station Historic District. Structures that contribute to the significance of the resource are the powerhouse, generating unit and governor, dam, intake structure and power canal. (Another contributing element, the former Chase leatherboard mill, is located outside the project boundaries and is owned by parties other than CVPSC.) The outdoor substation does not contribute to the significance of the station (CVPSC 1993d).

As required by VDHP, a Phase IA archaeological survey of the Passumpsic Project was conducted in 1990 for all of the

impoundment shoreline. The impoundment shoreline was divided up into 11 survey units C-1 through C-10 and unit C-12. (Unit C-11 is a canoe landing site on the right bank downstream of the dam.) Of the 12 survey sites, 6 were recommended for further Phase IB study. These survey units were characterized as areas where high archaeological potential and high rates of erosion coincide. Based on setting and soil profiles, five of the six units (C-1, C-3, C-4, C-8, C-9, and C-12) exhibit a high potential for prehistoric resources; based on historic map research, two units (C-8 and C-9) have high potential for historic archaeological resources. Site C-9 was never tested because the landowner refused to grant access (CVPSC 1993d).

The Phase IB survey work consisted of opening backhoe trenches at 20 meter intervals and digging test holes in the side wall of each trench in promising locations. No archaeological deposits were identified. Soils examined along these floodplain areas appeared to represent recent historic alluvium superimposed on Pleistocene deposits (Berger 1993).

b. Environmental impacts: The general policy of the National Historic Preservation Act of 1966 (NHPA) is to encourage preservation of the nation's historic and cultural resources for future generations. NHPA Section 106 requires Federal agencies to consider the effects of their actions on historic properties.

Historic and Architectural/Engineering Resources

For all four of the projects, continued operation in their present mode and routine maintenance and repairs to the contributing structures, which do not permanently alter the existing visual character of these structures, would have no effect upon the characteristics that qualify them for listing in the National Register.

Repairs or other activities to contributing structures that are limited to in-kind replacement of historic fabric or features (i.e., replacement with new fabric that duplicates the old in terms of materials, design, size, color, and texture) would have no adverse effect upon the characteristics that qualify the four projects for listing in the National Register.

Activities requiring replacement other than in-kind, and activities involving new construction, partial demolition or total demolition within the project boundary could potentially have an adverse effect upon the characteristics that qualify the four stations for listing in the National Register. The potential impact would depend upon the nature and scale of the activity.

Archaeological Resources

CVPSC contracted for a Phase IA historical and archaeological survey of the four Passumpsic River projects. Based on the results of the Phase IA survey, Phase IB surveys were completed at the Gage and Passumpsic projects, but were not needed at the Pierce Mills and Arnold Falls projects. The VDHP has not yet commented on the results of the archaeological studies conducted at the four projects.

Pierce Mills Project

There are no recorded prehistoric or historic archaeological sites eligible for the National Register at the site. Based on the results of the Phase IA survey, CVPSC's archaeological consultant recommends no further work to identify archaeological resources within the Phase IA survey units (Berger 1991).

Arnold Falls Project

There are no recorded prehistoric or historic archaeological sites eligible for the National Register at the site. Based on the results of the Phase IA survey, some areas appear to have high potential for historic archaeological resources; however, because these areas are presently experiencing little or no impacts from erosion or recreation-based foot traffic, CVPSC's archaeological consultant has not recommended any further work to identify archaeological resources within these Phase IA survey units (Berger 1991).

Gage Project

There are no recorded prehistoric or historic archaeological sites eligible for the National Register at the site. Phase IA Survey Units D-1 and D-3 are presently experiencing moderate to high levels of impact from shoreline erosion. Survey Unit D-5 is experiencing a moderate level of impact from recreational use, and Survey Unit D-4 is experiencing only a low level of impact from recreational use.

As a result of Phase IA and IB investigations, CVPSC's archaeological consultant recommends undertaking no further work to locate and identify archaeological resources at the study locations (Berger 1993).

Passumpsic Project

There are no recorded prehistoric or historic archaeological sites eligible for the National Register at the site. Based on the results of Phase IA and IB surveys, CVPSC's archaeological consultant recommends undertaking no further work to locate and

identify archaeological resources at the testing locations (Berger 1993).

Archaeological Monitoring

CVPSC proposes to implement a program of monitoring at 4-year intervals, beginning in 1996, to identify any increase in shoreline or recreation-induced erosion within areas where known archaeological sites or high archaeological potential coincide with low to moderate levels of erosion. Specific areas include: Survey Units F-1 and F-2 at the Arnold Falls Project (CVPSC 1993b); Survey Units D-1 and D-4 at the Gage Project (CVPSC 1993c); and Survey Units C-10 and C-12 at the Passumpsic Project (CVPSC 1993d). Results of these monitoring activities should be submitted by CVPSC to the State Historic Preservation Officer (SHPO) within 8 weeks following completion of the monitoring effort, accompanied by appropriate recommendations from the archaeologist undertaking the work. CVPSC should consult with the SHPO to determine if additional archaeological investigations are warranted to identify archaeological resources that may be eligible for the National Register of Historic Places.

In addition, before CVPSC initiates any project-related land clearing or ground-disturbing activities in areas that have not been subjected to an archaeological survey, including recreation developments at the project, CVPSC would consult with the SHPO concerning potential effects on National Register and eligible properties regarding options for avoiding or minimizing adverse effects.

Moreover, if previously unidentified historic properties are discovered during any project-related land-clearing or ground-disturbing activities, CVPSC would immediately alert the SHPO to the discovery and ensure that all work that may affect the property is halted until measures to address potential impacts to these historic properties have been carried out. CVPSC would also ensure that work crews are informed that they are required to report and protect historic properties that are encountered.

Our Analysis

We conclude that monitoring to ensure that archaeological sites are not subjected to erosion is an appropriate measure to include in the Cultural Resource Management Plans (CRMPs) for the four projects. Therefore, execution of the PAs for all four projects should be contingent upon inclusion of proper erosion monitoring plans in the CRMPs.

Cultural Resources Management Plan

CVPSC developed draft CRMPs to avoid or minimize disturbances to properties at each of the Passumpsic River

projects that are listed on or eligible for listing on the National Register of Historic Places, archaeological sites near the project, and any other historic properties that may be identified in the course of operating the projects or engaging in presently unscheduled ground-disturbing activities. The prime objective of the management plans is efficient, cost-effective maintenance of historic features in relation to the facility as a whole. Implementation of these plans by CVPSC would allow operation of the register-eligible project features as well as development of the proposed recreation enhancements without adversely affecting any register-eligible properties.

CRMPs are required to conserve the existing historic fabric and features of the National Register-eligible projects to the greatest extent practicable within the framework of continuity of use. Without continued "use" (i.e., operation), both during the facilities' period of significance and since that time, the facilities would not exist. Thus, continued operation is critical to the preservation of the facilities as National Register-eligible properties and to the conservation and care of historic features. CVPSC's draft CRMPs identify the following steps for future activities at the four Passumpsic River projects (CVPSC 1993a):

- ù Routine maintenance and repairs that do not permanently alter the existing visual or functional character of the fabric or feature shall be considered to have no effect, and therefore shall be undertaken as necessary without notification to the Vermont SHPO.

- ù Repairs or other activities limited to in-kind replacement of historic fabric or features (i.e., replacement with new fabric or feature that duplicates the old in terms of materials, design, size, color, texture, and functional characteristics) shall be considered to have no adverse effect. As a matter of information, CVPSC shall send a letter to the SHPO that summarizes the work to be performed and states why the activity will have no adverse effect.

- ù Activities requiring replacement other than in-kind replacement, and for new construction, partial demolition, or total demolition within the boundaries of the National Register-eligible property shall be considered to have a potential adverse effect. When the need for such activities is identified, CVPSC shall initiate consultation with the SHPO to consider ways to avoid or minimize potential adverse effects. As a documentary basis for this consultation, CVPSC shall prepare an alternatives analysis, in detail commensurate with the nature and scale of the proposed activity. The alternatives analysis shall include:

purpose and need, description of the affected fabric or feature, description of the proposed activity and its anticipated effect upon the historic feature and upon the historic character of the hydroelectric station as a whole, and an evaluation of alternatives. Measures agreed upon by both CVPSC and the SHPO to avoid or minimize adverse effects shall be documented through an activity-specific plan. If CVPSC determines that no agreement can be reached, CVPSC shall so inform the Commission, and shall undertake recordation of the affected feature prior to initiation of the proposed action. This recordation shall consist of 35 mm black-and-white photographs plus a summary report that describes the feature, its history and use, current condition, and the circumstances requiring the proposed action. The photographs and summary report shall be submitted to the SHPO.

Programmatic Agreement

In order to ensure that the provisions of the CRMP are reviewed, refined, and enacted, the Commission, Advisory Council on Historic Preservation, and the VDHP, with CVPSC as a concurring party, must execute a Programmatic Agreement (PA) before any licenses are issued for these four projects. The PA should stipulate further review and refinement of the CRMPs and require that they be filed for Commission approval within 1 year of the license issuing for each of the four Passumpsic River projects.

c. Unavoidable adverse impacts: None.

7. Recreation Resources

a. Affected environment:

Pierce Mills Project

The area surrounding the Pierce Mills Project is hilly, wooded, and undeveloped. The Caledonia Forest and Stream Club owns approximately 50 acres of land bordering the impoundment to the north. Members target practice at the shooting range and occasionally fish the river for trout.

Recreationists who use the project area access the site via a 500-foot-long dirt road off Highway 15 or via canoe. They usually park their cars in a clearing near the powerhouse and substation (see Figure 13). Based on CVPSC's observations and recreational use at other nearby hydroelectric projects, we estimate that there are a total of 500 recreation visits per year in the project area. (A recreation visit is defined as the use by one individual of a recreation area for recreation purposes

Figure 13

for any length of time.) Most visitors fish for trout below the dam, in the bypassed reach, and in the project's tailwaters.

Most of the 1.25-mile-long, 25-acre impoundment is riverine and shallow. Although studies suggest it has few game fish (see V.C.3, Fishery Resources), it attracts some anglers as well as swimmers.

Canoeists travel the Passumpsic River from April through October with trips originating upstream at West Burke (RM 25). The extensive impounding caused by the presence of seven hydroelectric dams extends the flatwater boating season along the mainstem Passumpsic River into the months of July through October. During these months, low flows generally prevent canoeists from using other area rivers, such as the White River.

The Passumpsic River varies from flatwater to rapids classified as Class II rapids with wide, clear channels that are evident without scouting. A canoe take-out, 500-foot-long portage trail, and canoe put-in (the only developed recreational facilities in the project area) provide passage around the dam. The 17-mile stretch of river below Pierce Mills has several sections of Class II rapids and four flatwater impoundments before joining the Connecticut River (AMC 1989).

Arnold Falls Project

Currently, there are no developed recreational facilities at the Arnold Falls Project. However, the project vicinity is popular for fishing, picnicking, swimming, boating, photography, and viewing.

Before the construction of the Arnold Falls Dam and powerhouse, the Passumpsic River near the Arnold Falls probably was used for salmonid fishing, picnicking, swimming, and viewing. Fred Mold Park, which offers parking, picnic facilities, angling areas, and car-top boating access, is located 500 feet downstream of the project dam. Anglers, hikers, and photographers walk upstream from this park to fish for trout in the Arnold Falls bypassed reach and to view and take pictures of the falls.

The Town of St. Johnsbury has initiated a planning effort to develop a recreation path along the 2 river miles between the Arnold Falls and Gage projects.

Canoeists who travel the Passumpsic River below the Pierce Mills Project cover 5 miles of fast moving water with riffles and small waves (Class I) before reaching the flatwater of the Arnold Falls impoundment (AMC 1989). Currently, canoeists can portage over Arnold Island. However, the portage route is steep and brushy, and improvements would make this route safer and easier. CVPSC has reconfigured the boat barriers above the dam so

canoeists are channeled to the island (Figure 14). Portage and "Danger Dam" signs are needed to warn canoeists.

Most of the project's recreational users are local people. Most recreationists either fish for trout in the bypassed reach or view and photograph the falls. Based on CVPSC's estimates and recreational use data from other nearby hydroelectric projects, we estimate that there are 300 recreation visits per year in the Arnold Falls Project area.

Gage Project

Access to the project area from Route 5 is via a service road that is steep and at a sharp angle to the highway. Pedestrians access the site from the east side of the river by crossing the Canadian Pacific Railroad tracks and walking along a maintenance road that skirts wetland areas and the project impoundment (Figure 15).

Canoeists who travel the Passumpsic River downstream from the Arnold Falls Project cover 2 miles of quick water before reaching the flatwater of the Gage impoundment (AMC 1989). A canoe take-out, 300-foot-long portage trail, and put-in (the only developed recreational facilities in the project area) provide for passage around the dam.

Local anglers fish for trout in the project's bypassed reach and below the tailrace. Occasional picnickers are seen in the project area during the summer (CVPSC 1993c). Based on CVPSC's observations and recreational-use data from other nearby hydroelectric projects, we estimate that there are 400 recreation visits per year to the project area.

Passumpsic Project

Currently, there are no developed recreational facilities at the Passumpsic Project. However, the project vicinity is popular for fishing, picnicking, swimming, boating, photography, and viewing (Figure 16).

Canoeists who travel the Passumpsic River downstream from the Gage Project cover 1 mile of quick water before reaching the flatwater of the Passumpsic impoundment (AMC 1989). Canoes can be removed from the river under the Town Highway 11 bridge above the dam, but there is no portage available currently. The land owner adjacent to the powerhouse, whose property used to be crossed for the portage trail and put-in, no longer allows people to cross his land. Other areas on the eastern side of the river are not suitable for a portage and put-in. Similarly, topography on the other side of the river precludes a portage there.

Figure 14

Figure 15

Figure 16

Downstream of the Passumpsic Project, canoeists cover 5 miles of quick water as the river winds through scenic gorges before reaching the impoundment of the East Barnet Hydroelectric Project. Portage is available around the dam at Barnet before 1 mile of easy paddling to the confluence with the Connecticut River (AMC 1989).

Local people account for most of the recreational use in the Passumpsic Project area. Recreationists fish for trout in the project's bypassed reach and tailrace, view and photograph the falls, swim in the impoundment or tailwaters, and hike along the shore.

Based on recreational use data from other nearby hydroelectric projects, we estimate that there are 300 recreation visits per year in the Passumpsic Project area.

b. Environmental impacts:

1. Recreation Issues Affecting All Four Projects

Expansion of CVPSC's Property Ownership

CVPSC does not propose to increase its land holdings at the four projects except to obtain easements for: (1) canoe portage, parking, and angling access at Arnold Falls; (2) access at Gage; and (3) canoe portage at Passumpsic. VANR (1993) and Interior (1993) request that CVPSC acquire additional property at the projects that would enable CVPSC to provide greater recreational opportunities.

Our Analysis

We agree that the project areas are limited in size, which restricts the development of recreational facilities. Nevertheless, we conclude that the applicant should continue its efforts to obtain easements in order to develop the facilities at the Arnold Falls and Passumpsic Projects.

The Commission generally does not require licensees of small projects to undertake significant land acquisition. The recreational enhancements CVPSC proposes to develop, plus the enhancements we recommend, would provide for recreational facilities that are appropriate for this section of the Passumpsic River. Therefore, we do not recommend that CVPSC be required to undertake major private land purchases at this time.

Interpretive Signs

CVPSC does not propose to install interpretive signs at the projects. VANR (1993) requests that CVPSC provide interpretive signs that convey information about the natural history of the

Passumpsic River, the history of each of the projects, and the historic architecture and pre-history of the project areas.

Our Analysis

We concur with VANR that interpretative signs would be beneficial and, therefore, recommend that CVPSC design and install at least one interpretive sign at each project. CVPSC should (1) consult with the Vermont Department of Forests, Parks, and Recreation on the design and location of these signs; and (2) file its plans for the interpretative signs with the Commission as part of a revised recreation plan.

Public Information on Recreational Opportunities

CVPSC (1991) proposes to use road signs, public notices, and advertising to make the public aware of the projects' recreational facilities.

VANR (1993) recommends that CVPSC, in coordination with businesses, groups, organizations, agencies, river users, and other operators of hydropower facilities on the Passumpsic River, provide public information and education about recreational opportunities along the length of the river. VANR (1993) suggests that CVPSC coordinate the production of a Passumpsic River canoeing guide to be distributed free throughout the local area and region.

Our Analysis

Because the applicant owns and operates five of the seven hydropower projects situated on the Passumpsic River, we agree with VANR's recommendation that CVPSC coordinate with area groups to provide public information and education concerning recreational opportunities along the Passumpsic River. Therefore, we recommend that CVPSC work with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation; the Town of St. Johnsbury; the Passumpsic River Watch; and other interested groups and individuals to develop a Passumpsic River recreation guide to be distributed free throughout the local area and region.

Recreation Master Plan

CVPSC (1991) proposes to monitor public use at the project sites by adding a record column to the daily check sheet of its operators. Visitor use would be recorded as observed by the operators while fulfilling their routine responsibilities.

VANR (1993) states that CVPSC's proposed monitoring approach is inadequate, because it does not include any provision for public participation or specific proposals for recreational

development. VANR (1993), therefore, requests that CVPSC be required to: (1) conduct a region-wide recreational resource analysis and provide a master plan for recreational development; (2) establish monitoring provisions in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation, the Vermont Department of Environmental Conservation, and the Town of St. Johnsbury; and (3) develop additional recreational enhancements, as needed, over the duration of the license.

Our Analysis

Standard license article 17 allows the Commission to require a licensee to make reasonable modifications or add recreational facilities throughout the term of the license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal and state agencies, after notice and opportunity for hearing.

In addition, Section 8.11 of the Commission's regulations requires licensees to collect and file periodic data on recreational use at projects where recreational activity occurs. This information helps to identify the need for additional project-related recreational facilities and enhancements.

Improved water quality of the Passumpsic River and the conversion of each project to run-of-river operation, which would enhance the quality of salmonid habitat downstream of each project, could result in significant growth in the demand for river access. We agree with VANR that CVPSC's proposal to monitor recreational use is inadequate. The applicant's proposed monitoring would not measure unsatisfied recreation demands.

Therefore, in addition to the standard provisions for monitoring recreation, we recommend that CVPSC 10 and 20 years after the issuance of any license, conduct a professional recreational-use survey of its four project areas to determine whether the demand for recreational opportunities is satisfied by CVPSC's facilities and, if not, to recommend further recreational enhancements.

In regard to VANR's request for CVPSC to conduct a region-wide recreational resource analysis, we conclude that CVPSC should be responsible for monitoring recreation that occurs in its project areas; CVPSC should not be required to monitor recreational use that occurs over a broad geographic area. It is unreasonable to request that CVPSC conduct a region-wide recreational resource analysis. This type of effort seems more appropriate for a state agency or regional planning group. However, CVPSC should provide its recreation-use data to any organization performing a regional analysis.

Access for the Disabled

Currently, there are no developed recreation facilities at the Pierce Mills, Arnold Falls, Gage or Passumpsic Projects that allow access for the disabled. CVPSC proposes to build the picnic and parking areas at the Pierce Mills Project, the parking and fishing areas at the Arnold Falls Project, and the parking area at the Passumpsic Project accessible to the disabled. CVPSC did not receive any comments from the public or from agencies about disabled access at the Pierce Mills, Arnold Falls, Gage, and Passumpsic Projects. CVPSC's proposal would provide picnic and fishing access to the Passumpsic River for the disabled. We recommended CVPSC reconfigure its proposed picnic area at the Passumpsic Project to accommodate the disabled. We also recommend CVPSC include in their revised recreation plan specifics on how the proposed facilities conform to the requirements of the Americans with Disabilities Act of 1990.

2. Project-Specific Recreation Issues

Pierce Mills Project

Day-Use Areas

CVPSC proposes to construct, operate, and maintain the following day-use facilities at the Pierce Mills Project:

- parking improvements;
- picnic and play area with restroom facilities; and
- stile or bridge for access to the river over the penstock.

CVPSC proposes to reconfigure the access drive and parking area to allow for screening of the substation. A play and picnic area would be constructed near the substation for picnickers and canoeists, and a stile would be constructed to allow visitors access over the penstock to the river's edge and a view of the falls (see Figure 13).

Disabled visitors to the project would have access to the picnic and parking areas. No grade along the walkways would have more than an 8 percent slope (CVPSC 1991).

VANR (1993) concurs with CVPSC's proposed recreational facilities at the Pierce Mills Project.

Our Analysis

We concur with the facilities proposed and recommend they remain as part of CVPSC's recreation plan. We also recommend that CVPSC install "Danger Dam" signs and signs directing paddlers to the existing portage trail.

Overnight Camping

CVPSC (1991) prefers not to develop facilities for overnight camping at any of the four projects, citing limited land ownership and lack of personnel to administer such facilities.

VANR (1993) recommends that, in the future, CVPSC should provide overnight camping for canoeists in the vicinity of the Pierce Mills and Gage projects.

Our Analysis

Based on our site visit and on our review of the 1988 Vermont Recreation Plan and The Passumpsic River Watershed Comprehensive River Plan (1992), we conclude that overnight camping facilities for people canoeing the Passumpsic River should be provided. Therefore, we recommend that CVPSC construct two overnight camp sites for tents in the vicinity of the Pierce Mills Project. The Pierce Mills Project area is more appropriate for overnight camping, because it is more secluded than the Gage Project area, and it is better situated along the Passumpsic River for canoeists who are taking a weekend trip down the river. These camp sites should be primitive consisting of only a tent pad and clearing, in order to maintain the area's existing character, and should be designed for canoeists. The portable restroom facilities CVPSC has proposed for the picnic and play area also would meet the needs of campers.

CVPSC should coordinate its plans for overnight camping facilities with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury, and file their plans with the Commission as part of a revised recreation plan.

Arnold Falls Project

Day-Use Areas

CVPSC proposes to construct, operate, and maintain the following day-use facilities at the Arnold Falls Project: a public access area with bank fishing and a parking area.

CVPSC proposes to develop a public access area that would afford optimal views of Arnold Falls and Arnold Island. This site would provide public access for bank fishing, and the proposed public parking area would allow visitors arriving by car convenient access to the river. Disabled visitors to the project would have access to the parking and fishing areas. No grade along the walkways would have more than an 8 percent slope (CVPSC 1991) (see Figure 14).

CVPSC does not currently own the land needed to develop its proposed public access area for parking and bank fishing. However, CVPSC (1993b) reports that a title search of the property on the east bank below the dam indicates that CVPSC has all the necessary rights to access the river and to use the existing parking area.

Our Analysis

We concur with CVPSC's plan to develop a day-use river access site and adjacent parking area and, therefore, recommend they remain part of CVPSC's recreation plan. However, if CVPSC is unable to acquire the necessary rights for public access or the site is not compatible with facilities for the disabled, we recommend CVPSC provide plans, as part of their revised recreation plan, for alternative facilities to substitute for the proposed facilities.

Canoe Portage

CVPSC proposes to construct canoe portage facilities on Arnold Island, located between the North and South dams at the Arnold Falls Project. The Town of St. Johnsbury currently owns the island; however, CVPSC currently has an easement to develop civil structures there (see Figure 14).

CVPSC relocated its boat barriers to allow access to the island and portage over the public land. CVPSC (1993b) reports that there is a general agreement among CVPSC and the Town of St. Johnsbury that title to the island will be transferred to CVPSC as soon as an easement for town highway improvements at Pierce Mills is executed.

VANR (1993) states that canoe portage over the island is the only feasible location; however, sufficient safety features should be in place, allowing paddlers safe access to the portage route as well as upstream signs warning persons on the river about the dam and advising them of the location of the portage. VANR (1993) recommends that CVPSC continue its negotiations with the town regarding the island portage.

Our Analysis

We recommend that CVPSC either purchase Arnold Island from the Town of St. Johnsbury or negotiate an easement with the town that allows portage over the island. We also recommend that CVPSC install "Danger Dam" signs and signs directing paddlers to the island and carry out sufficient clearing and grading on the island to create a safe portage route.

CVPSC should coordinate its plans for the signs and portage facilities with the Recreation Section of the Vermont Department

of Forests, Parks, and Recreation and the Town of St. Johnsbury, and file its plans with the Commission as part of its revised recreation plan.

Gage Project

Day-Use Areas

CVPSC proposes to develop a picnic area on the east side of the Passumpsic River that would be accessible by boat only (see Figure 15). Disabled users would not have access.

CVPSC does not propose any parking or non-canoeist day-use facilities because of poor access from Route 5, safety concerns about people crossing unsignalled railroad tracks, and recreation pressure on wetland wildlife. CVPSC, however, intends to continue its policy of allowing visitors to access the site from Route 5.

CVPSC does not want visitors to access the site via the existing maintenance road on the east side of the river, because access across the nearby railroad right-of-way is limited to CVPSC personnel, and excessive traffic could adversely affect wildlife in the wetland area adjacent to the service road (VANR 1993).

VANR (1993) concurs with the proposed picnic area, but requests that CVPSC provide parking adjacent to the town road on the east side of the river near the railroad grade crossing. VANR contends that nonvehicular access from the east side would be appropriate provided that vegetative screening is used to separate pedestrians from the wetlands.

Our Analysis

CVPSC (1994) has not been able to secure a right-of-way for the public to cross the Canadian Pacific Railroad. Allowing access over the railroad tracks would subject the public to unsafe conditions, and even moderate recreational use of the east side road would disturb the wildlife in the wetlands. In addition, adequate alternative locations for river access would be provided at the Pierce Mills, Arnold Falls, and Passumpsic projects. Therefore, we do not recommend that CVPSC provide access to the east side of the river by any other approach other than by boat. We do recommend that CVPSC include the proposed picnic area in a revised recreation plan and install "Danger Dam" signs and signs directing paddlers to the existing portage trail.

Overnight Camping

As discussed, CVPSC (1991) does not propose to develop facilities for overnight camping at any of the four projects

because of limited land ownership and lack of personnel to administer such facilities.

VANR (1993) recommends that, in the future, CVPSC provide overnight camping for canoeists in the vicinity of the Gage Project.

Our Analysis

We conclude that CVPSC should develop overnight camping at only one location. Earlier in this section we indicated that the Pierce Mills Project area is the most appropriate location, because it is more secluded than the Gage Project and is better situated along the Passumpsic River for canoeists taking a weekend trip down the river.

Passumpsic Project

Day-Use Areas

CVPSC proposes to construct, operate, and maintain the following recreational facilities at the Passumpsic Project:

- parking improvements;
- a picnic area; and
- a canoe access site at the project impoundment.

Disabled visitors would be able to use the parking area only. No grade along the walkways would have more than an 8 percent slope (CVPSC 1991).

VANR (1993) concurs with the applicant's proposed recreational facilities.

Our Analysis

We concur with CVPSC's proposed parking and canoe access facilities and, therefore, recommend they remain part of CVPSC's recreation plan. In addition, we recommend that CVPSC reconfigure its proposed picnic area to accommodate the disabled.

Canoe Portage

CVPSC (1994) states that, because they do not own right-of-way land, there is no practical route for canoe portage at the Passumpsic Project. Despite negotiations with adjacent property owners, CVPSC has not been successful at securing a right-of-way across private property for portage.

VANR (1993) recommends that CVPSC complete its investigation of alternative portage routes. If the route along the railroad is selected, CVPSC should attempt to move the put-in upstream

sufficiently to avoid the carry down the steep railroad embankment. This move would necessitate securing an easement or other right to allow the use of the west corner of the lot occupied by the building that adjoins the powerhouse. VANR (1993) suggests that perhaps the owner would be more receptive if the portage only crossed the lot corner.

Our Analysis

We agree with VANR and, therefore, recommend that CVPSC continue to negotiate with the owner of the land adjacent to the Passumpsic Project to secure a safe canoe portage trail at the project. We also recommend that CVPSC install "Danger Dam" signs and signs directing paddlers to the portage from the impoundment. Once a canoe portage route has been secured, CVPSC should coordinate the plans and construction of the portage facilities with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury, and file the plan with the Commission as part of its revised recreation plan.

3. Recreation Plan

Based on our site visit and the increasing demand for river access documented in the 1988 Vermont Recreation Plan, we conclude that the recreational enhancements CVPSC proposes, plus the enhancements we recommend, should be constructed, operated, and maintained by CVPSC. We conclude that CVPSC should revise its recreation plan for the four projects in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury. The revised recreation plan should be filed with the Commission for approval.

4. Dam Removal

Removal of the dams at the Pierce Mills and/or Gage projects would only slightly affect recreation on the Passumpsic River. As discussed previously, the extensive impounding caused by hydroelectric dams along the length of the Passumpsic River extends that river's flatwater boating season. Since there are seven dams on the Passumpsic River, the removal of two dams there would have only a small effect on year-round water levels and, therefore, little effect on the length of the boating season.

Removal of the Pierce Mills Dam and/or Gage Dam would eliminate human barriers restricting boating on the Passumpsic River. However, if these dams were removed, the steep gradient of the river in the vicinity of both the Pierce Mills and Gage dams probably would necessitate portage around waterfalls for all but highly skilled boaters.

Our analysis of the effects of dam removal on fishery resources indicates that only small areas of new salmonid habitat

would be created with the removal of the Pierce Mills and Gage dams. Therefore, dam removal would result in only minor gains in angling opportunity on the Passumpsic River.

Removal of either or both the Pierce Mills and Gage dams could reduce duck hunting opportunities along the Passumpsic River. No estimates are available of the number of recreation visits dedicated to duck hunting in the vicinity of the Pierce Mills and Gage projects. However, based on our site visit, we believe there are ample substitute locations for duck hunting in the vicinity of the Passumpsic River. Therefore, the removal of the Pierce Mills and Gage dams would displace duck hunters to nearby locations.

There currently is no residential or commercial development along the shorelines of the Pierce Mills and Gage impoundments. Therefore, there would be no loss in property value to landowners whose river frontage would be converted from slack water to riverine.

c. Unavoidable adverse impacts: None.

D. No-Action Alternative

Under the no-action alternative, the projects would continue to operate under the terms and conditions of their existing licenses, and no new environmental protection or enhancement measures would be implemented.

VI. DEVELOPMENTAL ANALYSIS

In this section we analyze the project's use of the Passumpsic River's water resources to generate hydropower (developmental resources), estimate the economic benefits of the proposed relicensing and address the economic effects of various measures considered in this DEA for the protection or enhancement of environmental resources (nondevelopmental resources).

Pierce Mills Project

A. Power and Economic Benefits

The main purpose of the project is to provide power for CVPSC's customers. With an installed capacity of 0.25 MW, the project generates about 1.610 GWh annually. This amount represents the project's average annual generation for the 20-year period prior to CVPSC's filing for relicense. This period is reasonable because CVPSC operated the Pierce Mills Project in a peaking mode during that time. This type of operation was in accordance with CVPSC's original license; it represents the appropriate base case for this project.

CVPSC does not propose to increase the project's installed capacity. However, proposed enhancements for aesthetic, recreational, and other environmental resources would affect project economics as a result of construction costs, operation and maintenance costs, and lost generation.

To analyze the economics of the project, we computed its net benefits using CVPSC's estimated average annual generation and the estimated annual operation and maintenance costs for the project.

The economic analysis covers a period of time based on the expected license term, which can extend up to 50 years. The Commission's policy is to establish 30-year terms for those projects that propose little or no redevelopment, new construction or new capacity; 40-year terms for those projects that propose moderate redevelopment, new construction or new capacity; and 50-year terms for those projects that propose extensive redevelopment, new construction or new capacity.

For Pierce Mills, we analyzed both 30- and 40-year terms. Although the license does not authorize construction of new capacity for or redevelopment of the project, the recreational and environmental enhancements authorized and mandated in the license entail substantial costs to CVPSC that are comparable to the costs of moderate redevelopment or new construction. Accordingly, we conclude that issuance of a new license for a term of 40 years is appropriate, and we report only those values in the following discussion.

We base our analysis of the project's net benefits on the following data:

ONE TIME COSTS	
Construction costs of new capacity	None
Other costs	$260,88117/
ANNUAL COSTS	
Operation and maintenance costs	$19,06918/

17/ This consists of licensing application preparation ($86,306), response to information requests ($39,149), and net investment ($135,426).

18/ In calendar year 1992, the O&M cost was $16,943, as stated in the application. This value was then escalated to 1994 at a rate of 3 percent.

Operation and maintenance escalation rate	3.0 percent19/
Discount rate	9.0 percent20/
Period of analysis	40 years
Term of financing	40 years
Levelized power value	91.25 mills/kWh21/

Based on this information, the existing project (without enhancements proposed by either applicant, agencies, or staff) would have positive net benefits of about $84,000 annually levelized over 40 years when compared to the alternative power source. This net benefit is equivalent to about 52.2 mills per kilowatt hour (mills/kWh).

B. Cost of Environmental Enhancement Measures

We analyzed recommendations made by the applicant, agencies, and others for protecting or enhancing nondevelopmental resources in the project area. Measures considered would affect the project in three ways:

- changing the mode of operation, and thereby, altering generation;
- increasing the project's costs by the construction and operation of new facilities; and
- reducing project generation by diverting flows for other purposes.

In this section, we look at the net economic effect on rate payers of the enhancement measures under consideration. Specifically, we consider five measures that could reduce the economic benefits of the project:

- run-of-river operation;
- spillage flows;

19/ Source: Staff.

20/ Source: CVPSC Application.

21/ We based the levelized power value on CVPSC's statement of avoided energy and capacity costs provided through the year 2020 included in their response to AIR No. 8, dated September 1993. We escalated the energy cost at 5 percent and the capacity cost at 4.8 percent through 2034 and levelized the resulting values over the 40-year license period.

- recreational enhancements;
- aesthetic enhancements; and
- downstream fish passage.

1. Run-of-River Operation

The Pierce Mills Project was originally licensed to run in the peaking and pulsing mode. CVPSC proposes to operate Pierce Mills using an instantaneous run-of-river mode. Our analysis shows that changing to run-of-river would decrease project benefits by $2,700 annually (based on lost generation of 29 MWh) or 1.67 mills/kWh, when levelized over a 40-year license period.

2. Spillage Flows

Spillage flows at Pierce Mills are proposed to enhance fish habitat, water quality, terrestrial habitat, aesthetics, and recreation.

We computed the annual lost generation and the resultant decline in net annual benefits for a range of spillage flows proposed by CVPSC, VANR, Interior, and staff. For fishery and water quality enhancement, we included continuous, year-round flows of 13 cfs (applicant's proposal), 49 cfs and 88 cfs (VANR's proposal). We included flows of 13, 49, 88, and 135 cfs for aesthetic enhancement. These flows would be maintained for 12 hours per day from April 15 through October 31. Table 6 provides a summary of the results.

We also include an allowance of $5,000 to develop and implement an approved spillage flow monitoring plan (CVPSC proposes to use equipment already in place to monitor flows). Monitoring minimum flows would decrease project benefits by $500 annually or 0.31 mills/kWh, when levelized over a 40-year license period.

3. Recreation

CVPSC proposes to develop the following recreational enhancements: a picnic area with parking and access to the river over the penstock. CVPSC estimates that the construction costs associated with these enhancements would be $4,200 in 1994 dollars. Our analysis shows that the proposed recreational enhancements would decrease project benefits by $600 annually or about 0.37 mills/kWh, when levelized over a 40-year license period.

Table 6. Decrease in Pierce Mills Project Benefits Due to Spillage Flows (Source: Staff)

Spillage Flow (cfs)	Annual Lost Generation (GWh)	Net Annual Benefits (Dollars)	(mills/kWh)
13 (continuous)	0.0750	-6,800	-4.22
13 (part-time)	0.0248	-2,300	-1.43
49 (continuous)	0.2600	-23,700	-14.72
49 (part-time)	0.0695	-6,300	-3.91
88 (continuous)	0.4949	-45,200	-28.07
88 (part-time)	0.1232	-11,200	-6.96
135 (part-time)	0.1577	-14,400	-8.94

We recommend, in addition to those enhancements proposed by CVPSC, the following measures: development of two overnight camp sites, interpretive signage, dam warning signs, a recreational opportunity guide, and two separate recreational use studies 10 and 20 years after the issuance of any license. We estimate $14,000 for those enhancements, which include erosion and sediment control planning and implementation during construction. For the recreational guide and use studies, the total cost is allocated equally among the four projects. Our analysis shows that our proposed enhancements would decrease project benefits by $1,900 annually or about 1.18 mills/kWh, when levelized over a 40-year license period.

4. Aesthetics

Aesthetic enhancements would include landscaping around the substation. The construction cost provided by CVPSC associated with landscaping is $6,000 in 1994 dollars. Our analysis shows that the aesthetic enhancements would decrease project benefits by about $800 annually or about 0.49 mills/kWh, when levelized over a 40-year license period.

5. Downstream Fish Passage

CVPSC estimates that the cost of downstream fish passage facilities would be $33,765 (including engineering,

mobilization/demobilization, construction, and contingency costs) in 1991 dollars with an annual operation and maintenance cost of $5,000 (1995 dollars). The cost to design and implement the associated erosion and sediment control plan is relatively small compared to the overall conceptual cost of the facilities, and we assume it is incorporated into the engineering and construction costs.

Our analysis shows that construction and operation of downstream fish passage would decrease project benefits by $11,500 annually or 7.14 mills/kWh, when levelized over a 40-year license period. Because CVPSC proposes to pass fish through a sluiceway into the bypassed reach at Pierce Mills, there would be no additional cost of lost generation above the bypass minimum flow at the project.

Staff estimates that the one-time cost of an effectiveness study would be $20,000. Our analysis shows that this study would decrease project benefits by about $1,900 annually or about 1.18 mills/kWh, when levelized over a 40-year license period.

Arnold Falls Project

A. Power and Economic Benefits

The main purpose of the project is to provide power for CVPSC's customers. With an installed capacity of 0.34 MW, the project generates about 1.580 GWh annually. This amount represents the average annual generation for a 20-year period prior to CVPSC's filing of the license application. This period is acceptable because CVPSC operated in the peaking mode during that time period. This type of operation was in accordance with CVPSC's original license; it represents the appropriate base case for this project.

CVPSC is not proposing any new hydropower development at the project. We consider enhancements for aesthetic, recreational, and other environmental resources, which would affect project economics through construction costs, operation and maintenance costs, and lost generation.

To analyze the economics of the project, we computed its net benefits using CVPSC's average annual generation and estimated annual operation and maintenance costs for the project.

The economic analysis covers a period of time based on the expected license term, which can extend up to 50 years. The Commission's policy is to establish 30-year terms for those projects that propose little or no redevelopment, new construction or new capacity; 40-year terms for those projects that propose moderate redevelopment, new construction or new

capacity; and 50-year terms for those projects that propose extensive redevelopment, new construction or new capacity.

For Arnold Falls, we analyzed both 30- and 40-year terms. Although the license does not authorize construction of new capacity for or redevelopment of the project, the recreational and environmental enhancements authorized and mandated in the license entail substantial costs to CVPSC that are comparable to the costs of moderate redevelopment or new construction. Accordingly, we conclude that issuance of a new license for a term of 40 years is appropriate, and we report only those values in the following discussion.

We base our analysis of the project's net benefits on the following data:

ONE TIME COSTS	
Construction costs	None
Other costs	$134,66522/ (1994)
ANNUAL COSTS	
Operation and maintenance costs	$27,16323/ (1994)
Operation and maintenance escalation rate	3.0 percent
Discount rate	9.0 percent
Period of analysis	40 years
Term of financing	40 years
Levelized power value	99.35 mills/kWh

Based on this information, the existing project (without enhancements proposed by either applicant, agencies, or staff) has positive net benefits of $101,300 annually levelized over 40 years when compared to the alternative power source. This net benefit is equivalent to 64.1 mills/kWh.

B. Cost of Environmental Enhancement Measures

In Section V (Environmental Analysis) we analyze recommendations made by the applicant, agencies, and others for protecting or enhancing nondevelopmental resources in the project area. Measures considered would affect the project in three ways:

22/ This consists of licensing application preparation ($83,542), response to information requests ($32,505) and net investment ($18,618).

23/ In calendar year 1989, the O&M cost was $23,431 as stated in the application. This value was then escalated to 1994 at a rate of 3 percent.

- changing the mode of operation, and thereby, altering generation;

- increasing the project's costs by the construction and operation of new facilities; and

- reducing project generation by diverting flows for other purposes.

In this section, we look at the net economic effect on rate payers of the enhancement measures under consideration. Specifically, we consider five measures that could reduce the economic benefits of the project:

- run-of-river operation;

- spillage flows;

- recreational enhancements;

- aesthetic enhancements; and

- downstream fish passage.

1. Run-of River Operation

The Arnold Falls Project was originally licensed to run in the peaking and pulsing mode. CVPSC proposes to change the mode of operation at Arnold Falls to instantaneous run-of-river. Our analysis shows that the proposed change to run-of-river mode would decrease project benefits by $4,000 annually (based on lost generation of 40 MWh) or 2.53 mills/kWh, when levelized over a 40-year license period.

2. Spillage Flows

Spillage flows at Arnold Falls are proposed to enhance fish habitat, water quality, terrestrial habitat, aesthetics, and recreation.

We computed the annual lost generation and the resultant decline in net annual benefits for a range of spillage flows proposed by CVPSC, VANR, Interior, and staff. For fishery and water quality enhancement, we included continuous, year-round flows of 20 cfs (applicant's proposal), 33 and 50 cfs, and 78 cfs (VANR's proposal). We included flows of 20, 44, 67, and 106 cfs for aesthetic enhancement. These flows would be maintained for 12 hours per day from April 15 through October 31. Table 7 provides a summary of the results.

We also include an allowance of $5,000 to develop and implement an approved minimum flow monitoring plan (CVPSC

proposes to use equipment already in place to monitor flows). Monitoring minimum flows would decrease project benefits by $500 annually or 0.32 mills/kWh, when levelized over a 40-year license period.

3. Recreation

CVPSC proposes to develop the following recreational enhancements: a canoe portage over Arnold Island, a river access area, and adjacent public parking. The construction cost that CVPSC estimates would be associated with these enhancements would be $4,300 in 1994 dollars. Our analysis shows that the proposed recreational enhancements would decrease project benefits by $600 annually or about 0.38 mills/kWh, when levelized over a 40-year license period.

Table 7. Decrease in Arnold Falls Project Benefits Due to Spillage Flows (Source: Staff)

Spillage Flow (cfs)	Annual Lost Generation (GWh)	Net Annual Benefits (Dollars)	(mills/kWh)
20 (continuous)	0.1280	-12,700	-8.03
20 (part-time)	0.0309	-3,100	-1.96
33 (continuous)	0.2050	-20,400	-12.91
44 (part-time)	0.0674	-6,700	-4.24
50 (continuous)	0.2800	-27,800	-17.59
67 (part-time)	0.0846	-8,400	-5.32
78 (continuous)	0.4000	-39,700	-25.13
106 (part-time)	0.1361	-13,500	-8.54

We recommend, in addition to those enhancements proposed by CVPSC, the following enhancements: interpretive signage, dam warning signs, a recreational opportunity guide, and two separate recreational use studies 10 and 20 years after the issuance of any license. We allow $12,000 for these enhancements, which includes erosion and sediment control planning and implementation during construction. Our analysis shows that these recreational

enhancements would decrease project benefits by $1,600 annually or about 1.01 mills/kWh, when levelized over a 40-year license period.

4. Aesthetics

We consider a continuous aesthetic flow of 17 cfs over the South Dam from April 1 to November 30. Our analysis shows that this enhancement would decrease project benefits by about $6,200 annually (based on lost generation of 62 MWh) or 3.92 mills/kWh, when levelized over a 40-year license period.

5. Downstream Fish Passage

CVPSC estimates that the cost of downstream fish passage facilities would be $35,025 (including engineering, mobilization/demobilization, construction, and contingency costs) in 1991 dollars with an annual operation and maintenance cost of $5,000 (1995 dollars). The cost to design and implement the associated erosion and sediment control plan is relatively small compared to the overall conceptual cost of the facilities, and we assume it is incorporated into the engineering and construction costs.

Our analysis shows that construction and operation of downstream fish passage would decrease project benefits by $12,200 annually or 7.72 mills/kWh, when levelized over a 40-year license period. The fish passage would be operational from April 1 through June 15 and from September 15 through November 15. In addition, the facility would require an additional flow of 20 cfs.

Staff estimates that the one-time cost of an effectiveness study would be $20,000. Our analysis shows that this study would decrease project benefits by about $1,900 annually or about 1.20 mills/kWh, when levelized over a 40-year license period.

As mentioned earlier, several spillage flows were recommended by various entities for fishery and water quality enhancement. Table 7 presents the costs associated with these flows. Table 8 shows the additional cost of adding 20 cfs to these spillage flows to operate the downstream fish passage facility. The increased energy losses associated with the operation of the downstream fish passage facility have a nonlinear impact on lost generation from spillage flows. This impact is a function of where the spillage flow occurs on the flow duration curve.

Table 8. Incremental Net Annual Benefits for Fish Passage Flows at the Arnold Falls Project (Source: Staff)

Agency	Spillage Flow (cfs)	Fish Passage Flow (cfs)	Incremental Net Annual Benefits (Dollars)	(mill/kWh)
Applicant	20	20	-4,100	-2.59
Staff	33	20	-1,000	-0.63
Staff	50	20	-800	-0.51
VANR/Interior	78	20	-4,600	-2.91

Gage Project

A. Power and Economic Benefits

The main purpose of the project is to provide power for CVPSC's customers. With an installed capacity of 0.70 MW, the project generates about 2.766 GWh annually. This amount represents the average annual generation for a 20-year period prior to CVPSC's filing of the license application. This period is acceptable because CVPSC operated in the peaking mode during that time period. This type of operation was in accordance with CVPSC's original license; it represents the appropriate base case for this project.

CVPSC is not proposing any new hydropower development at the project. We consider enhancements for aesthetic, recreational, and other environmental resources, which would affect project economics through construction costs, operation and maintenance costs, and lost generation.

To analyze the economics of the project, we computed its net benefits using CVPSC's average annual generation and estimated annual operation and maintenance costs for the project.

The economic analysis covers a period of time based on the expected license term, which can extend up to 50 years. The Commission's policy is to establish 30-year terms for those projects that propose little or no redevelopment, new construction or new capacity; 40-year terms for those projects that propose moderate redevelopment, new construction or new capacity; and 50-year terms for those projects that propose extensive redevelopment, new construction or new capacity.

For the Gage Project, we analyzed both 30- and 40-year terms. Although the license does not authorize construction of new capacity for or redevelopment of the project, the

recreational and environmental enhancements authorized and mandated in the license entail substantial costs to CVPSC that are comparable to the costs of moderate redevelopment or new construction. Accordingly, we conclude that issuance of a new license for a term of 40 years is appropriate, and we report only those values in the following discussion.

We base our analysis of the existing project's net benefits on the following data:

ONE TIME COSTS	
Construction costs	None
Other costs	$455,599[12]/ (1994)
ANNUAL COSTS	
Operation and maintenance costs	$50,993[13]/ (1994)
Operation and maintenance escalation rate	3.0 percent
Discount rate	9.0 percent
Period of analysis	40 years
Term of financing	40 years
Levelized power value	111.99 mills/kWh

Based on this information, the existing project (without enhancements proposed by either applicant, agencies, or staff) would have positive net benefits of $174,400 annually levelized over 40 years when compared to the alternative power source. This net benefit would be equivalent to 63.05 mills/kWh.

B. Cost of Environmental Enhancement Measures

In Section V (Environmental Analysis) we analyze recommendations made by the applicant, agencies, and others for protecting or enhancing nondevelopmental resources in the project area. Measures considered would affect the project in three ways:

- ù changing the mode of operation, and thereby, altering generation;

- ù increasing the project's costs by the construction and operation of new facilities; and

12/ This consists of licensing application preparation ($80,628), response to information requests ($66,415) and net investment ($308,556).

13/ In calendar year 1990, the O&M cost was $45,307 as stated in the application. This value was then escalated to 1994 at a rate of 3 percent.

- reducing project generation by diverting flows for other purposes.

In this section, we look at the net economic effect on rate payers of the enhancement measures under consideration. Specifically, we consider four measures that could reduce the economic benefits of the project:

- run-of-river operation;
- spillage flows;
- recreational enhancements; and
- downstream fish passage.

1. Run-of-River Operation

The Gage Project was originally licensed to run in the peaking and pulsing mode. CVPSC proposes to change the mode of operation to instantaneous run-of-river. Our analysis shows that this change would decrease project benefits by $2,900 annually (based on lost generation of 26 MWh) or 1.05 mills/kWh, when levelized over a 40-year license period.

2. Spillage Flows

Spillage flows at Gage are proposed to enhance fish habitat, water quality, terrestrial habitat, aesthetics, and recreation.

We computed the annual lost generation and the resultant decline in net annual benefits for a range of spillage flows proposed by CVPSC, VANR, Interior, and staff. For fishery and water quality enhancement, we included a 17 cfs flow from June 1 to September 30 and a 32 cfs flow for the remainder of the year (applicant's proposal with staff modified timeframe), a continuous, year-round flow of 55 cfs (staff's proposal for assessment purposes), and an 83 cfs flow from May 2 to September 30 and a 142 cfs flow for the remainder of the year (VANR/Interior's proposal). We included flows of 17, 55, 116, and 210 cfs for aesthetic enhancement. These flows would be maintained for 12 hours per day from April 15 through October 31. Table 9 presents a summary of the results.

We also include an allowance of $5,000 to develop and implement an approved minimum flow monitoring plan (CVPSC proposes to use equipment already in place to monitor flows). Monitoring minimum flows would decrease project benefits by $500 annually or 0.18 mills/kWh, when levelized over a 40-year license period.

3. Recreation

CVPSC proposes to develop a picnic area accessible by boat only. The construction cost that CVPSC estimates would be required for this enhancement would be $2,000 in 1994 dollars. Our analysis shows that this recreational enhancements would decrease project benefits by $300 annually or about 0.11 mills/kWh, when levelized over a 40-year license period.

We recommend, in addition to those enhancements proposed by CVPSC, the following developments: interpretive signage, dam warning signs, a recreation opportunity guide, and two recreational use studies 10 and 20 years after the issuance of any license. We allow $12,000 for these enhancements, which includes incorporating an erosion and sediment control plan into the design of all proposed recreational measures. Our analysis shows that the potential recreational enhancements would decrease project benefits by $1,600 annually or about 0.58 mills/kWh, when levelized over a 40-year license period.

4. Downstream Fish Passage

CVPSC estimates that the cost to construct a downstream fish passage would be $66,025 (including engineering, mobilization/ demobilization, construction, and contingency costs) in 1991 dollars and a yearly cost of $5,000 for operation and maintenance (1995 dollars). The cost to design and implement the erosion and sediment control plan is relatively small compared to the overall conceptual cost of the facilities, and we assume it is incorporated into the engineering and construction costs.

Our analysis shows that installation and operation of the downstream fish passage would result in a decrease in project benefits of about $16,900 or about 6.11 mills/kWh, when levelized over a 40-year license period. The fish passage would be in operation from April 1 through June 15 and from September 15 through November 15. In addition, the facility would require an additional flow of 20 cfs.

Staff estimates that the one-time cost of an effectiveness study would be $20,000. Our analysis shows that this study would decrease benefits by about $1,900 annually or about 0.69 mills/kWh, when levelized over a 40-year license period.

Table 9. Decrease in Gage Project Benefits Due to Spillage Flows (Source: Staff)

Spillage Flow (cfs)	Annual Lost Generation (GWh)	Net Annual Benefits (Dollars)	(mills/kWh)
17 (part-time)	0.0153	-1,700	-0.61
17 (part-time)	0.1357	-15,200	-5.50
32 (part-time)			
55 (continuous)	0.3100	-34,700	-12.54
55 (part-time)	0.0709	-7,900	-2.86
83 (part-time)	0.5597	-62,700	-22.67
142 (part-time) Interior			
82 (part-time)	0.5638	-63,100	-22.81
142 (part-time) (VANR)			
116 (part-time)	0.1295	-14,500	-5.24
210 (part-time)	0.1851	-20,700	-7.48

As mentioned earlier, several spillage flows were recommended by various entities for fishery and water quality enhancement. Table 9 presents the costs associated with these flows. Table 10 shows the additional cost of adding 20 cfs to these spillage flows to operate the downstream fish passage facility. The increased energy losses associated with the operation of the downstream fish passage facility have a nonlinear impact on the lost generation from spillage flows. This impact is a function of where the spillage flow occurs on the flow duration curve.

Table 10. Incremental Net Annual Benefits for Fish Passage Flows at the Gage Project (Source: Staff)

Agency	Spillage Flow (cfs)	Fish Passage Flow (cfs)	Incremental Net Annual Benefits (Dollars)	(mill/kWh)
Applicant	17/32	20	-6,000	-2.20
Staff	55	20	-800	-0.29
Interior	83/142	20	-1,400	-0.51
VANR	82/142	20	-1,500	-0.54

C. Dam Removal

We assessed the environmental consequences of removing both the Pierce Mills and Gage Dams. We concluded that removing the Pierce Mills Dam would result in minimal environmental gains in habitat in the impounded area and the bypassed reach. However, the environmental gains of removing the Gage Dam appear greater than at Pierce Mills. Therefore, we evaluated the economic impact of removing the Gage Dam.

We estimate that removing the dam at the Gage Project would cost approximately $230,000 (1995 dollars). This value is based on past experience with similar efforts and includes costs for removal of concrete, installation of a cofferdam, and disposal of material nearby. It does not include a cost for items such as disposal of hazardous materials or removal of the powerhouse. These costs would depend on site conditions and plans for the site.

The additional annual cost of replacement energy from an alternative source would be $309,742, levelized over a 40-year license period. This number is derived by considering the value of levelized power (104.22 mills/kWh) for the Gage Project and the average annual generation (2,765.8 MWh). The cost of replacement energy assumes that an alternative source would be needed to replace that provided by the project as historically operated.

Future operation of the project as we recommend would reduce the energy benefits of the Gage Project and the economic impact to the rate payer if the dam is removed. We estimate that average annual future generation of the project would be 2,550 MWh, and the associated cost of replacement energy would be $275,383.

The annual levelized cost of the dam removal for a 40-year license would be $21,390. Therefore, the total levelized cost incurred by the rate payer for purchasing alternative source, replacement energy and removing the dam would be $331,132 annually for the project as operated historically and $296,773 for the project as we recommend it be operated in the future, when levelized over a 40-year license period.

Passumpsic Project

A. Power and Economic Benefits

The main purpose of the project is to provide power for CVPSC's customers. With an installed capacity of 0.70 MW, the project generates about 3.869 GWh annually. This amount represents the average annual generation for a 20-year period prior to CVPSC's filing of the license application. This period is acceptable because CVPSC operated in the peaking mode during that time period. This type of operation was in accordance with CVPSC's original license; it represents the appropriate base case for this project.

CVPSC is not proposing any new hydropower development at the project. Enhancements considered would improve aesthetic, recreational, and other environmental resources and would affect project economics through construction costs, operation and maintenance costs, and lost generation.

To analyze the economics of the project, we computed its net benefits using CVPSC's average annual generation and annual operation and maintenance costs for the project.

The economic analysis covers a period of time based on the expected license term, which can extend up to 50 years. The Commission's policy is to establish 30-year terms for those projects that propose little or no redevelopment, new construction or new capacity; 40-year terms for those projects that propose moderate redevelopment, new construction or new capacity; and 50-year terms for those projects that propose extensive redevelopment, new construction or new capacity.

For Passumpsic, we analyzed both 30- and 40-year terms. Although the license does not authorize construction of new capacity for or redevelopment of the project, the recreational and environmental enhancements authorized and mandated in the license entail substantial costs to CVPSC that are comparable to the costs of moderate redevelopment or new construction. Accordingly, we conclude that issuance of a new license for a term of 40 years is appropriate, and we report only those values in the following discussion.

We base our analysis of the existing project's net benefits on the following data:

ONE TIME COSTS	
Construction costs	None
Other costs	$269,18314/ (1994)
ANNUAL COSTS	
Operation and maintenance costs	$27,51915/ (1994)
Operation and maintenance escalation rate	3.0 percent
Discount rate	9.0 percent
Period of analysis	40 years
Term of financing	40 years
Levelized power value	98.24 mills/kWh

Based on this information, the existing project (without enhancements proposed by either applicant, agencies, or staff) would have positive net benefits of $304,000 annually levelized over 40 years when compared to the alternative power source. This net benefit would be equivalent to 78.6 mills/kWh.

B. Cost of Environmental Enhancement Measures

In Section V (Environmental Analysis) we analyze recommendations made by the applicant, agencies, and others for protecting or enhancing nondevelopmental resources in the project area. Measures considered would affect the project in three ways:

- ù changing the mode of operation, and thereby, altering generation;
- ù increasing the project's costs by the construction and operation of new facilities; and
- ù reducing project generation by diverting flows for other purposes.

In this section, we look at the net economic effect on rate payers of the enhancement measures under consideration.

14/ This consists of licensing application preparation ($83,614), response to information requests ($52,332) and net investment ($133,237).

15/ In calendar year 1990, the O&M cost was $24,450 as stated in the application. This value was then escalated to 1994 at a rate of 3 percent.

Specifically, we consider five measures that could reduce the economic benefits of the project:

- run-of-river operation;
- spillage flows;
- recreational enhancements;
- landscaping; and
- downstream fish passage.

1. Run-of River Operation

The Passumpsic Project was originally licensed to run in the peaking and pulsing mode. CVPSC proposes to change the mode of operation to instantaneous run-of-river. Our analysis shows that the proposed change to run-of-river would decrease project benefits by $4,000 annually (based on lost generation of 41 MWh) or 1.03 mills/kWh, when levelized over a 40-year license period.

2. Spillage Flows

Spillage flows at Passumpsic are proposed to enhance fish habitat, water quality, terrestrial habitat, aesthetics, and recreation.

We computed the annual lost generation and the resultant decline in net annual benefits for a range of spillage flows proposed by CVPSC, VANR, Interior, and staff. For fishery and water quality enhancement, we included continuous, year-round flows of 26 cfs (applicant's proposal), 74 cfs and 88 cfs (Interior's proposal), and 110 cfs (VANR's proposal). We included flows of 26, 74, 110, 165, and 211 cfs for aesthetic enhancement. These flows would be maintained for 12 hours per day from April 15 through October 31. Table 11 provides a summary of the results.

We also include an allowance of $5,000 to develop and implement an approved minimum flow monitoring plan (CVPSC proposes to use equipment already in place to monitor flows). Monitoring minimum flows would decrease project benefits by $500 annually or 0.13 mills/kWh, when levelized over the 40-year life of the project.

3. Recreation

CVPSC proposes the following recreational enhancements: an improved parking area, multi-use/picnic area, and a canoe access site at the project impoundment. The construction cost that CVPSC estimates for these enhancements would be $3,300 in 1994

dollars. Our analysis shows that the proposed recreational enhancements would decrease project benefits by $500 annually or about 0.13 mills/kWh, when levelized over a 40-year license period.

Table 11. Decrease in Passumpsic Project Benefits Due to Spillage Flows (Source: Staff)

Spillage Flow (cfs)	Annual Lost Generation (GWh)	Net Annual Benefits (Dollars)	(mills/kWh)
26 (continuous)	0.2595	-25,500	-6.59
26 (part-time)	0.0651	-6,400	-1.63
74 (continuous)	0.6494	-63,800	-16.49
74 (part-time)	0.1914	-18,800	-4.86
86 (continuous)	0.7400	-72,700	-18.79
88 (continuous)	0.7494	-73,600	-19.02
110 (continuous)	0.8794	-86,400	-22.33
110 (part-time)	0.2213	-21,700	-5.61
165 (part-time)	0.2826	-27,800	-7.18
211 (part-time)	0.3395	-33,400	-8.63

We recommend, in addition to those enhancements proposed by CVPSC, the following developments: interpretive signage, dam warning signs, a canoe portage trail and put-in area, a recreation opportunity guide, and two separate recreational use studies 10 and 20 years after the issuance of any license. We allow $12,000 for these enhancements, which includes incorporating an erosion and sediment control plan into the design of all proposed recreational measures. Our analysis shows that these recreational enhancements would decrease project benefits by $1,600 annually or about 0.41 mills/kWh, when levelized over a 40-year license period.

4. Aesthetics

Aesthetic enhancements would include landscaping around the substation. The construction cost that CVPSC estimated for landscaping would be $4,300 in 1994 dollars. Our analysis shows that the aesthetic enhancements would decrease project benefits by about $600 annually or about 0.16 mills/kWh, when levelized over a 40-year license period.

5. Downstream Fish Passage

CVPSC estimates that the cost of downstream fish passage would be $32,010 (including engineering, mobilization/demobilization, construction, and contingency costs) in 1991 dollars, with $5,000 for the annual cost of operation and maintenance (1995 dollars). The cost to design and implement the erosion and sediment control plan is relatively small compared to the overall conceptual cost of the facilities, and we assume it is incorporated into the engineering and construction costs.

Our analysis shows that installation and operation of downstream fish passage would decrease project benefits by $11,800 or about 3.04 mills/kWh, when levelized over the 40-year license period. The fish passage would be operational from April 1 through June 15 and from September 15 through November 15. In addition, the facility would require an additional flow of 20 cfs.

Staff estimates that the one-time cost of an effectiveness study would be $20,000. Our analysis shows that this study would decrease project benefits by about $1,900 annually or about 0.49 mills/kWh, when levelized over a 40-year license period.

As mentioned earlier, several spillage flows have been recommended by various entities for fishery and water quality enhancement. Table 11 shows the costs associated with these flows. Table 12 shows the additional cost of adding 20 cfs to these spillage flows to operate the downstream fish passage facility. The increased energy losses associated with the operation of the downstream fish passage facility have a nonlinear impact on lost generation from spillage flows. This impact is a function of where the spillage flow occurs on the flow duration curve.

No-Action Alternative

The no-action alternative has also been evaluated in this DEA. Under the no-action alternative, the projects would continue to operate as they do now, and there would be no changes to the existing environmental setting or project operation. Therefore, there would be no incremental costs for this alternative. Costs associated with continued operation and

maintenance would continue to be incurred, but the net benefits would remain essentially unchanged compared to current operation.

Table 12. Incremental Net Annual Benefits for Fish Passage Flows at the Passumpsic Project (Source: Staff)

Agency	Spillage Flow (cfs)	Fish Passage Flow (cfs)	Incremental Net Annual Benefits (Dollars)	(mill/kWh)
Applicant	26	20	-4,100	-1.06
Staff	74	20	-2,700	-0.70
VANR	86	20	-3,400	-0.88
Interior	88	20	-4,400	-1.13
VANR	110	20	-4,400	-1.13

VII. COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

We considered the applicant's proposed project, Section 18 fishway prescriptions, agency recommendations, and the no-action alternative under Sections 4(e) and 10(a) of the FPA. From our independent analysis of the environmental and economic effects of the alternatives, we selected a recommended alternative that includes the implementation of the following measures at all four projects:

- ù develop a soil erosion and sediment control plan for all land-disturbing activities associated with these new licenses;
- ù operate in instantaneous run-of-river mode;
- ù design monitoring plans for all recommended minimum flows;
- ù construct and operate interim and permanent downstream fish passage facilities;
- ù conduct studies to ensure that the downstream fish passage facilities are operating effectively;
- ù install "Danger Dam" signs and signs directing paddlers to the portage from the impoundment;
- ù develop and implement a Programmatic Agreement among the Commission, Advisory Council on Historic Preservation, and the VDHP, with CVPSC as a concurring party;

- ù design and install at least one interpretive sign at each project after consulting with the Vermont Department of Forests, Parks and Recreation on the design and location, and file plans for the interpretive signs with the Commission as part of the revised recreation plan;

- ù work with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation; the Town of St. Johnsbury; the Passumpsic River Watch; and other interested groups and individuals to develop a Passumpsic River recreation guide to be distributed free of charge throughout the local area and region;

- ù develop a plan to conduct a professional recreational-use survey 10 and 20 years after the issuance of any license, in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury; submit the plan to the Commission, for approval; conduct the study to determine the adequacy of the project's recreational facilities; and provide additional recreational enhancements, as needed;

- ù ensure that the proposed and our recommended recreational facilities conform to the national standards established by the Architectural and Transportation Barriers Compliance Board; and

- ù revise the recreation plan for each of the four projects to include our recommendations in consultation with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury; and file the revised recreation plan with the Commission, for approval.

In addition, we recommend the following site-specific measures.

Pierce Mills Project

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling (following flashboard replacement, project maintenance, or other reservoir lowerings): 118 cfs from June 1 to September 30; 237 cfs from October 1 to March 31; and 948 cfs from April 1 to May 31. When natural inflow to the project is insufficient to meet these flow requirements and fill the impoundment, the impoundment shall be refilled while releasing 90 percent of the instantaneous inflow at all times;

- ù provide a year-round minimum instantaneous spillage of 88 cfs or inflow, whichever is less, to the bypassed reach for aquatic and aesthetic enhancement;

- ù develop, in consultation with VANR, and implement a landscaping plan;

- ù construct, operate, and maintain the applicant's proposed parking improvements, picnic and play area with restrooms, and access stile over the penstock; and

- ù construct two overnight camp sites for canoeists in the vicinity of the project, coordinating plans and construction with the Recreation Section of the Vermont Department of Forests, Parks and Recreation.

Arnold Falls Project

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling: 127 cfs from June 1 to September 30; 254 cfs from October 1 to March 31; and 1,016 cfs from April 1 to May 31. When natural inflow to the project is insufficient to meet these flow requirements and fill the impoundment, the impoundment shall be refilled while releasing 90 percent of the instantaneous inflow at all times;

- ù provide a year-round minimum instantaneous spillage of 78 cfs (plus leakage) or inflow, whichever is less, to the north channel bypassed reach for aquatic habitat enhancement and aesthetic enhancement;

- ù provide an instantaneous minimum flow of 21 cfs to the tailrace channel for aquatic habitat protection when the project is not generating;

- ù construct, operate, and maintain a canoe portage across Arnold Island (performing enough clearing and grading to create a safe passage); a public access and bank fishing area; and a parking area; and

- ù coordinate construction of the canoe portage with the Recreation Section of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury, and file plans with the Commission as part of their revised recreation plan.

Gage Project

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is

refilling: 207 cfs from June 1 to September 30; 413 cfs from October 1 to March 31; and 1,652 cfs from April 1 to May 31. When natural inflow to the project is insufficient to meet these flow requirements and fill the impoundment, the impoundment shall be refilled while releasing 90 percent of the instantaneous inflow at all times;

- ù reset the flashboards following any lowering before the impoundment water surface decreases 2 feet below the normal pool elevation of 539.15 feet msl;

- ù provide a minimum instantaneous spillage via the south spillway of 32 cfs or inflow, whichever is less, from October 1 to May 31 and 17 cfs or inflow, whichever is less, from June 1 to September 31 for aquatic enhancement; and

- ù construct, operate, and maintain a picnic area on the east side of the Passumpsic River accessible by boat only.

Passumpsic Project

- ù release the following instantaneous minimum flows downstream of the project when the reservoir is refilling: 214 cfs from June 1 to September 30; 428 cfs from October 1 to March 31; and 1,712 cfs from April 1 to May 31. When natural inflow to the project is insufficient to meet these flow requirements and fill the impoundment, the impoundment shall be refilled while releasing 90 percent of the instantaneous inflow at all times;

- ù provide a year-round instantaneous spillage of 74 cfs or inflow, whichever is less, for aquatic and aesthetic enhancement;

- ù develop, in consultation with VANR, and implement a landscaping plan;

- ù construct, operate, and maintain parking improvements, a picnic area, and canoe access at the project impoundment;

- ù reconfigure existing plans for the proposed picnic area to accommodate the needs of the disabled, and file the changes as part of the revised recreation plan; and

- ù acquire an easement for the construction, operation, and maintenance of a canoe portage trail and put-in and coordinate plans for the canoe portage with the

Recreation Section of the Vermont Department of Forests, Parks, and Recreation.

Implementation of these measures would improve aesthetics, water quality, fisheries and recreational resources; increase access to the river in the projects' area; and provide for future fish passage.

Though the cost of these recommended measures would reduce the existing power benefits of each of the four projects, they would still have net benefits over a new license term compared to the projects without enhancements (Tables 13, 14, 15, and 16). Specifically, we consider five measures that could reduce the economic benefits of the project: (1) run-of-river operation, (2) minimum flows, (3) aesthetics, (4) recreational resources, and (5) downstream fish passage.

A. Run-of-River Operation

CVPSC proposes instantaneous run-of-river operation at all four projects. Both VANR and FWS concur with CVPSC's proposal.

Instantaneous run-of-river operation would eliminate regular variation in reservoir elevation and downstream flows currently produced by the projects' peaking operation. Moreover, by switching to a run-of-river mode, wetland vegetation adjacent to the impoundments would be enhanced, water quality would be protected, and aquatic habitat upstream of the dam and below the powerhouse would be enhanced by the reduction of dewatering events. Therefore, we recommend run-of-river operation.

We calculate the annual cost of the change from peaking to run-of-river operation to be about $2,700 at Pierce Mills, $4,000 at Arnold Falls, $2,900 at Gage, and $4,000 at Passumpsic.

Table 13. Net Annual Benefits over a 40-year license term of the Pierce Mills Project (Source: Staff)

Enhancements	Applicant's Proposal	Additional Costs with Staff Enhancements	Total (Preferred Alternative)
Net Benefits of Existing Project	$84,000	--	$84,000
Run-of-River	($2,700)	--	($2,700)
Spillage	($6,800)	($38,400)	($45,200)
Flow Monitoring	--	($500)	($500)
Downstream Fish Passage	--	($11,500)	($11,500)
Fish Passage Effectiveness Study	--	($1,900)	($1,900)
Aesthetics	($800)	--	($800)
Recreation	($600)	($1,900)	($2,500)
Net Benefits	$73,100	--	$18,900

Derivation of these costs is discussed in Section VI.

Table 14. Net Annual Benefits over a 40-year license term of the Arnold Falls Project (Source: Staff)

Enhancements	Applicant's Proposal	Additional Costs with Staff Enhancements	Total (Preferred Alternative)
Net Benefits of Existing Project	$101,300	--	$101,300
Run-of-River	($4,000)	--	($4,000)
Spillage	($12,700)	($27,000)	($39,700)
Flow Monitoring	--	($500)	($500)
Downstream Fish Passage	--	($12,200)	($12,200)
Fish Passage Flow	--	($4,600)	($4,600)
Fish Passage Effectiveness Study	--	($1,900)	($1,900)
Recreation	($600)	($1,600)	($2,200)
Net Benefits	$84,000	--	$36,200

Derivation of these costs is discussed in Section VI.

Table 15. Net Annual Benefits over a 40-year license term of the Gage Project (Source: Staff)

Enhancements	Appl's Proposal	Add'l Costs with Staff Enhance-ments	Total (Preferred Alternative)	Total Including Flows Required by the WQC
Net Benefits of Existing Project	$174,400	--	$174,400	$174,400
Run-of-River	($2,900)	--	($2,900)	($2,900)
Spillage	($14,200)	($1,000)	($15,200)	($63,100)
Flow Monitoring	--	($500)	($500)	($500)
Downstream Fish Passage	--	($16,900)	($16,900)	($16,900)
Fish Passage Flow	--	($6,000)	($6,000)	($1,500)
Fish Passage Effectiveness Study	--	($1,900)	($1,900)	($1,900)
Aesthetics	--	--	--	--
Recreation	($300)	($1,600)	($1,900)	($1,900)
Net Benefits	$157,000	--	$129,100	$85,700

Derivation of these costs is discussed in Section VI.

Table 16. Net Annual Benefits over a 40-year license term of the Passumpsic Project (Source: Staff)

Enhancements	Appl's Proposal	Add'l Costs with Staff Enhance-ments	Total (Preferred Alternative)	Total Including Flows Required by the WQC
Net Benefits of Existing Project	$304,000	--	$304,000	$304,000
Run-of-River	($4,000)	--	($4,000)	($4,000)
Spillage	($25,500)	($38,300)	($63,800)	($72,700)
Flow Monitoring	--	($500)	($500)	($500)
Downstream Fish Passage	--	($11,800)	($11,800)	($11,800)
Fish Passage Flow	--	($2,700)	($2,700)	($3,400)
Fish Passage Effectiveness Study	--	($1,900)	($1,900)	($1,900)
Aesthetics	($600)	--	($600)	($600)
Recreation	($500)	($1,600)	($2,100)	($2,100)
Net Benefits	$273,400	--	$216,600	$207,000

Derivation of these costs is discussed in Section VI.

B. Minimum Flows

We recommend the same instantaneous minimum flows as the resource agencies at the Pierce Mills bypass and the north channel of the Arnold Falls Project. We present our rationale for these recommendations in detail in Section V.C.2.

A major factor influencing our recommendations is the potential Atlantic salmon nursery habitat in both bypassed reaches. Although salmon nursery habitat is present in the free-flowing sections of the mainstem Passumpsic River, the bypassed reaches offer a disproportionately large amount of the best nursery habitat. Therefore, we consider these two reaches to be important in terms of their potential contribution to the success of Atlantic salmon restoration efforts.

Our recommended bypass flows would result in an estimated 11,635 square feet of additional salmon nursery habitat in the Pierce Mills and Arnold Falls bypassed reaches than the flows proposed by CVPSC. We consider this an important incremental gain given the amount of resources (financial and otherwise) that have been invested in the salmon restoration program in the Connecticut River Basin. Providing these flows represents the best comprehensive use of the Passumpsic River.

In addition to the aforementioned minimum flows for aquatic resource enhancement, we considered spillage of 17 cfs over the South Dam at Arnold Falls from April 1 to November 30 for aesthetic purposes. Given the $6,200 in annual lost generation and the limited viewing potential, we have not recommended inclusion of this enhancement.

The annual cost in lost generation of providing these bypass flows for aquatic enhancement is about $45,200 at Pierce Mills and $39,700 at Arnold Falls (the cost of lost generation from flows bypassed through the fish passage facility on a seasonal basis is not included for Arnold Falls).

Essentially, we agree with the applicant's proposed minimum flows for the bypassed reach at the Gage Project, although we adjusted the timing of flows to better protect brown trout spawning and incubation. Some Atlantic salmon nursery habitat may be present in the bypassed reach (CVPSC's consultant estimates about 12 nursery units), but the species of concern to resource agencies at this site is brown trout. We interpret this as an indication that this reach does not represent uniquely important salmon nursery habitat. The bypass flows recommended by the resource agencies would result in minimal, if any, gains in brown trout habitat and would not represent the best comprehensive use of the waters of the Passumpsic River.

The annual cost in lost generation of providing our recommended bypass flows at Gage would be about $15,200, which does not include flows bypassed through the fish passage facility on a seasonal basis. The resource agency minimum flows would add about $47,900 per year to our estimated cost of lost generation.

Our recommended 74 cfs year-round bypass flow at Passumpsic represents a balancing of the cost of incremental gains in aquatic habitat and aesthetic enhancement. Although CVPSC's consultant estimates that there are about 41 salmon nursery units in this bypassed reach, the resource agencies indicate that the primary species of concern is rainbow trout. Quantification of habitat is relaxed from the estimate of usable habitat in square feet to an estimate of the "percentage of good rainbow trout habitat" in the reach. As indicated in our discussion of this bypassed reach (see Section V.C.B), the VANR-recommended flow of 110 cfs appears reasonable from a biological perspective.

However, the habitat gains realized when bypassed flows are increased from 74 cfs to 110 cfs are only 5 percent in "good rainbow trout habitat." The incremental cost of this 5 percent gain is estimated to be about $22,600 per year. We do not consider the minimal habitat gains in this steep, relatively short bypassed reach to warrant the resultant large economic cost in lost generation. The 86 cfs flow included in VANR's WQC condition is closer to our recommendation but the incremental annual cost for this small habitat gain is about $8,900.

We consider a flow of 211 cfs over the Passumpsic Dam to represent the best flow from an aesthetic perspective. However, a flow of 74 cfs is satisfactory. The best views of the bypassed reach are from downstream of the project, on or near the railroad bridge. Public access to this undeveloped area is not encouraged for safety considerations. Therefore, given the limited number of viewers, we consider that a flow of 74 cfs, although less than optimal, would provide sufficient aesthetic enhancement.

The cost in lost generation of releasing our recommended bypassed flow of 74 cfs would be about $63,800 per year. This cost does not include the bypassed flow through the fish passage facility on a seasonal basis.

C. Aesthetic Resources

We address minimum flows for aesthetic enhancement in Section VII.B.

We recommend that CVPSC, in consultation with VANR, revise its landscaping plans for the Pierce Mills and Passumpsic projects. The revised plans should be filed with the Commission, for approval.

With the addition of picnic areas at the Pierce Mills and Passumpsic projects, the number of visitors to the two sites would increase. Additional landscaping at the sites would enhance the appearance and provide a more enjoyable setting for visitors. We have calculated the annual levelized cost to CVPSC for the proposed landscaping at the Pierce Mills and Passumpsic projects to be $800 and $600, respectively.

D. Recreational Resources

We recommend that CVPSC revise its recreation plan for each project to include our recommendations. The comments of the Vermont Department of Forests, Parks, and Recreation and the Town of St. Johnsbury should be included, and the revised recreation plan should be filed with the Commission, for approval.

The recreation plan should include: diagrams showing the detailed dimensions of all new facilities; a description of the

materials to be used to construct each new facility; a description of how the proposed recreation facilities conform to the requirements of the Americans with Disabilities Act of 1990; a discussion of the location, material, and information of each interpretive sign; figures indicating the location, material, dimensions, and wording of each sign warning boaters and canoeists of the dam or advising them of the canoe portage; and a description of the status of the easements needed for canoe portage.

The demand for recreational enhancements along the Passumpsic River will continue to expand as a consequence of increases in the region's population and the proportion of the public that recreates. Improvements in water quality resulting from the conversion of each project to run-of-river operation would enhance the quality of salmonid habitat downstream of each project. This impact would result in an increased demand for river access in the future. Consequently, we consider it appropriate that CVPSC conduct recreational use surveys 10 and 20 years from license issuance, and develop recommendations regarding additional recreational enhancements.

The annual levelized cost to CVPSC for the proposed and recommended recreational enhancements for the four 40-year licenses would be about $2,500 at Pierce Mills, $2,200 at Arnold Falls, $1,900 at Gage, and $2,100 at Passumpsic.

E. Downstream Fish Passage

Atlantic salmon fry and parr have been stocked upstream of all four Passumpsic River projects. This stocking is part of a plan to restore Atlantic salmon runs to several New England river basins. Depending on the success of the restoration program, Interior may also require upstream passage in the future. However, construction of upstream passage facilities has been deferred to a time when migrating adults have access to the projects. Downstream passage facilities should be completed by the time the stocked fry and parr are ready to migrate downstream to the Atlantic Ocean.

There is an immediate need for downstream fishways at Gage and Passumpsic due to the stocking of parr in the Moose River (which joins the Passumpsic upstream of Gage) during 1991. Fishways should be operational at Pierce Mills and Arnold Falls by spring 1995.

Interior has asserted its authority under Section 18 of the FPA to prescribe downstream passage at all four projects. We recommend that CVPSC install interim downstream fish passage at all four projects by April 1, 1995. These facilities should be operated until permanent downstream passage facilities are installed.

The annual cost of downstream passage facilities would be about $11,500 at Pierce Mills, $12,200 at Arnold Falls, $16,900 at Gage, and $11,800 at Passumpsic. These costs include: the cost of designing and constructing each facility and the cost to maintain them.

The annual cost associated with the estimated 20 cfs required to operate each fishway varies depending on minimum flows. The costs based on our recommended flows are: $4,600 at Arnold Falls; $6,000 at Gage; and $2,700 at Passumpsic. Because CVPSC proposes to pass fish through a sluiceway into the bypassed reach at Pierce Mills, there is no additional cost of lost generation above the bypass minimum flow costs at this project. Based on VANR's flows in the WQC, the costs at Gage and Passumpsic would be $1,500 and $3,400, respectively. The estimated annualized cost of a fishway effectiveness study at each project is $1,900.

F. Conclusion

In conclusion, CVPSC should implement its proposal, with our modifications, Interior's fish passage prescription, and our recommended measures described in the staff's alternative section. We estimate that the cost of implementing these measures at all four projects would total $262,900 per year (Table 17). We believe that this cost is feasible given the project economics. This figure is the sum of: (1) the value of lost generation, and (2) the cost of project enhancements.

CVPSC must also implement spillage flows included in VANR's WQC. These differ from our recommended measures at Gage and Passumpsic. The incremental cost of implementing these flows and the related fish passage flows would total $52,700 per year. The total net annual benefit for the four Passumpsic River projects would be $348,100.

Table 17. Net Annual Benefits for a 40-year License Term of the Four Passumpsic River Projects (Source: Staff)

Enhancements	Appl's Proposal	Add'l Costs with Staff Enhance-ments	Total (Preferred Alternative)	Total Including Flows Required by the WQC
Net Benefits of Existing Projects	$663,700	--	$663,700	$663,700
Run-of-River	($13,600)	--	($13,600)	($13,600)
Spillage	($59,200)	($104,700)	($163,900)	($220,700)
Flow Monitoring	--	($2,000)	($2,000)	($2,000)
Aesthetics	($1,400)	--	($1,400)	($1,400)
Recreation	($2,000)	($6,700)	($8,700)	($8,700)
D/S Fish Passage	--	($52,400)	($52,400)	($52,400)
Fish Passage Flow	--	($13,300)	($13,300)	($9,500)
Fish Passage Effectiveness Study	--	($7,600)	($7,600)	($7,600)
Total	$587,500	--	$400,800	$347,800

VIII. RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of the FPA, as amended by the Electric Consumers Protection Act of 1986, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by Federal and state fish and wildlife agencies for the protection 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 each agency.

For the four Passumpsic projects, VANR and Interior have had an opportunity to make comments and recommendations. Interior

and VANR have provided recommended license articles; VANR also has issued WQCs for the four projects.

All VANR and Interior recommendations are evaluated and discussed in the water, fishery, and terrestrial resources sections of this EA, and our conclusions concerning the merits of these recommendations are presented there. Table 18 summarizes these conclusions and our recommended actions for those enhancement measures that relate to fish and wildlife.

The recommendations contained in this assessment are consistent with those filed by the Interior and the VANR with two exceptions, as shown in Table 18. The bypass flows at Gage and Passumpsic are considered within the scope of 10(j).

We did not agree with Interior's or VANR's recommendation to release seasonal bypass flows at Gage of 83 cfs and 142 cfs to provide brown trout habitat, because the benefit of that large a release is not warranted by the incremental costs. Our recommendation of 32 cfs and 17 cfs would provide similar suitable habitat at a significantly lower cost (see Sections V.C.3 and VI). However, VANR's version of this recommendation was subsequently made a condition of the WQC and is included in the license for the project. Interior subsequently indicated by letter dated July 1, 1994, that VANR's condition was acceptable; therefore, no 10(j) issue exists.

Similarly, we did not agree with Interior's recommendation for a minimum bypass flow of 88 cfs at Passumpsic or VANR's recommendation of 86 cfs, because the benefit of the large releases is not warranted by the incremental cost. Our recommendation of 74 cfs provides about 73 percent "good" habitat at a lower cost. VANR subsequently included a WQC condition for 86 cfs, which is included as part of the license for the project. Interior, in the letter dated July 1, 1994, stated that VANR's condition was acceptable; therefore, no 10(j) issue exists.

Table 18. Analysis of Fish and Wildlife Agency Recommendations

Recommendations All Four Projects	Agency	Within the Scope of 10(j)	Conclu-sion	Action
Run-of-river operation	Interior VANR	Yes	Agree	Adopted
Monitoring plan for run-of-river	Interior VANR	Yes	Agree	Adopted
Construct and operate interim downstream passage facilities by April 1, 1995	Interior	No-this is a Section 18 Prescrip-tion	Agree	Adopted
Construct and operate permanent downstream passage facilities	Interior VANR	Yes	Agree	Adopted
Submit functional design drawings of the interim fishways within 4 months of the FERC project licenses	Interior	No-not specific measure to protect F&W	Agree (with modifi-cations)	Adopted (ad-justed sub-mittal date from 4 to 6 months
Submit functional design drawings for permanent fishways with operation and maintenance procedures within 6 months of the FERC project licenses	Interior VANR	No-not specific measure to protect F&W	Agree (with modifi-cations)	Adopted (ad-justed sub-mittal date from 6 months to 1 year)

Recommendations	Agency	Within the Scope of 10(j)	Conclu-sion	Action
Operate the interim and permanent fishways from April 1 through June 15 and September 15 to November 15	Interior VANR	Yes	Agree	Adopted
Evaluate the effectiveness of fish passage facilities	Interior	Yes	Agree	Adopted
Minimum ABF flows below projects during impoundment refilling	Interior VANR	Yes	Agree	Adopted
Monitoring plan for bypass flows	Interior VANR	Yes	Agree	Adopted
Trashrack and flashboard debris disposal	VANR	No-not specific measure to protect F&W	Agree	Adopted
Develop recreation plans for each project and implement within 1 year of FERC project licenses	VANR	No-not specific measure to protect F&W	Agree (with modifi-cations)	Adopted (with modifi-cations)
Encourage public access to the river, subject to safety and liability limitations	VANR	No-not specific measure to protect F&W	Agree	Adopted
Develop a recreation master plan	VANR	No-not specific measure to protect F&W	Partial-ly agree	Partial-ly adopted

Recommendations	Agency	Within the Scope of 10(j)	Conclu-sion	Action
Pierce Mills				
Minimum bypass flow of 88 cfs	Interior VANR	Yes	Agree	Adopted
Develop and implement landscaping plan	VANR	No-not specific measure to protect F&W	Agree	Adopted
Arnold Falls				
Provide canoe portage within 1 year of license issuance	VANR	No-not specific measure to protect F&W	Agree	Adopted
Minimum bypass flow of 78 cfs over north dam	Interior VANR	Yes	Agree	Adopted
Minimum flow of 33 cfs to tailrace when plant not generating	Interior VANR	Yes	Disagree	Adopted*
Gage				
Minimum bypass flow of 82 cfs from June through September and 142 cfs from October through May +	Interior	Yes	Disagree	Adopted
Minimum bypass flow of 82 cfs from June through September and 142 cfs from October through May	VANR	Yes	Disagree	Adopted*

Recommendations	Agency	Within the Scope of 10(j)	Conclu-sion	Action
Develop a remediation plan and schedule for correcting erosion attributed to project operation	VANR	No-not specific measure to protect F&W	Disagree	Adopted*
Provide canoe portage within 1 year of license issuance	VANR	No-not specific measure to protect F&W	Disagree	Already built
Passumpsic				
Minimum bypass flow of 86 cfs +	Interior	Yes	Disagree	Adopted
Minimum bypass flow of 86 cfs	VANR	Yes	Disagree	Adopted*
Develop a canoe portage within 1 year of license issuance	VANR	No-not specific measure to protect F&W	Agree	Adopted (pending easement acquisi-tion)
Develop and implement landscaping plan	VANR	No-not specific measure to protect F&W	Agree	Adopted

* This recommendation must be adopted because it is also a lawful condition included in VANR's water quality certificate for the project.
\+ Based on Interior's letter dated July 1, 1994.

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 or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. Under Section 10(a)(2), Federal and Vermont agencies filed a total of 28 qualifying comprehensive plans of which we identified 10 Vermont and 5 United States comprehensive plans to be applicable. No conflicts were found. Comprehensive plans

relevant to this project are listed in Section XI. VANR also listed the Vermont Comprehensive Energy Plan, produced by the Vermont Department of Public Service in January 1991, although this plan is not included in the most recent (August 1993) listing of FERC-approved comprehensive plans. No conflicts were found with this plan.

X. FINDING OF NO SIGNIFICANT IMPACT

We conclude that none of the resources we studied--which include geologic resources, water resources, fishery resources, terrestrial resources, aesthetic resources, cultural resources, and recreational resources--would experience significant adverse effects under the proposed action or any of the action alternatives considered in this EA.

On the basis of the record and this EA, issuing a subsequent license for the projects as proposed by CVPSC, plus the enhancement measures we recommend, would not constitute a major Federal action significantly affecting the quality of the human environment. For this reason and pursuant to Commission regulations, no Environmental Impact Statement is required.

XI. LITERATURE CITED

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