ENVIRONMENTAL ASSESSMENT

FIFTEEN MILE FALLS HYDROELECTRIC PROJECT
FERC PROJECT NO. 2077-016

NEW HAMPSHIRE AND VERMONT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Environmental and Engineering Review
888 First Street, NE
Washington, DC 20426

November 2001

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
AMC	Appalachian Mountain Club
APE	Area of Potential Effect
APEA	Applicant Prepared Environmental Assessment
cfs	cubic feet per second
CLF	Conservation Law Foundation
COE	Corps of Engineers
CRASC	Connecticut River Atlantic Salmon Commission
CRCMP	Connecticut River Corridor Management Plan
CRJC	Connecticut River Joint Commissions
CRMP	Cultural Resources Management Plan
CRWC	Connecticut River Watershed Council
CWA	Clean Water Act
DO	dissolved oxygen
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FERC or Commission	Federal Energy Regulatory Commission
FMF	Fifteen Mile Falls
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
ISO	independent system operator
kW	kilowatt
mg/l	milligrams per liter
MOL	maximum operating level
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NCC	North Country Council
NEP	New England Power Company
NEPA	National Environmental Policy Act
NEPOOL	New England Power Pool
NGOs	non-governmental organizations
NH	New Hampshire
NHDES	New Hampshire Department of Environmental Services
NHFG	New Hampshire Fish and Game Department
NHNHI	New Hampshire Department of Resources and Economic Development, Natural Heritage Inventory

NHRC	New Hampshire Rivers Council
NHTU	New Hampshire Council of Trout Unlimited
NHSHPO	New Hampshire State Historic Preservation Office
NMFS	National Marine Fisheries Service
NPS	National Park Service
NVDA	Northeastern Vermont Development Association
PA	Programmatic Agreement
PSD	Proportional Stock Density
PUB	palustrine unconsolidated bottom group
RM	river mile
ROR	run-of-river
SAV	submerged aquatic vegetation
TNC	The Nature Conservancy
USGenNE	USGen New England, Inc.
USGS	U.S. Geological Survey
VANR	Vermont Agency of Natural Resources
VT	Vermont
VTDFW	Vermont Department of Fish and Wildlife
VTSHPO	Vermont State Historic Preservation Office
VTU	Vermont Council of Trout Unlimited
WQC	Water Quality Certification

SUMMARY

To relicense the Fifteen Mile Falls (FMF) Project, USGen New England, Inc. (USGenNE) elected to use an Alternative Licensing Process (ALP). This environmental assessment (EA) is based on a draft EA developed by USGenNE and a collaborative team, consisting of representatives of USGenNE, New Hampshire Department of Environmental Services, Vermont Agency of Natural Resources, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, National Park Service, regional planning agencies, and non-governmental organizations (NGOs), and filed with the Federal Energy Regulatory Commission (FERC/Commission) on July 29, 1999, as part of the ALP. The FMF Project consists of three developments: Moore, Comerford and McIndoes, and is located in Grafton County, New Hampshire and Caledonia County, Vermont. The FMF Project has a total nameplate capacity of about 291.36 megawatts. The FMF Project has a total average annual generation of approximately 639,000 megawatthours. The FMF Project does not occupy federally-owned lands.

As a result of the ALP, USGenNE and the stakeholders reached a Settlement Agreement on proposed operations and environmental measures. The proposed action, (see Section III.A.3), implements the terms of this Settlement Agreement (see Section I).

In this EA, we evaluate the environmental and economic effects of the proposed action defined by the Settlement Agreement, and various alternatives to the proposed action, including no-action. The application for this project is consistent with the Settlement Agreement. Implementing the provisions of the Settlement Agreement would result in the following: (1) operation of the Moore development to provide a maximum operating level (MOL) of 809 feet mean sea level (msl) for the reservoir, provide a minimum flow of 320 cubic feet per second (cfs) or inflow year-round, and provide targeted reservoir elevations during the spring spawning period; (2) operation of the Comerford development to provide a MOL of 650 feet msl for the reservoir, provide minimum flows of 818 cfs for the period June 1 through September 30, 1,145 cfs for the period October 1 through March 31, and 1,635 cfs for the period of April 1 through May 31, and provide targeted reservoir elevations during the spring spawning period; (3) operation of the McIndoes development to provide a MOL of 451 feet msl and a minimum operating elevation of 447.5 feet msl for the reservoir, provide minimum flows of 1,105 cfs or inflow for the period of June 1 through September 30, and 2,210 cfs or inflow for the period of October 1 through March 31, and for spring spawning flow and incubation, provide 4,420 cfs or inflow for the period of April 1 through May 31; (4) establishment of an Upper Connecticut River Mitigation and Enhancement Fund with a $3 million initial contribution and annual payments thereafter; (5) implementation of permanent conservation easements on about 4,000 acres of lands within the FMF Project

boundary, and on about 4,200 acres of non-project land contiguous to the FMF Project boundary; (6) implementation of a Fisheries Management Plan; (7) implementation of a Wildlife and Forest Management Plan; (8) implementation of a Rare and Unusual Plant/Plant Community Management Plan; (9) implementation of a Threatened and Endangered Species Management Plan; (10) implementation of a Recreational Facilities and Management Plan, including proposed recreation facility enhancements and safety enhancements; and (11) implementation of a Programmatic Agreement, including a Cultural Resources Management Plan.

Since the Connecticut River forms the boundary between Vermont and New Hampshire, Vermont and New Hampshire agreed under the Settlement Agreement, to a single WQC to be issued by New Hampshire. On April 16, 2001, New Hampshire issued a WQC for the project. On July 13, 2001, the Vermont filed its affirmation of the WQC. The conditions contained in the WQC, which are mandatory license conditions, are consistent with the proposed action and the Settlement Agreement.

Interior filed 16 recommendations for the project on September 27, 2000. Three of the 16 recommendations are outside the scope of Section 10(j) because they are not specific measures for the protection of fish and wildlife. We recommend adopting under Section 10(a) Interior's recommendations that the licensee consult and study passage for American eels at project dams. We do not recommend adopting Interior's recommendations requiring the licensee 1) to complete an assessment of Atlantic salmon smolt migration through the Moore and Comerford impoundments, and 2) to contribute to a mitigation and enhancement fund.

We considered 13 of Interior's 16 recommendations as valid recommendations under Section 10(j). We recommend that all 13 recommendations be adopted, with the following refinement. Interior recommended that conservation easements, as specified in the Settlement Agreement, be established for licensee-owned lands, to include some non-project lands. We recommend requiring the licensee to establish conservation easements with respect to project lands only.

Based on an independent review, we conclude that the FMF Project would allow USGenNE to operate the project as a beneficial and dependable source of power. Overall, the proposed measures would protect and enhance geology and soils, water quality, aquatic, terrestrial, land use and aesthetic, recreational, and cultural resources. Issuing a new license for the FMF Project, with our recommended measures, would not constitute a major federal action significantly affecting the quality of human environment.

ENVIRONMENTAL ASSESSMENT

FIFTEEN MILE FALLS HYDROELECTRIC PROJECT
FERC No. 2077-016
New Hampshire and Vermont

I. APPLICATION

The Fifteen Mile Falls (FMF) Hydroelectric Project (FERC No. 2077) is located in Grafton County, New Hampshire, and Caledonia County, Vermont, between river miles (RM) 268.2 and 294.5 on the Connecticut River. USGen New England, Inc. (USGenNE) holds the license for the FMF Project (previously licensed to New England Power Company [NEP]), which expired on July 31, 2001. On April 22, 1996, NEP filed with the Federal Energy Regulatory Commission (FERC or Commission) a Notice of Intent to relicense the FMF Project pursuant to 18 CFR § 16.6.

In October 1995, NEP initiated discussions about the Alternative Licensing Process (ALP), and beginning in February 1996, representatives of state and federal agencies, local interests, and non-governmental organizations (NGOs), working at the invitation of NEP, undertook a cooperative effort for the relicensing of the FMF Project. Settlement negotiation meetings were conducted during the spring of 1997, and these efforts resulted in a signed Settlement Agreement dated August 6, 1997, the Connecticut Lakes Supplementary Agreement, and Lake Frances Memorandum of Agreement. The latter two agreements do not directly involve the operation of the FMF Project, but act to preserve and further enhance the Upper Connecticut River watershed consistent with the Settlement Agreement by protecting and managing the Connecticut Lakes and Lake Francis.

The Settlement Agreement parties include: USGenNE/NEP; the State of New Hampshire through its Governor and the New Hampshire Fish and Game Department (NHFG), New Hampshire Department of Environmental Services (NHDES); the State of Vermont through its Governor and the Vermont Agency of Natural Resources (VANR); the U.S. Fish and Wildlife Service (FWS); the U.S. Environmental Protection Agency (EPA); the National Park Service (NPS); the Appalachian Mountain Club (AMC); the Connecticut River Joint Commission (CRJC); the Connecticut River Watershed Council (CRWC); the Conservation Law Foundation (CLF); the New Hampshire Rivers Council (NHRC); the North Country Council (NCC); the Northeastern Vermont Development Association (NVDA); the New Hampshire Council of Trout Unlimited (NHTU); and the Vermont Council of Trout Unlimited (VTU). The Settlement Agreement provides terms and conditions for water quality, fisheries, wildlife, terrestrial, recreation, land use, aesthetic, and cultural resources to be included in any new license issued for the FMF

Project. The proposed action, described in Section III.A.3, implements the terms of this Settlement Agreement.

On March 9, 1998, pursuant to 18 CFR § 4.34(i), NEP filed a request to use the ALP for submitting an application for new license for the FMF Project, which the Commission granted on April 22, 1998. The alternative procedures combine the prefiling consultation process with the FERC post-filing environmental review process, pursuant to the National Environmental Policy Act (NEPA)[1], allowing USGenNE to complete and file an Applicant Prepared Environmental Assessment (APEA) in lieu of Exhibit E, Environmental Report, required as part of the license application. On July 29, 1999, USGenNE filed a license application and APEA.

II. PURPOSE OF ACTION AND NEED FOR POWER

A. Purpose of Action

USGenNE is seeking a new license under Section 15 of the Federal Power Act (FPA) to authorize the continued operation and maintenance of the FMF Project. In this environmental assessment (EA), the environmental and economic effects of operating the project as proposed under the action alternatives and no-action are assessed.

B. Need for Power

USGenNE is a member of the New England Power Pool (NEPOOL) and the FMF Project is part of the NEPOOL interconnected power system for the New England region. NEPOOL, a voluntary organization of nearly 100 individual providers of electric services located throughout the six state New England region, accounts for essentially all of the region's electric power production. As of mid 1999 the USGenNE facilities are expected to bid their output into a competitive electricity market under the supervision of the Independent System Operator (ISO) New England. The use of FMF Project generated power will be within the context of this new market.

C. Scope of Cumulative Effects Analysis

According to the Council of Environmental Quality's (CEQ) regulations for implementing NEPA (40 CFR § 1508.7), a cumulative impact is the impact on the

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[1] National Environmental Policy Act of 1969, as amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), Sept. 13, 1982).

environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, to include hydropower and other land and water development activities.

We evaluate the cumulative effects of the proposed action and alternatives with regard to other existing and foreseeable development in the Connecticut River upstream and downstream of the project. We identified possible cumulative effects on geology and soils, water, fishery, terrestrial, aesthetic, recreation, and cultural resources that may be affected in a cumulative manner by the continued operation of the FMF Project in combination with other activities on the Connecticut River. These activities include the operation of other hydropower projects and dams on the river, growing pressures to develop riverfront properties, municipal and industrial discharges, and agricultural runoff. We used the resource area to determine the geographic and temporal scope of the analysis for this EA.

The effects of other actions occurring in the river basin relative to existing project resources can be derived from the following environmental document prepared by the Commission staff and is incorporated by reference per 40 CFR 1502.20: Holyoke Hydroelectric Project (FERC No. 2004, FERC No. 11607), Final Environmental Impact Statement, July 1999. See also, Appendix H of the license application for the FMF Project.

1. Geographic Scope

The geographic scope of our cumulative effects analysis defines the physical limits or boundaries of the proposed action's effects on the identified cumulatively affected resources. Because the proposed action may affect some of the resources differently, the geographic scope for each of the resources may vary. We chose the geographic scope based on the potential direct and indirect effects of project operations and other activities potentially affecting the resources within the Connecticut River Basin.

The geographic scope of analysis, as identified in Scoping Document 2 (September 1998) is:

- geology and soils resources - the FMF Project area (from Gilman dam downstream to Ryegate reservoir);
- water resources - the FMF Project area downstream to Wilder reservoir;
- fishery resources - the main stem of the Connecticut River and applicable tributaries;

- terrestrial, wetland, and wildlife resources - the FMF Project area (from Gilman dam downstream to Ryegate reservoir);
- aesthetic resources - the FMF Project area (from Gilman dam downstream to Ryegate reservoir);
- recreation resources - the FMF Project region (within 60 miles of FMF Project area); and
- cultural resources - the FMF Project area (from Gilman dam downstream to Ryegate reservoir).

Cumulative effects as identified by the stakeholders are presented in "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

2. Temporal Scope

The temporal scope includes a discussion of the past, present, and reasonably foreseeable future actions and their effects on cumulatively affected resources. Based on a license term, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present.

III. PROPOSED ACTION AND ALTERNATIVES

A. Proposed Action

1. Project Description

The FMF Project is located on the Connecticut River near Littleton, New Hampshire, and Waterford, Vermont. The FMF Project consists of three developments: Moore, Comerford, and McIndoes, with a rated capacity of 291.36 MW (see Figure 1). The FMF Project area involves about a 26-mile reach of the river, including the three reservoirs and about a 1.5-mile riverine reach between the Comerford and McIndoes reservoirs.

The Moore development (see Figure 2), the furthest upstream, is located 283.5 miles from the mouth of the Connecticut River and consists of the following: (1) an 11-mile-long reservoir with a surface area of 3,490 acres and 223,722 acre-feet of gross storage at a normal maximum operating level of 809 feet msl; (2) an earth and concrete gravity dam with an overall length of 2,920 feet and a height of 178 feet; (3) a 373-foot-long concrete spillway with a 15-foot-wide by 20-foot-high sluice gate, four 50-foot bays

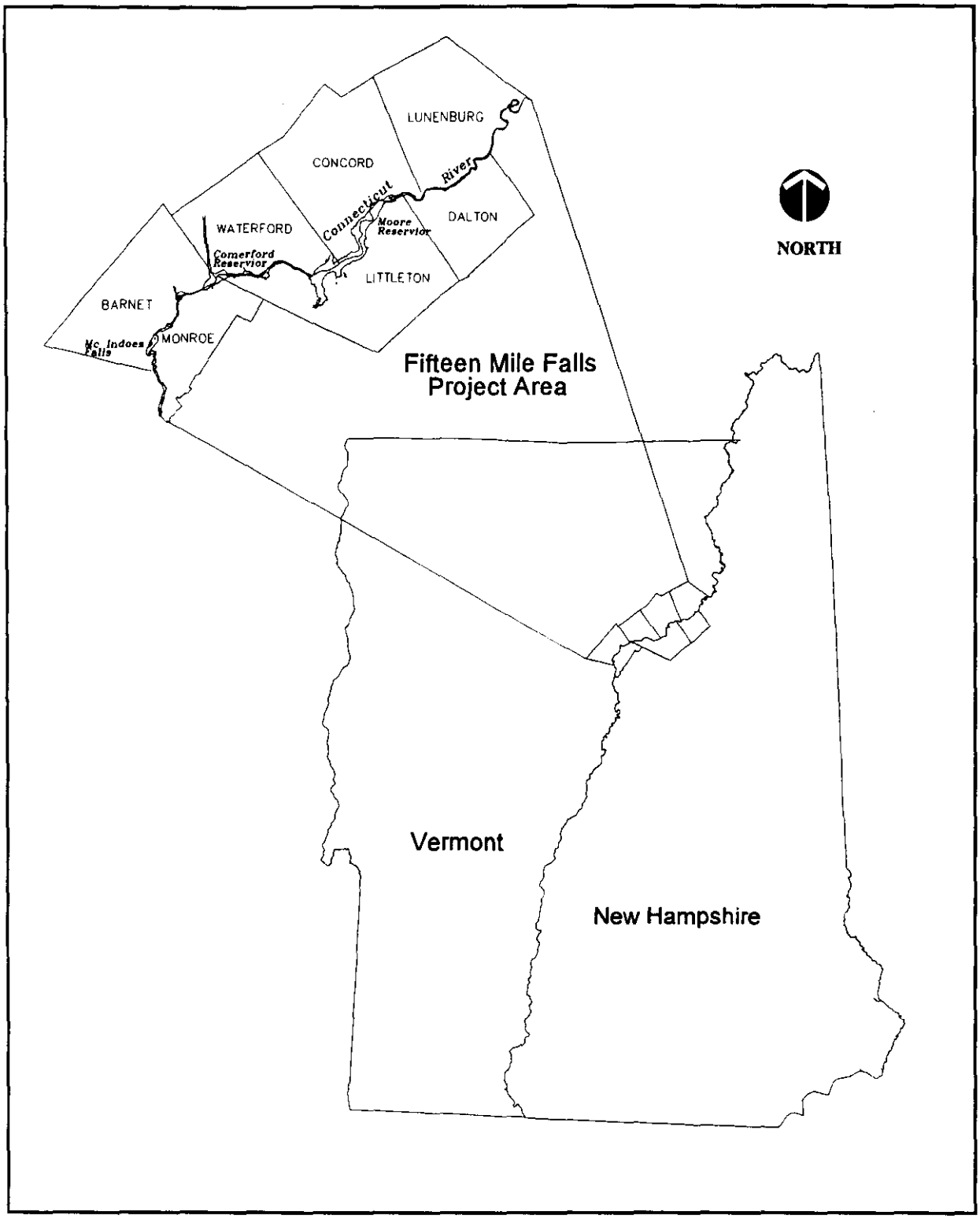

Figure 1. Location of the Fifteen Mile Falls Project Area. (Source: USGen New England, Inc. 1999)

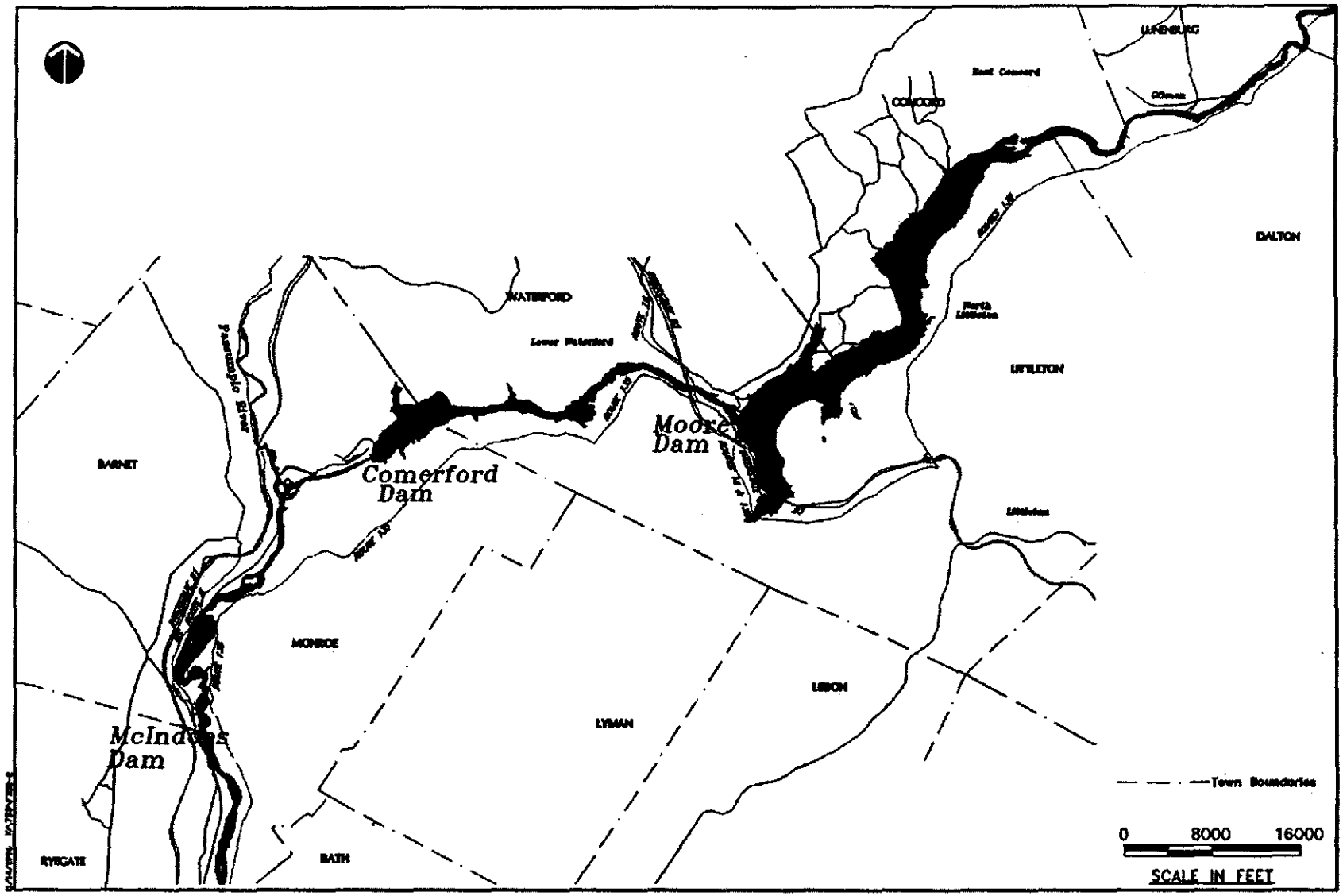

Figure 2. Location of Moore, Comerford, and McIndoes Developments. (Source: Applicant)

of 17-foot-high stanchions, and three bays of 36 foot-wide by 30-foot-high tainter gates; (4) four steel penstocks each 296 feet long; and (5) a powerhouse with four Francis type turbine-generator units. The turbines have a combined power rating of 225,600 horsepower (56,400 horsepower each) under a design head of 150 feet and a combined rated discharge of 13,300 cubic feet per second (cfs). Each generator is rated at 35,100 kilowatts (kW), yielding an overall rated capacity for the station of 140,400 kW. Maximum output at full load is 191,960 kW under a net head of 158 feet with a combined turbine discharge of 18,300 cfs.

The Comerford development (see Figure 2) is located 275.2 miles from the mouth of the Connecticut River and consists of the following: (1) an 8-mile-long reservoir with a surface area of 1,093 acres and 32,270 acre-feet of gross storage at a normal maximum operating level of 650 feet msl; (2) an earth and concrete gravity dam with an overall length of 2,253 feet and a height of 170 feet; (3) an 850-foot-long concrete spillway with six 7-foot-wide by 9-foot-high sluice gates, four bays of 8-foot-high flashboards and seven 10-foot-high stanchion bays; (4) four steel penstocks each 150 feet long; and (5) a powerhouse with four Francis type turbine-generator units. The turbines have a combined power rating of 216,800 horsepower (54,200 horsepower each) under a design head of 180 feet and a combined rated discharge of 12,010 cfs. Each generator is rated at 35,100 kW, yielding an overall rated capacity for the station of 140,400 kW. Maximum output at full load is 163,960 kW under a net head of 174 feet with a combined turbine discharge of 13,300 cfs.

The McIndoes development (see Figure 2) is located 268.2 miles from the mouth of the Connecticut River and consists of the following: (1) a 5-mile-long reservoir with a surface area of 543 acres and 5,988 acre-feet of gross storage at a normal maximum operating level of 454 feet msl; (2) a concrete gravity dam with an overall length of 730 feet and a height of 25 feet; (3) a 520-foot-long concrete spillway with a 12-foot-wide by 13-foot-high skimmer gate, three 24-foot-wide by 25-foot-high tainter gates, a 300-foot long spillway flashboard section with 6-foot flashboards, and two 50-foot-wide by 18-foot-high stanchion bays; and (4) a powerhouse with four Kaplan type turbine-generator units. The turbines have a combined power rating of 15,200 horsepower (3,800 horsepower each) under a design head of 29 feet and a combined rated discharge of 5,800 cfs. Each generator is rated at 2,640 kW, yielding an overall rated capacity for the station of 10,560 kW. Maximum output at full load is 13,000 kW under a net head of 26 feet with a combined turbine discharge of 5,800 cfs.

2. Existing Project Operations

The Moore development is a seasonal storage development operated in a daily peaking mode, with typical daily cycling of the headpond of less than 2 feet. Seasonally, the reservoir is filled close to maximum (809 feet msl) after the spring freshet and

operated throughout the summer for generation and flow augmentation purposes, on average, between 804 to 806 feet msl. Over the winter period, the reservoir is drawn down to a target elevation of 769 feet msl prior to the onset of the spring freshet which annually refills the reservoir. Currently there is no minimum flow requirement below Moore station into the Comerford headpond, which extends upstream to the Moore Dam.

The Comerford development is also a seasonal storage development operated in a daily peaking mode, essentially passing discharge from the upstream Moore station with little re-regulation. Comerford typically operates in the vicinity of elevation 647 feet msl within a seasonally dependent 2-foot range between elevation 646 and 648 feet msl. A winter drawdown is scheduled, however, to provide reservoir storage prior to the spring freshet to capture local spring runoff and any extra flow passed as spill from Moore. The target drawdown level is 640 feet msl by mid to late February, with an additional capability to reach 610 feet msl, if necessary. There is no minimum flow requirement at the Comerford development.

The McIndoes development operates on a daily cycle and is used primarily to levelize the inflow (Comerford discharge) by discharging at a more constant rate throughout each day. This entails daily cycling of the headpond through an average 4 foot range between elevations 450 and 454 feet msl. The minimum elevation at the beginning of each day is determined by scheduled generation at Comerford upstream and predicted inflow. This determines the McIndoes generation schedule to build the headpond throughout the day and draw it back down over night. A maximum drawdown range of 10 feet in the summer and 8 feet in the winter is occasionally used to re-regulate high inflows from both the unregulated tributaries and station discharges upstream. Under a special agreement not required by the existing license, McIndoes maintains a minimum flow of 1,850 cfs every 5 hours.

3. Proposed Operations and Environmental Measures

As a result of a cooperative consultation process involving state and federal resource agencies, regional planning agencies, local government associations, and various non-governmental organizations (NGO), NEP/USGenNE and the stakeholders reached a Settlement Agreement on proposed operations and environmental measures. The process of reaching this agreement included examination of the power and non-power tradeoffs and effects of a wide variety of different operational scenarios, based on computer modeling of the Connecticut River from the headwater storage lakes to downstream of the project. Various management scenarios involving combinations of various changes in project operations were evaluated. The operational changes included combinations of the following: various minimum flow levels below the project dams and the Connecticut Lake dams, reduced operating levels on the project impoundments, run-of-river operations, reduced winter drawdown, more stable summer lake levels, stable

lake levels in the spring to protect bass spawning, and others. The various operating scenarios, composed of combinations of these factors, were compared with one another and with current operations in terms of their expected environmental benefits as well as their effects on capacity, energy production, ancillary services, and other considerations.

This negotiation process, after careful consideration of alternatives, resulted in a balancing of power and non-power interests associated with the FMF Project through the FMF Project Settlement Agreement. In addition, during this negotiation process two separate supplemental agreements were reached: the Connecticut Lakes Supplementary Agreement and the Lake Francis Memorandum of Agreement. These supplemental agreements were negotiated by USGenNE and the stakeholders. These supplemental agreements are considered by the stakeholders to be negotiated as a package with the FMF Project Settlement Agreement. The increased flows released from these lakes under the agreements, would augment downstream flows and improve stream conditions for aquatic life.

The proposed action consists of the operational and environmental measures defined by the FMF Project Settlement Agreement. Other alternatives presented in this EA are limited in light of the fact that the proposed action was based on a thorough consideration and analysis during settlement discussions of other possible alternatives to the existing operation of the FMF Project, none of which were seen as meeting all the needs served by the provisions of the FMF Project Settlement Agreement and the proposed alternative.

Based on the FMF Project Settlement Agreement, USGenNE proposes the following measures:

1. Operate the Moore development as follows: reservoir surface elevation at 809 feet msl maximum operating limit; for spring fish spawning, achieve an elevation of at least 802 feet msl with target elevation of 804 feet msl by May 21 of each year; for the period from May 21 through June 30 the reservoir would not be drawn down more than 2 feet below any elevation previously attained in the same period; in the period from June 30 to May 21, reservoir operations would follow historic patterns and ranges; and release a minimum flow of 320 cfs or inflow year-round.

2. Operate the Comerford development as follows: reservoir surface elevation at 650 feet msl maximum operating limit; achieve an elevation of at least 645 feet msl, with a target elevation of 647 feet msl by May 21 for each year; for the period from May 21 through June 30 the reservoir would not be drawn down more than 2 feet below any elevation previously attained in the same period; in the period from June 30 to May 21, reservoir operations would follow historic patterns and ranges ; and release a minimum flow of 818 cfs for the period June 1 through September

30, 1,145 cfs for the period October 1 through March 31, and 1,635 cfs for the period of April 1 through May 31.

3. Operate the McIndoes development as follows: reservoir surface elevation at 451 feet msl maximum operating limit; reservoir may be drawn down a maximum of 3.5 feet to a minimum operations elevation of 447.5 feet msl; reservoir may surcharge above 451 feet msl if inflow exceeds discharge capability of 30,600 cfs; release a minimum flow of 1,105 cfs or inflow for the period of June 1 through September 30, and 2,210 cfs or inflow for the period of October 1 through March 31; inflow during these periods is defined as the sum of the applicable Comerford minimum flow and the prorated Passumpsic gage. In addition, for spring fish spawning flow and incubation: provide 4,420 cfs or inflow for the period from April 1 through May 31.

   If Moore and Comerford reservoirs are in danger of not filling, Comerford minimum flow would be reduced to no less than 50 percent of the Dalton gage flow, and McIndoes minimum flow would be the sum of prorated Passumpsic gage flow plus no less than 50 percent of the Dalton gage flow. The spawning flow could be reduced to 2,210 cfs if flows in excess of 50,000 cfs at Bellows Falls or in excess of 10,000 cfs at Wilder are expected. Finally, maximum flows would not exceed 5,800 cfs for more than 7 percent of the hours during the period from June 1 through February 28, but there would be no restriction on flows if Moore and Comerford reservoirs are both at their maximum operating limits or if stream flow (sum of the prorated Passumpsic and Dalton gages flows) exceeds 8,000 cfs during the months of March, April, and May.

4. Establish an Upper Connecticut River Mitigation and Enhancement Fund to provide funding for: project conservation easement [2] establishment, monitoring, and enforcement; river restoration work, such as dam removal and acquisition of development rights and property, fish passage at nonhydro dams, unlicensed hydropower facilities or natural barriers, or other riverine habitat improvements; restoration, protection, and enhancement of wetlands and adjacent buffer areas; riverine shoreland protection; and mitigation of tax revenue impacts in communities where lands in the Upper Connecticut Valley are proposed to be covered by conservation easements. By the terms of the 1997 Settlement Agreement, the expenditures of monies in the fund would be determined by a committee of stakeholders. The fund would be established with an initial contribution of $3 million, followed by annual payments thereafter. Fifty percent of the monies are to be allocated for river restoration efforts.

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[2]Conservation easements would maintain licensee-owned lands in undeveloped state and manage the lands for protection of natural resources.

5. Implement permanent conservation easements on about 4,000 acres of lands within the FMF Project boundary, and on about 4,200 acres of non-project lands contiguous to the FMF Project boundary to protect the scenic forestry and natural resource values of these lands. In addition, donate the land known as Sumner Falls, located in Hartland, Vermont, and Plainfield, New Hampshire, to the FWS or other identified suitable grantee.

6. Develop and implement a Fisheries Management Plan, which includes provisions for the following:

   (a) Plan for the protection, enhancement, and management of fish populations in the project area.

   (b) Investigate tributary access for spawning fish.

   (c) Provide a structural habitat enhancement plan for salmonids in the Moore and Comerford tailrace.

7. Provide downstream fish passage facilities at the McIndoes development within 2 years of licensing, and conduct an assessment of Atlantic salmon smolt migration through the Moore and Comerford reservoirs.

8. Provide upstream fish passage at the McIndoes development when 20 Atlantic salmon migrate upstream and reach Ryegate Dam for two consecutive years and the fishery agencies find the need for upstream passage is justified. The passage would consist of facilities located at McIndoes dam or participation in a trap and truck facility construction and operation program at East Ryegate dam. Also, if directed by the Connecticut River Atlantic Salmon Commission (CRASC) and the fisheries agencies, a fish trap would be installed at the base of Comerford dam and a trap and truck operation would be implemented.

9. Initiate consultation on the issue of passage for American eels at the project dams upon a duly made finding by FWS, VANR, and NHFG that such passage is necessary.

10. Finalize and implement a Wildlife and Forest Management Plan that would provide for the management of timber resources and the protection, enhancement, and management of wildlife resources and habitats for project lands.

11. Finalize and implement a Management Plan for Threatened and Endangered Species.

12. Finalize and implement a Recreational Facilities and Management Plan.

13. Develop and implement a Rare and Unusual Plant/Plant Community Management Plan within 2 years of licensing.

14. Develop and implement a Programmatic Agreement (PA), including a Cultural Resources Management Plan (CRMP).

In addition, USGenNE conducted the following studies identified in the Settlement Agreement and filed these studies as part of this license application.

1. A flow/habitat study to assess habitat under the proposed flow regime below Comerford and McIndoes (GSE, 1998).

2. The following studies associated with water quality conditions. In addition, USGenNE conducted an additional water quality study in 1999.

   (a) Study to assess causes of dissolved oxygen (DO) depletion in the deep water portions of the project reservoirs (NAI, 1998a; NAI, 1997).

   (b) Study of the effects on downstream fish and aquatic life from DO, turbidity, and temperature conditions in flow discharges from project generation facilities (NAI, 1998a; NAI, 1997).

   (c) Study of project effects on mercury levels contained in fish present in the reservoirs (Acres,1999d).

3. A study evaluating the effect of project operations on wetlands and littoral zone communities (LBA, 1997a; LBA and Lobdell Associates, 1999).

B. License Denial, Decommissioning, and Dam Removal

No agency or party has recommended dam removal or decommissioning, and this alternative is not considered a reasonable alternative. However, to present the alternative view of the stakeholders regarding the no-action alternative (see Section C below) this alternative is included for analysis in this EA. For the analysis in this EA, this alternative includes removal of the Moore, Comerford, and McIndoes dams, disabling the generating equipment, and allowing the powerhouse structures at Moore and McIndoes to remain (Comerford development powerhouse is located immediately below the dam and would be removed under this alternative). This alternative would have the effect of returning over 20 miles of impounded water to riverine conditions.

C. No-action [3]

Under no-action, the project would continue to operate as required by the original license. The enhancement and mitigation measures contained in the Settlement Agreement would not be implemented. We use no-action to establish the baseline environmental conditions for comparison with other action alternatives.

D. Alternatives Considered but Eliminated from Detailed Study

1. Project Retirement and Issuing a Non-Power License

This alternative would involve retaining the dams and removing the project generating facilities. It would require the Commission to identify another government agency willing and able to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward to assume such responsibility, and no stakeholder has advocated this alternative. We do not consider project retirement a viable alternative, and we have no basis for recommending it.

2. Federal Takeover and Operation of Project

No party has suggested that federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project. Federal takeover and operation of the project would require Congressional approval. Although that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. We do not consider, therefore, federal takeover to be a reasonable alternative.

IV. CONSULTATION AND COMPLIANCE

A. Agency Consultation

USGenNE has coordinated its relicensing efforts with the Commission staff and with members of the Collaborative Team. The Collaborative Team adopted a

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[3] The NGOs and some members of the Collaborative Team, including some federal agencies, commented that no-action should comprise pre-project conditions and that natural conditions be considered. The Collaborative Team included a discussion of pre-project conditions and the effects of this alternative view of no-action under license denial, decommissioning, and dam removal, and as appropriate, in the cumulative effects analysis. Inclusion of the alternative view of no-action does not mean that it is considered a reasonable alternative, but provides a way to allow representation and assessment of the Collaborative Team's views.

Communications Protocol, which outlines procedures for documenting consultation among participants and communications with the Commission staff. The ALP required some modifications to the traditional relicensing and consultation process. Accordingly, the applicant filed a request for waiver of the regulations that are inconsistent or duplicative with this coordinated process (see letter dated March 6, 1998). The Commission granted this request by letter dated April 22, 1998. The process involved identification of environmental issues associated with the relicensing of the FMF Project, and included:

- a public informational meeting in February 1996;
- a project site visit for agencies/stakeholders;
- a public meeting to solicit comments on the Initial Consultation Document (ICD) in June 1996;
- written comments submitted on the ICD; and
- a meeting of all the stakeholders during September 1996 to identify scoping issues.

The parties identified and agreed upon necessary environmental studies. NEP performed the studies and analyses, distributed and discussed preliminary data and results during the fall and early winter of 1996. In addition, extensive meetings were held during the winter and spring of 1997 among the agencies and NGOs to review project resource and operation information and develop a consolidated settlement proposal. Settlement negotiation meetings were conducted during the spring of 1997, and these efforts resulted in a signed Settlement Agreement dated August 6, 1997, and the Connecticut Lakes Supplementary Agreement and Lake Francis Memorandum of Agreement. NEP obtained support from the parties involved in the cooperative process and Settlement Agreement to pursue alternative procedures for relicensing the FMF Project.

B. Scoping

Scoping Document I (SDI) was prepared and circulated to appropriate federal, state, and local resource agencies, and other interested parties in May 1998. SDI was issued to aid federal and state agencies, local governments, NGOs, and interested persons in their understanding of the project and to solicit comments on the scope of the issues. Scoping meetings and a site visit were held in Littleton and Bethlehem, New Hampshire, on June 4, and June 5, 1998, respectively. Scoping Document II incorporated the comments received as a result of the scoping process and was issued on September 3, 1998.

C. Compliance

1. Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission shall require a licensee to construct, operate, and maintain such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, as appropriate. Under Section 18, Interior filed with the Commission, by letter dated September 27, 2000, a request that we reserve our authority to require such fishways as Interior may prescribe in the future, including measures to evaluate the need for fishways, and to determine, ensure, or improve the effectiveness of such fishways. The Commission recognizes that future fish passage needs and management objectives cannot always be determined at the time of project licensing. Under these circumstances, and upon receiving a specific prescription from Interior, we recommend the Commission follow its practice of reserving the Commission's authority to require such fishways as may be prescribed by the Secretary of the Interior. [4]

2. Water Quality Certification

Under Section 401(a)(1) of the Clean Water Act (CWA)[5], the Commission may not issue a license for a hydroelectric project unless either the licensee obtains water quality certification from the certifying agency of the state in which the project discharge would originate, or the certifying agency waives certification. Section 401(a)(1) states that certification is deemed waived if the certifying agency fails to act on a water quality certification request within a reasonable period of time, not to exceed 1 year. Section 401(d) of the CWS provides that state certification shall set forth conditions necessary to ensure that licensees comply with specific portions of the CWA and with appropriate requirements of state law.[6]

The Connecticut River forms the boundary between the states of Vermont and New Hampshire and thus, the project has identifiable discharges in both states. Consequently, the Connecticut River is a shared resource that lends itself to a coordinated approach by the two states with regard to compliance with state water quality

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[4]The Commission has specifically sanctioned the reservation of fishway prescription authority at relicensing. See Wisconsin Public Service Corporation, 62 FERC ¶ 61,095 (1995); affirmed, Wisconsin Public Service Corporation v. FERC, 32 F.3d 1165 (1994).

[5]33 U.S.C. Section 1341(a)(1).

[6]33 U.S.C. Section 1341(a)(1).

standards. As per the Settlement Agreement, the states of Vermont and New Hampshire agreed to a coordinated approach concerning compliance with their respective state water quality standards. Specifically, New Hampshire would issue a single water quality certificate for the project that would satisfy the interests of Vermont and be consistent with the Settlement Agreement.

On July 27, 1999, the licensee applied to the New Hampshire Department of Environmental Services (NHDES) for a water quality certification for the Fifteen Mile Falls Project. On July 29, 1999, the NHDES received the request. On June 2, 2000, the licensee withdrew its original request for a water quality certification and refiled the application for a water quality certification with the NHDES. NHDES received the request on June 5, 2000, confirming the withdrawal and re-application. On April 16, 2001, the NHDES issued a 401 water quality certificate for the project. On July 13, 2001, the Vermont Department of Environmental Conservation filed with the Commission its affirmation of the water quality certificate issued by NHDES for the project.

The following summarizes the key conditions required by the Section 401 Water Quality Certification (WQC) issued by NHDES for the FMF Project (various non-environmental, state regulatory requirements are omitted here for brevity):

1. **Reservoir and Flow Management**. Moore Development: Release a minimum flow of 320 cfs between January 1 and December 31. The maximum operating elevation of the Moore Reservoir shall be 809.0 feet msl with a maximum annual drawdown of the reservoir to 769.0 feet msl. To improve fish spawning in the reservoir, a minimum elevation of 802.0 feet msl is sought with a target elevation of 804.0 feet msl by May 21st. From May 21 through June 30, the reservoir shall not be drawn down more than 2.0 feet below the maximum elevation attained during that period.

Comerford Development: Release minimum flows of 818 cfs between June 1 and September 30; 1,145 cfs between October 1 and March 31; and 1,635 cfs between April 1 and May 31 (however, this April to May flow may be altered if the Moore and Comerford Reservoirs are unlikely to refill by May 21). The maximum operating elevation of the Comerford Reservoir shall be 650.0 feet msl and the maximum annual drawdown elevation shall be 624.0 feet msl. To improve fish spawning in the reservoir, a minimum elevation of 645.0 feet msl is sought with a target elevation of 647.0 feet msl by May 21st. From May 21 through June 30, the reservoir shall not be drawn down more than 2.0 feet below the maximum elevation attained during that period.

McIndoes Development: Release a minimum flow of 1,105 cfs between June 1 and September 30; 2,210 cfs between October 1 and March 31; and 4,420 cfs between April 1 and May 31(however, this April to May flow may be reduced to 2,210 cfs based on

flows in the river as recorded at the Bellows Falls and Wilder Projects). The maximum operating elevation of the McIndoes Reservoir shall be 451.0 feet msl and the maximum drawdown elevation shall be 447.5 feet msl. From June through February 28, the maximum discharge from the McIndoes Development shall not exceed 5,800 cfs for more than 7 percent of the hours during the period.

2. **Operating Plan.** An operating plan shall be developed in consultation with the resource agencies that addresses how reservoir storage will be used to provide guaranteed flows from the reservoir and minimizes impacts on the environment and public use.

3. **Deviations from Prescribed Operating Conditions.** The Applicant shall notify NHDES and VTDEC within 24 hours of any deviation in the reservoir and flow management operations specified in items 1 above and within 10 days submit a written report describing the event, explaining the reasons, identifying ways to avoid future occurrences, and proposing mitigative measures.

4. **Monitoring Plan for Reservoir and Flow Management.** Within 90 days of license issuance, the Applicant shall file a plan with NHDES and VTDEC for monitoring instantaneous reservoir levels, inflow, and outflow at all three project developments. The plan shall include provisions for this flow data to be available on a near real-time basis. The monitoring plan shall be filed annually with NHDES and VTDEC by March 31st. The annual filing shall specifically address compliance with the maximum flow restrictions identified in item 1 above for the McIndoes Development.

5. **Dissolved Oxygen in the Tailrace of the Moore and Comerford Developments.** Within 180 days of license issuance, the Applicant shall file a plan with NHDES and VTDEC, for measures necessary to meet dissolved oxygen standards in the river reaches below the Moore and Comerford Developments, and a schedule for implementation. If violations of dissolved oxygen standards persist, the Applicant shall revise the plan to include additional measures to meet dissolved oxygen standards.

6. **Monitoring of Tailrace Dissolved Oxygen and Temperature.** Within 180 days of license issuance, the Applicant shall file with NHDES and VTDEC, a plan for monitoring (1) dissolved oxygen and temperature in the tailraces of the Moore and Comerford Developments during the periods of reservoir stratification, and (2) temperature in the Moore and Comerford penstocks. The Applicant shall measure dissolved oxygen and temperature and file records of these results annually with NHDES and VTDEC by March 31 of the following year. Following the initial five year monitoring period, NHDES will review the data in consultation with VTDEC and may suspend this monitoring requirement.

7. **Reservoir Dissolved Oxygen.** Within 180 days of license issuance, the Applicant shall file a plan with NHDES and VTDEC for monitoring water temperature and dissolved oxygen in the Moore and Comerford reservoirs during the periods of reservoir stratification. Following approval of the monitoring plan, the Applicant shall then measure dissolved oxygen and temperature and file records of these results annually with NHDES and VTDES by March 31 of the following year. Following the initial five year monitoring period, NHDES will review the data in consultation with VTDEC and may suspend this monitoring requirement, all or in part.

8. **Monitoring Plan for Mercury in Fish Tissue**. Within 180 days of license issuance, the Applicant shall file with NHDES and VTDEC a long-term monitoring plan for monitoring mercury in fish tissue at Moore and Comerford reservoirs. The plan shall be subject to approval by NHDES, in consultation with VTDEC, prior to implementation. Monitoring results shall be reported to NHDES and VTDEC by December 31 of the sample year.

9. **Posting of Fish Consumption Advisories at Access Points.** The Applicant shall post and maintain fish consumption advisories at public access points within the Project boundary. It shall be the responsibility of the Applicant to post signs with the most updated fish consumption advisory information provided by each state.

10. **Prevention of Fish Entrainment and Impingement at Intakes.** Prior to the next replacement of intake trash racks at any Project facility, the Applicant shall determine the appropriate bar clear spacing, rack location, and other design elements, in consultation with the U.S. Fish and Wildlife Service (FWS), New Hampshire Fish and Game Department (NHFG), and the Vermont Department of Fish and Wildlife (VDFW), with a draft of the design submitted to NHDES and VTDEC for review.

11. **Fisheries Mitigation Measures.** The Applicant shall implement plans to enhance structural habitat in the Moore and Comerford tailraces and improve tributary access to fish as described in Appendix B and Appendix C of the Fisheries Mitigation Plan (September 2000) submitted as part of the license application. Within two years of receiving a federal license for the project, the Applicant shall file site-specific project plans with NHDEC and VTDEC for review.

12. **Downstream Fish Passage–McIndoes Development.** The Applicant shall provide downstream fish passage at the McIndoes Development within two years of receiving a federal license for the project. Plans for the fish passage facilities shall be developed in consultation with the NHFG, VDFW, FWS, and the Connecticut River Atlantic Salmon Commission (CRASC). Once new passage facilities are completed, the Applicant shall monitor their effectiveness in accordance with a plan developed in consultation with the NHFG, VDFW, FWS and the CRASC. A draft downstream fish passage monitoring

plan shall be filed with and subject to approval by NHDES and VTDEC prior to implementation. Following review of the final monitoring results by state and federal fishery agencies and VTDEC, NHDES may require additional measures to provide downstream fish passage.

13. **Downstream Fish Passage–Moore and Comerford Developments.** The Applicant shall provide downstream fish passage at the Moore and Comerford Developments within two years of being notified by the NHFG, VDFW, FWS, that an Atlantic salmon stocking program has been initiated upstream from Moore Reservoir and that such passage is needed. Upon a request from the CRASC to extend the implementation schedule, the schedule may be extended by NHDES, in consultation with VTDEC. The design and operating plan for fish passage facilities shall be developed in consultation with these agencies and the CRSAC, and shall be filed with NHDES and VTDEC. The design and operating plan shall be subject to approval by NHDES, in consultation with VTDEC, prior to implementation.

14. **Atlantic Salmon Upstream Passage.** The Applicant shall provide upstream fish passage past McIndoes Dam after 20 Atlantic salmon migrating upstream reach the East Ryegate Dam for two consecutive years and the NHFG, VDFW, FWS and CRASC determine that upstream fish passage is justified. At the discretion of the above-named agencies, the passage may consist of facilities located at McIndoes Dam or participation in a trap-and-truck operated institution. Passage measures shall be developed by the Applicant, in consultation with and following a schedule and plan acceptable to the above-named agencies. This requirement may be modified by the above-named agencies subject to approval by NHDES, in consultation with VTDEC. The upstream fish passage plan shall be subject to approval by NHDES, in consultation with VTDEC, prior to implementation.

15. **American Eel Passage.** The Applicant shall develop a plan to study eel passage or provide upstream and downstream eel passage within one year of being notified by the FWS, NHFG, and VDFW that eel passage is necessary. The plan will include an implementation schedule agreed to with the fishery agencies, and will be developed in consultation with the above-named agencies. The eel passage plan shall be subject to approval by NHDES, in consultation with VTDEC, prior to implementation.

16. **Threatened and Endangered Species.** The Applicant shall prepare a management plan for threatened and endangered species located on Project lands or affected by the Project. The plan will be developed in consultation with the FWS and the natural heritage programs of New Hampshire and Vermont. A draft plan will be submitted to NHDES and VTDEC for review within one year of the issuance of a federal license. The final plan shall be subject to approval by NHDES, in consultation with VTDEC, prior to implementation.

17. **Wildlife and Forestry Management Plan.** The Applicant shall prepare a management plan for the protection, enhancement, and management of wildlife resources, and management of timber resources on Project lands. The plan shall include provisions for the protection of riparian areas, wetlands, and water quality. The plan will be developed in consultation with the FWS, NHFG, and the Vermont Agency of Natural Resources. A draft plan will be submitted to NHDES and VTDEC for review within one year of the issuance of a federal license. The final plan shall be subject to approval by NHDES, in consultation with VTDEC, prior to implementation.

18. **Public Access.** The Applicant shall allow public access to the Project area for utilization of public resources, subject to reasonable safety and liability limitations. Such access should be prominently and permanently posted so that its availability is made known to the public.

19. **Recreation Plan.** Recreational facilities shall be constructed and maintained consistent with a recreation plan filed with NHDES and VTDEC within one year of the issuance of the FERC license. The plan shall include an implementation schedule. The Applicant shall consult with the appropriate state agency (NHDEC or VTDEC) during the development of site-specific project plans if any clearing of vegetation or earthwork would be involved. Where appropriate, the project plans shall include details on erosion control. Changes to the recreation plan shall also be subject to approval by the appropriate state agency over the term of the license.

20. **Erosion Control.** Upon a written request by NHDES or VTDEC, the Applicant shall design and implement erosion control measures as necessary to address erosion resulting from use of the Project lands for recreation that is causing turbidity or is otherwise compromising water quality. Any work that exceeds minor maintenance shall be subject to prior approval by NHDES or VTDEC, depending on the state where the erosion control measures will take place.

21. **Debris Disposal Plan.** The Applicant shall develop a plan for proper disposal of debris associated with Project operation, including trashrack debris, litter, and trash. The plan shall be submitted to NHDES and VTDEC for review within one year of the issuance of a federal license. The final plan shall be approved by NHDES, in consultation with VTDEC, prior to implementation. The approved plan shall be filed with FERC. The purpose of the plan is to protect downstream navigation and aesthetic quality. Proper disposal is defined as disposal in accordance with the New Hampshire and Vermont Solid Waste Rules in the affected state. The plan shall include information on the design and materials (including flashboard composition, failure characteristics, and attachment method) used for flashboard construction at McIndoes Dam and the potential for the discharge of flashboards downstream. Upon approval of the plan by NHDES and FERC, the Applicant shall implement the approved plan.

As discussed herein, we make recommendations consistent with the Settlement Agreement for project lands and consequently, the terms of the 401 WQC, which are mandatory conditions to be included in any license issued for the project.

3. Coastal Zone Consistency Certification

The FMF Project is not located in a state-designated coastal zone management area and therefore is not subject to the New Hampshire coastal zone management program review. Accordingly, our assessment is that no coastal zone consistency certification is needed for this project.

4. Endangered Species Act

We have prepared an assessment of the effects of relicensing the FMF Project under the terms of the Settlement Agreement on listed threatened and endangered species and designated critical habitat. Based on review of the best available information, the species' habitat preference, and field surveys, we conclude that the proposed FMF Project, with the inclusion of staff-recommended measures in any license issued, is not likely to adversely affect the federally-listed bald eagle and dwarf wedge mussel, and their habitat (See Section V.B.5). We are seeking FWS concurrence with our findings.

V. ENVIRONMENTAL ANALYSIS

In this section, we include the environmental analysis of the proposed action and alternatives (Section V.C). Section V.C is organized by resource area (e.g., Section V.C.1, geology and soils resources), under which we first describe the historical context for each resource area. We then describe the affected environment under each resource area (e.g., Section V.C.1.a, affected environment), which is the existing conditions. Finally, for each resource area, we assess the environmental effects of the project under each of the alternatives (e.g., Section V.C.1.b), including assessment of the proposed mitigation, protection, and enhancement measures, and assess the potential cumulative effects (e.g., Section V.C.1.c) of the proposed actions.

A. General Description of the Connecticut River Basin

The Connecticut River watershed spans portions of New Hampshire, Vermont, Massachusetts, Connecticut, and the Province of Quebec. Watershed topography moderates from mountains with elevations of more than 3,000 feet msl in the northern portion; to hilly and rolling country with elevations rarely above 2,000 feet msl; to a plateau with elevations below 700 feet; and finally to an outwash zone of tidal marshes,

Table 1. Dams on the Mainstem of the Connecticut River

Name	FERC No.	Function[a]	Approx. RM[b]	Installed Capacity (MW)	Res. Surface Acres
Enfield	NA	Breached Dam	68	NA[c]	NA
Holyoke	No. 2004 No. 11607	H, R	86	43.75	2,290
Turners Falls	No. 1889 No. 2622	H, F, S, R	119	57.51	2,000
Vernon	No. 1904	H, F, S, R	123	24.4	2,550
Bellows Falls	No. 1855	H, F, S, R	142	40.8	2,804
Wilder	No. 1892	H, F, S, R	174	35.6	3,100
Ryegate	No. 8011	H, S, R	217	5	290
McIndoes	No. 2077	H, S, R	268	13	543
Comerford	No. 2077	H, F, S, R	275	164	1,093
Moore	No. 2077	H, F, S, R	283	192	3,490
Gilman	No. 2392	H, F, S, R	300	4.85	130
Northumberland	NA	Breached Dam	321	NA	NA
Lyman Falls	NA	Breached Dam	347	NA	NA
Canaan	No. 7528	H, F, S, R	370	1.1	20
Murphy	NA	F, S, R	380	NA	--
First CT Lake	NA	F, S, R	392	NA	3,125
Second CT Lake	NA	F, S, R	399	NA	1,272

Sources: CRASC, 1998; CRJC, 1997; FWS, 1995a.

[a] H-hydropower; S-storage; F-flood control; R-recreation

[b] RM - river mile

[c] NA - not applicable

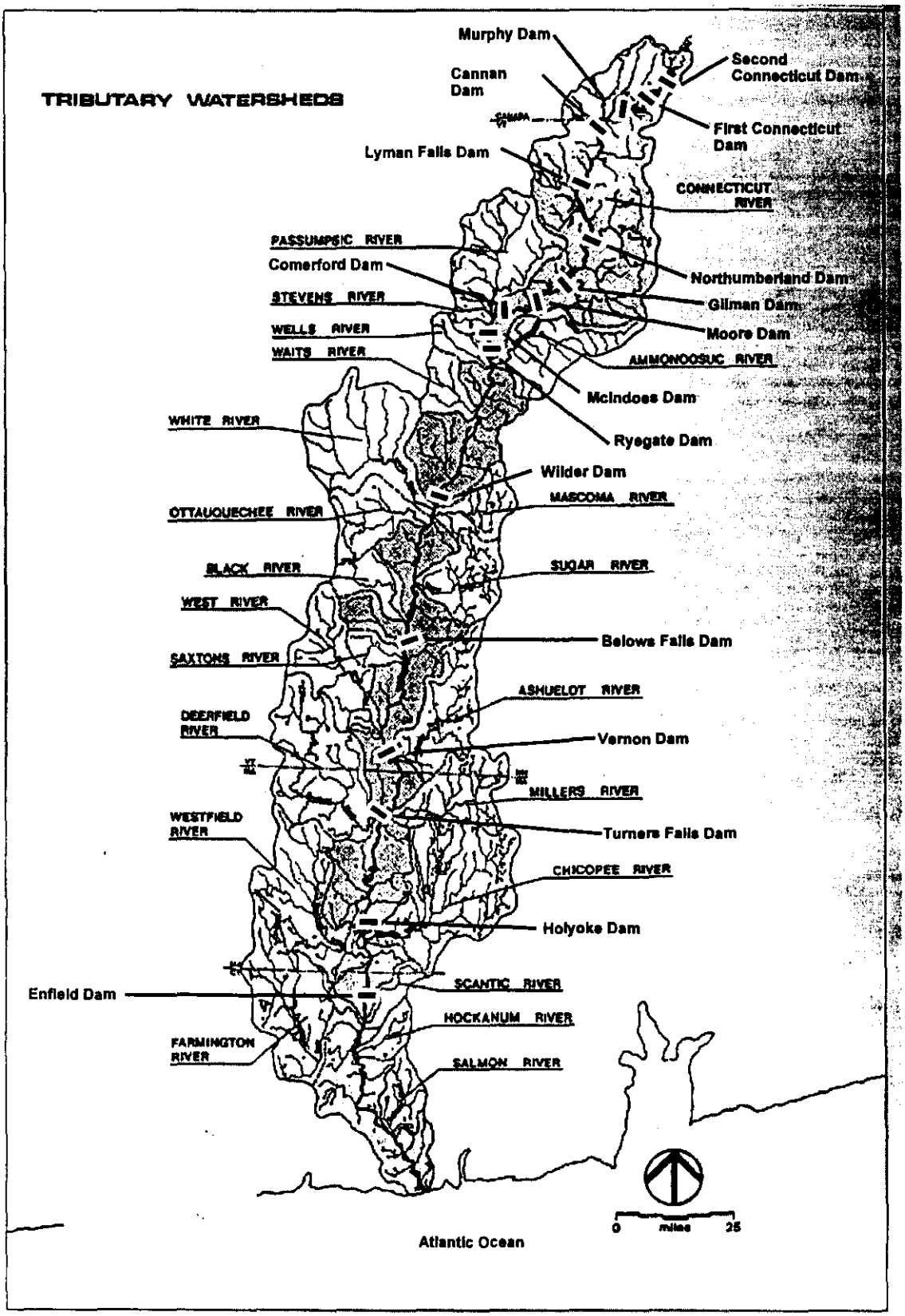


Figure 3. Location of Dams on the Mainstem of the Connecticut River.

coves, and meadowlands. The Connecticut River profile gradually flattens as the river flows southward, from a narrow mountain stream with a drop of about 900 feet in 30 miles near the river's origin, to a tidal river at Long Island Sound.

The Connecticut River originates at the mouth of the Fourth Connecticut Lake near the Canadian border and flows southward a total of 410 miles to its mouth on Long Island Sound. Together with its major tributaries, the Connecticut River drains a watershed of roughly 11,265 square miles which extends 280 miles north to south and as much as 62 miles east to west. Thirty-six major tributaries join the Connecticut River; the principal of these are the Passumpsic, White, West, Ottaquechee, and Black Rivers in Vermont; the Ammonoosuc, Mascoma, Sugar, and Ashuelot Rivers in New Hampshire. the Millers, Deerfield, Chicopee, and Westfield Rivers in Massachusetts, and the Farmington River in Connecticut. There are 17 dams on the Connecticut River, 11 of which are associated with hydroelectric facilities (Table 1 and Figure 3).

Land uses in the watershed include predominantly forest and recreation in the northern counties; open agricultural land in rolling hills and along alluvial floodplains and terraces; and mixed residential, commercial, and industrial uses in population centers and along transportation corridors. Overall, 80 percent of watershed land is forested, 12 percent is in agricultural use, and 3 percent is wetland (FWS, 1995a).

B. Environmental Analysis of the Proposed Action and Alternatives

1. Geology and Soils Resources

The majority of the Connecticut River bordering Vermont and New Hampshire conforms to the regional topography and flows roughly north-south. Between Wells River and Lancaster, the Connecticut River cuts across the north-south trending topography of the landscape formed during Appalachian orogenies, following a northeasterly-southwesterly swing in the Bronson Hill volcanics and the Ammonoosuc Fault (Rankin, 1996; Van Diver, 1987). Slicing against, rather than with, regional topography apparently led to the development of a deep, narrow, pre-glacial gorge, carved through bedrock, known as Fifteen Mile Falls. Although uncharacteristic for an Appalachian Mountain gorge, the Fifteen Mile Falls gorge was infilled by till, almost completely burying bedrock expression with Quaternary Period sediments. By 1920, dams were in place at the major falls except Beecher Falls, Fifteen Mile Falls, and Sumner Falls. The dams impeded the movement of the river's bedload down the river and coarser grained materials settled out in the reservoirs. These coarser materials, which made up the original river bed in many places, were covered over with fine silts and sediments as a result of increased erosion and sedimentation. In the 1920's, approximately half of the land in the Connecticut River valley in Vermont and approximately a quarter of land in New Hampshire was cleared for agriculture.

a. Affected environment:

The Moore reservoir averages about 0.7 mile in width and has two large bays near the dam. Land areas in the lower portion of the development consist of valley upland covered by glacial till. Typical shorelines around the development include a low scarp cut into sloping terrain, with a pebble and cobble beach in front of the scarp. The upper end of the development consists primarily of a narrow river valley with slender terraces notched into steep, till-covered valley walls.

During the assessment of the shoreline habitat (LBA, 1997a), four primary areas were identified where shoreline erosion was occurring at Moore Reservoir. The locations of these areas included: an area between the North Littleton access area and the Gilman access area on the New Hampshire side of the Moore reservoir; an area across the cove from the Dodge Hill access area; an area adjacent to and downstream of the Waterford access area; and several small areas within the Pine Island Cove.

The Comerford reservoir trends almost directly east to west, has the steepest gradient of the three, and has relatively extensive areas of high terraces. These high terraces are not submerged, but are visible at approximately the 700-foot contour on the Vermont side from the I-93 bridge to the dam. They are less notable on the New Hampshire side, but can be seen just north of the West Littleton cemetery, and also just upstream of the dam. A large, level sandy ground just north of the dam itself and extending eastward to the north bay of the reservoir is also part of the system of terraces at the 700-foot-contour.

Within the Comerford reservoir, erosion was observed in five principal areas. These areas included: two areas downstream of the Waterford Bridge access area on the New Hampshire side of the reservoir; an area upstream of the Pine Grove access area on the Vermont side of the reservoir; an area encompassing the Pine Grove access area cove; and an area adjacent to the Comerford dam picnic area (LBA, 1997a).

At the McIndoes reservoir the gradient of the river is not as steep as in the Moore and Comerford sections, and low terraces of probable Holocene age line much of the McIndoes development. Back channels and oxbows are evident. In addition to low terraces, there are also higher glacial wash terraces lining the valley.

Two primary erosion areas were identified within the McIndoes Reservoir (LBA, 1997a), including an area on the New Hampshire side of the reservoir, extending from the first major bend in the river upstream of the McIndoes dam to where Route 135 runs close along the reservoir, and a smaller area on the Vermont side of the reservoir a little further upstream.

b. Environmental effects of the alternatives:

No-action

Under no-action, the existing conditions would remain unchanged. Areas where shoreline erosion occurs could continue to erode.

Proposed Action

Under the proposed action, the minimum flows below the Moore, Comerford, and McIndoes developments would have minimal effect on shoreline erosion due to the predominantly cobble and boulder substrates in the tailrace areas. In addition, the flows associated with the spring freshet would continue to scour the tailrace area, removing fine sediments in these areas. The proposed operational measures and associated reservoir elevations and shoreline erosion would be similar to existing conditions for the Moore and Comerford developments. The proposed operations and resulting reduced reservoir fluctuation at the McIndoes development would result in decreased shoreline erosion due to reduced reservoir fluctuations.

The proposed recreation enhancements would include minimal soil disturbance except for the areas planned for boat ramp construction, parking area expansion, or grading and widening of the access road. The proposed recreation enhancements would include measures to minimize soil erosion and include shoreline stabilization. The proposed conservation easements would protect areas from adverse effects resulting from potential shoreline development and clearing, such as runoff, erosion, and sedimentation.

Therefore, in any license issued for the FMF Project, we recommend that USGenNE, in consultation with the NHFG or the VANR, the NH State Historic Preservation Office (SHPO) or the VTSHPO, depending on the State where the soil erosion control measures would be implemented, develop and, upon Commission approval, implement soil erosion control measures as part of its revised Recreational Facilities and Management Plan (see Section V.B.6). Our recommended measure for soil erosion control is consistent with condition no. 21 of the 401 WQC issued for the project.

License Denial, Decommissioning, and Dam Removal Alternative

This alternative would result in conversion of over 20 miles of reservoir to a free-flowing river. Sediments accumulated behind the existing dams would be released and suspended in the water column and redistributed downstream. Erosion also would occur in the exposed areas where the reservoirs exist, contributing to the sediment dispersal downstream until these areas revegetated and stabilized. This alternative could restore

the set of rapids at Fifteen Mile Falls.

c. Cumulative effects:

The FMF Project dams contribute to cumulative changes to geology and soils in the immediate area of the project and downstream as far as the Wilder dam. Construction of the dams altered the geologic character of the area, reduced downstream sediment transport, contributed to changes that reduce flooding and replenishment of floodplain soils, and created conditions that resulted in shoreline erosion around the reservoir perimeters.

As most of the river below the project was dammed before the project dams were built, the effect of the FMF Project in reducing sediment transport was and continues to be fairly limited. Inundation of the areas behind the dams began a process of erosion in shoreline areas with steep or highly erodible soils; however, the project reservoirs may have inundated certain areas along the river that had been eroding, halting further erosion in these areas.

An additional cumulative impact resulting from the construction of dams along the Connecticut River has been the inundation of major waterfalls. Hydrologic changes resulting from the project include the conversion of one of the river's most notable stretches of falls and rapids to an impounded condition. The falls at Fifteen Mile Falls was reported to be a tumultuous set of rapids, especially the stretch known as Mulliken's Pitch where the Comerford Dam was built.

Flood control projects and, to some degree, management of the FMF Project and other hydropower facilities and headwater lakes, reduce flooding in the basin, and together with the entrapment of sediments in the reservoirs, reduce the natural process of replenishing the floodplain soils.

The proposed action includes measures to address shoreline erosion in areas of archaeological or historical significance, as well as measures that would reduce the occurrences of rapid changes in flows below the project and reducing the fluctuation of downstream river flows. In addition, the proposed conservation easements would protect 4,000 acres of lands within the existing project boundary from development and those lands would be managed in accordance with guidelines to prevent erosion from forestry or agricultural operations. Funds from the Upper Connecticut River Mitigation and Enhancement Fund (Section IV. Settlement Agreement) would be available for riverine shoreland protection, including restoring naturalized buffers along the river and/or streams in the drainage, and stabilizing eroding shorelands both up and downstream of the FMF Project area.

Other actions cumulatively affecting geologic and soil resources in the river basin include: development pressures for riverfront properties; the donation, by USGenNE, of permanent conservation easements on 4,200 acres of non-project land with management restrictions that would further reduce erosion; and continued land protection and acquisition efforts by land trusts and conservation interests in the river basin, including efforts of the FWS to establish land protection through the Silvio O. Conte National Fish and Wildlife Refuge (U.S. Fish and Wildlife Service, 1995a).

For a more complete discussion of historic conditions and cumulative effects, see "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

d. Unavoidable adverse effects: None.

2. Water Resources

The Connecticut River Basin is a well regulated system. The construction of dams on the river altered the character of the river from free flowing with a number of falls and rapids, to one which consists largely of a series of reservoirs separated by slow moving, meandering sections. The development of hydropower projects on the river, which began as early as 1900, further changed the river's flow regime to one with more frequent and rapid fluctuations and periods of low flows below hydropower projects operated for peaking power (FPC, 1976).

Prior to Euro-American settlement, the waters of the Connecticut River in New Hampshire and Vermont would likely have been colder, better oxygenated, with less dissolved constituents and less suspended matter than exists today. The number of falls and steep gradients both on the tributaries and on the mainstem in the upper basin would have produced well oxygenated waters.

The introduction of pollutants to the river from municipal and industrial waste discharges and runoff from agricultural and urban areas led to the most significant change in water quality on the Connecticut River. Until the 1970's, the river was used for the disposal of untreated wastes. The condition of the river reached its worst in the mid 1950's, when only 40 miles of the entire length of the Connecticut River were classed as "suitable for bathing and recreation, irrigation and agricultural uses; good fishing habitat; good aesthetic value" (NENYIAC, 1954).

Over the last twenty years, largely as a result of the CWA, the condition of the river has greatly improved. However, the long history of pollution continues to affect areas where pollutants have been trapped in the sediments and are being recycled, both chemically and biologically. The highest mercury concentration in fish taken from the entire Connecticut River between 1992 and 1994 was recorded at a sampling site near

Lancaster, New Hampshire, above the FMF Project (USGS, 1995a). It is not clear what sources contributed to this high mercury concentration, but it provides some evidence that elevated upstream levels contribute to reservoir levels of mercury at the FMF Project. Fish consumption advisories include those issued for mercury contamination in Connecticut, Massachusetts, New Hampshire and Vermont; and for PCB contamination along certain lengths of the Connecticut River in Massachusetts and Connecticut (USGS, 1995a and 1995b).

a. Affected environment:

Water Quantity

From the river's outflow at the Fourth Connecticut Lake downstream to Pittsburg, New Hampshire, the river drops 900 feet over 30 miles. This stretch of river is narrow and swift, dropping more sharply than any other stretch of the river. From the outlet of Lake Francis south into the FMF Project area, the river is fed by several tributaries including Indian and Halls Streams, and the Mohawk, Upper Ammonoosuc, Israel, John's, and Passumpsic Rivers. Despite one of the steepest drops along the stretch of the entire river, the portion of the river from Lake Francis to the project area includes stretches of wider, slower, meandering water surrounded by moderate elevations which occasionally rise above 2,000 feet msl (FWS, 1995a).

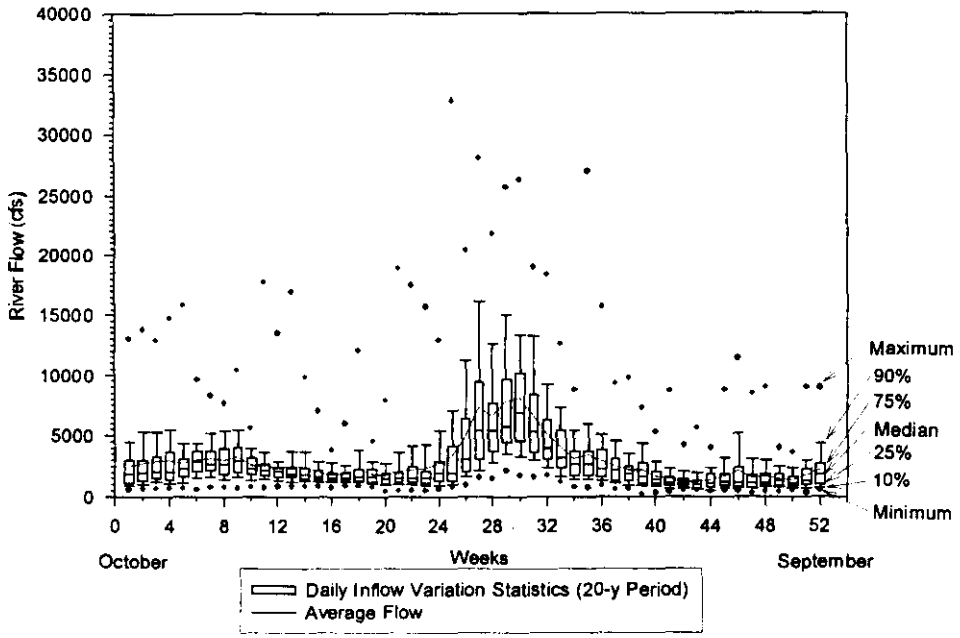
Inflow to the FMF Project area is from the Connecticut River at the upstream end of the Moore reservoir and flow releases from the Moore Station enter directly into the Comerford reservoir. Flow released from the Comerford reservoir is conveyed along an approximately 1.5-mile-long river reach before entering the McIndoes reservoir. The Passumpsic River also enters the Connecticut River along this reach.

Moore Reservoir

The Moore reservoir is approximately 11 miles long, up to approximately 180 feet deep, and has a surface area of approximately 3,490 acres at the normal maximum operating level (MOL) of 809 feet msl. The principal source of water is the Connecticut River, with only a few small streams entering the reservoir from the surrounding slopes. The total impounded storage is 223,722 acre-feet, of which 114,176 acre-feet represents the available usable storage utilizing a 40-foot drawdown range. Reservoir elevations typically range between 804 to 806 feet msl, and the reservoir is typically drawn down to a target elevation of 769 feet msl during the winter period, prior to the spring freshet.

The reservoir has a drainage area of 1,600 square miles. The inflow is a mix of 89 percent natural and 11 percent regulated inflow from the various mainstem tributaries. The closest mainstem U.S. Geological Survey (USGS) gaging station upstream of the

Figure 4. **Moore Reservoir, Annual Inflow Pattern at USGS Gage near Dalton, NH (1974 to 1994)**



reservoir is near the town of Dalton. The drainage area for the Dalton gage is 1,514 square miles, or 95 percent of the drainage area of the Moore reservoir. The prorated lowest daily inflow for the Moore reservoir in the last 20 years was 311 cfs and the prorated maximum daily inflow was 34,670 cfs. The months with the lowest inflow were August and September (weeks 44 - 52); the month with the highest inflow was April (weeks 26 - 30)(See Figure 4).

Comerford Reservoir

The Comerford reservoir has a length of approximately 8 miles, a depth of up to approximately 160 feet, and a surface area of approximately 1,093 acres at a normal maximum operating level of 650 feet msl. The total impounded storage is 32,270 acre-feet which represents the available usable storage utilizing a maximum 40-foot drawdown range. Reservoir elevations typically range between 646 and 648 feet msl. The reservoir during the winter period, prior to the spring freshet, is typically drawn down to a target elevation of 640 feet msl with the capability of being drawn down to 610 feet if necessary. The Comerford reservoir has a drainage area of 1,635 square miles, which is only 35 square miles (2 percent) larger than the drainage area for the Moore reservoir. The inflow to the Comerford reservoir is almost entirely dependent on the flow release pattern at the Moore Station.

McIndoes Reservoir

The McIndoes reservoir has a length of approximately 5 miles. Above the reservoir to the base of Comerford dam, the upper approximate 1.5 miles are riverine in nature with maximum depths of approximately 10 to 15 feet. The maximum depth in the lower three miles of the reservoir is greater, ranging generally between 15 and 30 feet with the exception of one location with a maximum depth of 50 feet. At the normal maximum operating level of 454 feet msl, the reservoir has a surface area of 543 acres. The total impounded storage is 5,988 acre-feet, of which 4,080 acre-feet represents the available live storage utilizing a 10-foot drawdown range. Reservoir elevations typically range between 450 to 454 feet msl. A maximum licensed drawdown range of 10 feet in the summer and 8 feet in the winter is occasionally used to re-regulate flows.

The McIndoes reservoir has a drainage area of 2,210 square miles, which is 575 square miles larger than the drainage area for the Comerford reservoir. Approximately 485 square miles (84 percent) of these 575 square miles are contributed by the watershed of the Passumpsic River. The remaining inflow is contributed by small streams, such as Stevens River, and sidehill runoff.

The gaging station closest to the mouth of the Passumpsic River is the station in the Village of Barnet, 4 miles upstream from the mouth. The drainage area of the Passumpsic River at that location is 436 square miles, which represents 76 percent of the drainage area of the river at the point of entry into the McIndoes reservoir. Over the last 20 years, the prorated daily mean inflow from the Passumpsic River entering the McIndoes reservoir was 1,054 cfs, or approximately 24 percent of the total inflow to the reservoir. The lowest daily inflow was 86 cfs and the maximum inflow was 12,990 cfs. The month with the highest inflow from the Passumpsic River was April; the months with the lowest inflow were August and September (weeks 44 - 52)(see Figure 5). The variable flows in and out of McIndoes reservoir results in water level fluctuations as shown in Figure 6 for the 20-year period, 1974 to 1994.

Lower River Flow Regime

Inflow to the Lower Connecticut River reach downstream of the McIndoes Station is comprised of releases from the reservoir which is operated to re-regulate flow into this reach. The closest USGS gaging station downstream of the McIndoes is the Wells River station, located 8.5 miles downstream. The drainage area for this station is 2,644 square miles, which is 20 percent larger than the drainage area at the McIndoes Station. Between 1978 and 1997, the mean inflow at the Wells River Gage (prorated by 20 percent to reflect the outflow from the McIndoes Station) was 4,322 cfs, the minimum inflow was 192 cfs, and the maximum inflow was 37,530 cfs. The highest flows occur in spring (see Figure 7).

Figure 5. **McIndoes Reservoir, Annual Local Inflow Patterns Local Component, Passumpsic River Tributary**

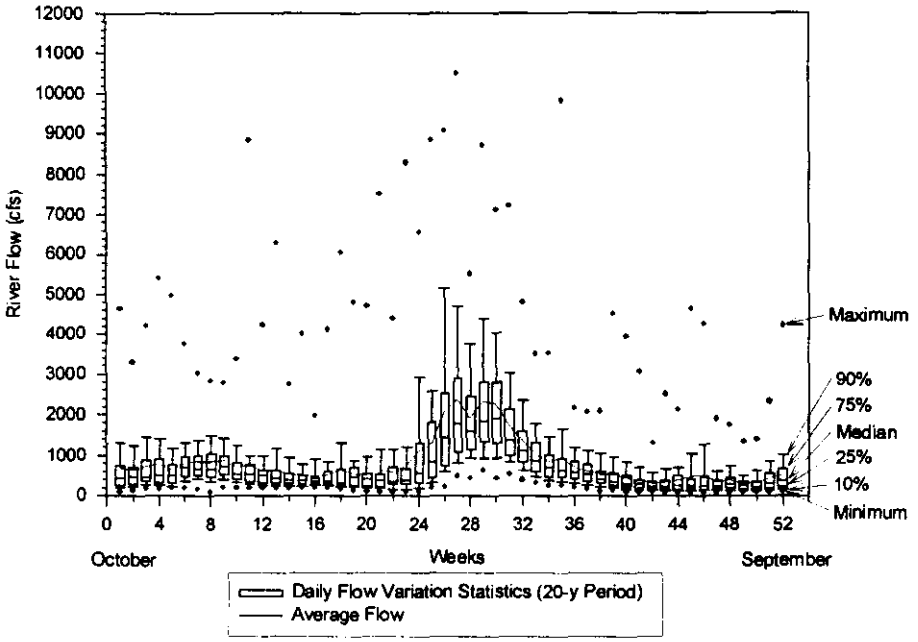


Figure 6. **McIndoes Reservoir, Annual Level Fluctuations (1974 to 1994)**

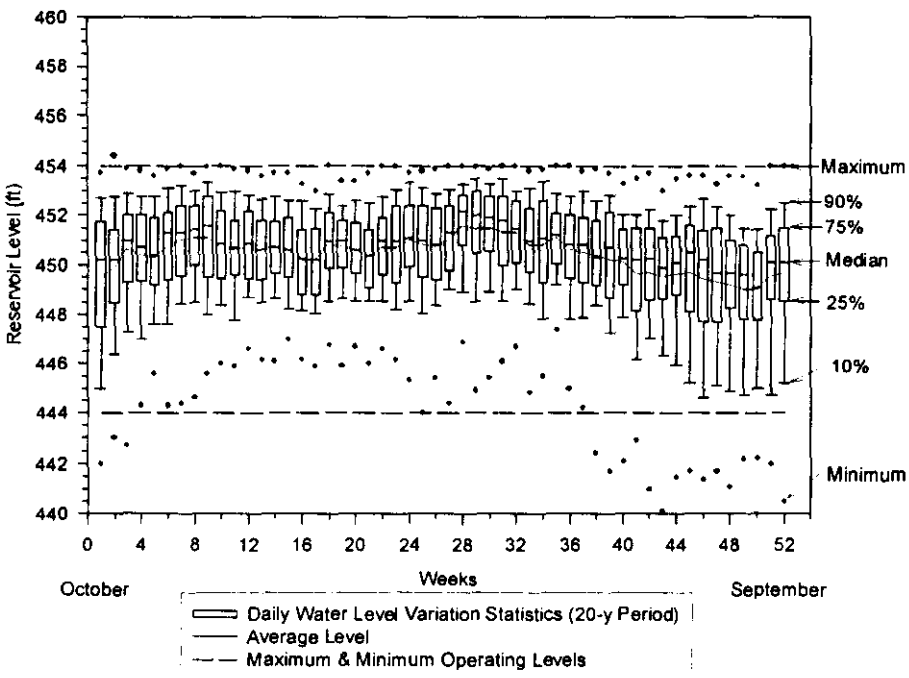
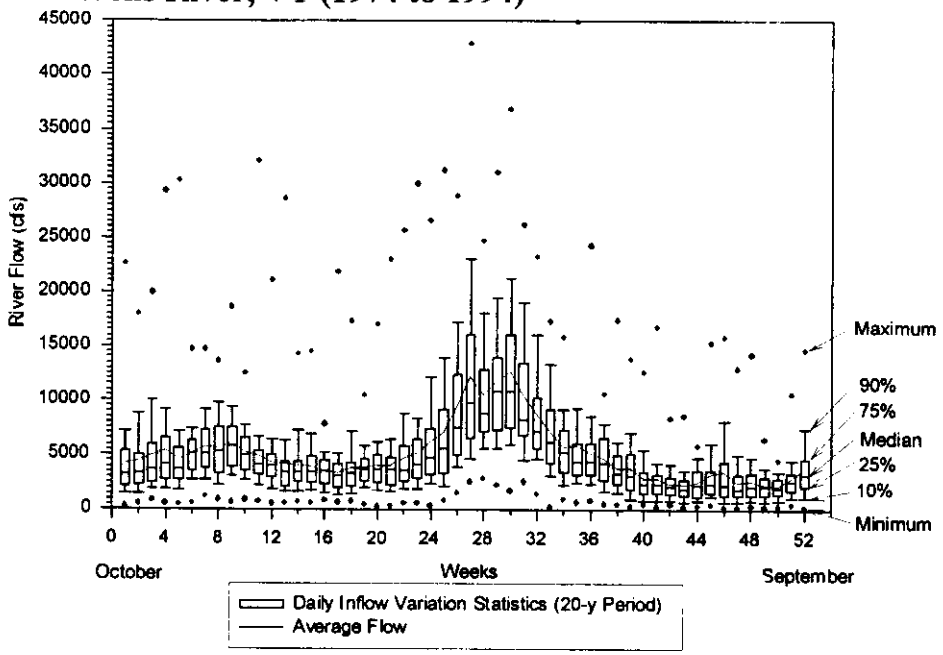


Figure 7. **Lower Connecticut River, Annual Flow Pattern at USGS Gage near Wells River, VT (1974 to 1994)**



Water Quality

River water uses in the region include aquatic habitat; fishing, swimming, and recreational uses; and commercial uses, primarily hydroelectric power generation, cooling water for a wood-fired power plant, and process water for pulp and paper-making mills (i.e., Simpson Paper and CPM in Ryegate), fire protection, and irrigation. River water is not generally used for drinking water supplies by any of the communities in the FMF Project area.

The state of New Hampshire classifies all reaches of the Connecticut River affected by the Project as Class B waters. Class B waters are those which are high quality waters with no objectionable physical characteristics, are acceptable for fishing, swimming, and other recreational purposes, and, after adequate treatment, for use as water supplies. The Class B designation also entails that waters within the epilimnion of impoundments and reservoirs shall contain dissolved oxygen content of at least 75 percent saturation based on a daily average and an instantaneous minimum dissolved oxygen (DO) content of at least 5 mg/l. For water designated cold water fish habitat, the state of Vermont water quality standards provide for DO concentrations of not less than 7 mg/l and 75 percent saturation at all times in areas determined by the VANR as salmonid

spawning and nursery areas important to the establishment and maintenance of the fishery resource, and not less than 6 mg/l or 70 percent saturation at all times in all other waters designated as cold water fish habitat. The Project river reach has not been designated by the VANR, to be an area important to salmonid spawning or nursery and therefore the lesser DO standards apply. In addition, Vermont's proposed changes for DO and saturation levels in the classification standards became effective July 2, 2000, which changed the "or" to "and" in conditions for DO to 6 mg/l "and" 70 percent saturation at all times.

With the passage of the CWA in the 1970's, and subsequent improvements to waters discharged to the river, water quality for this segment of the river is much better than it was historically and continues to improve. Examples of improvements include: more complete treatment of wastewater from municipal and industrial sources; increased land use restrictions; and reduction of untreated non-point sources, such as erosion from logging, earthmoving, dredging and filling. These changes have resulted in waters which are much cleaner than they have been for decades. Despite this progress, some water quality problems resulting from past and present point and non-point discharges persist, e.g., low secchi disk (transparency) readings and low DO levels at depth in the impoundments during the summer.

The Licensee conducted water quality sampling studies for the FMF Project area during 1996 and 1998 (NAI, 1997 and 1999a), and conducted additional water quality sampling in 1999 (referred to herein as the Berger Study)(Louis Berger & Associates, Inc., 2000). The State of New Hampshire also sampled the Moore reservoir during its lake and pond monitoring program (NHDES, 1996) and Louis Berger & Associates, Inc. sampled reservoir DO levels and distribution in the Moore and Comerford reservoirs in 1999 (Louis Berger & Associates, Inc., 2000).

Moore Reservoir

The Moore reservoir is unstratified most of the year with DO levels above 75 percent saturation, however, the reservoir demonstrated some stratification at depths during a short portion of the summer sampling period. During the summers of 1997 and 1998, the epilimnion extended to a depth of approximately 80 feet, and in 1996 to approximately 100 feet near the dam. The reservoir depth at these monitoring locations was 140 in 1997 and 160 feet in 1996 and 1998. Surface water temperatures ranged from 20 to 23 degrees Celsius; temperatures below the thermocline were typically between 6 and 8 degrees Celsius. The DO saturation levels during the summer were typically well above the state water quality standards with readings of 75 percent in the upper water column (about 0-40 feet) and DO concentrations well above 5 milligrams per liter (mg/l). Below this depth, the DO saturation levels decreased to generally 60 percent (about 40-60 foot depths), 40 percent (about 60-100 foot depths), and with minimum concentrations

reaching 20 percent at depths greater than 100 feet (NAI, 1997 and 1999a).

In the tailrace, DO levels measured for three days (during which no minimum flows were provided during non-generation periods) in the summer of 1996 decreased to approximately 50 percent saturation and to concentrations of just below 5 mg/l (NAI, 1997). During two weeks of continuous monitoring in the summer of 1998 under conditions of minimum flow (as per the Settlement Agreement) and power generation, DO concentrations in the tailrace of the reservoir and half a mile downstream generally met both NH and proposed VT regulatory standards for DO. The DO at both monitoring locations during normal generation was typically well above 75 percent saturation and above 6 mg/l, except during two of the monitored days when the level dipped briefly (for less than 1 hour) to approximately 72 percent saturation while the mg/l remained at or above 6 mg/l (NAI, 1999a).

Based on 1993 spot sampling, NHDES modified their classification of Moore reservoir from eutrophic to oligotrophic. In the 1996 and 1997 sampling, Moore reservoir classifications were characterized as having improved, but remained eutrophic. Metal concentrations in the Moore reservoir generally met both NH and proposed VT water quality criteria for the protection of aquatic life. The only exceptions were aluminum, copper, and lead concentrations in a few samples which slightly exceeded the criteria within the chronic range for lead and copper in the middle and lower parts of the water column. It is unknown to what extent, if any, these concentrations affect aquatic life. Concentrations of bacteriological indicators along public use areas met the water quality standards for primary contact recreation.

Benthic soil samples taken near Lean-To Island in Moore reservoir and tested in 1992 as part of a municipal groundwater supply study indicated that the river bottom sediments in this area were typical of bottom sediment commonly found in lakes. The samples from this area did not contain 2,3,7,8 TCDD (dioxin), which is usually attributed to bleaching operations and wastewater discharges from paper mills (Roy F. Weston, 1992). These results may not be typical of the entire lake bottom.

Comerford Reservoir

The Comerford reservoir is unstratified most of the year with DO levels well above 75 percent saturation, however, the reservoir demonstrated some stratification at lower depths during the summer sampling period (NAI, 1997 and 1999a). During the summers of 1997 and 1998, the epilimnion extended to a depth of approximately 100 feet; the reservoir depth at the monitoring location was approximately 150 feet. Surface water temperatures were consistently between 18 and 20 degrees Celsius; temperatures below the thermocline were typically between 8 and 10 degrees Celsius. The DO level was typically well above 75 percent saturation in at least the upper 50 feet of the water

column with concentrations well above 5 mg/l. Below this depth, the DO saturation levels decreased to 40 to 60 percent at depths below 90 feet in 1997, and to 0 to 20 percent at depths below 100 feet in 1998.

In the tailrace of the Comerford reservoir, DO levels measured during no-flow conditions during three days in the summer of 1996 decreased to approximately 60 percent saturation and to concentrations just above 5 mg/l (NAI, 1997). During two weeks of continuous monitoring in the summer of 1998 under conditions of minimum flow (as per the Settlement Agreement) and power generation, DO concentrations in the tailrace of the reservoir and half a mile downstream generally met both NH and proposed VT water quality standards for DO. The DO at both monitoring locations was typically well above 75 percent saturation except during a few occasions when the level dipped briefly to between 62 and 75 percent saturation. The DO concentrations, however, remained above 5 mg/l (NAI, 1999a). USGenNE conducted an additional water quality study in 1999 to verify the results from previous year studies (Louis Berger & Associates, 2000). The Berger study (2000) had five objectives: (1) confirm and augment the water quality data base (through continuous monitoring) at the Comerford Development, (2) establish DO profiles throughout the Moore and Comerford Reservoirs, (3) test the effectiveness of aerated flows at the Moore Development tailrace, (4) evaluate air entrainment and aerated flow effects downstream from the Comerford Development, and (5) assess the impacts of project operations on Moore and Comerford Reservoir DO distribution.

Based on the 1996 and 1997 sampling, Comerford reservoir classifications were characterized as having improved, but were still eutrophic. Metal concentrations in the Comerford reservoir generally met both NH and proposed VT water quality standards. The only exceptions were aluminum, copper, and lead concentrations in a few samples in the middle and lower part of the water column. Concentrations of bacteriological indicators along public use areas met the water quality standards for primary contact recreation.

McIndoes Reservoir

The McIndoes reservoir does not appear to stratify; DO concentrations remain at more than 75 percent saturation throughout the year (NAI, 1999a). During the summer of 1997, DO levels were always higher than 85 percent saturation with DO concentrations always well above 5 mg/l meeting NH and VT water quality standards. Temperatures during the monitoring period were between 18 and 21 degrees Celsius; there was no thermocline.

In the tailrace of the McIndoes reservoir, DO levels measured during no-flow conditions on August 20, 1996, decreased from approximately 85 to 50 percent

saturation, and to concentrations of 4.5 mg/l (NAI, 1997). During monitoring in 1997 under minimum flow conditions (as per the Settlement Agreement), the DO levels in the tailrace of the reservoir and half a mile downstream met both NH and VT regulatory standards for DO at all times with DO levels at both monitoring locations well above 75 percent saturation, and above 6 mg/l (NAI, 1997).

Based on the 1996 and 1997 sampling, McIndoes reservoir classifications were characterized as having improved conditions above eutrophic to more mesotrophic conditions. Metal concentrations in the McIndoes reservoir generally met both NH and proposed VT water quality standards. As in the other two reservoirs (Moore and Comerford), the only exceptions were aluminum, copper, and lead concentrations which slightly exceeded the state standards in a few samples.

b. Environmental effects of the alternatives:

No-action

Under no-action the Moore and Comerford reservoirs would continue to stratify during the summer with low DO concentrations in the deeper waters, while the McIndoes reservoir would be expected to remain unstratified. In the tailrace of all three developments, low DO levels below regulatory standards may occur in the summer during no-flow periods. Input levels of nutrients, and therefore, the trophic states of the reservoirs would be expected to continue gradual improvement with additional improvement in land use practices.

Proposed Action

Moore Reservoir

Under the proposed action, the operation of Moore development would be similar to existing conditions, with the exception of target reservoir elevations for the period between May 21 and June 30 and for proposed minimum flows (see Table 2). The target level for May 21 is 804 feet msl with a minimum elevation of 802 feet msl. During this period, the targeted water elevation would not decrease by more than 2 feet below the level attained previously in the same period. The existing license places no restriction on the daily water level fluctuations for this period. Therefore, the proposed operations would provide more stabilized elevations during this period and greater protection of the aquatic ecosystem.

The water quality within the Moore Reservoir would be similar to existing conditions, since the operating conditions of the facility and thus the residence time of the

Table 2. Comparison of Existing and Proposed Project Operations

	Existing	Proposed Action*
Moore Development		
MOL	809 feet msl	809 feet msl
Annual operating levels	809 feet msl max. 769 feet msl min. (40 foot range)	*6/30 to 5/21:* same as historic *5/21 to 6/30:* minimum of 802 feet msl with target of 804 feet msl by May 21, drawdown not to exceed 2 feet from highest achieved level in this period.
Daily cycle range	typically 0-2 feet (806-804 feet msl), except during winter drawdown	*6/30 to 5/21:* same as historic *5/21 to 6/30:* 2 feet or less from highest achieved level.
Minimum flow	none required	*All year:* 320 cfs or inflow
Comerford Development		
MOL	650 feet msl	650 feet msl
Annual operating levels	650 feet msl max. 610 feet msl min. (40 foot range) levels have not been drawn to below 625 feet msl over the last 20 years	*6/30 to 5/21:* same as historic *5/21 to 6/30:* minimum of 645 feet msl with target of 647 feet msl by May 21, drawdown not to exceed 2 feet from highest achieved level in this period.
Daily cycle range	typically 0-2 feet (648-646 feet msl), except during winter drawdown	*6/30 to 5/21:* same as historic *5/21 to 6/30:* 2 feet or less from highest achieved level.
Minimum flow	none required	*6/1 to 9/30:* 818 cfs *10/1 to 3/31:* 1,145 cfs *4/1 to 5/31:* 1,635 cfs
McIndoes Development		
MOL	454 feet msl	451 feet msl (can exceed if flows exceed discharge capability of 30,600 cfs)
Annual operating levels	454 feet msl max., 444 feet msl min. (10 foot range)	*all year:* 451-447.5 feet msl (3.5 foot range)
Daily cycle	typically 4 feet (454-450 feet msl)	3.5 foot (451-447.5 feet msl)
Minimum flow	1,850 cfs every 5 hours	*6/1 to 9/30:* 1,105 cfs or inflow *10/1 to 3/31:* 2,210 cfs or inflow *4/1 to 5/31:* 4,420 cfs or inflow
Maximum flow	No restrictions	*6/1 to 2/28:* not to exceed 5,800 cfs for more than 7% of the hours, except during naturally high stream flows *3/1 to 5/31:* no restrictions

* See proposed operations(Section III.A.3) for further description.

water in the reservoir would remain largely unchanged. The Berger Study (2000) found a unique DO profile in the main reservoir body, where the lowest DO levels occurred at mid-depth rather than reservoir bottom. Proposed project operations would not affect these DO levels and aquatic species could follow a contiguous zone of passage in the reservoir during reservoir stratification at depths up to ten meters. High DO levels also occurred throughout the photic zone throughout the reservoir.

The Settlement Agreement specifies a minimum flow of 320 cfs from the Moore Development. There are presently no minimum flow requirements for the Moore Development. Water quality monitoring of the tailrace of the Moore Development (NAI, 1999a) suggests that the proposed minimum flow may be effective in keeping the DO concentration above the NH and VT water quality standards, and would, therefore, improve water quality conditions downstream during low flow periods. However, there were questions about the study results and the Berger Study (2000) was conducted to confirm the earlier results. The Berger Study (2000) determined that water quality standards were not always met and also confirmed that during project operation, aeration effectiveness generally decreases as unit discharge increases, but use of minimum flow units with open aeration significantly increases the level of DO in discharged waters. If further watershed control/enhancement measures per the Upper Connecticut River Mitigation and Enhancement Fund are implemented, additional water quality improvement can be expected over the long term. The Berger Study (2000) found that the use of vacuum breakers to introduce air into entrained water at the powerhouse was most noticeable at lower flows but was effective at all flows if at least one unit was able to entrain air. Adoption of an operating mode that includes aerated minimum flows would maximize the compliance with NH and VT water quality standards for DO in the discharges from the Moore powerhouse. Staff recommends USGenNE develop a plan and schedule, in consultation with the resource agencies, to ensure project operations would result in tailrace DO levels that meet state water quality standards at all times.

Comerford Reservoir

The proposed operation of the Comerford development includes target reservoir elevations between May 21 and June 30 and minimum flows (see Table 2). The target level for May 21 is 647 feet msl with a minimum elevation of 645 feet msl. During this period, the targeted water elevation would not decrease by more than 2 feet below the level attained previously in the same period. The existing license places no restriction on the daily water level fluctuations for this period. Therefore, the proposed operation for the Comerford development would improve the protection of the aquatic ecosystem.

The water quality conditions within the Comerford reservoir affected by project operations would remain largely unchanged from existing conditions since the operating procedures remain similar to existing procedures, although minimum flows from the

Moore Development could improve DO conditions. The Berger Study (2000), as was shown for the Moore Reservoir, indicates a drop in DO in the reservoir bottom during the summer stratification, but there remained contiguous portions of the Comerford Reservoir, at about the 30-foot depth, that would allow fish to move throughout the reservoir. The Comerford dam does create a zone of low DO near the dam, but project operations do not appear to influence the set up or establishment of this zone. The Settlement Agreement specifies minimum flows for the Comerford Development ranging from 818 to 1,635 cfs during different times of the year. There are no minimum flow requirements under the existing project conditions. Water quality monitoring of the tailrace from the Comerford Development (NAI, 1999a) suggests that the minimum flow is effective in keeping the DO concentration above the NH and VT water quality standards), and would, therefore, improve water quality conditions downstream during low flow periods. The Berger Study (2000) indicates that in addition to the proposed minimum flows, the use of unit aeration (vacuum breakers) at low flows increased DO levels from intake to tailrace of up to 2 mg/l. Staff recommends USGenNE develop a plan and schedule, in consultation with resource agencies, to ensure project operations would result in Comerford tailrace DO levels that meet state water quality standards at all times. In addition, staff recommends USGenNE develop a plan for monitoring DO and temperature in the reservoirs and tailraces of the Moore and Comerford Developments during periods of reservoir stratification, and temperature in the Moore and Comerford penstocks during the same time period.

McIndoes Reservoir

The proposed operating range for the McIndoes reservoir would be reduced from presently licensed 10 feet (454 to 444 feet msl) to 3.5 feet (451 to 447.5 feet msl) (see Table 2). The water quality within the McIndoes reservoir could improve as a result of the lower maximum operating limit and resulting decreased residence time of the water in the reservoir.

The Settlement Agreement specifies minimum flows ranging from 1,105 to 4,420 cfs during different times of the year. There are no minimum flow requirements presently. Water quality monitoring of the tailrace from the McIndoes development under minimum flow conditions, as proposed under the Settlement Agreement (NAI, 1999a), suggests that it is effective in keeping the DO concentration above the NH and proposed VT water quality standards. It is therefore anticipated that water quality conditions downstream during low flow periods would improve. USGenNE believes that based upon the more limited storage capacity in McIndoes and a continuous minimum flow, discharge would be more continual and at a stable level for longer periods than the present operation. The level of discharge would depend upon the upstream discharge. Comerford would have a slightly less fluctuating and more stable flow based upon the higher minimum flow requirement. The proposed operating regime and minimum flows

would result in more continuous flow downstream of the McIndoes reservoir due to the minimum flow conditions, and reduced periodicity of high flow conditions.

In addition, a maximum flow rate of 5,800 cfs is proposed between June 1 and February 28. USGenNE proposes to release this flow rate so that it would not be exceeded during more than 7 percent of the hours within this period. Under the existing license, there are no maximum flow restrictions; however, the existing operation already generally meets the proposed maximum flow conditions.

Staff Recommendations

Because of the relationship between all three project reservoirs and the operation of each project development, staff recommends, in consultation with the resource agencies, that USGenNE prepare an operating plan that addresses how reservoir storage would be used to provide guaranteed minimum flows for each of the developments. Since USGenNE proposes to release minimum flows and to manage reservoir levels at each of the developments as proposed in the Settlement, and in accord with the NHDES WQC for the Project, staff recommends USGenNE prepare a monitoring plan (as stipulated by WQC condition no. 4) for reservoirs and flow management, to be filed with the Commission and NHDES and VTDEC, for monitoring instantaneous reservoir levels, inflow, and outflows at all three project developments. The plan should include provisions for the flow data to be made available on a near-real-time basis, and include in the monitoring plan, copies of the turbine rating curves, which should accurately depict the flow/production relationship. Staff recommends, USGenNE should also measure flows and reservoir levels and file the records annually with NHDES and VTDEC by March 31 of the following year and specifically address compliance with the maximum flow restrictions at the McIndoes Development, as described in the Aquatic Resources Section of this EA.

Staff also recommends that USGenNE notify NHDES and VTDEC within 24 hours of any deviation from the minimum flows and reservoir levels and schedules proposed by USGenNE and that within 10 days a written report describing the event (including the extent of the deviation), explaining the reasons, identifying ways to avoid future occurrences, and proposed mitigative measures. USGenNE should file an annual report of all such deviations of the proposed operating conditions in conjunction with the annual filing of the monitoring plan for reservoir flow management.

Mercury

Mercury is a toxic metal that exists as a trace element in the earth's crust. Mercury is specifically addressed in the Vermont and New Hampshire water quality standards. The standards include maximum allowable concentrations in water to protect the health

of both aquatic biota and humans. The concentrations of mercury for the protection of human health are based on the concentration of mercury in fish tissue that is considered hazardous to human health. The state water quality standards for mercury, however, do not account for accumulation of mercury through the food chain, and are not based on the easily assimilated and highly biomagnified methyl form of mercury. In addition, the concentration of mercury identified in the state standards is orders of magnitude higher than those typically observed in VT and NH waters. Vermont did not apply the numeric standards for mercury during its review of the Project. Vermont, instead focused on the potential for mercury levels to result in impairments to fish and wildlife habitat and angling, which are designated uses for Class B waters under both NH and VT water quality standards.

No data for mercury concentrations in project waters (the water column) exist and such data would be unlikely to offer answers or experimental data on the rate fish accumulate mercury directly from the waters in which they live. Because of elevated atmospheric mercury deposition in the U.S. and Eastern Canada, all northeastern states and three eastern Canadian provinces have issued fish consumption advisories that recommend limits on the consumption of potentially-contaminated fish. As mentioned in the introduction to the Existing Environment Section for Water Resources, it is unclear what sources contribute to high mercury concentrations occurring in fish captured in the Project reservoirs, but those levels may be the result of contributions from upstream sources near Lancaster, New Hampshire. The effects of mercury are discussed in the Aquatic Resources Section, Environmental Effects.

Upper Connecticut River Mitigation and Enhancement Fund

Under the Settlement Agreement, an Upper Connecticut River Mitigation and Enhancement Fund would be established. Potentially supported activities under this fund would include river restoration work, monitoring and enforcement of conservation easements, riverine shoreland protection, and protection and enhancement of wetlands and adjacent buffer areas. The use of the fund would be determined by a committee comprised of stakeholders.

Potential tasks undertaken by the fund could improve the water quality and aquatic resources in the reservoirs. Activities within the watershed of the Connecticut River upstream of the FMF facilities could result in a reduction of nutrient input to the river. This nutrient reduction could improve the trophic state of all three reservoirs and could also improve the low DO conditions in the deeper waters of the Moore and Comerford reservoirs during the summer period by reducing the input of materials causing increased biological oxygen demand. Consequently, aquatic resources , particularly water quality sensitive salmonids (including Atlantic salmon) and macroinvertebrates would be enhanced. The above measures are the types of measures that would be generally needed

to enhance aquatic resources, and staff recommends these measures be supported by the fund. For further discussion concerning the fund, see Section VIII of this document.

License Denial, Decommissioning, and Dam Removal Alternative

Removal of the dams would restore riverine conditions on over 20 miles of river and one of the most significant rapids on the Connecticut River. Removal of the dams would result in the release of sediments accumulated in the reservoirs and behind the dams. These sediments would be distributed downstream as far as the Wilder dam reservoir. In the short-term, the release of sediments would result in increased turbidity and suspended solids and therefore, result in potential adverse effects to water quality. The sediment would cover downstream spawning areas (gravel and cobble) in the Connecticut River in the short term. Some areas may retain sediments longer than other areas until flooding events flush the sediments further downstream. Although no sediment samples were taken or analyzed behind the dams, the eroding sediments may contain accumulated nutrients and toxins buried in the sediment column as a result of agricultural and industrial discharges in the watershed during earlier years of the developments. Removal of the dams would also affect the hydrology of the river by converting over 5,000 surface acres of reservoir to riverine conditions. The removal of the dams would increase the potential for flooding along the Connecticut River, specifically during the spring freshet.

c. Cumulative effects:

The FMF Project's contribution to water quality changes on the river include some effects immediately downstream of the project, due to discharge of hypolimnetic waters, and low and no flows resulting from dam operations. Flows below the project may affect the amount of permanently wetted stream habitat and may affect aquatic life, particularly during low and no flow periods. Fluctuating reservoir levels may affect shoreline erosion and reduce the capacity for aquatic life as a result of sedimentation and dewatering in the affected littoral zones. Depressed oxygen levels in the reservoirs exist, most likely due to accumulation of organics from upstream discharges, and increased accumulation and possibly bioavailability of mercury.

Today, in Vermont and New Hampshire, 143.5 miles or approximately 54 percent of the river is impounded (Fallon-Lambert, 1998). The FMF Project accounts for about 25 miles or 9 percent of the river in Vermont and New Hampshire. The FMF Project dams created approximately 5,200 acres of new lake habitat, primarily suitable for warmwater/coolwater fisheries, replacing 20 miles of riverine habitat.

The contribution of the FMF Project to the cumulative hydrologic effects to the Connecticut River is largely confined to the changes in the river at the project and below

the project to the upper reaches of the Wilder dam reservoir. Hydrologic changes resulting from the project include: the conversion of one of the river's most notable stretches of falls and rapids to an impounded condition; reservoir fluctuations, including winter drawdown on both the Comerford and Moore reservoirs; changes to river flows below the project due to project operations; and higher minimum and reduced maximum flood flows.

The proposed action includes measures that would provide beneficial cumulative effects to water quality, including: providing minimum flows below the project dams, studying depressed oxygen conditions in the project area, aerating flows when needed to meet state water quality standards, donating conservation easements on both project and non-project lands, and water quality protection projects that may be funded using the Upper Connecticut River Mitigation and Enhancement Fund.

The proposed project operations would provide less variable downstream flows and would reduce water level fluctuations at the McIndoes reservoir. Other changes contributing to cumulative effects on hydrology include increased minimum flows below dams on the Connecticut Lakes headwaters as a result of an agreement negotiated among the dam owners and other interests (state and federal agencies, regional agencies, and NGOs). These increased flows would improve conditions for aquatic life, and would augment downstream flows. See also "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

d. Unavoidable adverse effects: Operation of the project under the proposed action would not cause any significant, unavoidable adverse effects to existing water resources.

3. Aquatic Resources

Atlantic salmon, American shad, blueback herring, sea lamprey, and alewife historically ascended the mainstem Connecticut River and many tributaries to spawn. Shad migrated as far upstream as Bellows Falls, Vermont, (downstream of the project area), while salmon traveled past this natural barrier as far upstream as Beecher Falls near Stewartstown, New Hampshire. Other anadromous species migration (alewife, blueback herring, sea lamprey) apparently also were blocked by Bellows Falls. In the late 1700's, salmon migrations in the upper Connecticut River disappeared as industrialization began in the Connecticut River valley. In 1798, the first mainstem Connecticut River dam was built across the river at Turners Falls, Massachusetts (NHFG, 1939); effectively blocking the upstream migration of salmon, shad, and other anadromous species, and eliminating these species from the reach of the upper Connecticut River (CRASC, 1998).

Development of the Connecticut River with dams, in addition to blocking anadromous fish runs, changed the ecology of the river. Prior to development of the FMF Project, nearly half of the river had been impounded, changing the ecology of the river from one sustaining primarily coldwater fish to one favoring warmwater species. By slowing flows in the river and creating reservoirs, the dams had the effect of increasing deposition of solids. The river bottom once contained extensive areas of gravel, and historically spawning by Atlantic salmon occurred over much of the river (CRASC, 1998). However, by 1939 there were 14 dams on the mainstem of the Connecticut River (not including the headwater lake dams); at that time NHFG reported that "the river bottom for the most part is of silt and sand with interspersions of gravel and rubble," as a result, reducing the suitability of much of the river as habitat for coldwater fish. Changes to the river flows and river bottom also affected macroinvertebrates, including fresh water mussels that prefer free-flowing clean water, such as the Dwarf Wedge Mussel.

a. Affected environment:

Aquatic Habitat

The aquatic habitat in the project area generally consists of lentic (impounded) conditions associated with the three project reservoirs, and short reaches of riverine habitat. Much of the substrate throughout the project area consists of boulders, cobble and gravel, but areas dominated by sand and silt also occur. Moore reservoir is characterized by large areas of deep water habitat and back bays, with a dominant substrate of cobble and boulders in the littoral zone. There are a few areas of active erosion, but for much of the reservoir the erosion potential is low due to the stable, rocky banks. Submerged aquatic vegetation (SAV) occurs in a few scattered areas of the reservoir; these are associated with silt or sand in 3.5 to 5 feet of water (LBA, 1997a). Low DO concentrations in the hypolimnion limit the availability of this habitat for coldwater fish during the summer.

A short reach of riverine habitat occurs in the upper end of Moore reservoir. The length of this riverine section is governed by water levels in the reservoir, outflow from the upstream Gilman dam, and a natural ledge outcrop that creates a hydraulic control located about 2,400 feet downstream of the Gilman dam. The river above this point (to the base of Gilman dam) is a relatively deep pool (up to 25 feet deep) with low current velocities (GSE, 1998). The riverine section of the Moore reservoir downstream of the hydraulic control is approximately 2,600 feet long, and consists primarily of a shallow to moderate depth run (2 to 12+ feet), with primarily a cobble and boulder substrate (GSE, 1998).

Aquatic habitat in Comerford reservoir is similar to Moore reservoir, with a preponderance of deep water and some back bay habitat. The primary substrate is cobble,

but areas of sand and silt are present in the downstream end of the reservoir and in some of the back bays. Accordingly, more SAV occurs in Comerford than in Moore, principally in depths of 2 to 7 feet (LBA, 1997a). A short reach of riverine habitat is located in the upper section of Comerford reservoir immediately downstream of the tailrace of Moore dam. Habitat conditions are largely controlled by reservoir levels in Comerford reservoir and flow releases from Moore dam. Habitat in this area is characterized by shallow shoals dominated by large cobble and boulder substrate separated by deeper pool areas. The deeper channel extends downstream from the Moore dam tailrace along the west bank of the river (GSE, 1998). There are some areas of active erosion along this stretch of the Comerford reservoir.

McIndoes reservoir is more riverine and contains little deep water habitat and few back bays. A mixture of substrate occurs in McIndoes: the more riverine upper end is rocky with boulders and rock outcrops with cobble substrate, while the lower end is dominated by sand and silt. Of the three project reservoirs, McIndoes reservoir has the largest number of SAV beds and considerably more SAV acreage than the other reservoirs (19 acres versus 1 acre or less in each of the other reservoirs) (LBA, 1997a). The depths of the SAV beds range from about 1.5 to 8 feet during normal full pool, but most SAV is located in water depths of 2 feet or more.

The largest riverine section in the project area is in the upper section of McIndoes reservoir and includes the Nine Islands area. Immediately below the Comerford dam, a narrow, deep run section extends about 4,800 feet downstream, including the excavated tailrace reach below the Comerford powerhouse. The next 1,500 feet of riverine habitat is shallow run dominated by cobble and small boulder substrate, extending to the Nine Islands area. The Nine Islands reach, about 2,100 feet long, has several islands in the mainstem of the river and is primarily riffle habitat with a series of side channels also containing some runs and pools at higher flows. This area contains a mixture of velocities and substrate, including cobble, gravel, sand, and silt with some areas of emergent vegetation. Included within the Nine Islands reach is the confluence of the Passumpsic River. Below the Nine Islands area, the reservoir becomes run habitat, again dominated by cobble and small boulders. Lacustrine conditions, i.e., the end of the riverine habitat, occur at the end of this run (GSE, 1998).

Fishery Resources

The FMF Project waters primarily support a warmwater/coolwater fish community; however, a coldwater fishery for salmonids also exists in the project area, supported by a stocking program, with some wild trout production in the tributaries to the project reservoirs. According to USGenNE's fishery consultant, Acres International, the fish community has all trophic levels represented (from top predators/carnivores to forage fishes). Sport or game fish species are well represented and include northern pike,

chain pickerel, smallmouth bass, yellow perch, rock bass, pumpkinseed, trout (brown, brook and rainbow), and small numbers of landlocked Atlantic salmon. The project area is also included within the reach of the Connecticut River considered for Atlantic salmon restoration. The Connecticut River Atlantic Salmon Restoration Program, is described in greater detail below.

NEP conducted fishery surveys in the project area during two seasonal sampling events in fall 1996 and spring 1997, utilizing boat electrofishing, trap netting, gill netting, and seining (Acres, 1999b; 1999c; and 1998b). These surveys collected nearly 5,000 fish representing 28 species. Species diversity was greatest in Comerford reservoir (25 species collected), followed by Moore (23 species), and McIndoes (19 species). Yellow perch dominated the overall catch, while smallmouth bass was the most common sport/gamefish collected. Salmonids were present but comprised less than 1 percent of the catch. This relatively low catch of salmonids, however, is assumed not necessarily representative of the overall population of salmonids in the project area. The sampling gear utilized in the fishery surveys did not target salmonids, which are known to support a fishery in the project area. Overall, Acres International concluded the fish community appeared to include a good mixture of species and age-groups and good condition factors.

The surveys also included sampling in the tributaries to the project reservoirs to determine if these tributaries supported natural trout production, which in turn could contribute to the fishery in the project reservoirs. Sampling of tributary streams indicated that trout natural reproduction occurs in two tributaries to Moore reservoir (Cushman Brook and Halls Brook) and in five tributaries to Comerford reservoir (Chandler Brook, Mad Brook, Bill Little Brook, and two unnamed tributaries), based on the collection of juvenile trout. Suitable salmonid habitat also exists in other tributary streams that could not be effectively sampled. There is limited available habitat, however, in many of the streams because of natural obstructions near the mouth, or very low stream flows during the drier periods of the year (summer, fall), which coincide with the fall spawning period for brook trout and brown trout.

Based on the stream surveys, which collected only low numbers of juvenile trout, it appears that the tributary streams contribute little to the overall fishery in the Moore and Comerford reservoirs. This fishery is dominated by warmwater/coolwater species (smallmouth bass, yellow perch, rock bass), which do not use the tributaries for spawning. The trout fishery that occurs in the project area is concentrated in the tailraces of Moore and Comerford dams. The probable source of the trout for this fishery is the 10,000 to 12,000 trout stocked annually in project waters by the states of Vermont and New Hampshire (Acres, 1999a). Trout stocking in project waters was initiated by both states in 1994 for a put-and-take and a put-grow-and-take fishery.

Proportional Stock Density

Proportional stock density (PSD) is an index of population balance based on length-frequency distributions, developed for managing recreational fisheries. PSD is reported as the proportion of a given population with fish over a specific "quality" length, which varies according to the species. For most panfish species (e.g., bluegill, crappie, pumpkinseed and rock bass), PSD values for balanced populations generally range from about 20 or 30 through 50 or 60. Balanced yellow perch and smallmouth bass populations generally have PSD values between 30 and 60 (Anderson and Neumann, 1996). The PSD values for smallmouth bass, rock bass, and yellow perch in the study area generally fell within these ranges (Acres, 1999c), indicating balanced populations of these species.

As a warmwater/coolwater fishery, the studies indicated that it is well represented by over 20 species, including popular game species such as smallmouth bass and chain pickerel. In addition, although yellow perch may have comprised the highest percentage of the catch in the surveys conducted, larger size classes of perch were common, which would also be available to the fishery. Yellow perch are a desirable species for many anglers, and smaller size classes of perch also serve as forage for game species, such as bass and trout. Even with the dominance of the warmwater fishery, however, a fair trout fishery still exists in the project area in the Comerford and Moore tailwaters.

Health and Mercury Toxicity Levels

The fishery surveys indicated little evidence of anomalies (e.g., sores, lesions, etc.) on the fish collected, and no evidence of overwinter stress or mortality (Acres, 1999c). Condition factors are a commonly used measure of well-being, based on a ratio of length to weight. Comparison of condition factors for smallmouth bass, rock bass, yellow perch, and pumpkinseed collected in the project area with similar data from the northeastern and midwestern U.S. indicated that these species (in project area) had average or slightly below condition/well-being than those in the other areas of the country (Carlander, 1977; Acres, 1999b and 1999c). Condition factors for smallmouth bass (> 250 mm) from the project area were similar to those from other New Hampshire lakes (Acres, 1999c). Smallmouth bass growth rates (i.e., length at age data) for the project area, however, appeared to be as good as or better than those from several other New Hampshire lakes (Acres, 1999c).

While the fishery by common indicators appears to be healthy, mercury levels in fish collected in the project area were elevated. A total of 96 fish tissue samples were analyzed, and all had detectable levels of mercury (Acres, 1999d). Most of the tissue samples were from yellow perch and smallmouth bass, and mercury levels were higher in these species than from similar species samples from other waterbodies in Vermont and

Maine. The average mercury level for yellow perch tissue samples from the project area was 0.6 parts per million (ppm)(mg/kg), and for smallmouth bass, 0.83 ppm. Consumption action levels in northeastern states range from 0.3 to 1.0 ppm, and the U.S. Food and Drug Administration's consumption action level is 1.0 ppm (Acres, 1999d). Statewide consumption warnings/guidelines have been issued for freshwater fish in New Hampshire and Vermont, indicating a possible widespread, regional issue.

Atlantic Salmon

The Connecticut River Atlantic Salmon Commission, through its member agencies: the state fisheries agencies of New Hampshire, Massachusetts, Connecticut and Vermont, FWS, the National Marine Fisheries Service (NMFS), and the U.S. Forest Service (USFS), with support from private industry and public conservation organizations, is involved in a cooperative effort to restore Atlantic salmon to the Connecticut River. The broad goal of the salmon restoration program encompasses two primary objectives that represent the interests of both the federal and state cooperating agencies. The focus of the federal effort is to restore the adult salmon spawning population to a level that will fully utilize the spawning habitat available to them, and will be self-sustaining, eventually allowing the termination of smolt and fry stocking in the restored portions of the river basin. The state agencies have the additional objective of generating a surplus of adult salmon that will be available to sport fisherman.

Atlantic salmon were collected during the project area fishery surveys (Acres, 1999b and 1999c), and were reported in the recreational fishing surveys (LBA, 1996b and 1999). Some of these fish were identified as landlocked, but others, primarily in McIndoes reservoir, were considered to be parr or smolt from fry stockings associated with the Atlantic Salmon Restoration Program. The VANR and FWS, in a cooperative effort, currently stock Atlantic salmon fry in the Passumpsic River in an effort to produce "wild" reared smolt for the restoration program, and may have been the source of the collections. Recent (1997 and 1998) fry stockings into the Passumpsic and Stevens Rivers (both tributaries to the McIndoes development) have numbered up to 524,000 fish annually. In addition, up to 100,000 fry have been stocked annually during this same time period into tributaries upstream of the Moore development (Acres, 1999a). Over 412,000 Atlantic salmon fry were stocked upstream of the project area in 2000. After two years of instream rearing, these surviving fish will pass downstream through the project area as smolts.

USGenNE conducted an assessment of Atlantic smolt migration through the Moore and Comerford reservoirs (NAI, 1999b). A total of 99 tagged smolts were released during 4 periods between May 12 through May 28, 1999 at water from 14 to 19 degrees Celsius. Observations of the tagged smolts found that movement through the

reservoirs was limited and none were detected passing the Moore and Comerford stations.

There was some question whether the test fish used in the 1998 study had advanced to the smolt stage, and therefore, would not exhibit downstream movement behavior. For this reason, the study was repeated in 2000 (Normandeau Associates, Inc., 2001). In this second study, 148 smolts were released into the Moore Reservoir on five occasions between May 6 and 27, 2000 (groups of fish released to the Moore Reservoir between May 6 and 27 and into the Comerford Reservoir between May 17 and 22, 2000). These fish were tested to ensure they were in the smolt stage of development, and therefore, were considered adequate for testing and representative of an emigrating population of Atlantic salmon smolts. The test passage results were influenced by unusually high river flows that resulted in spill conditions at the Moore Dam for three days (May 11 through 13) and for six days at the Comerford Dam (May 10 through 15). Of the 108 fish released into the Moore Reservoir, ten fish passed downstream, 9 via spillage at the dam and one via the turbine. Of the 40 fish released into the Comerford Reservoir, none passed the Comerford Dam; however, 4 of the same fish that had passed over the Moore Dam also passed over the Comerford Dam and traveled downstream where they were detected at Turners Falls Dam six to eight days after passing the Comerford Dam.

The FWS is involved in a cooperative effort with the state fisheries agencies of New Hampshire and Vermont, NMFS, and USFS, as well as private industry and public conservation organizations, to restore Atlantic salmon to the Connecticut River. The broad goal of the salmon restoration program encompasses two primary objectives that represent the interests of both the federal and state cooperating agencies. The focus of the federal effort is to restore the adult salmon spawning population to a level that will fully utilize the spawning habitat available to them, and will be self-sustaining, eventually allowing the termination of smolt and fry stocking in the restored portions of the river basin. The state agencies have the additional objective of generating a surplus of adult salmon that will be available to sport fisherman.

In cooperation with the fry stocking efforts, USGenNE provides downstream fish passage for outmigrating salmon smolt during the spring, through the seasonal opening of a log sluice at the McIndoes dam. Downstream passage is also provided by other dam owners at the Ryegate dam, and other projects further down river. Although, as noted above, experimental fry stocking has occurred upstream of the Moore development, no permanent commitment has yet been made for stocking salmon fry into the mainstem or tributary streams of the Connecticut River upstream of the Passumpsic River. Thus, downstream fish passage has yet to be provided at Moore and Comerford dams, and under the "Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut

River" (CRASC, 1998), downstream passage at these two dams is listed as "needed" but "not planned".

Atlantic salmon adult returns from these restoration efforts have been disappointing to date. Since 1985, the total number of documented adult salmon returns to the Connecticut River have ranged from 95 to 490 fish annually (199 in 1997, and 300 in 1998)(CRASC, 1998). The majority of these returns are captured at downstream projects for use as hatchery brood stock, and few adult salmon are released upstream to the upper Connecticut River. Generally, only occasional adult salmon pass upstream over Wilder dam (only 9 fish over the past 11 years), which is the most upstream project with adult passage facilities. It is about 40 miles to the next upstream dam (Ryegate). Thus, no adult sea-run salmon currently occur in the project area. The Strategic Plan, however, calls for the potential future construction of upstream fish passage facilities at both Ryegate and McIndoes, if larger numbers of adult salmon eventually return to the upper Connecticut River.

Freshwater Mussels

Mussels are sparsely distributed throughout the FMF Project area. Eastern floaters were found only in Comerford reservoir. The Eastern elliptio was found below McIndoes dam, at one site in Comerford reservoir, and in Moore reservoir. Other mussels, including the squawfoot, triangle floater, and the federally-listed dwarf wedge mussel (*Alasmidonta heterodon*), were found upstream of Moore reservoir (WAI, 1998).

b. Environmental effects of the alternatives and recommendations:

No-action

No-action would maintain aquatic habitat in the project area in its current state. This habitat would remain primarily lacustrine with short reaches of riverine/lotic habitat. There would be no changes in substrate within the project area, and this habitat would continue to be exposed to the same project operational conditions as have occurred during the past several decades. Any limiting effects on aquatic habitat from this operation would continue.

Aquatic resources in the project area would continue to be affected by daily and seasonal water level fluctuations and variable flow releases from peaking operations. Reservoir water level fluctuations could adversely affect fish populations by dewatering and altering spawning habitat, influencing fish spawning behavior, and reducing spawning success. Impoundment fluctuations may reduce the area of suitable spawning habitat, cause nest abandonment and exposure, may desiccate eggs and strand young fish, and lead to the gradual loss of shoreline shelter as a result of erosion and reservoir aging

(Miracle and Gardner, 1980; Ploskey, 1983; von Geldern, 1983). Centrarchids, e.g., smallmouth bass, are particularly susceptible to water level fluctuations because they spawn primarily in the shallow, littoral zone. Below the projects, hydropower peaking/pulsing may adversely affect habitat by intermittently watering and dewatering areas, may strand fish, or may dewater spawning areas resulting in the loss of eggs and fry (Hildebrand et al., 1980). Peaking flow releases may adversely affect macroinvertebrate populations (food source for fish) through scouring, desiccation of habitat, altered flow patterns, and creation of an unstable food supply (Fisher and LaVoy, 1972; Armitrage, 1976; Covich et al., 1978). The adverse affects may be somewhat limited, however, as a result of available macrohabitat and shelter that exists in the tailrace areas.

Based on the water quality monitoring studies, periods of reduced DO are of relatively short duration in late summer, having a minor overall effect on habitat availability (see Section V.C.2). USGenNE conducted an additional water quality study in 1999 (Berger Study), and the results confirm the earlier study results.

The warmwater/coolwater fish community would continue to dominate the fishery within the FMF Project area, although the coldwater salmonid fishery in the Moore and Comerford development tailraces would also continue. Yellow perch, rock bass, and smallmouth bass would continue to be the dominant species in the fishery throughout the project area, with smaller numbers of trout (brown, brook, and rainbow) and a few landlocked Atlantic salmon also taken in the fishery.

The operation of the FMF Project has no direct influence on mercury levels, although mercury may have been deposited in the sediments of the project reservoirs, particularly Moore and Comerford. The source of mercury is likely to originate from either atmospheric deposition, bedrock sources, micro-habitats in river bottom soils, or upstream sources of contamination from industrial activities (BioDiversity Research Institute, 1998), rather than sources attributable to project operations. Under the no-action alternative, the existing conditions are expected to remain unchanged. Statewide consumption guidelines that provide recommended limits for fish consumption have been issued for freshwater fish in New Hampshire and Vermont. This indicates that mercury contamination may be a widespread, regional issue, and not limited to the project area.

There is no evidence that the fish population is adversely affected by entrainment and turbine-related mortality. There are no anadromous or other migratory fish in the project area, except for Atlantic salmon that are stocked as fry in upstream tributaries and pass downstream through the project area as smolts. Anadromous species currently do not have access to the project area due to a downstream impassable dam (Ryegate). No fish passage facilities exist at the FMF project developments, except a log sluiceway at the McIndoes Dam that is opened 3.5 feet below normal pool from April 1 to June 15, for

downstream passage of Atlantic salmon smolt. Any salmon smolt that do not successfully use the sluiceway or project spillways (if there is spillage due to high flows) for downstream passage, however, would pass downstream through the project turbines and would experience some level of mortality. A recent Electric Power Research Institute (EPRI) review of turbine-related mortality at hydroelectric projects found that turbine mortality of small fish (less than 8 inches) was less than 10 percent (EPRI, 1992). Under the no-action alternative, downstream and upstream fish passage would remain unchanged.

Proposed Action

Under the proposed action, the project fishery would remain similar to the existing fishery, dominated by warmwater/coolwater species. Fisheries habitat in the project area, however, would be enhanced as a result of improved water management measures (minimum flows and reservoir level restrictions) provided for under the 1997 Settlement Agreement. Fisheries in the project area would also be managed in accordance with the FMF Project Fisheries Management Plan (now called the Fifteen Mile Falls Project Fisheries Mitigation Plan [FMP]). The FMP would provide a framework for future management and enhancement of fishery resources in the project area in cooperation with state and federal resource agencies and NGO's. Implementation of any of the FMP's management strategies would be funded by the $3 million budget provided for under Section VI of the Settlement (with the exception of the construction of fish passage facilities that would be funded from a different source). USGenNE would implement the selected fisheries management strategies over a period of years and the selection of individual strategies to be implemented would be determined by state and federal resource agencies and NGO's with tradeoffs possibly occurring on which measures are selected because of changing resource priorities and budget constraints (there are other studies, plans, and mitigation measures for other resources that would also be seeking to use funds from the $3 million budget).

USGenNE proposes the following strategies and tactics under the FMP:

a. Warmwater species

To protect and enhance shoreline aquatic habitat and to facilitate smallmouth bass and other shoreline spawning fish species, USGenNE proposes to operate the Moore Development impoundment to achieve an elevation of at least 802 ft. msl, with a target elevation of 804 ft. msl by May 21 each year. Similarly, the Comerford Development impoundment would be operated to achieve an elevation of at least 645 ft. msl by May 21 each year with a target elevation of 647 ft. msl. For the period of May 21 through June 30, both reservoirs would not be drawn down more than two feet below any elevation previously attained by May 21.

b. Coolwater species

Yellow perch, northern pike, and chain pickerel are the three most abundant coolwater fish species in the project area. Yellow perch and chain pickerel are the only two species the resource agencies have an interest in managing for natural reproduction in the project reach and immediately downstream of the project. Northern pike were thought to have been introduced into the Moore impoundment in the 1990's by overzealous anglers and the resource agencies have no intention of managing this species. Walleye occur downstream of the project and are a resource agency management priority for natural reproduction below the project in the Connecticut River. The NGO's are opposed to introducing or managing walleye in any of the project impoundments. The resource agencies have not recommended any specific measures for managing coolwater species in the project area. Improved reservoir operations of the project should be beneficial to coolwater species by limiting spring drawdown.

c. Coldwater species

Rainbow trout, brown trout, and brook trout are the three coldwater fish species of interest in the project area. The rainbow and brown trout are generally concentrated in the tailraces of the Moore and Comerford Development and in the riverine reach of the McIndoes impoundment downstream of the Comerford dam. Rainbow and brown trout populations are sustained by frequent stocking efforts, although some natural reproduction occurs. Brook trout are found in tributaries to the project impoundments and in the mainstem Connecticut River where they maintain small, self-sustaining populations. Juvenile brook, brown, and rainbow trout were collected in two tributaries to the Moore reservoir and five tributaries to the Comerford reservoir by Acres in spring surveys conducted in 1997 (Acres 1999). The resource agencies and NGO's believe the full potential of the project area is unrealized and there is great interest in enhancing the coldwater fishery in the project area.

The resource agencies' current management goals are to manage rainbow and brown trout for natural reproduction in all project stream reaches and to use hatchery supplementation above the McIndoes impoundment. Their future management goal is to increase natural reproduction of rainbow and brown trout, using supplemental stocking only where necessary, for all riverine reaches and reservoirs. For brook trout, the resource agencies' current management goal is to manage brook trout for natural reproduction in tributaries with some supplemental hatchery stocking above the Moore impoundment. Their future management goal for brook trout is to increase natural reproduction and to improve access to tributaries in project impoundments and in the Moore and Comerford tailraces.

Specifically, the FMP, provides six measures to improve and enhance coldwater fisheries management in the project area:

1. USGenNE would retain a tailrace habitat enhancement expert to: (a) analyze scuba diver videotapes of the Comerford and Moore Development tailrace substrate habitats to assess the need and feasibility of creating velocity shelters and holding areas, (b) review previous Gomez and Sullivan surveys of Comerford and Moore Development tailraces; and (c) issue a feasibility report to USGenNE and stakeholders which ranks the various enhancement options based on expected benefits and costs, and include recommendations as to which option should be implemented based on the best potential for providing enhanced fishery benefits, and best potential for success and costs.

   Following the receipt of the feasibility report from the tailrace habitat enhancement expert, USGenNE proposes to consult with stakeholders to identify the availability of funds for implementing the highest rated enhancement option(s). Once the available funds are identified, USGenNE and the stakeholders would make the final decision as to which option(s) is implemented. A plan and schedule for implementing the structural enhancement plan would be developed by USGenNE in consultation with the resource agencies and stakeholders. USGenNE prefers this plan and schedule be developed after a license is issued for the project and tentatively expects construction of selected structural enhancement measures to occur in the summer of 2003.

2. Enhance and protect the salmonid habitat in the tailraces of the Moore and Comerford dams, and in the McIndoes Development, through water management measures that would ensure water quality sufficient to sustain a rainbow and brown trout fishery. To accomplish this objective, USGenNE proposes to release a minimum flow of 320 cfs, or inflow, from the Moore Dam throughout the year and the following minimum flows from the Comerford dam under this schedule: 818 cfs from June 1 through September 1; 1,145 cfs from October 1 through March 31; and 1,635 cfs from April 1 through May 31.

3. Develop structural habitat enhancement measures to improve salmonid holding areas in the Comerford and Moore tailraces. Appendix B of the FMP describes the measures to be implemented by USGenNE. This enhancement approach involves a four-step process that includes the retention of a tailrace habitat enhancement expert to review existing information for the tailraces for the Moore and Comerford tailraces and recommendations from this "expert" on the best structural option(s) (see item 1 above), and implementation of various structural measures for creating velocity shelters and holding areas for fish. The structural measures proposed include: (a) adding large rocks (boulders) to the tailraces of the

Moore and Comerford Developments to create velocity refuges, and increasing the size or length of the existing rocky shoal in the Moore tailrace; (b) diking the lower end of a back channel on the state of Vermont bank downstream of Comerford dam and upstream of Nine Islands, to enhance an existing wetland; (c) diverting flow into the existing braided stream channels upstream of Nine Islands, to improve habitat conditions at low river flows; and (d) providing flow into the old river channel on the state of Vermont bank downstream of Comerford dam.

4. Further investigate tributaries to the project reservoirs to determine the potential for and measures required to improve salmonid access to these tributaries. Of the 23 streams surveyed by Acres in 1997 (Acres, 1999), (13 in Comerford, 8 in Moore, and 2 in McIndoes), 4 were found to have too steep a gradient or waterfalls near the mouth that were natural barriers to the migration of fish from the reservoirs to the stream for spawning or other purposes. Other streams examined were blocked by debris at the tributary mouths. Appendix C of the FMP describes measures and a tentative schedule to be taken by USGenNE to improve access for spawning coldwater fish to tributaries to the three project reservoirs. The four-step process is as follows:

(a) Resource agencies and stakeholders would review existing information collected by Acres in the 1997 surveys and determine if any data gaps exist. This review could include additional field reconnaissance of the tributary streams. The stakeholders and resource agencies would report their results to USGenNE and identify which streams should be further studied for potential enhancement measures.

(b) USGenNE would retain a consultant to collect additional data from streams identified by the resource agencies and stakeholders in step one. The consultant would conduct studies on selected tributaries selected in consultation with the resource agencies and stakeholders. The objective of the results obtained by the consultant is to develop a list of streams with the greatest potential for improvement that would allow spawning fish access to these streams. The consultant would also prepare an estimate of costs and benefits associated with conducting improvements at the streams identified as having the greatest potential for improvement of access.

(c) The consultant would prepare a report for USGenNE, upon the completion of studies, that would rank the various tributary streams based on potential benefits and estimated costs, for providing access or other habitat improvements. USGenNE would then develop a prioritized list of streams slated for removal of barriers to upstream fish movement or for other habitat improvements.

(d) USGenNE would identify, in consultation with the resource agencies and stakeholders, the availability of study funds for implementing improvement measures on

the highest rated streams and highest rated enhancement options for those streams identified in item (3) above. USGenNE envisions that the implementation of stream enhancement measures would occur after a license is issued for the project and during the Summer/Fall of 2003.

5. Enhance available salmonid habitat in the McIndoes Development impoundment by stabilizing the reservoir elevations to facilitate the use of near shore habitat and cover in the reservoir. To reach this coldwater fisheries management objective, USGenNE proposes to:

(a) operate the McIndoes reservoir with a normal operating level of 451 feet msl;

(b) If inflow to the reservoir exceeds the McIndoes dam discharge capacity (approximately 30,600 cfs at elevation 451 feet msl), the impoundment may rise above this level; and

(c) the reservoir may be allowed to be drawn down a maximum of 3.5 feet to a minimum operating elevation of 447.5 feet msl.

6. Enhance available salmonid habitat downstream of the McIndoes Development by releasing minimum flows and spring spawning and incubation flows. To reach this coldwater fisheries management objective, USGenNE proposes to release the following minimum flows:

(a) 1,105 cfs or inflow, from June 1 through September 30;

(b) 2,210 cfs or inflow, from October 1 through March 31; and

(c) 4,420 cfs or inflow, from April 1 through May 31.

For April 1 through May 31, the inflow is defined as the sum of the applicable Comerford Development minimum flow and the prorated Passumpsic gage. The minimum flow during the April 1 through May 31 period may also be reduced by dry conditions and flood conditions as follows: If dry conditions are predicted to result in the Moore and Comerford Development reservoirs failing to fill by the end of the spring runoff, the minimum flow below the Comerford Development can be reduced to no less than 50% of the Dalton gage flow. In such an event, the corresponding minimum flow below the McIndoes Development will be the sum of the prorated Passumpsic gage flow and no less than 50% of the Dalton gage flow. In order to preserve the flood control benefits of the project, if the minimum flow at McIndoes is expected to contribute to flows in excess of 50,000 cfs at Bellows Falls or in excess of 10,000 cfs at Wilder, the minimum flow at McIndoes

may be reduced to 2,210 cfs. If future operational or structural changes at the downstream projects reduce the adverse impacts of flows at or above these levels, the need to restrict minimum flows at McIndoes under these circumstances will be reviewed.

e. Catadromous Species

The presence of American eels in the project area is uncertain. No American eels were captured in the project area during any of the fishery surveys conducted by the contractors for USGenNE. American eels historically were present throughout the Connecticut River, including the project area, as reported by the New Hampshire Fish and Game in their 1939 biological surveys of the Connecticut watershed. There are several dams on the mainstem Connecticut River below the project that impede the upstream movement of eels.

Since no American eels have been identified to currently inhabit the project area, under the FMP, USGenNE proposes to develop plans for upstream and downstream eel passage measures, or plans for studies to address eel passage at the project dams, and to develop a schedule to implement the proposed measures or studies (stipulation VI.B.4, Settlement Agreement). These plans and/or studies would be developed in consultation with the state and federal fishery agencies and would be developed within one year of notification of a finding by the state and federal fishery agencies that such eel passage is necessary for the project.

We recommend that USGenNE develop a plan to study eel passage or provide upstream and downstream eel passage at the project within one year of being notified by the FWS, NHFG, and VTDFW that eel passage is necessary at the project. The plan should be developed in consultation with the above named fishery agencies and include an implementation schedule agreed to with the fishery agencies.

f. Non-game Species

The current non-game species in the project area include rock bass, white sucker, fallfish, pumpkinseed, golden shiner, longnose sucker, and assorted minnows, dace, and sculpins. USGenNE is not proposing to implement any additional measures to further enhance non-game fish populations in the project area. USGenNE believes the current FMP would provide substantial enhancements for habitat for non-game species by providing spring spawning reservoir management guidelines as defined for the Warmwater Species under the plan, and by providing minimum flows and minimum and maximum operating levels for the reservoirs as defined for the Coldwater Species part of the FMP. We agree the recommendations we have made for warmwater and coldwater fish species would adequately benefit non-game fish species.

g. Anadromous Species

The FMP proposes four measures that USGenNE has agreed to do in support of improving conditions for anadromous fish in the project area, including current and future Atlantic salmon populations:

1. **Downstream passage for Atlantic salmon smolts**. USGenNE proposes, in consultation with the state and federal fishery agencies and CRASC, to provide downstream fish passage facilities at the McIndoes Dam within two years after license issuance for the project. USGenNE proposes to continue using the existing skimmer gate that is operated for outmigrating Atlantic salmon smolts from April 1 through June 15. This gate operation meets the typical FWS criteria for fish bypass flows equaling three percent of the full powerhouse hydraulic capacity. However, in some instances, the lowering of the reservoir pool level as a result of re-regulating McIndoes reservoir levels to accommodate discharges from the upstream project developments, causes discharge through the skimmer gate to cease for short periods of time. To ensure smolt passage is accomplished through the skimmer gate during the outmigrating period, USGenNE proposes a program whereby the skimmer gate would remain open throughout the changing reservoir elevations to ensure fish passage 24 hours a day during the outmigrating period. USGenNE believes the dedicated operation of the skimmer gate for smolt passage, combined with the passage route over the dam provided by natural heavy spills in the April-May time frame, would provide adequate downstream passage for Atlantic salmon smolts. To protect downstream migrating Atlantic salmon smolts that are stocked upstream of the Moore Reservoir, we agree with USGenNE's proposal to employ skimmer gate and natural spills, and therefore recommend USGenNE provide downstream fish passage at the McIndoes Development within two years of license issuance. We recommend USGenNE develop a plan, in consultation with the state and federal fishery agencies and CRASC, to include methods of monitoring the effectiveness of the fishway, to ensure the fish passage facilities (skimmer gate and any structural or operational refinements) provide adequate downstream passage for smolts.

2. **Conduct an assessment of Atlantic salmon smolt migration through the Comerford and Moore Developments**. Experimental stocking of Atlantic salmon fry upstream of the Moore Development is likely to continue. As mentioned earlier, Atlantic salmon fry were stocked upstream from the Moore Development in 2000. These fish, after two years of instream rearing, would pass downstream through the project area as smolts. The results of the 1998 and 2000 smolt passage studies showed that fish passage at the Moore and Comerford Dams was best accomplished through spills over the dam. There was very little passage of smolts through the turbines at both developments. USGenNE had proposed in the FMP to provide smolt fish passage at the two developments based on the results of the two fish passage studies. Specifically, USGenNE proposed to provide downstream passage for Atlantic salmon smolts at the

Moore and Comerford Developments if the studies showed that the project blocked the downstream passage of smolts, and there would be a continued need for fish passage based on continued Atlantic salmon fry stocking upstream of the project. Further, USGenNE proposed to develop the downstream smolt passage measures at the Moore and Comerford Developments in consultation with the state and federal fishery agencies and CRASC, with implementation within two years of being notified by these three entities that such passage was needed at the two developments.

Based on the results of the two smolt passage studies, successful downstream passage of smolts past the Moore and Comerford Developments would occur if specific measures are taken at both facilities to facilitate the downstream passage of fish. It does not appear that passage through the turbines at either development is a realistic expectation, probably because of the depth of the turbine intakes. Because it appears a smolt stocking program would likely continue above the Moore Reservoir, to protect downstream migrating smolts, staff recommends that USGenNE develop and design downstream smolt passage measures, including an operating plan, at the Moore and Comerford Developments in consultation with the three entities named above. In developing and designing the fish passage facilities and operating plan for the two developments, we also recommend USGenNE be flexible and extend the implementation schedule for the passage facilities, in consultation with NHFG, VTDFW, and FWS, if needed and when requested to do so by CRASC.

3. **Provide upstream passage for adult Atlantic salmon at the McIndoes Dam.** Currently no Atlantic salmon adults reach the McIndoes dam. USGenNE has agreed as part of the FMP to provide upstream adult Atlantic salmon passage at the McIndoes Dam when 20 adult anadromous Atlantic salmon migrating upstream, reach the Ryegate Dam (located about 51 miles downstream from the McIndoes Dam) for two consecutive years, and the CRASC and state and federal fishery agencies report that the need for upstream salmon passage is needed. The date for installing these upstream passage facilities at the McIndoes Dam may be further delayed if so determined by the CRASC and state and federal fishery agencies. At the discretion of CRASC and the state and federal fishery agencies, USGenNE has also agreed that the passage facilities may consist of installing facilities at the McIndoes Dam or their participation in the construction and operation of a trap and truck facility at the Ryegate Dam. USGenNE has agreed to design the adult Atlantic salmon upstream passage facilities, including a plan and schedule for operation, in consultation with CRASC and the state and federal fishery agencies. We agree and recommend the measures outlined in the FMP for upstream passage for the McIndoes Dam, and perhaps trap and truck operations at the Ryegate dam, be developed and implemented in consultation with CRASC and the state and federal fishery agencies.

4. **Provide upstream passage for adult Atlantic salmon at the Comerford Dam.** Currently no Atlantic salmon adults reach the Comerford dam. USGenNE has agreed as

part of the FMP, to install a fish trap at the base of the Comerford dam, and to conduct a trap and truck operation for Atlantic salmon when directed to do so by the CRASC and the state and federal fishery agencies. USGenNE agrees to have any Atlantic salmon captured in the trap, trucked to destinations specified by the fishery agencies so long as such destinations are legally authorized repositories. We recommend USGenNE develop the trap and truck passage facilities in consultation with CRASC and the state and federal fishery agencies, including a plan and schedule for the facilities.

Aquatic Habitat

Gomez and Sullivan, P.C. (Gomez and Sullivan) conducted studies and collected information for the applicant in cooperation with many stakeholders, resource agencies, and NGO's, concerning the characteristics of the riverine aquatic habitats associated with the project. These study results were reported in four reports: (1) Draft Riverine Habitat Mapping Report (1997); (2) Demonstration Flow Study for the Nine Islands Reach of the Connecticut River (1997); (3) Flow Effects on Riverine Habitat in the Main Stem of the Connecticut River (1998); and (4) USGenNE's Final Riverine Habitat Report (1999). The results of these four reports were incorporated into the final FMP submitted by Berger in 2000 (Louis Berger & Associates, 2000). The studies examined the effects of proposed project flow releases or operations on five different stream habitat reaches: on the mainstem of the Connecticut River from the tailrace of the Comerford Development to the upstream end of the McIndoes Development impoundment; the mainstem of the Connecticut River stream habitat downstream of the East Ryegate Dam; and the riverine portion of the Upper Moore impoundment. The tailrace areas of the Moore and McIndoes Developments were not included in the study because the discharges from both these developments enter impoundments formed by the downstream Comerford development and project (Ryegate), respectively, and these areas are primarily pool habitat with very little to no riverine habitat. Similarly, the riverine portion of the Upper Moore impoundment is fed by the uncontrolled Simpson Paper Company dam, and this stream reach is mostly pool and run habitat that would remain relatively unchanged by the proposed Moore Development impoundment operating levels.

In addition to minimum-flow-release effects on aquatic riverine habitat, the McIndoes impoundment elevation limit was also important because the lower impoundment elevation limit selected during settlement negotiations would create additional riverine habitat at the upstream end of the McIndoes impoundment. The minimum flow requirements for the spring for the McIndoes Development were also analyzed to determine whether they offered improved spawning and egg incubation flows for walleye.

Based on our analysis of the flow effects and flow demonstration studies conducted by Gomez and Sullivan, we recommend USGenNE release, in accordance with

the 1997 Settlement, the following flows and reservoir operating levels for enhancing aquatic habitat in the project-affected reaches of the Connecticut River as identified in Table 2.

The proposed operations, such as limiting water level fluctuations and drawdown in the reservoirs, would better mimic natural (ROR) flow patterns, and would benefit many species of fish and invertebrates that utilize the reservoir littoral zone for spawning and other life stages. Smallmouth bass populations respond positively to stable water levels during spawning and fry development stages, as do other phytophilic species such as northern pike, pickerel, and yellow perch (Hildebrand et al., 1980; Edwards et al., 1983; Ploskey et al., 1984). Based on the smallmouth bass survey conducted at the project (Acres, 1998a), and the elevation of nests observed, the proposed 2-foot reservoir drawdown limit during the spawning season (May 21 through June 30) at the Moore and Comerford Developments would help protect bass nests from desiccation.

Minimum flow releases, identified by the Settlement Agreement, would work to "mask" or dampen the range of flow fluctuations downstream of the powerhouses. The minimum flow releases would also create more natural streamflow conditions and benefit aquatic macroinvertebrates and fishes by providing more stable habitat conditions in areas where suitable habitat conditions exist. Aquatic biota would no longer be exposed to existing flow fluctuations that result from intermittent periods of high flows and nearly dewatered conditions. With the proposed minimum flows, macroinvertebrate production and fish utilization would be expected to increase in reaches receiving the minimum flows and where suitable habitat exists.

The proposed physical habitat management structures discussed in Appendix B of the FMP would augment the enhancements from minimum flow releases and controlled reservoir manipulations proposed for the project. In addition, the tributary access enhancements proposed in Appendix C of the FMP would also offer further enhancement to the fishery resources in the project area. We recommend USGenNE implement the FMP, including Appendices B and C, with site-specific project plans filed with NHDES, VTDEC and the Commission, within two years of license issuance, with implementation of the plans upon Commission approval.

Since some of the proposed enhancement measures are targeted at the riverine reaches in the project area, they would function to benefit salmonids and in turn would be supportive of the Atlantic Salmon Restoration Program. Improvements to the current downstream passage facilities (the sluiceway gate) are planned at McIndoes no later than 2 years after license issuance. Upstream passage at McIndoes, or participation in a trap and truck operation at Ryegate dam, may also be provided when the need is justified, i.e., when a minimum of 20 up-migrant adult Atlantic salmon reach the downstream Ryegate dam for 2 consecutive years. Upstream passage through a trap and truck operation may

also be provided at the Comerford development, depending on the results at Ryegate, and when deemed necessary by the resource agencies.

The fishery within the project area by common indicators appears to be healthy. It is unlikely that continued project operation under the proposed action would result in any adverse effects associated with entrainment. In addition, the various mitigative and enhancement measures previously discussed under the Settlement Agreement, such as the enhanced downstream fish passage facility at McIndoes, are expected to have a positive effect on the fishery in the project area.

Mercury

Conditions related to mercury contamination in the project reach of the Connecticut River are not expected to change under the proposed action. Because there is no single factor that accounts for mercury in water bodies (BioDiversity Research Institute, 1998), the project may play only a very limited role. The large watershed upstream of the project, the location of the project in a river valley, and a complex of other factors may also play significant roles. Overall conditions responsible for this contamination would not be affected by changes in project operations under the proposed action. Staff believes past or future project operations, including drawing down reservoirs or water level manipulation are not likely to be the cause of mercury levels in the project reservoirs because the reservoirs are not drawn down significantly and the relatively stable shorelines are not likely to contribute mercury from flushing the banks. Researchers are continuing to study the link between water level fluctuation and bioaccumulation of mercury. The contribution of water level management to the fish tissue mercury levels in Moore and Comerford Reservoirs remains unknown.

USGenNE collected fish from all three project reservoirs in 1996 and 1998 for tissue mercury analysis. Yellow perch and smallmouth bass comprise 14 and 42 percent, respectively, of the actively managed fishery in the project according to recreational fishing surveys. Fish captured in Moore and Comerford reservoirs had higher levels of mercury in their tissues than fish captured from the McIndoes reservoir. Smallmouth bass contained higher levels of mercury than did yellow perch. Mercury levels in fish sampled from the Moore and Comerford reservoirs were higher than the average statewide (for Vermont) levels for mercury-contaminated fish caught in similar lakes and reservoirs.

As part of the Settlement Agreement, USGenNE said it would conduct a study of mercury levels in fish and other biota in the project reservoirs, and would contribute to other studies or other reasonable options for mitigating mercury levels in biota **only** if the project was contributing to higher mercury levels in these organisms. Since there was no nexus between the project and mercury levels detected in the sampled fish, USGenNE did

not propose any mitigation at the conclusion of their mercury studies on fish. We agree with USGenNE. However, the WQC issued for the project requires USGenNE to develop, in consultation with NHDES and VTDEC, a long-term plan for monitoring mercury in fish tissue at the Moore and Comerford reservoirs, with monitoring results reported to NHDES and VTDEC by December 31 of the sampling year.

Since statewide fish consumption advisories for mercury are in effect for both states (VT and NH), and both states have issued restrictive fish consumption advisories for all three project reservoirs, the WQC issued for the project requires USGenNE to post and maintain the most updated fish consumption advisories from each state (VT and NH) at public access points within the project boundary. The mercury fish monitoring plan and posting of fish consumption advisories at project access points would become terms and conditions of any license issued for the project. As staff sees it, USGenNE has two options, (1) to appeal this matter in court after a license is issued, if it so desires, or (2) USGenNE could negotiate some different, more reasonable terms and conditions (e.g., concerning the frequency of fish sampling and target maximum costs associated with monitoring fish) when developing the plans required by the WQC. The WQC requires these monitoring plans be developed in consultation with the NHDES and VTDEC, and perhaps some cost-saving measures could be developed by USGenNE in negotiating how these plans would be developed and implemented.

The Upper Connecticut River Mitigation and Enhancement Fund, as proposed under the Settlement Agreement, would provide funding for a variety of projects benefitting aquatic resources. Many of the Fund's projects are aimed at protecting and enhancing the project area watershed and restoring or enhancing riverine conditions. Most of these improvements would result in better water quality (e.g., reducing sedimentation and nonpoint source pollution), which would benefit aquatic biota, particularly water quality sensitive salmonids (including Atlantic salmon) and macroinvertebrates.

License Denial, Decommissioning, and Dam Removal Alternative

If the project dams were to be removed, as the reservoirs are dewatered, the previously inundated land would be devoid of vegetation and susceptible to erosion. Erosion would likely occur, resulting in potential adverse effects to water quality on the Connecticut River as a result of high turbidity and increased sedimentation. Sediments trapped by the dams would be released. The hydrologic change in the project area may also result in the loss of adjacent wetlands and SAV, which would adversely affect aquatic biota, including the federally-listed dwarf wedge mussel. Over the long-term, the approximate 20 miles of currently submerged riverine conditions and associated habitat and riverine wetland areas should be restored to this region.

The overall effects on fish resources would be to replace the current fishery, which is dominated by lacustrine warmwater and coolwater species, with a fishery dominated by riverine species. Many of the species that now occur in the project area would remain, although probably at reduced population levels. Species such as smallmouth bass and rock bass would likely still support a fishery in the area, but at a reduced level from the current reservoir fishery.

The removal of the project dams would remove obstructions and enhance salmon passage through the area, if Atlantic salmon are in the future successfully restored to this reach of the Connecticut River. If, however, the salmon restoration program is not successful in restoring salmon to this reach, the benefits of removing these obstructions to fish migration would be less. In-river movements of resident riverine species would be enhanced, but these benefits would be limited to the approximately 20-mile-long formerly impounded project reach, since upstream and downstream dams would presumably remain in place.

c. Cumulative effects

While the project dams created the largest conventional hydropower project in the Connecticut River watershed (and in New England), they were constructed after most of the mainstem river had already been developed with dams, and after as many as 1,000 smaller dams had been built on the tributaries. Hence, many of the major changes that affected the fish and aquatic resources of the Connecticut River, such as the elimination of the Atlantic salmon run, occurred prior to the project development. Nonetheless, they contributed to fragmentation of riverine habitat on the Connecticut River and eliminated the Fifteen Mile Falls rapids, historically one of the major rapids on the Connecticut River.

Water level fluctuations and drawdown at the FMF Project, as in other reservoirs, may limit the establishment of aquatic vegetation beds and emergent wetlands. This may diminish the habitat value of some areas of the reservoirs for fish and aquatic life, as well as wildlife. Daily increases and decreases in river flows resulting from peaking operations may stress aquatic life and reduce the area that is permanently wetted, if minimal or no minimum flow is provided. Reservoir fluctuations may also adversely affect shore spawners such as bass, and tributary access for spawning fish may be impeded during periods of reservoir drawdown.

Degradation of the water quality by wastewater and toxic discharges and nonpoint sources of pollution have further limited aquatic life habitat (see Section C.2). The long history of pollution in the basin continues to affect the overall water quality of the Upper Connecticut River. In some reservoirs, including the project reservoirs, these pollutants depress DO levels in the colder bottom waters, reducing habitat for coldwater fish.

Phosphorus, nitrogen and chlorophyl A values measured in 1996 in the project reservoirs were indicative of moderate to highly productive waters (NAI, 1997).

The proposed action should improve riverine aquatic habitat by: reducing flow variations and providing minimum flows, and reducing water level changes during the spring spawning season to protect bass spawning, and changing the management of the McIndoes dam to increase the length of riverine habitat and encourage the establishment of emergent and aquatic bed wetlands.

Other measures included in the proposed action include river restoration and water quality protection projects that may be funded using the Upper Connecticut River Mitigation and Enhancement Fund (See Section V.B.2). The proposed action also includes measures to initiate upstream fish passage measures at the FMF Project when a salmon run is sufficient to warrant the action as determined by CRASC and the fishery agencies. See also "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

d. Unavoidable adverse effects: Operation of the project under the proposed action would not cause any significant, unavoidable adverse effects to existing aquatic resources.

4. Terrestrial Resources

The vegetative and wildlife resources along the Connecticut River were altered with the arrival of European settlement and the industry, dams, communities, and agriculture that followed. The region's wildlife was altered as large animals, such as wolves, were hunted to regional extinction and habitats changed. Around 1860, the population and agricultural economy in the project area peaked, and some of the previously cleared agricultural land began to revert back to forest land.

By the 1920's, prior to the construction of the project dams, about half of the Connecticut River mainstem was impounded. These dams impounded thousands of acres of land along the river, and were likely a significant cause for the loss of riverine wetlands. While some wetlands re-established in the shallows of the reservoirs, water level fluctuations and drawdown limited their extent and productivity when compared to wetlands in natural lakes and ponds. Clearing of rich alluvial bottom lands for agriculture also heavily affected wetlands, eliminating a majority of the floodplain forested wetlands in the basin, and likely pockets of emergent wetlands and vernal pools.

The substantial amount of undeveloped land in private and other holdings, such as land owned by USGenNE, the White Mountain National Forest to the east, various

nearby state forest and parks in Vermont and New Hampshire, and paper company holdings create a large and undeveloped natural environment.

a. Affected environment:

The FMF Project lies in the upper Connecticut River watershed. Two forest regions occur in this area: northern hardwoods and transition hardwoods-white pine (DeGraaf *et al*). Forests in the northern hardwoods region include beech, sugar maple, and yellow birch. Hemlock, white ash, black cherry, and red maple are other common species. These forests occur in higher elevations, typically between 500 and 2,600 feet msl. Forests in the transition hardwoods-white pine region include paper birch, beech, red maple, white pine, and hemlock. These forests occur at lower elevations, up to about 1,500 feet (DeGraaf *et al*).

Within the FMF Project vicinity, the transition forest occurs on the lower slopes, adjacent to the impoundments, and the northern hardwoods occur on the upper slopes USGenNE, 2000a). Forested, scrub-shrub and emergent wetland communities are also present in varying amounts along each reservoir. USGenNE manages forested lands using silvicultural methods and environmental protection practices.

Wetlands

A total of 50 wetlands, comprising about 455 acres, abut the three reservoirs. The extent of the wetlands is smallest at Comerford development (13 wetlands) and greatest at Moore development (21 wetlands). However, many of the wetlands on Moore have little actual littoral frontage when compared to the total wetland acreage and extend back from the reservoir (Lobdell Associates, *et al*, 1999).

Limited wetlands abut Comerford because of steep slopes along portions of the shoreline and a lack of depressional areas adjacent to the reservoir. The McIndoes development has substantial amount of wetlands (16) due to the floodplain and gentle slopes of the surrounding land (LA et al., 1996).

Freshwater wetlands within the project area are identified within each of three systems, riverine, lacustrine, and palustrine, classified according to the FWS classification (Cowardin, et al., 1979). The wetlands within the reservoirs are lacustrine system rather than riverine because the dams influence the flow of water. Areas within and above the zone of fluctuation that support persistent wetland vegetation are classified palustrine. The hydrology that maintains palustrine wetlands is somewhat independent of the lacustrine system. Palustrine wetlands interconnected or bordering the lacustrine wetlands are inundated by surface water during seasonal floods or periods of high water; however, they are primarily maintained by high groundwater tables, precipitation and

surface runoff similar to palustrine wetlands located within riverine floodplains (Ried and Wood, 1976, cited by Cowardin et al., 1979).

The riverine system within the project area occur downstream of the Comerford dam near the confluence of the Passumpsic River in the McIndoes reservoir and where a perennial stream, such as the Stevens River enters the reservoir.

Palustrine forested wetlands (species include silver maple and willow) represent the largest component of the wetlands abutting project waters (Table 3). However, many of these lie at the greatest distance from the reservoir. Palustrine emergent wetlands (species include reed canary grass, wool grass, and arrowhead), the next most extensive grouping, are generally closer to the reservoirs. The majority of these emergent wetlands are either the result of beaver activity or favorable hydrologic conditions within or directly adjacent to the zone of fluctuation.

Table 3. Summary of Wetland Subclasses by Reservoir

Subclass	Moore (acres)	Comerford (acres)	McIndoes (acres)
Palustrine emergent (PEM)	58	15	73
Palustrine scrub-shrub (PSS)	48	16	11
Palustrine forested (PFO)	144	28	7
Palustrine unconsoldated bottom/aquatic bed (PUB/PAB)	20	1	12
Lacustrine limnetic/littoral(L1/2)	6	0	6
Riverine lower perennial (R2)	0	0	10

Source: LA et al., 1996; LBA and Lobdell Associates, 1999.

Much of the palustrine unconsolidated bottom group (PUB) shown in all three reservoirs are caused by beaver activity either on the banks of the river or upstream. These beaver ponds are of various ages and condition and are a temporary, constantly changing component of the wetland systems. When the beavers abandon a wetland or pond, a successional vegetative pattern often takes place, changing from open water to emergent to scrub- shrub wetland types.

Field observations of wetlands abutting the reservoirs reveal that some wetlands lie within an area that is influenced hydrologically by water levels within the reservoirs, while other wetlands, even though they lie adjacent to the reservoirs, are not (Lobdell Associates, et al., 1999). Those wetlands that do not receive hydrology from project

waters generally lie at an elevation above the high water mark and receive their water from surface runoff, streams, or groundwater.

Most of the existing SAV beds (19 acres) occur in the McIndoes reservoir (See Section V.B.3). Common SAV species include curly pondweed, long-leaf pondweed, water lilies, and wild celery (LBA and Lobdell Associates, 1999).

Wildlife

Four species of frogs and toads were identified during a 1997 field investigation (WAI, 1997) including: American toad, gray treefrog, spring peeper, and green frog. All four species are considered to be common to the FMF Project area. All four species were observed at the Moore and Comerford reservoirs, and only American toads, gray treefrogs, and spring peepers were observed at the McIndoes reservoir. The field survey also noted that emergent wetlands accounted for the preponderance of observations.

Additional species may occur within the FMF Project area that were not observed during the field investigation, such as the wood frog and bullfrog. The wood frog is common and suitable habitat exists within the project area. Suitable habitat also exists for bullfrogs within the project area, and this species is known to occur at downstream locations.

Field surveys for turtles identified only one painted turtle in Moore reservoir and one snapping turtle in McIndoes reservoir. Suitable turtle hibernating habitat appears to be available at the McIndoes reservoir.

Mammals expected to occur within the FMF Project lands include deer mice, skunk, raccoon, muskrat, beaver, otter, and white-tail deer (WWM, 1996). During field visits for wetland evaluations, tracks of both eastern coyote and black bear were observed along the shoreline of McIndoes reservoir. Both of these species are anticipated to occur within lands adjoining the other reservoirs as well. The State of Vermont identified part of the western shore of the Moore reservoir as a deer wintering range. Wildlife management prescriptions for deer wintering areas are incorporated into the Wildlife and Forest Management Plan to enhance and protect deer wintering areas within the FMF Project lands.

Wetland dependent birds and waterfowl use the reservoirs and associated lacustrine and palustrine wetland systems. The greatest number and diversity of bird species coincide with spring and fall migrations. The reservoirs also serve as feeding sites for several species throughout the breeding season, including osprey, bald eagle, great blue heron, green heron, kingfisher, wood duck, mallard, and Virginia rail. Osprey, bald eagle, and great blue herons are not known to breed within the FMF Project area.

Proposed Action

Wetlands

Of the estimated 455 acres of wetlands that abut the FMF Project, 99.6 acres are directly influenced by project waters (Lobdell Associates, et al., 1999). Under the proposed action, existing wetlands associated with the Moore and Comerford reservoirs would not be appreciably affected by the changes in their respective operating regimes. The proposed changes from existing conditions are relatively minor and aimed at providing more stable water levels for enhancement of fishery resources. The timing also coincides with the growing season of vascular and aquatic plants and may, in some instances, aid in the establishment and growth of some wetland plant species. This is accomplished by providing more stable water levels and avoiding potential drought conditions caused by early drawdown.

During 1998, USGenNE conducted a study of the effects of the proposed operating regime on wetlands for the McIndoes reservoir (LBA and Lobdell Associates, 1999). The proposed operating regime includes a lower maximum operating limit of 451 feet msl, a maximum daily drawdown of 3.5 feet to elevation 447.5 feet msl, and surcharges above 451 feet msl if inflow exceeds discharge capability (primarily in the spring).

The study concluded that the proposed operating regime at McIndoes reservoir would: (1) create intermittently exposed lacustrine littoral vegetated flats dominated by non-persistent plant community in some areas that are shallowly flooded at the proposed MOL; (2) create additional intermittently exposed unvegetated lacustrine littoral flats in some areas that are more deeply flooded (water depths exceeding 12 inches); (3) create sites more suitable for the recruitment and establishment of woody plants as a result of changes in wetland hydroperiods in the upper elevations of some palustrine wetlands; (4) result in essentially unchanged SAV beds; and (5) result in changes in wetland functions and values relative to the increase in vegetated and unvegetated flats and their role in providing vegetation that would increase functions related to nutrient uptake and wildlife habitat.

In addition, the study concluded that colonization of exposed shorelines by emergent plants is not expected for steeply sloped shorelines due to fluctuations in moisture regimes (repeated drying and wetting) and disturbance by non-project related activities, such as wave action and ice flows. Most of the reservoir shoreline within the band exposed by fluctuating water levels would remain unvegetated. Wetlands immediately adjacent to the reservoir may be influenced by a reduction in the local groundwater table and a reduction in surface water flooding due to the lower surface

water elevation of the reservoir. The influence of the reduced MOL would depend on multiple factors but is not anticipated to extend far beyond the immediate wetland areas.

Overall, the proposed action would result in beneficial effects on the existing wetlands and associated wildlife within the FMF Project area. Effects to some aquatic beds and some hydrologically connected palustrine wetlands would be temporary and/or minor. No significant losses in wetland extent or functions are anticipated.

Wildlife and Associated Habitat

Wildlife and associated habitat would be protected and enhanced through the proposed implementation of permanent conservation easements on 4,000 acres of project and 4,200 acres of non-project lands (see Section V. B.6). USGenNE's proposal to implement its Wildlife and Forest Management Plan, dated September 2000, would also protect and enhance existing wildlife habitat by guiding resource management decisions on FMF Project lands through a series of resource specific management provisions (e.g., non-native nuisance species control, deer yard management, and a 100-foot riparian no-cut zone). However, we note that the plan is conceptual and does not include an implementation schedule or map(s) that identify(ies) areas of special concern, such as vernal pools, as recommended by the FWS. Therefore, in any license issued for the FMF Project, we recommend that USGenNE develop, in consultation with the FWS, NHFG, and VANR, and, upon Commission approval, implement a final Wildlife and Forest Management Plan, as identified in Stipulation VI C of the Settlement Agreement, for managing lands within the existing project boundary. Our recommendation is consistent with condition no. 18 of the 401 WQC.

The proposed operating regimes for the Moore and Comerford reservoirs would not adversely affect wildlife and associated habitat. The proposed operating regime for the McIndoes reservoir would contribute to a beneficial effect on wildlife by increasing the availability of mud/sand flats and vegetated flats for wetland dependent birds and mammals, and migratory shorebirds.

License Denial, Decommissioning, and Dam Removal Alternative

This alternative may result in an alteration of existing wetlands and wildlife habitat along the reservoirs. Water levels would be reduced to the former channel of the Connecticut River, resulting in the potential draining and loss of some wetland areas adjacent to the reservoir. Available habitat for wetland-dependent wildlife would also potentially be reduced, including available mud/sand flats for migratory shorebirds.

Piscivorus bird species, including the bald eagle, and osprey, may be adversely affected by the reduction of feeding areas, reduction in fish stocks (see Section V.C.3.b),

and loss of available perches. For many years, much of the riparian corridor would not support trees large enough to support these birds. The result would be the dispersal of birds to other locations and a reduction in the population of these bird species within the region. Over the long term, however, wetlands and associated habitat could become established, providing a riverine wildlife habitat corridor.

c. Cumulative effects:

Cumulative effects on terrestrial resources in the Connecticut River Basin were influenced by the original settlement of the river basin by Euro-Americans and the subsequent changes to the environment, including the removal of old-growth forests, conversion of forested land to cleared land for agriculture and development, pollution of the basin's waters, over-hunting, introduction of non-native species, and the alteration of the river's hydrology through dams along the mainstem and on the tributaries.

Wetlands

Today, as a result of development of the river and its tributaries with dams, and land use changes in the watershed, the cumulative loss of wetlands in the Connecticut River Basin is identified through an historical context. The majority of these losses are due to urban development and agricultural conversions. The FWS estimates that the Connecticut River Basin originally contained between 375,000 and 750,000 acres of wetlands as compared to the present day extent of 257,000 acres (FWS, 1995a). Wetland losses are thought to have been heaviest in Massachusetts and Connecticut (over 50 percent), but still significant in the upper basin, with losses in Vermont estimated at 35 percent and unknown in New Hampshire (FWS, 1995a).

The proposed action to modify operations at the McIndoes dam should enhance existing, and establish new, littoral wetland areas and shrub-scrub wetlands at the reservoir, and reduce large variations in flows below the project, thereby enhancing downstream wetlands as far as the Wilder impoundment. In addition, the Upper Connecticut River Mitigation and Enhancement Fund would be used for restoration, protection, and enhancement of wetlands and adjacent buffer areas. Consequently, a cumulative beneficial effect on wetlands and associated wildlife within the FMF Project area and in the river basin would occur.

Wildlife

The development and operation of hydropower and other developmental and non-developmental activities in the river basin has resulted in changes to wildlife habitat. While most of the cumulative effects on vegetative and wildlife resources occurred prior to the project, the project dams contributed to a loss of terrestrial habitat (approximately

7,500 acres through inundation) and fragmentation of the river as a wildlife corridor. However, the project also created habitat for aquatic species, waterfowl, shorebirds, and fish-eating mammals and birds of prey including the bald eagle and osprey. Fluctuating water levels in the reservoirs may affect access to tributaries for fish spawning; and winter drawdown may reduce the successful overwintering of certain species of frogs and turtles, and aquatic furbearers, including beavers, muskrats, and otters.

See Section V.B.4.b for a discussion on the proposed measures. Furthermore, the donation of lands at Sumner Falls in Hartland, Vermont, which is located outside the project boundary, should protect and enhance fish and wildlife habitat, rare plant habitat, and a free-flowing stretch of the river. In addition, a portion of the Upper Connecticut River Mitigation and Enhancement Fund would be used for restoring buffer areas along the river and/or streams in the drainage and stabilizing eroding shorelands both upstream and downstream of the FMF Project area.

d. Unavoidable adverse effects: Operation of the project, as proposed, is not expected to have any significant, unavoidable adverse effects on existing terrestrial resources. Some minor land disturbance would occur during construction of the proposed or improvement of the recreation facilities. The sites would be revegetated, as necessary, following construction or improvement.

5. Threatened and Endangered Species

Today, a total of 68 species (40 animals and 28 plant species) no longer exist in the Connecticut River watershed, including several species which once occurred in the FMF region: the passenger pigeon, the eastern elk, cougar, lynx, and wolf. Ten species (six animal and four plant species) which occur in the watershed are currently federally-listed, and 18 species are being considered for listing (four plant and 14 animal species) (FWS, 1995b). In addition, state listed rare species in the Connecticut River watershed include, in Vermont, seven animal and 38 plant species, and in New Hampshire, 10 animal and 103 plant species (FWS, 1995b).

It is estimated that, prior to development of dams on the river, the dwarf wedge mussel was found along most of the length of the Connecticut River; it was historically documented to have occurred at 7 sites on the Connecticut River in Vermont and New Hampshire, including 3 sites near the project: Northumberland, New Hampshire; 2 miles above Monroe, New Hampshire; and below the project at Ryegate, Vermont (Ecosearch, 1983). Today four known sites are monitored by the State of Vermont in the Upper Connecticut River, all located below the project.

a. Affected environment:

1. Federally-listed Species

No federally-listed threatened or endangered plant species are known to occur within the project area.

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is federally-listed as threatened [7] and listed in VT and NH as endangered. The New Hampshire Department of Resources and Economic Development, Natural Heritage Inventory (NHNHI) identified records of the bald eagle within the project area. USGenNE supported the Audubon Society of New Hampshire and the Vermont Institute of Natural Sciences over a period of years for observing the presence of the bald eagle. In 1988, eighteen bald eagles were observed using the study area with the primary activity occurring between the Comerford and McIndoes dams. Sixty-two bald eagle perch sites were identified, thirty-four (55 percent) were located between McIndoes and Comerford dams, nineteen (33 percent) were on Comerford reservoir, and nine (14 percent) were on Moore reservoir.

Dwarf wedge mussel (*Alasmidonta heterodon*)

Historically, the dwarf wedge mussel was known to occur along most of the length of the Connecticut River. The dwarf wedge mussel was listed as an endangered species on March 14, 1990 (55 Federal Register 9447). Channelization, removal of shoreline vegetation, agriculture, industrial pollution (such as, potassium, a common pollutant associated with paper mills and irrigation return water), and road and dam construction contributed to the decline of the species (U.S. Fish and Wildlife Service, 1993). Suitable dwarf wedge mussel habitat includes creeks and rivers with mud, sand, and gravel substrates, scattered patches of wild celery, and in water up to 15 feet deep. A survey of the project area for the dwarf wedge mussel was conducted in 1997, and seven dwarf wedge mussel specimens were found in the upper section (riverine habitat) of Moore reservoir (WAI, 1998).

2. State Listed Species

Several state threatened and endangered plant species have been identified within or near the FMF Project area by the Vermont Department of Fish and Wildlife (VTDFW), and the NHNHI. The Nature Conservancy manages more than 100 Special Habitat Sites along the Connecticut River, nine of which are on USGenNE property and three within

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[7] On September 1, 1999, the FWS proposed to remove the bald eagle from the Federal List of Endangered and Threatened Wildlife in the lower 48 states. The action to remove the bald eagle from the list is pending.

the FMF Project boundaries. These sites encompass the majority of the known locations of state-listed threatened and endangered plant species in the project area. USGenNE/NEP has entered into a cooperative agreement with The Nature Conservancy to designate and protect these areas of special concern (see Section V.B.5.a).

New Hampshire state endangered plant species known to occur in or near the FMF Project area include: chestnut sedge (*Carex castanea*), Garber's sedge (*Carex garberi var bifaria*), small dropseed (*Sporobulus neglectus*), spurred gentian (*Halenia deflexa*), showy ladyslipper (*Cypripedium reginae*), and leafy pondweed (*Potamogeton foliosus*). New Hampshire state threatened plant species known to occur in or near the FMF Project area include: satin willow (*Salix pellita*), sticky false asphodel (*Tofieldia glutinosa*), Grass-of-parnassus (*Parnassia glauca*),golden-fruited sedge (*Carex aurea*), gregarious black snakeroot (*Sanicula gregaria*), three-leaved black snakeroot (*Sanicula trifoliata*), dwarf ragwort (*Senecio pauperculus*), Kalm's lobelia (*Lobelia kalmii*), Loesel's twayblade (*Liparis loeselii*), shining lady's tresses (*Spiranthes lucida*), and meadow horsetail (*Equisetum pratense*).

Vermont state threatened plant species known to occur in or near the FMF Project area include: sticky false asphodel (*Tofieldia glutinosa*), bog wintergreen (*Pyrola asarifolia*), Muehlenberg's sedge *(Carex muehlenbergii).* Garber's sedge *(Carex garberi) and* marsh horsetail *(Equisetum palustre).* No Vermont state endangered plant species are known to occur in or near the FMF Project area.

The VT/NH threatened osprey (*Pandion haliaetus*) is known to occur at the FMF reservoirs during its breeding season though it has not been confirmed as breeding on FMF project lands. During field investigations, a northern harrier (*Circus cyaneus*) (NH threatened, VT species of concern) was observed during migration on two consecutive days on the McIndoes reservoir (WWM, 1996). VANR identified loon (listed as state endangered in Vermont) nesting occurrences on an island above the high water mark on Moore reservoir during 1997 and 1998 (letter from Brian Fitzgerald, Vermont Agency of Natural Resources, Waterbury, Vermont, dated May 28, 1999).

b. Environmental effects of the alternatives:

No-action

Under no-action, the following plans, as stipulated in the Settlement Agreement, would not be implemented: (1) Rare and Unusual Plants/Plant Community Management Plan; (2) Management Plan for Threatened and Endangered Species; and (3) Wildlife and Forest Management Plan. Consequently, terrestrial resources would not be protected and enhanced. In addition, there would be no changes to existing project operations, as stipulated by the Settlement Agreement.

Proposed Action

USGenNE's proposal to implement its Management Plan for Threatened and Endangered Species, dated September 2000, which includes measures such as pruning near nest platforms and protecting supercanopy white pines, would protect threatened and endangered species and their habitat within the existing FMF Project boundary. However, we note that the plan is conceptual and does not include an implementation schedule. To protect threatened and endangered species and their habitat, including the bald eagle and dwarf wedge mussel, we recommend that USGenNE develop, in consultation with the FWS, NHFG, and VANR and, upon Commission approval, implement a final Management Plan for Threatened and Endangered Species (as identified in Stipulation VI E of the Settlement Agreement) and operate the FMF Project according to the Settlement Agreement. These measures, along with operating the project as stipulated in the Settlement Agreement, would help meet the FWS's recovery objectives for the dwarf wedge mussel and its habitat.

Based on our review of the best available information (USGenNE, 2000b), the species' habitat preference, and field surveys, we conclude that the proposed FMF Project, with the inclusion of these measures in any license issued, is not likely to adversely affect the federally-listed bald eagle and dwarf wedge mussel, and their habitat.

Existing State threatened or endangered plant communities and associated wildlife would be protected through: (1) implementation of permanent conservation easements on 4,000 acres of project and 4,200 acres of adjoining non-project lands; (2) development and implementation of a Rare and Unusual Plant/Plant Community Management Plan; (3) implementation of a Management Plan for Threatened and Endangered Species; and (4) operation of the project according to the provisions contained in the Settlement Agreement.

As part of the Settlement Agreement, USGenNE proposes to develop and implement a Rare and Unusual Plant/Plant Community Management Plan within 2 years of the license issuance (see Stipulation VI D). Such a plan would protect and enhance sensitive plant habitats and communities. Therefore, we recommend that in any license issued for the FMF Project, USGenNE develop, in consultation with the FWS, NHFG, VANR, TNC, and, upon Commission approval, implement a Rare and Unusual Plant/Plant Community Management Plan, as identified in VI D of the Settlement Agreement, to complement the Management Plan for Threatened and Endangered Species.

License Denial, Decommissioning, and Dam Removal Alternative

The general discussion and effects of this alternative on Threatened and Endangered Species are similar to the effects on the resources addressed in Sections V.B.3, Aquatic Resources and V.B.4, Terrestrial Resources.

c. Cumulative effects:

As a cumulative beneficial effect, the project retained thousands of undeveloped acres of land, which are valuable habitat for species, such as the bald eagle and osprey. The proposed action includes permanent conservation easements for those lands. In addition, USGenNE entered into an agreement with TNC for the protection and management of 10 sites with rare, threatened or endangered plants or plant communities within the FMF Project boundary. The proposed action also includes conducting an additional inventory and management plan for medicinal plants and other plants of cultural significance to Native Americans, and any other rare or unusual plants or plant communities not adequately covered by existing inventories.

d. Unavoidable adverse effects: Operation of the project, as proposed, is not expected to have any significant, unavoidable adverse effects on existing threatened and endangered species. Some minor land disturbance would occur during construction of the proposed or improvement of the recreation facilities.

6. Land Use and Aesthetic Resources

Since the settlement of the Connecticut River Valley in the early 1700's, land use in the valley has undergone a series of changes, as the first settlers cleared and farmed for a subsistence living, and later farmed and logged commercially, left the farms during the industrial revolution to work in the woolen mills, machine tool factories, and paper mills, and later, with the advent of automobile transportation, moved back into the country to live and commute to the growing urban commercial, industrial, and service centers.

In the 1920's, prior to the development of the project, land use in the Connecticut River basin was a mix of forest and agriculture, particularly in the intervales along the Connecticut River. In 1925, agricultural land occupied 55 percent and 24 percent of the land in counties bordering the river in Vermont and New Hampshire, respectively. The area now occupied by the Moore impoundment reportedly was some of the most productive farmland in the Littleton area (LBA, 1997b).

The aesthetic character of the Connecticut River has changed over time from a free flowing river to one impounded by 17 dams on its main stem. Most rapids and falls on the river have disappeared and have been replaced by dams and their associated reservoirs. These reservoirs alter the aesthetic character of the area by replacing riverine

sections of the river with lake type environments. The river's aesthetic character has also been affected by development, agriculture, and industry along its banks.

a. Affected environment:

The general pattern of development within the vicinity of the FMF Project area consists of two regional commercial centers, Littleton, New Hampshire and St. Johnsbury, Vermont, surrounded by small rural communities and undeveloped forest land. Littleton borders the project and is the largest developed community in the project area. Other New Hampshire towns bordering the project include Monroe, Lyman, Dalton, and Bath, which are smaller rural communities with small village centers and scattered low-density residential development.

In Vermont, the towns adjacent to the project area include Barnet, Waterford, Concord, and Lunenburg. These towns also contain small rural communities with scattered, low-density residential development and small village centers. St. Johnsbury, a commercial center for many of the project area Vermont towns, is located about 15 miles north of the project area. The predominant land use of the region surrounding the project area in both Vermont and New Hampshire is undeveloped forest land.

USGenNE manages its project lands for multiple uses which include hydropower, forestry, recreation, fisheries, and wildlife habitat protection and enhancement. Timber management of the project lands occurs on a 500 to 1,000 acre unit basis, with actual harvesting occurring on approximately 200 acres per year. In addition to timber management activities, USGenNE entered into a cooperative agreement with The Nature Conservancy to preserve and protect unique ecosystems within the project lands. The agreement protects an area below the Comerford Dam, which The Nature Conservancy characterizes as one of the most significant ecological sites in the State, as well as the floodplain forests of Nine Islands area in the McIndoes development.

Aesthetic features include views of the reservoirs, wetlands, wildlife, and riverine stretches. Moore reservoir has numerous coves, inlets and small islands, and a predominantly undeveloped and forested shoreline. The recreational access areas (see Section V.B.7) offer some of the best viewing opportunities on the reservoir shoreline. Views include the wide expanse of the reservoir and the steep, wooded, and undeveloped hills along the shoreline. The shoreline of Comerford reservoir is largely composed of undeveloped forest land situated on steep hillsides and areas of interspersed residential houses, such as along the Vermont shore. McIndoes reservoir differs from the other reservoirs in that some of the shoreline consists of agricultural land and the reservoir is bordered by gently sloping hills.

b. Environmental effects of the alternatives:

No-action

Under no-action, the project would continue to operate under existing conditions and no new environmental protection or enhancement measures would be implemented. The daily cycling and seasonal drawdown associated with project operations would affect the visual character of the project area as a result of the exposed shoreline substrates, particularly during the winter drawdown period. Land use and aesthetic resources of the shoreline areas could be adversely affected as a result of future shoreline development and timber harvesting.

Proposed Action

Proposed recreation enhancements (see Section V.B.7, Recreation Resources) would be located primarily at existing recreation sites and minimal additional clearing at these sites would occur; therefore, these measures would not significantly alter the land use or aesthetic features within the project area.

USGenNE proposes, as per the Settlement Agreement, placement of conservation easements on 4,000 acres of project and estimated 4,200 acres of non-project lands. We recommend that USGenNE establish a conservation easement only with respect to the 4,000 acres of lands located within the project boundary. While the conservation easements would protect and enhance the scenic, cultural, and natural resources occurring on both project and non-project lands, the 4,200 acres of non-project lands are not needed for project purposes because:

1. Enhancement and mitigation measures under the Settlement Agreement and the WQC occur on existing project lands only; therefore, these lands are adequate for project purposes.

2. Some of the non-project lands are remote and far away from the project and river, are not totally contiguous to the project (there are separate parcels and isolated pockets), and are managed for timber, hunting, fishing, and other non-project uses. These lands are outside project effects zone for certain resources, such as cultural and recreation resources.

3. There is an existing perpetual conservation easement between The Nature Conservancy, Vermont Land Trust, and the Society for the Protection of New Hampshire Forests for the non-project lands.

Therefore, our recommended measure would contribute to a cumulative beneficial effect on the resources within the river basin. See Section V.B.4, Terrestrial Resources, for further discussion on additional staff-recommended measures.

Under the proposed action, project operations would not significantly alter the reservoir elevations at Moore and Comerford reservoirs, as compared to existing conditions. The proposed minimum flow releases would provide increased and more constant flows in the tailrace areas. Proposed McIndoes operations would reduce the MOL from 454 msl to 451 msl (or greater, if triggered by inflow) and reduce the normal operating band from 4 feet to 3.5 feet. Over the short-term, additional shoreline substrates would be exposed at McIndoes reservoir, due to the lower operating level. Over the long-term, however, these areas would become revegetated, restoring the aesthetic character of this area.

License Denial, Decommissioning, and Dam Removal Alternative

See Section V.B.1, Geology and Soils Resources. The general discussion is similar.

c. Cumulative effects

See Section V.B.1, Geology and Soils Resources, for a similar discussion. See also "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

d. Unavoidable adverse effects: None.

7. Recreation Resources

The expansion of the railroad into the upper river valley in the mid-1800's brought tourists from New York and Boston to enjoy the resorts, hunting and fishing camps, and other outdoor attractions of the area. In the early 1900's tourism expanded into a year-round industry aided by the growth in popularity of hiking and skiing and the advent of the automobile. The surrounding area was used for activities such as fishing, hunting and hiking, though these activities were affected by the timber industry. Some level of boating, swimming, and fishing most likely took place, but most usage was likely for purposes such as transportation, industry, and logging. With the passage of the CWA in 1972 and associated improved water quality for the Connecticut River, the river gradually became less polluted and recreation use increased to its present level.

a. Affected environment:

Regional Recreational Resources

Within an hour's drive of the FMF Project, there are nine State of New Hampshire and eight State of Vermont parks, as well as publicly accessible forests, fish and wildlife management areas, municipal parks, and the 773,241-acre White Mountain National

Forest. These regional resources provide numerous and varied public recreation opportunities, including rest areas and picnicking, developed and primitive camping sites, hiking trails, snowmobile trails, alpine and Nordic skiing facilities, access points to lakes and rivers for fishing, boating, swimming, and many other recreation opportunities.

Regional Recreation Comprehensive Plans

The 1994 *New Hampshire Statewide Comprehensive Outdoor Recreation Plan* (NHSCORP) (NHDES, 1994) identified facility needs as an important issue facing New Hampshire's communities. The needs relevant to the FMF Project area include: trails, swimming pool/beach, picnic areas, and boat launches. In addition to increasing the number of facilities, the NHSCORP recommends that existing recreation facilities be made more accessible to persons with disabilities.

The Vermont Statewide Comprehensive Outdoor Recreation Plan (VTSCORP) (VANR, 1994) identified the recreation needs of northern Vermont. The needs and concerns of the FMF Project area include: swimming access, facilities for people with disabilities, recreation facilities/services, utility company constraints on access, and trail access. In addition to increasing the number of facilities, the VTSCORP recommends additional lands and/or improved access to large tracts of recreational lands, better public information about existing recreational opportunities, and creating partnerships between agencies (state, national, and private sector) to respond to the public's changing recreation needs and desires.

The 1989 *Vermont Lakes and Ponds Management Program* identifies constraints in the provision of water-based recreational opportunities, and develops a program that addresses sound management strategies for the future. According to the plan, the FMF Project area is included as a special focus area for preservation and provision of recreational opportunities.

Recreation Resources within the FMF Project Area

USGenNE maintains a total of 12 designated public recreation access areas within the FMF Project boundary. These sites include a visitor center, boat launches, picnic areas, hiking trails, swimming areas, and bank fishing areas (see Table 4). In addition to the 12 designated and developed recreation sites, there are informal access sites and trails within the project area, which receive regular use by local area residents.

Table 4. FMF Project Area Public Recreation Access Areas

Public Recreation Access Areas	Boat Ramp	Fishing	Swimming	Nature Trail	Picnic Area	ADA Facilities	Picnic Tables	Port-a-Johns	Parking Spaces	Grills/Fire Places	Portage Trail	Dock/Pier
Moore Reservoir												
Gilman	X	X	X						10			
North Littleton	X	X	X	X	X	X	3	1	10	1		
Dodge Hill	X	X	X	X	X	X	9	2	30	6/2		X
Pattenville	X	X	X		X	X	4	2	15	3		
Pine Island	X	X	X						15			
Moore Dam	X	X	X		X	X	8	2	10	4		
Moore Dam Visitor Center				X	X	X	1		50		X	
Waterford	X	X	X		X	X	5	2	25	5/1		X
Comerford Reservoir												
Waterford Bridge	X	X	X	X	X		2	1	10	2		
Pine Grove	X	X	X		X		6	2	45	4		
Comerford Dam	X	X	X		X		5	1	30	1	X	
McIndoes Reservoir												
McIndoes Dam		X			X		2	1	16	1	X	

Table 5. Summary of Recreation Use at the FMF Project Public Access Areas (May through October)

Location	Average Party Size	Total Traffic	Total Recreation Days	Percent of Total
Gilman	3.17	1,362	4,317	3.2%
N. Littleton	3.24	2,091	6,775	4.9%
Dodge Hill	3.50	7,830	27,405	20.0%
Pattenville	3.62	2,205	7,982	5.8%
Pine Grove	3.94	3,171	12,494	9.1%
Moore Visitor Ctr	2.50	7,586	18,965	13.8%
Moore Boat Launch	3.16	2,385	7,537	5.5%
Waterford VT	4.49	4,637	20,820	15.2%
Waterford Bridge	2.32	4,620	10,718	7.8%
Pine Island	2.81	3,254	9,144	6.7%
Comerford	4.36	1,275	5,559	4.1%
McIndoes	2.67	2,015	5,380	3.9%
All Sites	3.23	42,431	137,096	100%

Recreation Use Within the FMF Project Area

During 1996 and 1997, NEP conducted a recreation study to identify and characterize recreation use within the FMF Project area (LBA, 1999). Recreation use was estimated during the primary recreation season (May through October) through the use of traffic counter data and recreation user surveys (see Table 5). Total recreational use was estimated at approximately 137,096 visitor days during the primary recreation season, with June, July, and August receiving the highest levels of recreational use.

The average party size during May through October was approximately 3.23 people, with the average length of stay approximately 3.37 hours. Of the visitors surveyed, 92 percent reside near the project area in Vermont or New Hampshire. The average party size dropped to 1.9 during the off-peak recreation months (November through April), with the average length of stay decreasing to 2.7 hours. Approximately 98 percent of off-peak month visitors reside in Vermont or New Hampshire.

The predominant recreation use has been picnicking, boat and bank fishing, swimming, and sightseeing, which when combined, represented more than 75 percent of the total summer recreation use. Other activities that occur during these months included mountain biking, tubing, walking and relaxing. During the off-peak months of November through April, the predominant recreation activities include ice fishing, bank fishing, snowmobiling, hunting and sightseeing.

The main attractions to the area were the location and easy access to the recreation facilities and water-related activities. In addition, the recreation users indicated the peacefulness and beauty of the area as a main attraction. The recreation users indicated that overall the perceived crowdedness of the facilities was minimal, an average of 1.54 on a scale of 1 (light) to 5 (heavy). The majority of the visitors (86 percent) felt the existing recreation facilities were adequate to meet their needs. The suggested facility improvements indicated by recreational users included: restroom facilities, improved access roads, more picnic areas, improved boat ramps, beaches, and overnight camping.

Recreational Fishing

Recreational fishing surveys were conducted in the project area in 1996-1997 (LBA, 1996 and 1999) and reinforced the fishery survey data (Acres, 1999b and 1999c). Results of the recreation fishing surveys indicated that yellow perch and smallmouth bass were the most frequently caught fish, with rock bass the next most commonly caught species. A fishing tournament conducted in the project area during 1997 also reflected the survey data: yellow perch, smallmouth bass, and rock bass were the most abundant fish caught.

Salmonid species were caught infrequently during the survey period. Trout (rainbow and brown) comprised between 2 and 7 percent of the surveyed fisherman's catches, and landlocked salmon comprised less than 1 percent of the catches. The highest catch rates in 1996 were from the Waterford Area of Comerford reservoir (0.86 fish per hour), and the next two highest catch rates were from Moore reservoir at the Gilman Area (0.75 fish per hour) and Pine Island Area (0.67 fish per hour).

In 1997, Moore reservoir had three of the four highest catch rate locations - Gilman Area, North Littleton, and Dodge Hill Areas (0.13, 0.06, and 0.06, fish per hour, respectively). The Pine Grove Area of Comerford reservoir had the second highest catch rate in 1997 (0.09 fish per hour). The species in the project area most desired by anglers was smallmouth bass (42 percent of angling effort), followed by northern pike (18 percent) and yellow perch (14 percent)(LBA, 1996 and 1999).

Table 6. Proposed Recreation Enhancements for the FMF Project Area

Proposed Enhancements	Gilman	North Littleton	Dodge Hill	Pattenville	Pine Island	Moore Dam	Waterford	Waterford Bridge	Pine Grove	Comerford Dam	McIndoes Dam	Primitive Camping
Add designated swimming area			X		X	X				X		
Create/improve beach area			X		X							
Install new boat ramp	X					X						
Lengthen existing boat ramp		X	X									
Repair existing boat ramp				X								
Add picnic table(s)	X			X	X	X			X			X
Add portable toilet(s)	X				X	X						
Add benches/shoreline trail						X						
Improve boat dock			X				X					
Enlarge parking area		X		X	X	X	X	X				
Grade parking area			X				X			X		
Improve traffic circulation		X		X		X						
Add signage	X	X	X	X	X	X	X	X	X	X	X	X
Maintain hiking trail			X									
Improve access road (USGENNE owned)				X		X						
Install camping platforms												X

b. Environmental effects of the alternatives:

No-action

Under no-action, project operations and environmental conditions would remain unchanged. USGenNE would provide ongoing maintenance to the existing recreation facilities. There would be no new measures implemented to improve or enhance recreation resources.

Levels of participation in recreation within the project area are estimated to increase with population growth and the growing interest in outdoor recreation. Passive recreation activities, such as sightseeing and photography, are expected to show the largest increase, reflecting approximately a 20 percent increase in total participation by 2010. Current use of the project facilities is well below the capacity of the recreation facilities and resources. Under no-action, the estimated 16.5 percent growth of recreation use is not likely to meet or exceed the capacity of the existing recreation resources by 2010.

Proposed Action

USGenNE developed a Recreation Resource Assessment and Management Plan, dated February 1999, for the FMF Project to identify recreation management goals and enhancements to be implemented as part of the proposed action.

The proposed recreation enhancements were determined based on: assessment of existing recreation use within the project area; assessment of estimated recreation needs and demand in the project area through public input, survey information, site observations, field assessment of the existing resources, and assessment of regional recreation management plans; and USGenNE's overall recreation management goals and objectives.

Recreation Access Site Enhancements

Table 6 provides a summary of USGenNE's proposed recreation enhancements. The portage trails at the Moore, Comerford and McIndoes dams, which provide the opportunity for paddlers to navigate through the project area, would be maintained. The proposed facilities would provide additional barrier-free enhancements, and maintain barrier-free accessibility at sites where barrier-free accessibility currently exists. In addition to the proposed enhancements at the existing recreation access sites, USGenNE proposes to establish two primitive camping areas within the FMF Project area and expand the recreation facilities at the Moore dam access site. At all of the USGenNE

public recreation access sites, USGenNE would provide signage denoting facilities rules and regulations, hours of operation, and safety precautions.

For the Moore dam access area, USGenNE would expand the site and relocate the boat launching area in the new expansion area. This would allow for additional boat launch capacity and parking and would maintain a boat launching area that is separate from the newly designated swimming area. The proposed enhancements at the new expansion area include installing a new boat launch; creating a picnic area with two picnic tables and grills and a portable toilet; reconfiguring the traffic circulation at the site; and creating a designated swimming area and a parking area. In addition, informational and directional signage, and signage related to safety precautions at the designated swimming area would be installed. A shoreline trail with several park benches would be established between the existing boat launching area and the new expansion area to enhance shoreline fishing opportunities.

The proposed primitive camping facilities would include a limited number of sites and would be accessible to all public recreators by obtaining a permit from USGenNE or its designee. These primitive camping facilities would be geared towards "paddling through" paddlers and would be primarily accessible from the reservoirs. The two primitive camping areas, one located downstream of Moore Dam and one located downstream of the Gilman Bridge, would include 10 campsites. Facilities at the campsite would include cleared campsite areas, picnic tables and bathroom facilities. Policies regarding use of these facilities would be posted as well as distributed to the public.

The proposed recreation enhancements would provide additional recreation facilities and enhance public access, thereby contributing to a beneficial cumulative effect on recreational resources, while maintaining the undeveloped nature of the project area. The proposed expansion of the Moore Dam access site would allow for enhanced recreational use of the site, providing additional boat launching and parking capacity, segregated boat launching and swimming use, additional picnic facilities, and enhanced shoreline fishing opportunities. The proposed primitive camping areas would provide camping opportunities primarily for individuals paddling through the project area. The proposed permitting system would help ensure appropriate use of these facilities, and help ensure that the undeveloped nature of the area is preserved, enabling a more pristine recreational experience for the recreation users. Appropriate soil erosion and sedimentation control measures would be implemented during any construction activities associated with the development of the proposed recreation enhancements, minimizing any potential adverse effects of the proposed development.

Recreation Safety Enhancements

USGenNE proposes to explore potential measures to install flow warning devices below the Moore, Comerford, and McIndoes dams. These devices could create an audible sound and visible warning prior to times when releases are: (1) initiated from the generator; (2) initiated from spill structures; and (3) increased by a significant quantity of flows (to justify an alarm). Safety precaution signage could be installed in the tailrace areas to warn the public of the potential flow release dangers and to provide interpretation of the warning devices. USGenNE proposes to maintain the existing boater constraint barriers at the intake areas at all three developments.

USGenNE proposes to explore potential measures to address the clean-up of debris in the FMF Project reservoirs, such as driftwood, that is potentially hazardous to recreational boaters. Potential measures would include organization and coordination of a cooperative clean-up activity to remove driftwood. USGenNE would also explore measures to cooperate with the state in identifying navigational hazards; however, USGenNE recognizes that the state is responsible for the marking of any navigational hazards.

Currently, swimming takes place informally throughout the project area. Often, swimmers utilize the boat launch areas because of the ease of access to the site. Proposed site-specific enhancements include the development of four designated swimming areas with buoyed markers to keep boaters away from swimmers, and clear signage indicating that swimming is prohibited in boat launch areas. The addition of designated swimming areas that are separate from boat launch and boat dock areas would increase the overall safety of the project recreation sites.

To enhance recreational resources at the FMF Project and within the river basin, we recommend that, in any license issued for the project, USGenNE develop a revised Recreational Facilities and Management Plan in consultation with the FWS, NHFG, and VANR, and file for Commission approval and upon approval, implement the plan. The revised plan should compliment USGenNE's Recreational Facilities and Management Plan, dated February 1999, and include soil erosion control measures (see Section V.B.1) and an implementation schedule. The revised plan should be developed in conjunction with the Wildlife and Forest Management Plan, Management Plan for Threatened and Endangered Species, and Cultural Resources Management Plan. The level of proposed recreation enhancement measures is appropriate for the type of recreation use and projected future recreation demand. Our recommendation is consistent with condition nos. 19 and 20 of the 401 WQC issued for the project.

Effects of the Proposed Operations

The proposed operations at Moore and Comerford developments would have little effect on recreation use within the project area. In the short term, proposed elevation

changes in McIndoes may cause adverse effects on recreational use, due to the lower maximum operating limit elevation of 451 feet msl, 3 feet lower than the existing conditions, and exposed mudflat areas. However, over the long term, the proposed operations would result in slightly fewer exposed mudflat areas and fewer exposed shoreline areas during the lower reservoir elevation periods as compared to existing conditions.

Adoption of the proposed minimum flow regime from the three developments should have beneficial effects on summer recreation activities. During the dry summer months, the proposed minimum flow would represent an increase in volume in the riverine reaches. The increase in volume should beneficially affect access for canoeing and other riverine boating activities. The limited intensity of the proposed minimum flows, however, should also benefit bank fishing and other riverine recreation activities, such as aesthetic viewing in these downstream reaches.

License Denial, Decommissioning, and Dam Removal Alternative

This alternative would have the effect of changing over 20 miles of impounded waters to a free flowing river, and recovering more than 4,000 acres of flooded lands. USGenNE would no longer provide recreation facilities and public access sites within the project area. Local municipalities or other organizations would need to assume responsibility for the management and maintenance of any existing facilities, as well as the construction and management of new facilities.

Removal of the Moore, Comerford, and McIndoes dams would likely have both adverse and beneficial effects on recreation use. Removal of the project dams would create the potential for additional riverine recreation opportunities, such as whitewater boating and scenic viewing of any whitewater reaches and falls that would be created. Removal of the dams would eliminate current reservoir-based recreation pursuits, such as flatwater motor boating, lake fishing, swimming, and ice fishing activities that currently occur within the project area. Without the water storage represented by the FMF Project, summer season canoeing of the Connecticut River would be problematic in many reaches. Given the size of the Moore and Comerford reservoirs, and the distribution of area lakes and ponds, there are no local substitutes to accommodate the demand for these activities.

In the short-term, it is unlikely that riverine recreation would replace these recreation activities. The exposed, muddy band left when the reservoir waters recede, up to 0.5 mile in places, would make access to the newly established riverine reaches difficult. Over time, however, riverine recreation activity may increase. If the removal of the dams were to provide long-term benefits to fish spawning and increase fish habitat, a corresponding increase in riverine angler efforts may occur.

c. Cumulative effects:

The construction of the project dams contributed to the cumulative changes to recreational resources in the basin by converting a stretch of fast flowing water, including the most notorious rapids on the river, Mulliken's Pitch, to a series of reservoirs that now offer flatwater boating and swimming opportunities. While providing extended flatwater boating opportunities, this reduces opportunities for fastwater canoeing, and extended river canoe trips.

The proposed action would contribute to a cumulative beneficial effect on recreational resources in the project area and the river basin by: (1) providing improved safety measures for anglers below dam tailraces; (2) considering the needs of the disabled in designing the recreational facilities; and (3) providing facilities needed for multi-day canoe trips and maintaining the portages at the project dams. In addition, the Upper Connecticut River Mitigation and Enhancement Fund would further enhance the recreational resources by contributing to improved water quality, maintaining conservation lands, re-establishing forested buffers along the river, and protecting unique or unusual natural areas and scenic features. See also "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

d. Unavoidable adverse effects: Construction of, and improvement to the proposed recreation facilities and public access would cause temporary, minor disturbance in local areas. Implementing soil erosion control measures during and after construction, and revegetation of disturbed areas, where appropriate, would minimize soil erosion and subsequent effects on water quality and terrestrial resources.

8. Cultural Resources

The Connecticut River Valley is rich in history, both in terms of its original Native American habitation, which began after the retreat of the last major glacier 14,000 years ago, and in terms of the Euro-American settlement that began only 300 years ago in the Lower Valley and 200 years ago in the Upper Valley. Archaeologists point out that the Connecticut River comprised one of the most significant travel corridors in the Northeast for Native Americans. The Connecticut River and its tributary routes provided access to the interior of New England and the Champlain and St. Lawrence drainage basins (LBA, 1997b).

At the time of European contact in the seventeenth century, the Vermont and New Hampshire portion of the Connecticut Valley was inhabited by Western Abenakis (LBA, 1997b). The Abenaki were hunters, anglers, trappers, and agriculturalists, and established a number of permanent villages near the intervale lands along the Connecticut. It appears that the area above Fifteen Mile Falls was used more lightly than

areas downstream as it may have been territory disputed between the Mohawks and the Western Abenakis.

By 1920, Native American villages, campsites, and agricultural fields were replaced by Euro-American settlements. Early farmsteads and villages occurred at the mouths of the tributaries to the Connecticut River where there were both favorable intervale or floodplain terraces for agriculture, and access to water power. Five villages formed along the river roads in the vicinity of the project during the peak of the economic prosperity of the first half of the nineteenth century: McIndoes Falls, Monroe, Barnet, Lower Waterford, and Waterford.

In 1926, the newly developed New England Power Association and its subsidiary, Connecticut River Development Company, began acquiring land and water rights in the area. Between 1926 and 1928, plans were developed for the construction of three large hydropower plants promoted as the Fifteen Mile Falls developments to generate electricity for the urban and industrial markets in Massachusetts and Rhode Island. A formal announcement was made in December of 1928 and construction took place on the Comerford dam and station between 1928 and 1930. When finished, the Comerford dam would be the largest in New England at the time. The McIndoes dam was constructed between 1928 and 1931. The construction of the Moore dam was put on hold until 1953 because of an insufficient demand for power. Following the post-World War II population boom there was an increased need for power which resulted in the completion of the Moore dam construction in 1957.

a. Affected environment:

Archaeological Resources

In 1996, USGenNE commissioned an historic assessment of project facilities and a Phase IA archaeological study of the FMF Project lands to inventory previously recorded archaeological sites and identify additional areas of archaeological sensitivity within the existing project boundary, the Area of Potential Effect (APE) (LBA, 1997b).

One previously recorded prehistoric archeological resource, reported to be a prehistoric locality, was identified within the Moore development APE. No additional prehistoric archeological sites were identified during the Phase IA reconnaissance. A total of 60 areas (23 above, 11 within the drawdown zone, and 26 submerged) within the Moore development APE were designated as sensitive for prehistoric archaeological resources (LBA, 1997b).

One previously recorded prehistoric archeological resource was identified within the Comerford development APE. The site contains a variety of materials dating to the

late Woodland period. No additional prehistoric sites were identified during the Phase IA reconnaissance. A total of 41 areas (22 above, 11 within the drawdown zone, and 8 submerged) within the Comerford development APE were designated as sensitive for prehistoric archaeological resources.

There were no previously recorded prehistoric archeological sites identified within the McIndoes development APE. A total of 36 areas (26 above, 10 within the drawdown zone, and 0 submerged) within the McIndoes development APE were designated as sensitive for prehistoric archaeological resources.

Historical Resources

In 1996, an historic assessment of the FMF Project was conducted (LBA, 1997c). This study suggests that the Moore, Comerford and McIndoes hydroelectric stations collectively meet the National Register of Historic Places (National Register) definition of a discontiguous historic district, the three stations being united historically by design and by integrally functional relationships.

Within the context of hydroelectric development in the United States, the FMF Project is potentially significant in the areas of industry, engineering, and architecture. It appears to meet National Register (36 CFR § 60.4) Criteria A for its association with the extensive growth of the hydroelectric power industry in New England during the 1920s. It also appears to meet Criteria C as illustrative of facilities built (beginning in the 1920s) specifically to provide peaking power.

The following four cultural resources, which are not functionally integral to the project, are currently in the process of being evaluated for National Register eligibility: Moore Development Visitor's Center, constructed in the mid-1950's; former Moore Development construction camp building, now altered and used for storage; and two former Comerford construction camp buildings, one vacant and one used for salt and sand storage.

b. Environmental effects of the alternatives:

No-action

Under no-action, USGenNE would maintain existing project operations, and environmental conditions potentially affecting historic properties would remain unchanged. The features of the FMF Project are well maintained and with little alteration from their original construction. Areas of archaeological sensitivity along impoundment shorelines would be potentially affected in areas where shoreline erosion occurs. Sites and areas of archaeological sensitivity would be potentially affected by public access to project

lands. Historic archaeological sites, in particular, are often readily visible due to the presence of cellar holes and remains of building foundations, allowing for potential informal excavations for and removal of archaeological materials.

Proposed Action

Measures proposed by USGenNE under the terms of the Settlement Agreement include the development and implementation of a CRMP, which would protect and enhance the historic characteristics and qualities of the project (Stipulation VI.G, Settlement Agreement).

The proposed conservation easements within the project boundary and the Wildlife and Forest Management Plan include measures to ensure the protection of cultural, historic, and archaeological resources.

To protect Historic Properties within the existing FMF Project boundary, we recommend that, in any license issued for the FMF Project, USGenNE develop and upon Commission approval, implement a CRMP. The CRMP would be part of a Programmatic Agreement (PA). A PA has been developed by the Commission, NH, and VT SHPO's, the Advisory Council on Historic Preservation, and other interested parties, and is in the process of being signed by the parties.

License Denial, Decommissioning, and Dam Removal Alternative

Removal of the project dams, disabling the generating equipment and leaving the powerhouses in situ would result in adverse effects on the FMF Project historic qualities. Leaving the powerhouses and any appurtenant features in situ also would likely result in adverse effects to the FMF Project historic qualities due to neglect and resulting deterioration of powerhouse materials and features.

Dam removal and the return of more than 20 miles of impounded water to riverine stretches would result in the exposure of archaeological resources now wholly or partially submerged. Exposure of such archaeological resources, would potentially subject them to natural processes of shoreline erosion and to potential damage from vandalism.

c. Cumulative effects:

The project dams contributed to the cumulative effects to historic and cultural resources; however, it is likely that, prior to the development of the project, other land use changes, including the establishment of villages, roads, and railroads, and clearing and cultivation of lands, had already affected archeological sites in the project region. Nevertheless, some sites were likely inundated by the dams.

The project also affected early American historic resources, by inundating farms and rural residential areas, agricultural lands, a mill complex at McIndoes Falls, the small village of Pattenville, and most of the village of Waterford. Three cemeteries, one in Pattenville and two in Waterford, were relocated in 1954, relocating over 300 graves.

The proposed action includes the development of a CRMP for the project area, which would include measures for the protection of identified archaeological and historical resources, and measures to address potential shoreline erosion in areas of known or potential archaeological significance. In addition, a portion of the Upper Connecticut River Mitigation and Enhancement Fund would be available for protecting areas of cultural significance including historic and cultural resources, located within the existing project boundary. See also "Understanding Cumulative Effects in the Connecticut River Basin."

d. Unavoidable adverse effects: None.

9. Socioeconomic Resources

Prior to the development of the FMF Project, the population of the smaller towns in the immediate vicinity of the FMF Project (Monroe, Concord, Waterford, and Barnet) were declining, from a total population of 5,074 in 1860 to 3,717 in 1920 (a 27 percent decline); however, after the project was fully in place, between 1950 and 1990, these communities grew significantly (35 percent), from a total population of 3,282 to 4,444. Littleton, on the other hand, has grown steadily since before the construction of the first dams, from a population of 4,239 in 1920 to 5,827 in 1990 (37 percent increase).

At the turn of the century the region began developing a thriving dairy industry, as well as industries focusing on logging, papermaking, and the manufacture of a variety of iron, leather and paper-based specialty products. The growth of these industries particularly contributed to the growth of urban centers in St. Johnsbury and Littleton. In 1929, there were approximately 5,200 manufacturing jobs in the four county region surrounding the project, Essex and Caledonia counties in Vermont, and Coos and Grafton counties in New Hampshire. By 1947, just prior to construction of the Moore dam, manufacturing jobs in the four county surrounding region had increased to 6,500. On the Vermont side, farm income exceeded manufacturing income, and recreation had become a significant part of the regional economy, with recreation income nearly equal to manufacturing income on the New Hampshire side (CRWC, 1953).

a. Affected environment:

The FMF Project is located in Grafton County in New Hampshire and Caledonia and Essex Counties in Vermont. The study area for the socioeconomic analysis is this

Table 7. Population and Income Profile for the Study Area

Area	Persons	Families	Households	Median Household Income	Per Capita Income in 1989
State of New Hampshire	1,148,253	294,538	411,387	$40,665	$22,357
Grafton County	74,929	18,600	27,527	$30,065	$22,384
Dalton	808	234	323	$22,562	$10,472
Littleton	4,618	1,285	1,911	$24,085	$11,598
Monroe	788	224	278	$32,955	$12,171
State of Vermont	584,771	145,721	210,633	$34,077	$19,437
Caledonia County	26,564	7,431	10,372	$25,356	$16,230
Essex County	6,570	1,750	2,362	$22,358	$13,318
Barnet	1,398	391	514	$25,732	$11,097
Waterford	1,056	307	367	$33,792	$15,881
Concord	1,057	326	411	$26,339	$10,762
Lunenburg	1,176	332	447	$22,255	$9,624

Source: U.S. Bureau of the Census,1990 Summary Tape Files 3A, Vermont and New Hampshire and 1998 Current Population Survey.

three-county area. The study area is sparsely populated and characterized as having scattered village centers, a small commercial and industrial base, and income that lags behind the more urbanized counties in the two states.

Population and Income

In most instances, the median income levels in towns where the project is located lag behind the median income levels in their respective states, and they have a higher percentage of residents below the poverty level. However, the percentage of persons below the poverty line who live in Vermont towns (12 percent or 14 percent, depending upon the county) is higher than those residing in New Hampshire (9 percent). Table 7 shows the population and incomes for the states, counties, and towns in the study area.

Between the 1980 and 1990 Census, population in Vermont's northeast (Caledonia, Essex, and Orleans Counties) grew by 4.9 percent. During that same period, Grafton County in New Hampshire grew by 13.9 percent. The increase in population can be

partially attributed to two related factors: (1) the construction of the interstate highway system in Vermont and New Hampshire which began in the late 1960s and was largely finished in the 1970s; and (2) a significant migration from urban to rural areas which was first documented in the 1980 Census and has continued.

Employment

Employment in the study area is primarily in the service, trade, and manufacturing sectors. The service sector provides 37 percent of jobs in the study area. The health services sector in Grafton County, New Hampshire, provides jobs for 6,402 people, or 19 percent of the county's employment. Tourism-related employment in the study area is represented by service sectors such as hotels and lodging, eating and drinking establishments, and entertainment and recreation. The employment in these sectors in Essex and Caledonia Counties, Vermont, is 888, or 10 percent of employment, and 5,735, or 17 percent of employment in Grafton County, New Hampshire.

Retail trade, as compared to wholesale trade, constitutes the majority of the total trade in the area. Manufacturing accounts for more than 22 percent of the employment in the study area, service sector jobs 37 percent, tourism accounts for 10 percent on the Vermont side and 17 percent on the New Hampshire side and utilities 2 percent. The type of manufacturing is generally wood products and industrial machinery and equipment. Ethan Allen, in Beecher Falls, Vermont, employs more than 1,000 people, and Split Ball Bearing, an equipment manufacturer, is located in Lebanon, New Hampshire, and employs more than 700 people. Essex County, Vermont produces roughly a third of Vermont's softwood and a fifth of Vermont's hardwood. Employment opportunities for residents of the smaller host communities are typically located outside their respective communities in the larger labor centers of Littleton, New Hampshire, and St. Johnsbury, Vermont.

Derivative Benefits to the Local Economy

The FMF Project generates a significant amount of economic activity in the local area through local expenditures in the Upper Connecticut River region. USGenNE's ongoing forest management activities generate revenues for the local economy. The forest program creates employment opportunities for logging contractors, trucking companies, several local mills, and equipment sales and service. Other indirect benefits, in addition to employment and the multiplier effect on the local economy, include the sale of wood chips, which supplies fuel, in part, to the three wood-fired generators in the region.

The recreational resources of the FMF Project generate economic activity and employment opportunities related to spending by fishing, hunting, snow mobile, and other visitors using the project lands. Based on recreation user surveys, Visitors spend an average of $34.12 per visit, per recreation party. The visitors to the FMF Project area

spent an estimated $1,447,745 on recreation-related expenditures related to their visit, during May through October 1997. Based on user surveys, 69 percent of the spending related to recreation, or approximately $998,900, occurred within 30 miles of the project area. Annual primary and secondary benefits to the region of recreation-related spending in the FMF Project area amount to $1.88 million in 1997 dollars.

b. Environmental effects of the alternatives:

No-action

No-action would have no effect on existing socioeconomic resources within or immediately adjacent to the FMF Project boundaries. The FMF Project would continue to affect the study area through the employment of USGenNE employees and USGenNE purchases from local merchants.

The FMF Project's recreational opportunities would also continue to generate spending that would benefit local service, retail, restaurant, and lodging establishments.

Proposed Action

Employment for the operation and maintenance of the FMF Project would not change from existing levels under the proposed action. USGenNE would not significantly increase its spending on local purchases under the proposed action. USGenNE is likely to make minimal purchases of local goods, services, and materials for the development of the recreational enhancements they propose.

USGenNE's proposal to place conservation easements on project lands would reduce their property tax contributions. USGenNE's proposed recreational enhancements would increase property tax contributions a minimal amount. The Upper Connecticut River Mitigation and Enhancement Fund is structured to consider potential changes in property assessed value from the placement of conservation easements.

The proposed recreational enhancements would contribute to a beneficial effect on the socioeconomic resources of the study area by encouraging additional recreational use of the FMF Project area. USGenNE projects recreational use of the FMF project area to increase by 16.5 percent from 1996 to 2010, based on population and recreation use trends. This increase in recreational use would result in a corresponding increase in the economic benefits from spending by people using the project area for recreation.

License Denial, Decommissioning, and Dam Removal Alternative

This alternative would significantly affect the socioeconomic resources of the study area. The people operating and maintaining the FMF Project would lose their jobs. USGenNE's purchases from local establishments would decline significantly. The loss of public recreational access to the Connecticut River in the FMF Project area would result in a significant loss of recreation-related spending in the study area.

c. Cumulative effects:

Both in terms of the local project area and the broader New England region, socioeconomic conditions continue to be driven by other factors with far more influence than the FMF Project. The local economy was shifting from agriculture to manufacturing and recreation-based services even before the FMF Project was constructed. Nevertheless, the development of the FMF Project contributed to changes in the local population and economy by eliminating a number of residential, commercial, and small manufacturing concerns, and flooding agricultural land in the area.

The FMF Project provides beneficial socioeconomic effects to the region, however, by: providing jobs; contributing to the local economy through purchase of goods, services and materials; and creating recreational facilities, contributing to the growth of the recreation industry in the area, now valued at $1.88 million/year. Indirectly, the project provides valuable auxiliary services for the NEPOOL system, and contributes to economical electric rates throughout New England, and supporting economic growth in the broader region.

The proposed action would maintain the economic value of the project, and continue to support and enhance the value of the local recreation-related businesses through enhanced recreational facilities, and the preservation of the project's undeveloped and scenic character. The proposed action would also include use of a portion of the Upper Connecticut River Mitigation and Enhancement Fund to mitigate tax revenue effects in the communities affected by conservation easements. See also "Understanding Cumulative Effects in the Connecticut River Basin" (LWA, 1999).

d. Unavoidable adverse effects: None.

VI. DEVELOPMENTAL ANALYSIS

In this section, the effects of the proposed action on project economics is summarized, including estimates of the costs of various environmental protection, mitigation, and enhancement measures and the effects of changes in annual energy generation under the proposed action.

A. Effects of the Proposed Action on Project Economics

Table 8 provides an estimate of the annual costs of the enhancements under the proposed action. Table 9 summarizes the changes in peak and off-peak energy generation at each development for the proposed operational measures. [8]

Table 8. Summary of Annual Costs of Enhancements Under the Proposed Action

Measure	Capital Cost (1999$)	O&M Cost (1999$)	Annual Cost (1999$)
Operational Changes [a,b]	-	-	$1,074,000
Upper CT River Mitigation and Enhancement Fund	$3,000,000	$100,000	$558,000
Conservation Easements/Land Donation[c]		-	
Resource Studies	$1,000,000	-	$153,000
Management Plans	$2,000,000	-	$305,000
Total	$6,000,000	$100,000	$2,090,000

[a] See Section III.A.3 for a description of the proposed operations of Moore, Comerford, and McIndoes developments under the proposed action.

[b] It is difficult to quantify and project the costs of the MWh due to the evolving changes in the NEPOOL market (this figure is based on an estimate of $35/MWh peak and $17/MWh off-peak).

[c] Costs do not include an estimate of the real property that is being donated as identified in the Settlement Agreement.

Table 9. Summary of Changes in Annual Energy Generation under the Proposed Action

Measure	Peak Energy Change (MWh)	Off-Peak Energy Change (MWh)	Total Energy Change (MWh)
Moore Development	(14,503)	12,598	(1,905)
Comerford Development	(30,098)	26,092	(4,006)
McIndoes Development	(3,923)	(1,967)	(5,890)
Total Developments	(48,524)	36,723	(11,801)

[8] Appendix G of the license application provides a summary of the operation model developed to estimate the effects of the proposed operations.

The project generates an average annual energy generation of 639,000 MWh (based on 10 years). With enhancement measures, it would generate about 627,000 MWh. The total average annual cost of the project associated with existing operations is $36,374,000, in addition to enhancement cost of $1,016,000. [9] Using a NEPOOL annual average energy clearing price of $46.38/MWh, the value of the project power would be $29,637,000 for existing conditions. For the project with enhancement measures, the total annual cost to produce the power would be $37,390,000, and the value of the project power would be about $29,080,000.

B. License Denial, Decommissioning, and Dam Removal

If the project no longer operated, the existing mix of peak and off-peak energy, capacity, and ancillary services would no longer be provided. There would also be costs associated with the actual demolition and disposal of the dams themselves and related facilities and equipment, as well as for maintenance of the sites. We do not attempt to estimate those costs here since this alternative is not considered reasonable.

C. No-action

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

D. Pollution Abatement

Continued hydropower operation of the project would offset the need for increased operation of fossil-fueled plants, which produce pollutants that must be removed from emissions to the atmosphere. Replacement of the FMF Project's current annual output of 685,638 MWh (based on the modeled outputs) would require the combustion of approximately 287,728 tons of coal, 1,162,431 barrels of oil, or 7,076 million cubic feet of natural gas. Table 10 summarizes the resulting production of pollutants and the associated removal costs.

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[9] Assumptions: cost of capital is 10 percent; Federal taxes are $5,000,000; property taxes are $5,000,000; depreciation is $6,078,771; and operation and maintenance is $8,500,000.

Table 10. Summary of Annual Fossil Fuel Pollutant Emissions for Replacement of FMF Project Energy (Based on AP-42 Emission Factors)

	Coal	Oil	Natural Gas
Oxides of Sulfur (tons)	5,211[a]	6,710[b]	2.22
Oxides of Nitrogen (tons)	1,508	1,006	518
Carbon Monoxide (tons)	69	126	311
Carbon dioxide (tons)	828,251	628,502	443,648
Particulates (tons)	8,365[c]	-	-

[a] Assumed sulfur content of 1 percent.
[b] Assumed sulfur content of 1.7 percent.
[c] Assumed ash content of 6.1 percent.

VII. COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

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

This section contains the basis for, and a summary of, our recommendations to the Commission for licensing the Fifteen Mile Falls Project.

A. Recommended Alternative

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

We recommend this alternative because: (1) issuance of a license would allow USGenNE to continue to operate the project as a dependable source of electric energy; (2) the 291.36-MW project would avoid the need for an equivalent amount of fossil-fuel fired electric generation and capacity, continuing to help conserve these nonrenewable energy resources and reduce atmospheric pollution; and (3) the recommended environmental protection, mitigation, and enhancement measures as stipulated in the Settlement

Agreement would protect or enhance water quality, fishery resources, terrestrial resources, land uses, improve public use of recreation facilities and resources, and protect historic and archeological resources within the area affected by project operations.

We recommend, consistent with most of the terms of the FMF Project Settlement Agreement dated August 6, 1997, including the following environmental measures in any license issued by the Commission for the Fifteen Mile Falls Project:

- Operate the Moore development as follows: 809 feet msl maximum operating limit; for spring spawning, achieve an elevation of at least 802 feet msl with target elevation of 804 feet msl by May 21 of each year; for the period from May 21 through June 30, the reservoir would not be drawn more than 2 feet below any elevation previously attained in the same period; in the period from June 30 to May 21, reservoir operations are to follow historic patterns and ranges; and provide a minimum flow of 320 cfs or inflow year-round.

- Operate the Comerford development as follows: 650 feet msl maximum operating limit; achieve an elevation of at least 645 feet msl, with a target elevation of 647 feet msl by May 21 for each year; for the period from May 21 through June 30 the reservoir would not be drawn more than 2 feet below any elevation previously attained in the same period; in the period from June 30 to May 21, reservoir operations are to follow historic patterns and ranges; and provide minimum flows of 818 cfs for the period June 1 through September 30, 1,145 cfs for the period October 1 through March 31, and 1,635 cfs for the period of April 1 through May 31.

- Operate the McIndoes development as follows: 451 feet msl maximum operating limit; reservoir may be drawn down a maximum of 3.5 feet to a minimum operations elevation of 447.5 feet msl; reservoir may surcharge above 451.0 feet if inflow exceeds discharge capability of 30,600 cfs; provide minimum flows of 1,105 cfs or inflow for the period of June 1 through September 30, and 2,210 cfs or inflow for the period of October 1 through March 31; inflow during these periods is defined as the sum of the applicable Comerford minimum flow and the prorated Passumpsic gage. In addition, for spring spawning flow and incubation: provide 4,420 cfs or inflow for the period of April 1 through May 31 If, Moore and Comerford reservoirs are in danger of not filling, the Comerford minimum flow would be reduced to no less than 50 percent of Dalton Gage, McIndoes minimum flow would be the sum of prorated Passumpsic Gage flow plus no less than 50 percent of the Dalton Gage. The spawning flow could be reduced to 2,210 cfs, if flows in excess of 50,000 cfs at Bellows Falls or in excess of 10,000 cfs at Wilder are expected. Finally, maximum flows would not exceed 5,800 cfs for more than 7 percent of the hours during the period from June 1 through February 28, but no

restriction on flows, if Moore and Comerford are both at their maximum operating limits or if stream flow (sum of the prorated Passumpsic Gage and Dalton gages) exceeds 8,000 cfs during the months of March, April and May.

- Implement permanent conservation easements on about 4,000 acres of lands within the FMF Project boundary to protect the scenic forestry and natural resource values of these lands.

- Implement a Fisheries Management Plan, which includes provisions for the following:

  (1) Plan for the protection, enhancement, and management of fish populations in the project area.

  (2) Investigate tributary access for spawning fish.

  (3) Provide structural habitat enhancements for salmonids in the Moore and Comerford tailrace.

- Provide downstream fish passage facilities at the McIndoes development within 2 years of licensing, and conduct an assessment of Atlantic salmon smolt migration through the Moore and Comerford reservoirs.

- Provide upstream fish passage at the McIndoes development when 20 Atlantic salmon migrate upstream and reach the Ryegate Dam for two consecutive years and the fishery agencies find the need for upstream passage is justified. The passage would consist of facilities located at McIndoes dam or participation in a trap and truck facility construction and operation at East Ryegate dam. Also, if directed by the CRASC and the fisheries agencies, a fish trap would be installed at the base of the Comerford dam and a trap and truck operation would be implemented.

- Initiate consultation on the issue of passage for American eels at the project dams upon a duly made finding by FWS, VANR, and NHFG that such passage is necessary.

- Develop and implement a final Wildlife and Forest Management Plan for managing lands within the FMF Project's boundary.

- Develop and implement a Rare and Unusual Plant/Plant Community Management Plan.

- Develop and implement a final Management Plan for Threatened and Endangered Species.

- Develop and implement a revised Recreational Facilities and Management Plan, which includes the following measures:

  (1) (a) provide a designated swimming area at Dodge Hill, Pine Island and Moore dam access areas; (b) create or improve the beach area at Dodge Hill and Pine Island access areas; (c) install new boat ramps at Gilman and Moore dam access areas; (d) lengthen the existing boat ramps at North Littleton and Dodge Hill access areas; (e) add picnic tables and grills at Gilman, Pattenville, Pine Island, Moore dam, and Pine Grove access areas; (f) add portable toilets at Gilman, Pine Island and Moore dam access areas; (g) enlarge the parking areas at North Littleton, Pattenville, Pine Island, Moore dam, Waterford and Waterford Bridge access areas; (h) grade the parking areas at Dodge Hill, Waterford, and Comerford dam access areas; (i) improve the access road at Pattenville and Moore dam access areas; (j) improve traffic circulation at North Littleton, Pattenville, and Moore dam access sites; (k) establish two primitive camping areas within the FMF Project area; (l) provide signage denoting facilities rules and regulations, hours of operation, and safety precautions; and (m) implement soil and sediment control measures to be used during construction of the facilities.

  (2) Explore measures to provide the following safety measures: (a) install flow warning devices below the Moore, Comerford, and McIndoes dams; (b) install safety precaution signage in the tailrace areas; and (c) maintain the existing boater constraint barriers at the intake areas at all three developments.

  (3) soil erosion control measures.

  (4) an implementation schedule.

- Implement the provisions of a Programmatic Agreement, including a Cultural Resources Management Plan.

B. Conclusion

Based on our independent analysis of the Fifteen Mile Falls Hydroelectric Project, we conclude that operation of the project by USGenNE with our staff recommended measures, would protect and enhance environmental conditions in the project area and the river basin, and would be a beneficial use of the resources.

VIII. CONSISTENCY WITH FISH AND WILDLIFE RECOMMENDATIONS

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

Table 11 lists the fish and wildlife recommendations subject to Section 10(j), and whether staff recommends adopting each recommendation. Recommendations that we consider outside the scope of Section 10(j) have been considered under Section 10(a) of the FPA and are addressed in the specific resource sections of this document. The NHFGD filed late, two recommendations on November 11, 2000, which we consider outside the scope of Section 10(j). NHFGD's recommendations that 1) all the provisions of the 1997 Settlement be included in any new license issued for the project and 2) FERC preserve NHFGD's right to petition FERC for changes to the license order to assure protection to fish and wildlife, are adequately addressed in the EA, by the WQC mandatory conditions, or by the standard L-Form articles incorporated into all licenses issued.

Interior filed 16 recommendations for the project on September 27, 2000. Three of the 16 recommendations are outside the scope of Section 10(j) because they are not specific measures for the protection of fish and wildlife. We consider under Section 10(a) and recommend adopting Interior's recommendation that the licensee consult and study American eels at project dams to determine when passage facilities for eels are needed. The licensee agreed to this measure under the Settlement Agreement, and the WQC also requires the eel study. We do not recommend adopting Interior's recommendations requiring the licensee to 1) complete an assessment of Atlantic salmon smolt migration through the Moore and Comerford impoundments, [10] and 2) contribute to a mitigation and enhancement fund.

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[10]USGenNE completed smolt studies in May 1998, and May 2000, which answers Interior's question about smolt passage at the two developments. We see no need to require further smolt passage studies as USGenNE has agreed to provide downstream fish passage facilities at the two developments.

Establishment of an Upper Connecticut River Mitigation and Enhancement Fund would provide funding for various activities, such as: project conservation easement establishment, monitoring and enforcement; river restoration work, such as dam removal and acquisition of development rights and property, fish passage at nonhydro dams, unlicensed hydropower facilities or natural barriers, or other riverine habitat improvements; restoration, protection, and enhancement of wetlands and adjacent buffer areas; riverine shoreland protection; and mitigation of tax revenue impacts in communities where lands in the Upper Connecticut Valley are proposed to be covered by conservation easements. The uses of the fund would be determined by a committee comprised of stakeholders. Although potential activities undertaken by the fund would benefit project related aquatic, water quality, terrestrial, cultural, and recreational resources, some measures would have no nexus between the fund and project operations or would not be a fish and wildlife measure, such as mitigation of tax revenue impacts and installation of fish passage at non-hydro dams or unlicensed projects. Therefore, staff does not recommend adopting this recommendation; however the licensee has agreed to this measure pursuant to the Settlement Agreement.

We recommend that all 13 of Interior's 10(j) recommendations be adopted by the Commission, with the following refinement. Interior recommended that conservation easements, as specified in the Settlement Agreement, be established for licensee-owned lands, to include some non-project lands. The staff recommends the Commission require any licensee to establish conservation easements on project lands only. (See Land Use and Aesthetic Resources section.)

Table 11. Analysis of Interior's fish and wildlife recommendations for the Fifteen Mile Falls Project.

Recommendation	Within Scope of 10(j)	Capital Cost (1998$)	Recommend Adopting?
1. Moore Reservoir elevations should be consistent with historic project operations as defined in the 1997 Settlement. The maximum operating level of Moore Reservoir should be 809 feet MSL. To facilitate spring spawning fish, the Moore Reservoir should be operated to achieve an elevation of at least 802 feet MSL, with a target elevation of 804 feet MSL by May 21 of each year. Between May 21 and June 30 the Moore Reservoir should not be drawn down more than two feet below any elevation previously attained during this period.	Yes	$1,074,000 annual Cost for all operational changes	Yes
2. A continuous minimum flow of 320 cfs or inflow, if less than 320 cfs should be provided from the Moore Development throughout the year.	Yes	See above item 1	Yes

Recommendation	Within Scope of 10(j)	Capital Cost (1998$)	Recommend Adopting?
3. Comerford Reservoir elevations should be consistent with historic project operations as defined in the 1997 Settlement. The maximum operating level of the Comerford Reservoir should be 650 feet MSL. To facilitate spring spawning fish, the Comerford Reservoir should be operated to achieve an elevation of at least 645 feet MSL, with a target elevation of 647 feet MSL by May 21 of each year. Between May 21 through June 30, the reservoir should not be drawn down more than two feet below any elevation previously attained during this period.	Yes	See above item 1	Yes
4. The following minimum flows should be released from the Comerford Dam: 818 cfs from June 1 through Sept 30; 1,145 cfs from Oct 1 through March 31; and 1,635 cfs from April 1 through May 31. All minimum flows from the Comerford Dam should be guaranteed, releasing from reservoir storage if necessary. The licensee should develop an operating plan to address how reservoir storage would be used to provide guaranteed flows while minimizing the impacts on the environment and public use.	Yes	See above item 1	Yes
5. The McIndoes Reservoir should be operated with a normal maximum operating level of 451 feet MSL, except in instances when inflow exceeds the McIndoes Dam discharge capability and a reservoir surcharge occurs. The McIndoes Reservoir may be drawn down a maximum of 3.5 feet to a minimum operating elevation of 447.5 feet MSL.	Yes	See above item 1	Yes
6. The following minimum flows should be released from the McIndoes Dam: 1,105 cfs or inflow, if less than 1,105cfs from June 1 through Sept 30; and 2,210 cfs or inflow, if less than 2,210 cfs from October 1 through March 31. Project inflows should be defined as the sum of the applicable Comerford Station minimum flow and the prorated Passumpsic gage flow.	Yes	See above item 1	Yes
7. From April 1 through May 31, a minimum flow of 4,420 cfs or inflow, if less, should be released from the McIndoes Development for spring fish spawning and egg incubation flows. During this period, inflow should be defined as the sum of the applicable Comerford minimum flow and the prorated Passumpsic gage flow. If dry conditions are predicted to result in the Moore and Comerford Reservoirs failing to fill by the end of the spring runoff, the minimum flow below the Comerford Development can be reduced to no less than 50% of the Dalton gage flow. To preserve the flood control benefits of the Project, if minimum flows at McIndoes are expected to contribute to flows in excess of 50,000 cfs at Bellows Falls, or in excess of 10,000 cfs at Wilder, the minimum flow at McIndoes may be reduced to 2,210 cfs.	Yes	See above item 1	Yes
8. From June 1 through February 28, the maximum discharge from the McIndoes Dam should not exceed 5,800 cfs for more than 7% of the hours during the period. This restriction should not apply if Moore and Comerford Reservoirs are at their maximum operating limit, or when the sum of the prorated Passumpsic gage and Dalton gages exceeds 8,000 cfs. There is no restriction on the maximum McIndoes discharge during the months of March, April, and May.	Yes	See above item 1	Yes

Recommendation	Within Scope of 10(j)	Capital Cost (1998$)	Recommend Adopting?
9. The licensee should provide operating downstream fish passage facilities at the McIndoes Development within two years of the completion of licensing, as described in the 1997 Settlement, and in consultation with and approved by the FWS, VANR, NHFGD, and CRASC.	Yes	$2,000,000 Annual Cost = $305,000 for total management plan measures	Yes
10. The licensee should complete an assessment, acceptable to the state and federal fisheries agencies, of Atlantic salmon smolt migration through the Moore and Comerford impoundments.	No; not specific measure to protect fish and wildlife.	$1,000,000 Annual Cost = $153,000 for resource studies	No. However, downstream passage of smolts would be provided by future fishways (see item no. 11 below).
11. The licensee should provide downstream fish passage measures at the Moore and Comerford Developments that are acceptable to state and federal agencies within two years after being notified by the agencies that such passage is needed. This recommendation is based on the continuation of the current Atlantic salmon stocking program occurring upstream from the Moore and Comerford Developments.	Yes	$2,000,000 Annual Cost = $305,000 for total management plan measures	Yes
12. The licensee should provide upstream fish passage at the McIndoes Development when 20 Atlantic salmon migrating upstream reach the Ryegate Dam for two consecutive years and the CRASC, FWS, and other fishery agencies duly find that the need for upstream passage is justified. Upstream fish passage may be considered for a later date if so determined by these same entities. At the discretion of the CRASC, FWS, and other fishery agencies, the fish passage facilities may consist of facilities located at the McIndoes Dam or entail participation in trap and truck facility construction and operation at East Ryegate Dam. At the time of recommending upstream fish passage facilities at the McIndoes Dam, the FWS, CRASC, and other fisheries agencies may also recommend the licensee install trap and truck facilities at the base of the Comerford Dam and operate a trap and truck operation with Atlantic salmon captured in the trap and truck facility trucked to legal destinations specified by the fishery agencies. The licensee should design the fish passage facilities in consultation with the fishery agencies.	Yes	$2,000,000 Annual Cost = $305,000 for total management plan measures	Yes
13. The licensee should initiate consultation on the issue of passage for American eels at the Project dams when a duly made finding by the FWS, VDFG, and NHFGD indicates that such passage is necessary. Within one year of a determination by the fishery agencies that fish passage is needed for American eels, the licensee should develop plans for upstream and downstream eel passage measures or plans for conducting studies to address eel passage at the project, including a schedule to implement the proposed measures or studies. The eel passage measures or studies should be developed in consultation with the state and federal fishery agencies and implemented according to a schedule agreed to with the same entities.	No; not a specific measure to protect fish and wildlife.	$1,000,000 Annual Cost = $153,000 for resource studies	Yes
14. The licensee should contribute to the Upper Connecticut River Mitigation and Enhancement Fund as described and specified in the 1997 Settlement.	No; not a specific measure to protect fish and wildlife.	$3,000,000 Annual Cost = $558,000	No; The staff considers some purposes and uses of the Fund to be beyond FERC's regulatory authority.
15. The licensee should implement fisheries mitigation measures in accordance with the filed Fisheries Mitigation Plan. The final decisions on the fisheries mitigation projects that will be undertaken and the implementation schedules for those projects should be determined in consultation with and concurred to by the FWS, VDFW, NHFGD, and other settlement parties.	Yes	$2,000,000 Annual Cost = $305,000 for total management plan measures	Yes

Recommendation	Within Scope of 10(j)	Capital Cost (1998$)	Recommend Adopting?
16. The licensee should establish conservation easements, as specified in the 1997 Settlement, on USGen New England lands in the Fifteen Mile Falls Project area for the protection and enhancement of fish and wildlife habitat. The final determination of easement holder should be made by USGen New England in consultation with the Settlement parties.	Yes	Indeterminate	Yes, partially; the staff concurs with easements for project lands inside the project boundary (~ 4,000 acres); establishing easements for nonproject lands (~ 4,200 acres) would be up to licensee and settlement parties.

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, and conserving waterways affected by the project. Under Section 10(a)(2), Federal and state agencies filed a total of 38 plans that address various resources in New Hampshire and Vermont. Of these, we identified and reviewed 18 plans relevant to the FMF Project.[11] No conflicts were found.

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[11] **New Hampshire**: (1) New Hampshire Office of State Planning. 1977. Wild, scenic and recreational rivers for New Hampshire. Concord, New Hampshire. June 1977; (2) New Hampshire Office of State Planning. 1989. New Hampshire wetlands priority conservation plan. Concord, New Hampshire; (3) New Hampshire Office of State Planning. 1989. New Hampshire outdoors, 1988-1993: state comprehensive outdoor recreation plan. Concord, New Hampshire; (4) New Hampshire Office of State Planning. 1991. Public access plan for New Hampshire's lakes, ponds, and rivers. Concord, New Hampshire. November 1991; (5) Policy Committee for Fisheries Management of the Connecticut River. 1982. A strategic plan for the restoration of Atlantic salmon to the Connecticut River Basin. Laconia, New Hampshire. September 1982; (6) State of New Hampshire. 1990. New Hampshire rivers management and protection program. Concord, New Hampshire. July 1, 1990; (7) State of New Hampshire rivers management and protection program. Concord, New Hampshire; (8) State of New Hampshire. 1992. Act designating segments of the Connecticut River for New Hampshire's rivers management and protection program. Concord, New Hampshire. May 15, 1992; and (9) Connecticut River Joint Commissions. Connecticut River Corridor Management Plan. May 1997.

Vermont: (1) Vermont Agency of Environmental Conservation. 1983. Vermont state comprehensive outdoor recreation plan, 1983-1988. Montpelier, Vermont. June 1983; (2) Vermont Agency of Environmental Conservation. 1986. Vermont Rivers Study. Waterbury, Vermont; (3) Vermont Agency of Natural Resources. Department of Environmental Conservation. 1988. Hydropower in Vermont: an assessment of environmental problems and opportunities. Waterbury, Vermont. May 1988; (4) Vermont Agency of Natural Resources. Department of Forests, Parks and Recreation. 1988. Vermont recreation plan. Waterbury, Vermont; and, (5) Vermont Agency of Natural Resources. Department of Forests, Parks and Recreation. Wetlands Steering Committee. 1988. Wetlands component of the 1988 Vermont

We also reviewed the following plan that is relevant to the FMF Project, but is not listed as a Commission-approved comprehensive plan: U.S. Fish and Wildlife Service, Silvio O. Conte National Fish and Wildlife Refuge, October 1995. No conflicts were found.

X. FINDING OF NO SIGNIFICANT IMPACT

On the basis of our independent analysis, we conclude that issuance of a new license for the FMF Project, with our recommended environmental measures, would not constitute a major Federal action significantly affecting the quality of the human environment.

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