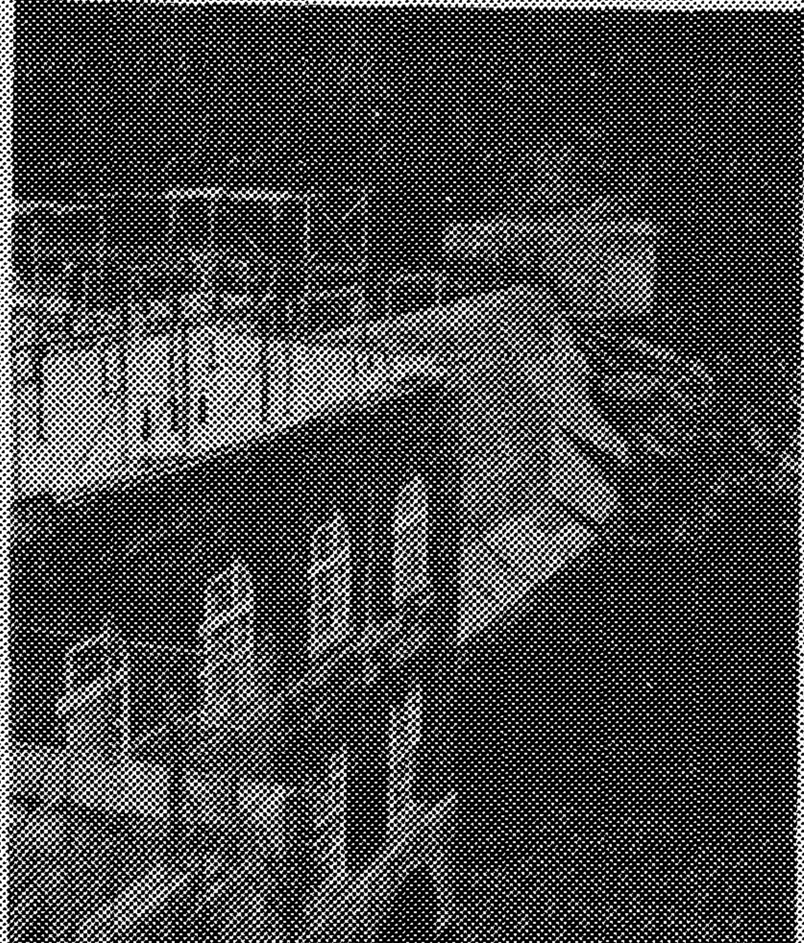
Federal Energy Regulatory Commission

Office of Hydropower Licensing

August 1996

FERC/FEIS-0105



Final Environmental Impact Statement

Deerfield River Projects

Vermont - Massachusetts

(FERC Project Nos 2323-012, 2669-02, & 2334-01)

9610030376

888 First Street N.E. Washington, DC 20426

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF HYDROPOWER LICENSING

FINAL ENVIRONMENTAL IMPACT STATEMENT

DEERFIELD RIVER PROJECT
BEAR SWAMP PUMPED STORAGE PROJECT
GARDNERS FALLS PROJECT

in the Deerfield River Basin

FERC Project Nos. 2323, 2669, and 2334

Additional copies of this Final Environmental Impact Statement are available from:

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August 1996

COVER SHEET

a. Title: Deerfield River Project, Bear Swamp Pumped Storage Project, Gardners Falls Project, in the Deerfield River Basin FERC Project Nos. 2323, 2669, and 2334.

b. Final Environmental Impact Statement (FEIS)

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract: New England Power (NEP) filed an application for a new license (relicense) for the Deerfield River Hydroelectric Project (Deerfield Project) on the mainstem of the Deerfield River, in Vermont (four Deerfield developments) and Massachusetts (four Deerfield developments). Western Massachusetts Electric Company (WMEC) filed a relicense application for the Gardners Falls Hydroelectric Project (Gardners Falls) in Massachusetts. Additionally, NEP proposes changes in project operation at the Bear Swamp Pumped Storage Project (Bear Swamp Project) (FERC No. 2669) to include increased minimum flows and scheduled recreational whitewater releases.

An Offer of Settlement (Settlement) was negotiated between NEP and 12 state and Federal resource agencies and non-governmental organizations (NGOs). On October 6, 1994, NEP filed the Settlement with the Commission as part of its relicensing proceedings.[1] As a result, the application for new license for the Deerfield Project has been superseded, by the provisions of the Settlement and a Cultural Resources Management Plan. Therefore, except where noted in this FEIS, NEP's proposal for the Deerfield Project and the Settlement are considered as one and the same.

The Deerfield River Settlement purports to resolve all issues regarding: fisheries, fish passage, wildlife, water quality, project lands management and control, recreation, and aesthetic resources associated with the Deerfield Project developments. Enhancements associated with the Commission licensed Bear Swamp Project are also included in the Settlement[2]. Although the Gardners Falls Project is a component of the hydroelectric production in the Deerfield River Basin, it is not incorporated into the Settlement and WMEC is not a signatory to the Settlement.

The environmental resources evaluated in the EIS include: (1) geology and soils, (2) water quality and quantity, (3) fishery resources, (4) vegetation and wildlife resources, (5) threatened and endangered species, (6) recreation and land use resources, (7) aesthetic resources, (8) archeological and historic resources, (9) socioeconomic resources, and (10) air quality. In addition, the resources cumulatively affected by the projects and analyzed are: water quality and quantity, anadromous fishery resources, wetlands and associated terrestrial resources, recreation and land use resources, aesthetic resources, and hydroelectric generation.

The Commission staff's recommendations are: to approve the Settlement, to relicense the Deerfield River and Gardners Falls Projects as proposed with additional resource enhancements; and to change the operation of the existing Bear Swamp Project license as required by the Settlement.

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[1] Filed on October 6, 1994 pursuant to 18 C.F.R Section 385.602(b), and noticed on October 19, 1994.

[2] Any change in project operation at the Commission licensed Bear Swamp Pumped Storage Project (FERC No. 2669) would require Commission approval.

e. Contacts

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f. Transmittal: This final environmental impact statement prepared by the Federal Energy Regulatory Commission's (Commission) staff in connection with the relicense applications filed by New England Power for the existing Deerfield River Project (FERC No. 2323); and Western Electric Massachusetts Company for the Gardners Falls Project (FERC No. 2334); and the Offer of Settlement for the Deerfield Project, which includes a proposal to amend and operate the existing Bear Swamp Project, filed by NEP is being made available to the public on or about August 15, 1996, as required by the National Environmental Policy Act (NEPA)[3] of 1969 and the Commission's Regulations Implementing the NEPA (18 CFR Part 380).

Front cover: Deerfield River Project, No. 2 Development powerhouse and dam (Staff photo).

[3] 42 U.S.C. §4321 et.seq.

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[4] and the U.S. Department of Energy (DOE) Organizational Act[5] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric developments subject to its jurisdiction, on the necessary conditions:

> [T]hat the project adopted . . . shall be such as in the judgement of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in Section 4(e) . . .[6]

The Commission may require such other conditions not inconsistent with the FPA as may be found to provide for the various public interests to be served by the project[7]. Compliance with such conditions during the licensing period is required.

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4 16 U.S.C. §§791(a)-825(r), as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986) and the Energy Policy Act of 1992, Public Law 102-486 (1992).

5 Public Law 95-91, 91 Stat. 556 (1977).

6 16 U.S.C. Sec. 803(a).

7 16 U.S.C. Sec. 803(g).

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ACRONYMS AND ABBREVIATIONS

ABF	Aquatic Base Flow
AC	Acres
AF	Acre-feet
AMC	Appalachian Mountain Club
AR	American Rivers, Inc.
AWA	American Whitewater Affiliation
Bear Swamp Project	Bear Swamp Pumped Storage Project, FERC No. 2669
C	Celsius
CEA	Cumulative effects analysis
cfs	Cubic feet per second
Commission, the	Federal Energy Regulatory Commission
CLF	Conservation Law Foundation
Corps	U.S. Department of the Army, Corps of Engineers
Council, the	Advisory Council on Historic Preservation
CRA	Charles Ritzi Associates
CRMP	Cultural Resources Management Plan
CWA	Clean Water Act
Deerfield No. 2	Deerfield River Project, Number 2 Development
Deerfield No. 3	Deerfield River Project, Number 3 Development
Deerfield No. 4	Deerfield River Project, Number 4 Development
Deerfield No. 5	Deerfield River Project, Number 5 Development
Deerfield Project	Deerfield River Hydroelectric Project, FERC No. 2323
DEIS	Draft environmental impact statement
DO	Dissolved oxygen
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DPCA	Commission's Division of Project Compliance and Administration
DRC, the	The Deerfield River Compact
DRWA, the	The Deerfield River Watershed Association
DSM	Demand-side management
ECPA	Electric Consumers Protection Act of 1986
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FEIS	Final environmental impact statement
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
Fife Brook Dam	Bear Swamp Pumped Storage Project
Gardners Falls Project	Gardners Falls Hydroelectric Project, FERC No. 2334
GSE	Gomez and Sullivan Engineers
GWh	Gigawatthours
Harriman	Harriman Development, Deerfield River Project
HEC-5 Model	Simulation of Flood Control and Conservation Systems Computer Model
hp	Horsepower

IA	Ichthyological Associates, Incorporated
IFIM	Instream Flow Incremental Methodology
KA	Kleinschmidt Associates
km	Kilometer
kV	Kilovolt
kVa	Kilovolt-ampere
kW	Kilowatts
kWh	Kilowatthours
m	meters
MA DEM	Massachusetts Department of Environmental Management
MA DEP	Commonwealth of Massachusetts - Department of Environmental Protection
MA DEQE	Massachusetts Department of Environmental Quality and Engineering
MA DFW	Massachusetts Division of Fisheries and Wildlife
MA DPU	Massachusetts Department of Public Utilities
MA NHP	Massachusetts Natural Heritage Program
MA WPC	Massachusetts Division of Water Pollution Control
mgd	Million gallons per day
mg/l	Milligrams per liter
mi^2	Square miles
msl	Mean sea level
MW	Megawatts
MWh	Megawatt-hours
NHPA	National Historic Preservation Act
National Register	National Register of Historic Places
NE FLOW	New England FLOW Group
NEP	New England Power Company
NEPA	National Environmental Policy Act
NEPOOL	New England Power Pool
NGVD	National Geodetic Vertical Datum
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service
NPS	National Park Service
NPCC	Northeast Power Coordinating Council
NU	Northeast Utilities Service Company
NWI	National Wetlands Inventory
NYPP	New York Power Pool
O&M	Operation and maintenance
PHABSIM	Physical Habitat Simulation System
ppm	Parts per Million
QA/QC	Quality assurance/quality control
river basin	Deerfield River Basin
RM	River mile
SAV	Submerged Aquatic Vegetation
SDI	Scoping Document No. I
SDII	Scoping Document No. II
Searsburg	Searsburg Development, Deerfield River Project
Settlement, the	Deerfield River Project, Offer of Settlement
Sherman	Sherman Development, Deerfield River Project
SHPO	State Historic Preservation Officer
SI	Suitability Index
Somerset	Somerset Development, Deerfield River Project

staff, the	Federal Energy Regulatory Commission's staff
T&E species	Threatened and Endangered Species
TU	Trout Unlimited
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VANR	Vermont Agency of Natural Resources
VDEC	Vermont Department of Environmental Conservation
VDFW	Vermont Department of Fish and Wildlife
VFSC	Vermont Federation of Sportsmen's Clubs
VNRC	Vermont Natural Resources Council
WMEC	Western Massachusetts Electric Company
WRC	Windham Regional Commission
WQC	Water Quality Certificate
WUA	Weighted Usable Area
WWA	Weighted Wetted Area
WWTF	Shelburne-Buckland Wastewater Treatment Facility
YAEC	Yankee Atomic Electric Company
yoy	young-of-the-year fish

EXECUTIVE SUMMARY

Located in northwestern Massachusetts and southern Vermont, the Deerfield River drains about 665 square miles at the confluence with the Connecticut River. On the mainstem of the Deerfield River there are two hydroelectric projects, the 76.9-megawatt (MW) Deerfield River Project owned by New England Power Company (NEP) and the 3.6-MW Gardners Falls Project owned by Western Massachusetts Electric Company (WMEC). The Deerfield River Project consists of nine dams, seven powerhouses and eight impoundments. The 611.25-MW Bear Swamp Pumped Storage Project also owned by NEP uses an impoundment on the Deerfield River as the lower reservoir. This FEIS evaluates the potential environmental benefits, economic costs, and environmental effects associated with three proposed actions: (1) relicensing the Deerfield River Project by implementing a proposed Offer of Settlement and Cultural Resources Management Plan, (2) relicensing the Gardners Falls Project (not included in the Settlement), and (3) amending the license of the Bear Swamp Pumped Storage Project, which is part of the Settlement.

The Settlement is a negotiated agreement among NEP and 12 resource agencies and NGOs that provides terms and conditions for fisheries, fish passage, wildlife, water quality, land management and control, recreation, and aesthetics for inclusion into any new license issued for the Deerfield River Project.[8] FERC staff reviewed and provided comments on preliminary drafts of the Settlement prior to filing with the Commission. NEP is also proposing to prepare and implement a cultural resources management plan. For the Bear Swamp Project, NEP would implement the proposals contained in the Settlement under an amendment to its existing license. The proposed Settlement does not include the Gardners Falls Project.

The average annual energy generation at NEP's Deerfield River Project is currently about 289,000 MWh and has an annual net power benefit of $4,440,000. Under provisions of the Settlement, NEP would implement reservoir level restrictions and fishery flows, construct fish passage facilities, establish conservation easements and establish forest management guidelines. For the Bear Swamp Project, NEP would implement year-round fishery flows and provide seasonal recreational whitewater releases. Under the Settlement, energy generation and net annual power benefits for the Deerfield River Project would decrease about 12.1 percent and 52 percent, respectively. Water quality certificates containing several conditions have been issued by the Vermont Agency of Natural Resources (VANR) and the Massachusetts Department of Environmental Protection (MA DEP) for the Deerfield River Project.[9] We believe several of the conditions required in the WQCs exceed the scope of Section 401 authority as discussed in *Tunbridge*.[10] This issue would be addressed in any license order issued for the projects. On February 14, 1995, the VNRC and the Vermont Federation of Sportsmen's Clubs (VFSC) appealed the Vermont WQC, challenging findings, conclusions, and conditions contained in the WQC for the Deerfield River Project. On February 14, 1995, NEP also filed an appeal. Conditions in the WQCs would reduce annual generation and net annual power benefits from existing conditions by about 13.3 percent and 55.3 percent, respectively. Implementing Vermont Natural Resource Council's (VNRC) recommendations would

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[8] The Offer of Settlement for the Deerfield Project was signed by: New England Power Company (NEP), the U.S. Fish and Wildlife Service (USFWS), the U.S. Environmental Protection Agency (EPA), the National Park Service (NPS), the Massachusetts Division of Fisheries and Wildlife (MA DFW), American Rivers, Inc. (AR), the Appalachian Mountain Club (AMC), the Deerfield River Compact (DRC), New England Flow (NE FLOW), American Whitewater Affiliation (AWA), the Conservation Law Foundation (CLF), the Deerfield River Watershed Association (DRWA), and Trout Unlimited (TU). The Vermont Natural Resources Council *opposes* relicensing the Deerfield River Project as proposed by NEP.

[9] None of the WQCs are inconsistent with each other or with the Settlement. However, the Vermont WQC included measures not included in the Settlement.

[10] 68 FERC ¶ 61,078

reduce energy generation and net power benefits from existing conditions by 27.0 percent and 85.5 percent, respectively.

For the Gardners Falls Project, the current average annual generation is about 16,800 MWh. WMEC's proposed environmental measures as affected by the Settlement would reduce this generation about 1,663 MWh annually. These measures include: a seasonal minimum flow, downstream fish passage facilities, nature trail, canoe launch and access, soil erosion control plan, and a cultural resources management plan. The conditions of the WQC issued by MA DEP for the Gardners Falls Project would reduce the annual generation about 1,760 MWh and net annual power benefits by $136,000.

In addition to the proposed actions, the Staff evaluated the no-action alternative and agency/NGO recommendations. The issues addressed in this FEIS are the impacts of the proposed action and alternatives to: (1) water quality and quantity, (2) fish resources, (3) terrestrial resources, (4) recreational resources, (5) geology and soils, (6) aesthetic resources, (7) archeological and historic resources, and (8) air quality. Cumulative effects of the proposed actions and alternatives on water quality and quantity, anadromous fish resources, fish habitat, wetlands, recreation and land use, aesthetic resources, and hydroelectric generation were also analyzed in this FEIS.

Since the proposed actions and alternatives involve tradeoffs between energy production and enhancement of environmental quality, we gave equal consideration to developmental and non-developmental values in accordance with the FPA. Based on our independent review and evaluation, Staff recommends relicensing the Deerfield River Project as proposed by NEP in the Settlement, Cultural Resources Plan, and the provisions of the WQCs. Staff also recommends approving almost all aspects of the settlement and amending the license of the Bear Swamp Pumped Storage Project, upon receipt and notice of an amendment application. Staff selected the Settlement and Cultural Resources Management Plan over that proposed by VNRC, because the additional environmental benefits of VNRC's recommendations were only slightly higher or in some cases might have a negative impact on environmental resources. When we compared the benefits to the costs of implementing VNRC's recommendations, we found the costs exorbitant---30 percent greater in terms of decreased net power benefits than NEP's proposal. Finally, Staff found that for the most part, NEP's proposal embodied in the Settlement and the Cultural Resource Management Plan to be well balanced and providing a good mix of environmental enhancement and power benefits.

For the Gardners Falls Project, we recommend relicensing the proposed project with additional staff recommended measures. Measures that we recommend in addition to WMEC's proposed measures include: implementation of the stipulations contained in the Programmatic Agreement and the Massachusetts WQC.

Pursuant to Section 10(j) of the FPA, we found that **no** Federal or state fish and wildlife agency recommendations for the Deerfield River and Gardners Falls Projects conflict with the comprehensive planning and public interest standards of Sections 4(e) and 10(a) of the FPA.

We believe our recommendations would be best adapted to a comprehensive plan for the use of water power development while concurrently protecting and enhancing environmental resource values and uses. Issuing a new license for the Deerfield River Project and amending the license for the Bear Swamp Project in accordance with the Settlement would assist in the restoration of anadromous fish and the enhancement of resident fish and recreational use along the Deerfield River. Issuing a new license for the Gardners Falls Project would assist in the restoration of anadromous fish and recreational enhancement along the lower Deerfield River. Relicensing the Deerfield River Project and the Gardners Falls Project would allow NEP and WMEC, respectively to operate their projects as beneficial and dependable sources of electric energy.

1. PURPOSE AND NEED FOR ACTIONS

1.1 PURPOSE OF ACTIONS

The proposed actions pending before the Commission consist of three separate interrelated actions. The first proposed action deals with the relicensing of the 76.9-MW Deerfield Project which is embodied by the proposed Settlement and a Cultural Resource Management Plan. The Settlement (filed on October 6, 1994) purports to resolve all issues regarding: fisheries, fish passage, wildlife, water quality, project land management and control, recreation, and aesthetics associated with the Deerfield Project. The second proposed action deals with the relicensing for the 3.6-MW Gardners Falls. License applications for these two projects were filed by NEP on December 27, 1991, for the Deerfield Project and by WMEC on December 23, 1991, for Gardners Falls Project. Finally, the third proposed action consists of a change in project operation, of the Commission licensed 611.25 MW Bear Swamp Pumped Storage Project. The FEIS will make recommendations to the Commission on all three of the above actions.

This FEIS is prepared as required by NEPA[1] and Commission regulations, to provide the Commission with descriptions and evaluations of the potentially significant environmental effects associated with the three aforementioned actions. The FPA[2] provides the Commission with the exclusive authority to license nonfederal water power projects on navigable waterways and federal lands.

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

In this FEIS, staff assesses the environmental and economic effects of continuing to operate: (1) the Deerfield Project as proposed in the Settlement and CRMP, (2) the proposed Gardners Falls Project, and (3) modifications to the Bear Swamp Pumped Storage Project. We also assess the impacts associated with and the effects of the no-action alternative.

1.2 NEED FOR POWER

Deerfield Project

The seven hydropower generating facilities owned by NEP have a total nameplate capacity of 76.9 MW. The total average annual energy production of the seven facilities is approximately 289 GWh. The eighth facility, Somerset dam, is a storage facility only (Figure 1-1, Table 1-1).

The service area of NEP as well as its eight Deerfield hydropower facilities for which the utility company is applying for a new license is located in the NEPOOL Sub-Region of the NPCC Region.

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

2 16 U.S.C. §§791(a)-825(r), as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986) and the Energy Policy Act of 1992, Public Law 102-486 (1992).

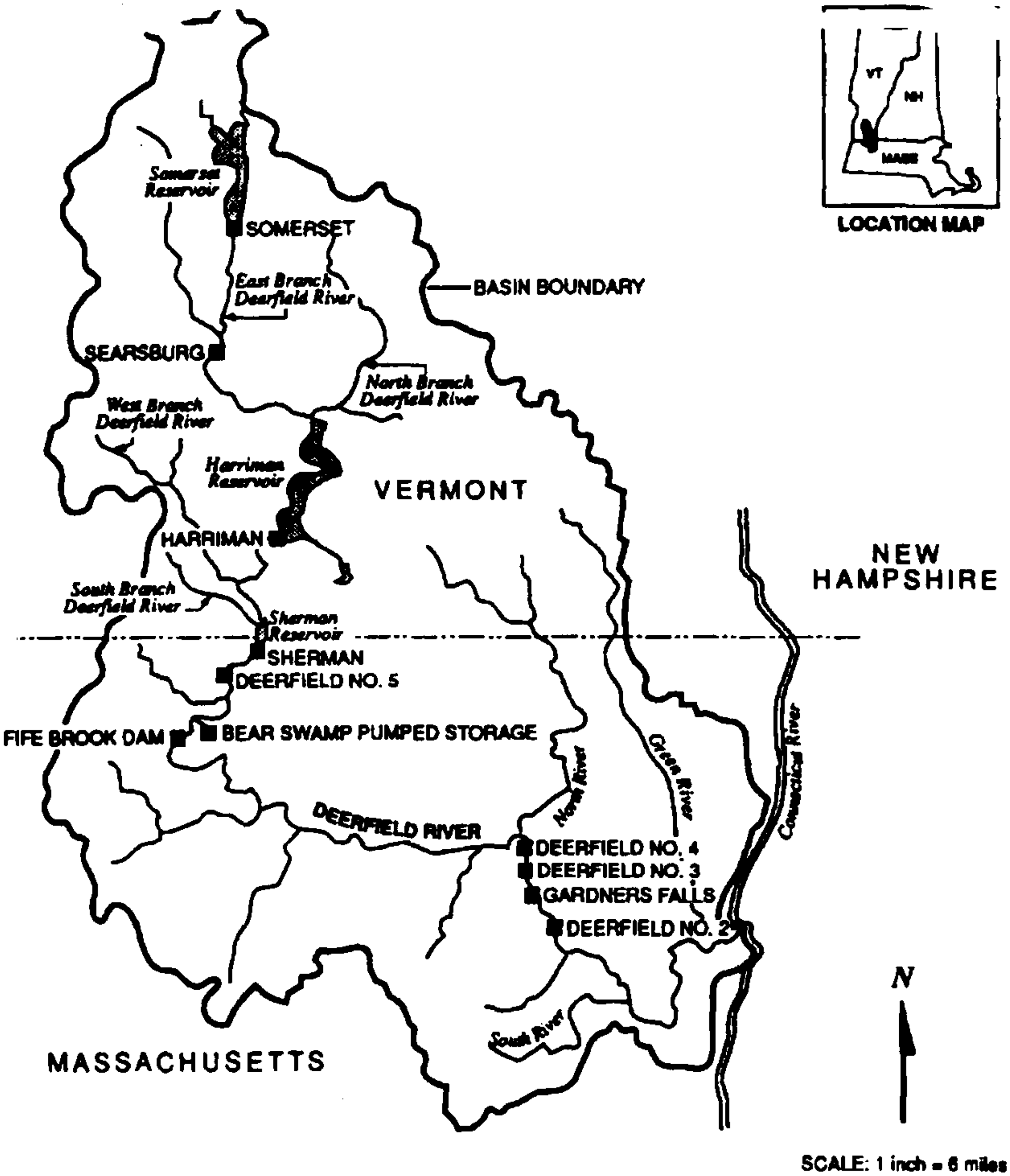

Figure 1-1. Location of the Deerfield River Project developments, Gardners Falls Project, and the Bear Swamp Project.

Table 1-1 Electric generating facilities on the mainstem and the East Branch of the Deerfield River (Source: NEP 1991, as modified by Staff).

Station Name / (Project No.)	Approximate River Mile (RM)	Operational Date	State	Type	Capacity (MW)
Somerset (2323)	66.0	1913	VT	Storage	0
Searsburg (2323)	60.3	1922	VT	Hydroelectric	4.16
Harriman (2323)	48.5	1924	VT	Hydroelectric	33.60
Sherman (2323)	42.0	1927	VT / MA	Hydroelectric	7.20
Yankee Atomic	42.0	1961	MA	Nuclear Power	shut down
No. 5 (2323)	41.2	1915	MA	Hydroelectric	17.55
Bear Swamp (2669)	39.0	1974	MA	Pumped Storage	600
Fife Brook (2669)	37.0	1974	MA	Hydroelectric	11.25
No. 4 (2323)	20.0	1915	MA	Hydroelectric	4.80
No. 3 (2323)	17.0	1915	MA	Hydroelectric	4.80
Gardners Falls (2334)	15.7	1904	MA	Hydroelectric	3.58
No. 2 (2323)	13.2	1915	MA	Hydroelectric	4.80

In the Introduction to the NEPOOL section of the 1994 NPCC OE-411 Report, the annual compound growth rate for 1994 through 2003 is forecast to be 1.3 percent for the summer peak-hour load, 1.3 percent for the winter peak-hour load, and 1.4 percent for annual net energy requirements. These data are consistent with the conclusion that load growth is a monotonically increasing entity, and consistent with the conclusion that a need for power that exists during the near term will most probably exist into the long term.

The Deerfield No. 5 development, owned by NEP, has been in operation for 20 years and the other six facilities with generation included in the Deerfield Project have been in operation for 67 years or longer.

The cited lengthy periods of operating history during which the seven generating facilities have supplied New England's customers with low-cost energy produced by generating facilities which produce no atmospheric pollution and consume no non-renewable primary energy--when considered alongside of the OE-411 Report data--support, in adequate fashion, NEP's short term and long term needs for the electricity generated by the Deerfield Project.

Gardners Falls Project

The nameplate capacity of WMEC's Gardners Falls Project is about 3.6 MW and the average annual energy generation from the facility is expected to be 14.0 GWh. WMEC's Gardners Falls Project has been in operation for 90 years. This very long period of operation, and the OE-411 Report on load-growth data, demonstrates WMEC's short term and long term needs for the electricity generated by the Gardners Falls Project.

Demand Side Management Programs

Both NEP and WMEC utilize DSM programs to improve electricity consumption at the point of end use. DSM is the technical term presently being used to include both electric energy conservation and load management. Load management programs were--in earlier times--designed primarily to reduce peak-hour demands for additional capacity, or to defer the need for additional generating capacity. Load management and energy conservation--it should be noted; however, are not, in their effects, completely independent.

The DSM programs deserve careful consideration in any discussion of "Need for Power" issues. Projected benefits from DSM programs are incorporated in projected peak-hour demand and projected generating resources data which appear in the annual OE-411 Reports--for on-going 10-year planning periods. Electric utilities give serious and careful consideration to the DSM programs which are cost-effective in their system operation. The DSM programs of the applicants--NEP and WMEC--will be discussed separately in this document.

NEP has implemented most, if not all, of the DSM programs which major utilities have found cost-effective. The list of programs being pursued by NEP and WMEC, and which follows below, is an abbreviated list which includes only a few of these programs, as examples:

Commercial/Industrial Programs:

Cooperative Interruptible Service - Large commercial/industrial customers agree to shed part of their load on peak days when requested by the Companies.

Energy Initiative - Offers financial assistance to facilitate the installation of comprehensive electricity saving measures in existing facilities, and improve customer management of electricity use.

Residential Programs:

Energy Crafted Homes - Training, financial incentives and promotional marketing are provided to builders of efficient new housing.

Energy Fitness - This program installs conservation measures in the homes of customers who reside in predominantly low-income neighborhoods.

Residential Electric Space Heating - This program promotes the installation of insulation, air sealing and other conservation measures in electrically heated homes.

Based on review of NEP's DSM programs which appear in Section H of NEP's Application for a new license (NEP 1991), we find that NEP has an effective energy consumption efficiency program.

WMEC is required by the MA DPU to file its conservation and load management programs with the Department annually for approval. WMEC states that it has complied with this requirement since its existence began in 1990. WMEC states in their license Application (WMEC 1991) that all of its programs comply with the directives set forth by the MA DPU.

WMEC has in-place and on-going, most if not all, of the DSM programs which major utilities have found to be cost-effective. A limited number of examples of programs being pursued by WMEC follows:

Mass-Save Energy Conservation Services - Mass-Save is a non-profit consortium of Massachusetts utilities which provides various conservation services to utility customers.

SPECTRUM - Single Family Electric Heat - This program provides the maximum amount of cost-effective services to electrically heated homes possible.

SPECTRUM - Multifamily Electric Heat - This program provides electric conservation measures to electrically heated residential buildings containing five or more dwelling units.

SPECTRUM - Public Housing - This program provides comprehensive conservation services to Public Housing Authorities, targeting units with electric heat, domestic hot water, and general service buildings.

In addition to the above programs, Appendix J of WMEC's Application for a new license for its Gardners Falls Projects (WMEC 1991) lists and describes about a dozen other DSM programs. Based on a review of WMEC's DSM programs listed in Appendix J, we find that WMEC has put forth a good-faith effort to comply with, and support the objectives of ECPA. Both NEP and WMEC have built energy conservation and load management into their projections of future need for power. We further conclude that energy conservation is not a mutually exclusive alternative to the licensing of the projects with which this FEIS is concerned.

1.3 SCOPE OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT

The Commission issued a Public Notice of the Settlement on October 19, 1994, pursuant to 18 CFR Section 385.602(b), and a notice on October 27, 1994, of our intent to prepare an EIS and to conduct public scoping meetings. A notice issued on October 31, 1994, scheduled project site visits in Massachusetts and Vermont.

We reviewed public and agency comments filed with the Commission; prepared an SDI (issued October 1994); visited the project sites on November 14 through November 16, 1994; held public scoping meetings in Buckland, Massachusetts and Wilmington, Vermont on November 15 and 16, 1994, respectively; held an agency scoping meeting in Shelburne Falls, Massachusetts on November 17, 1994; and reviewed public and agency comments resulting from this scoping process.

Based on the scoping comments received on SDI, the license applications as supplemented,[3] the proposed Settlement, agency comments, and preliminary staff analysis, we prepared and distributed to agencies, NGOs, the public, and interested parties SDII (issued January 1995), which identified the issues to be addressed in this FEIS. These issues include potential impacts to and effects on: (1) geology and soils, (2) water quality and quantity, (3) fishery resources, (4) vegetation and wildlife resources, (5) threatened and endangered species, (6) recreation and land use resources, (7) aesthetic resources, (8) cultural resources, (9) socioeconomic resources, and (10) air quality.

We also reviewed all resources to see whether they could be affected in a cumulative manner by the proposed actions, other hydroelectric projects, and non-hydro activities and we then used this information to determine the geographic and temporal scope of our cumulative effects analysis. In SDII, we identified: (1) water quality and quantity, (2) anadromous fishery resources, (3) wetlands and dependent terrestrial resources, (4) recreation and land use, (5) aesthetic resources, and (6) hydroelectric generation as resources that could be affected in a cumulative manner by the Deerfield Project and Gardners Falls Project, the Settlement and proposed actions, and other activities in the Deerfield River Basin. These issues are addressed in this FEIS.

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[3] The Deerfield Project (FERC No. 2323) license application was supplemented with filings of additional information on January 10, 1994; January 18, 1994; and February 22, 1994. The Gardners Falls Project (FERC No. 2334) license application was supplemented with filings of additional information on March 16, 1992; December 11, 1992; February 11, 1993; and on June 16, 1993, with the filing of supplemental information pertaining to the Soil Erosion and Sediment Control Plan.

The alternatives for action on to continued operation of the Deerfield River, Bear Swamp, and Gardners Falls Projects, as proposed in the Settlement and by NEP and WMEC, and described herein include: (a) no action, *i.e.*, continued operation as required by the existing licenses; and (b) continued operation of the projects as proposed, with modification recommended by Federal and state resource agencies, NGO's, other entities, or staff.

1.3.1 PROJECT INTERACTION AND CUMULATIVE EFFECTS

1.3.1.1 Geographic Scope

The geographic scope of our cumulative effects analysis defines the physical limits or boundaries of the proposed actions' and alternatives' effects on: (1) water quality and quantity, (2) anadromous fishery resources, (3) fisheries habitat, (4) wetlands, (5) recreation and land use, (6) aesthetics, and (7) hydroelectric generation. Since the proposed actions and alternatives affect the various resources differently, the geographic scope for each resource varies.

For water quality and quantity and anadromous fisheries resources, the geographic scope of analysis will encompass the East Branch of the Deerfield River and the mainstem Deerfield River downstream to the confluence with the Connecticut River (Figure 1-1). We chose this geographic scope because of fish habitat and fish passage related issues occurring within the projects-influenced Deerfield River Basin.

For wetlands and dependent wildlife resources, the geographic scope is the mainstem of the Deerfield River and the East Branch of the Deerfield River downstream to the confluence with the Connecticut River (Figure 1-1). We chose this geographic scope because of the extent and value of existing wetlands along the Deerfield River and the possible cumulative effects of the projects' operation on wetlands.

For recreation, land use, and aesthetic resources, the geographic scope of analysis will encompass the East Branch and mainstem Deerfield River from the headwaters of the Somerset impoundment downstream to the confluence with the Connecticut River, including all impoundments and riverine reaches, all project lands, and all non-project shoreland areas adjacent to the impoundments and riverine reaches. We chose this geographic scope for recreation and land use in this area because these resource areas are affected by the operation of the existing hydroelectric developments at the Deerfield River, Bear Swamp, and Gardners Falls Hydroelectric Projects. Moreover, for recreational whitewater boating, we will also consider regional recreational whitewater boating resources. We chose this focus for recreational resources because whitewater boating resources and opportunities are of a regional nature, requiring whitewater recreationists to drive to various locations at different times of the year in order to find adequate river flows in the rivers of the region, as well as, varying degrees of challenge. We chose the same geographic scope of analysis for aesthetic resources to cover all project-related alterations to the Deerfield River landscape.

For hydroelectric generation, the geographic scope of analysis will encompass the East Branch of the Deerfield River and the mainstem Deerfield River downstream to the confluence of the Connecticut River. We chose this geographic scope because of the operational effects (peaking operation and minimum flows) the proposed projects have on each other in the Deerfield River Basin.

For the remaining resource areas (in Section 3.3), we focus our analysis on the site specific project areas of the Deerfield Project and Gardners Falls Project.

1.3.1.2 Temporal Scope

The temporal scope of our cumulative effects analysis includes a discussion of the past, present, and future actions and their effects on water quality and quantity, anadromous fishery resources, fisheries habitat, wetlands, recreation and land use, aesthetic resources, and hydroelectric generation. Based on a likely new license term of 30 to 50 years we have looked 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions (for example, the effect on anadromous fisheries, wetlands, and whitewater boating from potential future water withdrawals within the Deerfield River Basin). The historical discussion was, by necessity, limited by the amount of available information for each resource. Future actions affecting each of the cumulatively affected resources are also limited to available information. We've identified the present resource conditions based on the license applications, the Settlement, and previous comments. These are documented in this FEIS. The quality and quantity of information, however, diminish as we analyze resources further away in time from the present.

2. PROPOSED ACTIONS AND ALTERNATIVES

2.1 CURRENT PROJECT OPERATION

2.1.1 Deerfield Project

The eight individual developments are listed below from the most upstream development to the downstream developments.

2.1.1.1 Somerset

NEP operates the Somerset Development as a seasonal storage reservoir that supplies a constant and reliable source of water for seven (excluding Gardners Falls and Bear Swamp Pumped Storage Projects) other hydropower developments located downstream on the Deerfield River. The Somerset Development has no hydropower generating capabilities. An earthfill dam, about 110 feet high, impounds the 5.6-mile long, 1.1-mile wide reservoir, which has a surface area of about 1,514 AC at maximum pool with a gross storage capacity of about 57,345 acre-feet. During normal operations, Somerset reservoir has an average maximum winter drawdown of 15 feet and an average summer drawdown of 5 feet. The amount of drawdown varies seasonally depending on the amount of precipitation. In wet years drawdowns may exceed 15 feet and in dry years the drawdowns would be less than 15 feet. Maximum normal reservoir elevation is reached in May, followed by a slow drawdown until December, and then a steady drawdown to minimum reservoir elevation in March. The reservoir refills during the period from March to May. Typically, during the winter period from December 1 to March 31, flows are released from the Somerset reservoir to ensure the 24-hour operation of the downstream Searsburg development.

The development has several water release points: a fixed opening pipe at the Somerset dam gatehouse releases a constant minimum flow of about 4 cfs, and during the winter months about 120 cfs is released from the main outlet works. In addition, there are two other gates that can be opened to release additional flows and these gates are usually opened twice a week to release flows under normal flow conditions. Gate changes must be done manually, on site. Currently, there is no minimum flow required from the Somerset Development, but since 1963, NEP has voluntarily released 4 cfs to enhance fishing opportunities in the East Branch of the Deerfield River.

2.1.1.2 Searsburg

NEP operates the Searsburg Development as a daily peaking project. Flow into the Searsburg reservoir is from regulated releases from the Somerset reservoir and from unregulated inflow from the Deerfield River. The Searsburg Development operates over a range of headwater elevations on a daily basis to provide peaking hydropower. The project dam is about 50 feet high. From May 1 to October 31, five-foot-high flashboards are maintained on the dam. During this period, NEP operates the Searsburg reservoir over an eight-feet range, from three feet below the spillway crest up to the crest of the five-foot-high flashboards. From November 1 to April 30 the flashboards are removed and the reservoir operates between spillway crest and three feet below the crest. Any flows in excess of hydraulic capacity of the plant (340 cfs) are spilled and during times of low water supplies naturally, water is released from the Somerset reservoir to provide sufficient flow to operate the development. During the period of winter drawdown from Somerset Reservoir (December 1 to April 1) the Searsburg development is operated as a run-of-the-river project. The continuous operation also keeps the wooden penstock from freezing. During spring runoff or during other high water periods, a 24-hour operation is also conducted. There is a 3.5-mile long bypassed stream reach where there is no required minimum flow from this development and there are no other streams emptying into this bypassed reach.

2.1.1.3 Harriman

NEP operates the Harriman Development as a daily peaking project. The Harriman Development, like the Somerset Development, functions as a seasonal storage reservoir that holds spring and fall runoff and releases the captured water to augment downstream flows during the summer and winter dry periods. Harriman reservoir, impounded by a 215.5-foot-high earthfill dam, is drawn down an average maximum of 42 feet during the winter and an average maximum of 11 feet from the spillway crest during the summer under typical hydrologic conditions. There have been occasions (for example, in March 1987, the reservoir was drawn down 50 feet in anticipation of an approaching storm) historically (from 1940 to the present) when the reservoir was drawn down as much as 75.36 feet to 1416.3 feet msl.

The reservoir is typically filled in May and falls (or drains) slowly into December, then falls steadily to normal maximum winter drawdown in March. The reservoir refills to normal full pool elevation between March and May. Like the Somerset Development, the amount of drawdown also varies seasonally depending on the amount of precipitation. There is a 4.4-mile-long bypassed stream reach below the Harriman dam. This bypassed reach receives flows during times of spill, from leakage from the Harriman dam, and from the West Branch of the Deerfield River that empties into the lower portion of the bypassed reach.

The hours of generation at Harriman powerhouse are dependent on the time of year and flow conditions. During periods other than the spring freshet, Harriman powerhouse operates to provide peak power and augment downstream flows for several hours between 7:00 a.m. and 11:00 p.m., Monday through Friday. During the spring runoff period, when water is being ponded into the reservoir, Harriman's generation is curtailed to fewer hours per day.

The Harriman development has three water release points: (1) all spill is through the morning glory spillway which has a fixed crest elevation of 1491.66 feet msl, to which six-foot-high flashboards are added to bring the crest to 1497.66 feet msl. A 21.5-foot-high horseshoe-shaped tunnel discharges water from the spillway to the downstream channel (the bypassed reach); (2) a 12,812-foot-long horseshoe-shaped concrete tunnel carries water to the powerhouse where it is released into the river; and (3) a 4-foot diameter pipe located at elevation 1315.96 feet msl that leads from the original construction diversion tunnel to the morning glory spillway tunnel. Currently, there is no minimum flow required to be released from the Harriman Development.

2.1.1.4 Sherman

NEP operates the Sherman Development as a daily peaking project. The Sherman Development can be operated manually on site or remotely from the Harriman Development. The Sherman reservoir typically fluctuates over the height of the four-foot flashboards on a weekly basis. Typically, the reservoir, impounded by a 110-foot-high earthfill dam, is kept at full pond on Monday morning with a general drawdown occurring over the week. Flows into Sherman reservoir are comprised of regulated releases from the Harriman Development (which empties directly into the Sherman reservoir) and from unregulated flows entering the Deerfield River from its West and South Branches. The South Branch, the Tower Brook, and the Wheeler Brook, also empty directly into the Sherman reservoir. The periods of operation of the Sherman Development are dictated by Harriman's operation, unless there are high flows in the river and then the Development will operate continuously. Occasionally, the reservoir level is drawn down 7 feet to meet peak power demands or to create storage in anticipation of high runoff. The Sherman reservoir formerly provided once-through cooling water for the YAEC nuclear generating station located on the reservoir at Rowe, MA. The Sherman powerhouse discharges directly into the Deerfield No. 5 impoundment.

2.1.1.5 Deerfield No. 5

NEP operates the Deerfield No. 5 Development in a daily-peaking mode, similar to the peaking operation of the Sherman Development. The reservoir, impounded by a 35-foot-high dam and a 12-foot-high diversion structure on Dunbar Brook, typically fluctuates over a five-foot range on a daily basis. There is a constant minimum flow release of 25 cfs into the 2.6-mile-long bypassed stream reach. Deerfield No. 5 discharges directly into the Fife Brook Impoundment, which is the lower reservoir for the Bear Swamp Project. Because of Bear Swamp's alternating pumping and generating operation, fluctuations in water levels in the Fife Brook Impoundment are dependent upon Bear Swamp's operations as well as the releases from the Deerfield No. 5 powerhouse. Flows released from the Deerfield No. 5 powerhouse range from 500 to 1,250 cfs.

2.1.1.6 Deerfield No. 4

NEP operates Deerfield No. 4 Development in a daily peaking mode. The development is operated on-site. The reservoir, impounded by a 50-foot-high dam, fluctuates 6 to 8 feet on a daily basis depending on the season and river flows. During the high flows occurring in the spring, the flashboards are removed and the water level in the reservoir fluctuates between the crest of the spillway and 8 feet below the spillway. In the months of June through October, the flashboard height is 8 feet and this level is reduced to 6 feet for November through May. The flashboards are removed for the months of March through May.

The Deerfield No. 4 powerhouse generates between 7:00 a.m. and 11:00 p.m.., Monday through Friday. The No. 4 powerhouse and the downstream projects of No. 3, Gardners Falls, and No. 2 are typically operated on the same demand schedule since there is little impoundment storage at any of these sites.

There is a 1.5-mile-long bypassed stream reach. Flows released from Deerfield No. 4 are used to operate the downstream Deerfield No. 3 development. Flows between 100 and 1,470 cfs (hydraulic capacity) are released from the powerhouse into a free-flowing stretch of river. The Deerfield No. 4 development is located downstream from a 17-mile free-flowing stretch of the Deerfield River.

2.1.1.7 Deerfield No. 3

NEP operates Deerfield No. 3 Development in a daily peaking mode during the five-day work week. The development is operated on-site or remotely from the Deerfield No. 4 powerhouse. Water is stored in the reservoir on weekends. Flow into the Deerfield No. 3 reservoir is from regulated releases from Deerfield No. 4 and from unregulated inflow, primarily from the North River. Under high water conditions, the powerhouse generates continuously. The reservoir, impounded by a 15-foot-high dam, fluctuates over the height of the 6-foot flashboards on a daily basis. Flows in excess of the hydraulic capacity of the development (1,490 cfs) are spilled. The 0.4-mile-long bypassed reach receives flow from local drainage and there is currently no minimum flow. The Deerfield No. 3 powerhouse discharges into a section of the Deerfield River that is impounded by the Gardners Falls Project.

2.1.1.8 Deerfield No. 2

NEP operates the Deerfield No. 2 Development in a daily peaking mode. Water stored between the 70-foot-high spillway and the 6-foot flashboards are used to generate power. During non-peak periods, the Development releases an average hourly minimum flow of 100 cfs with no shutdown longer than four hours as required by the Massachusetts WQC. Flow into the Deerfield No. 2 reservoir is from regulated releases from the upstream Gardners Falls Project and from minor unregulated inflows. Under high water conditions in the spring, the development operates continuously up to its hydraulic capacity of 1,490 cfs. Any excess flows above 1,490 cfs are spilled. Flows released from the powerhouse range from 150 to 1,490 cfs.

2.1.2 Gardners Falls Project

WMEC fluctuates the reservoir, impounded by a 30-foot-high dam, up to 1.8 feet on a daily basis in response to river inflow and for project operation. The bypassed reach is 1,400 feet long and about 100 feet wide. Flows to the project are regulated by NEP releases from its Deerfield No. 3 development located about 1 mile upstream and may vary considerably. There are periods when project inflow is reduced or eliminated. Normally, spillage into the bypassed reach occurs when project inflows exceed the plant hydraulic capacity of 1,420 cfs. There is also some leakage from the dam. Spillage usually occurs between 5 and 77 percent of the time.

The Gardners Falls Project is semiautomatically operated with manual overrides. The four existing units are controlled by float sensors that activate the units depending on water levels at the canal intake on the impoundment. Under automatic float control, the four units sequentially pick up or reduce load as the pond elevation varies according to the following schedule:

Unit No.	Pond Elevation Start Generation (feet)	Pond Elevation Stop Generation (feet)
5	334.0	333.0
4	334.2	333.2
3	334.4	333.4
2	334.6	333.6

The maximum hydraulic capacity is 1,420 cfs. Inflows are currently stored until the pond level reaches the first set point, initiating generation of the first unit. Flows greater than the hydraulic capacity of the station are spilled at the dam.

Operation of the project is dependent upon flows that are received from upstream projects owned and operated by NEP. NEP uses their upstream storage capability to capture high spring flows for releases throughout the year. The Gardners Falls project utilizes flows that are released from these upstream projects in a pond-and-release mode, utilizing a 1.8-foot drawdown to match, insofar as possible, the inflows from upstream to the hydraulic capacities of the project turbines.

2.1.3 Bear Swamp Project

The Bear Swamp is a pumped-storage project. Under its current daily peaking operating scenario, 125 cfs or inflow is released from July 1 to August 31 and 75 cfs from September 1 to June 30 from the lower reservoir at Fife Brook dam.

2.2 PROPOSED PROJECTS

2.2.1 Deerfield Project

The proposed Deerfield Project consists of a Settlement and CRMP. The Settlement is a negotiated agreement among NEP and 12 resource agencies and interested parties (see Appendix A for a copy of the Settlement). The Settlement purports to resolve all issues regarding: fisheries, fish passage, water quality and quantity, wildlife, project lands management and control, recreation, and aesthetics associated with the Deerfield Project. The Settlement also contains streamflow provisions for the Commission licensed Bear Swamp Project, which would require amendment of its license. The primary objective of the Settlement is to create an optimal blend of beneficial mitigation and enhancement measures and power benefits for the Deerfield River watershed from the headwaters in Vermont to the confluence with the Connecticut River in Massachusetts.

The 13 signatories to the Settlement, filed on October 6, 1994 and noticed on October 19, 1994, include: NEP, EPA, NPS, USFWS, MA DFW, AR, AWA, AMC, CLF, DRC, DRWA, NE FLOW, and TU.

None of these parties to the Settlement recommended in their final comments on the application any measures that conflict with the terms of the Settlement. The VANR issued a WQC for the project developments in Vermont containing measures that conflict with the Settlement, but not significantly (Section 2.3.1.1.1 summarizes WQC conditions and section 4.2 discusses their effects). The VNRC filed recommendations to stabilize reservoir fluctuations in Vermont that would conflict with the flow releases of the Settlement. In summary, the Settlement (NEP 1994) sets forth the following general enhancements:

- reservoir management restrictions and fishery flows;
- capital expenditures for fish passage and flow control facilities;
- scheduled flow releases for whitewater boating below Fife Brook Dam and the Deerfield No. 5 Dam;
- recreation facilities development at the Deerfield Project, as described in NEP's proposed Recreation Plan for the Deerfield Project as a supplement to the application for new license (NEP 1993);
- a Deerfield River Basin Environmental Enhancement Trust Fund of $100,000 (1994 dollars) for watershed conservation, recreation, and education projects and facilities, as proposed by nonprofit organizations, educational institutions, and units of government in Vermont and Massachusetts;
- various wildlife measures (as detailed in response to Additional Information Request #19, filed by NEP on October 1, 1993);
- potential conservation easements on up to 15,736 AC in Vermont and 1,564 AC in Massachusetts, of project and non-project lands owned by NEP to be granted to qualified government or non-government land management organizations to provide for the continued preservation in their natural state in order to protect existing scenic, forestry, and natural resource values; reimbursement of easement holders' reasonable costs for monitoring and enforcing the terms of the conservation easements; and granting easement holders an option to purchase the lands at fair market value if the conservation easements are not renewed at the end of the licenses; and
- establish Forest Management Guidelines for NEP's timber management programs at the Deerfield Project to protect riparian zones, visual quality within important viewsheds, limit the use of vegetative clear cutting, reduce soil erosion, and protect and manage wildlife habitat.

The Settlement establishes the following enhancement measures specific to each of the Deerfield Project developments and the Bear Swamp Project (beginning with the most upstream development to downstream). No enhancements were proposed at the Sherman development. The recreation plan proposes the staged development and improvement of 38 facilities at the project over a 10-year period following the issuance of a new project license. The Settlement includes:

Somerset

- limit impoundment fluctuations to ± 1 foot during the period May 1 through July 31 to facilitate common loon waterfowl nesting.
- release minimum flows to the Deerfield River downstream of Somerset reservoir of: (a) 12 cfs from May 1 to September 30, (b) 30 cfs from October 1 through December 15, (c) 48 cfs from December 16 to February 28, and (d) 30 cfs from March 1 to April 30 (*Note*: from May 1 to July 31, flow may be reduced to 9 cfs if necessary to maintain reservoir elevations).
- maintain active beaver flowages through the implementation of a Beaver Management Plan.

- install various artificial nesting structures to include: wood duck boxes, black duck baskets, loon rafts, and osprey nesting platforms around the Somerset reservoir.

Searsburg

- release the lesser of 35 cfs or inflow from June 1 to September 30 and release 55 cfs or inflow from October 1 to May 31 to the bypassed reach of the Deerfield River downstream of the Searsburg Dam to provide potential for spawning of landlocked Atlantic salmon and for a year-round cold water fishery.

Harriman

- maintain rising or stable reservoir levels during the period May 1 through June 15 each year; and from June 16 through July 15, the reservoir water level elevation will drop no more than 1 foot per day.

- release a flow of 70 cfs from October 1 to June 30 and 57 cfs from July 1 to September 30 to the Harriman bypassed reach (4.4 miles-long) to develop a year-round cold water fishery.

Deerfield No. 5

- release the lesser of 73 cfs or inflow (although inflow will not be less than the 57 cfs guaranteed at Harriman) for a year-round cold water fishery.

- provide 32 whitewater releases of an average flow of 1,000 cfs during each year from May through October in accordance with a monthly allocation schedule for whitewater boating opportunities; weekend or holiday releases would be of five hours duration, and Friday releases would be of four hours duration.

Deerfield No. 4

- release the lesser of 100 cfs or inflow from October 1 to May 31 and the lesser of 125 cfs or inflow from June 1 to September 30 for cold water fishery opportunities.

- provide downstream fish passage for Atlantic salmon.

Deerfield No. 3

- release the lesser of 100 cfs or inflow to protect smallmouth bass fishery habitat and public uses such as swimming.

- provide downstream fish passage for Atlantic salmon.

Deerfield No. 2

- release a flow of 200 cfs to provide a quality resident cold water fishery and enhance summer canoeing flows.

- provide upstream and downstream passage for Atlantic salmon.

<u>Additional Measures Proposed But Not Part of Settlement (NEP filing October 1993)</u>

- Prepare and implement a CRMP in consultation with the Vermont and Massachusetts SHPOs, including:

- operate and maintain the Deerfield Project developments so that National Register-eligible elements of the developments are protected from possible adverse effects of routine activities at the Deerfield Project;

- consult with affected SHPO to ensure that potential effects are avoided where feasible or that appropriate mitigation is incorporated into any alteration of National Register-eligible components (including demolition and/or replacement);

- monitor archeological sites and sensitive areas to ensure that archeological resources are not being affected by Project operation, and develop a mitigation strategy if any such resources are affected; and

- provide means for taking into account any previously unidentified cultural resources which may be discovered during the term of any license issued.

- Follow appropriate standards and guidelines when conducting additional cultural resource surveys or archeological data recovery.

2.2.2 Gardners Falls Project

WMEC proposes to: (1) release a continuous minimum flow (when available from inflow) from the Gardners Falls Project dam of 50 cfs and a supplemental flow release of 100 cfs from the powerhouse area during April, May, and June of each year when the powerhouse turbines are not operating and inflow permits; (2) provide downstream fish passage facilities for out migrating Atlantic salmon smolts; (3) develop a new canoe launch at Wilcox Hollow, including access for the disabled; (4) develop a self-guiding nature trail with signs along the project canal; (5) provide improved canoe access to the impoundment near the project dam; (6) implement the "Soil Erosion and Sediment Control Plan" (dated June 15, 1993) during construction of proposed recreational facilities; and (7) in consultation with the Massachusetts SHPO, prepare and implement a CRMP to avoid or minimize disturbances to currently identified historical and archeological resources at the Gardners Falls Project and any others that may be identified in the future.

2.2.3 Bear Swamp Project

No change in existing project facilities is proposed. Per the Settlement, NEP proposes to:

- release a flow of 125 cfs from Fife Brook dam year-round to maintain a high quality cold water fishery.

- provide 3-hour whitewater flow releases of at least 700 cfs on 106 days annually from April through October in accordance with a monthly allocation schedule for whitewater boating opportunities.

- develop recreation facilities described in NEP's proposed Recreation Plan (NEP 1993).

- establish conservation easements on 1,056 acres of NEP owned project land.

2.3 MODIFICATIONS TO THE PROPOSED PROJECTS

2.3.1 Deerfield Project

Several NGOs have recommended that the Commission analyze several alternatives in addition to the proposed Settlement. The VNRC recommends that the Commission analyze alternative operating scenarios for the upstream Vermont projects including a run-of-the-river operation model. Also, TU has expressed some concern over the effects of whitewater releases on aquatic habitat in the reach downstream of the Deerfield No. 5 development. The VANR in their WQC for the Deerfield Project, includes additional conditions for project operations such as minimum flows and ramping rates beyond those measures proposed in the Settlement (see below). Due to these requests and concerns, staff analyzed these recommended actions and conditions in this FEIS (see Section 4.2).

2.3.1.1 Water Quality Certificates

NEP requested a WQC from Vermont, required by the CWA, on December 1991. The application was subsequently withdrawn and refilled in October 1992, June 1993, and January 1994. The VANR issued the final WQC for the Deerfield Project on January 30, 1995. On February 14, 1995, the VNRC and the VFSC appealed to the State of Vermont Water Resources Board, challenging findings, conclusions, and conditions contained in the Vermont WQC for the Deerfield Project. On February 14, 1995, NEP, also filed an appeal. These appeals are pending. The MA DEP issued a WQC on December 14, 1994. We believe several of the conditions required in the WQCs exceed the scope of Section 401 authority because they are unrelated to water quality.[1] This issue would be addressed in any license order issued for the projects. The WQCs are not inconsistent with each other or with the Settlement. However, the Vermont WQC includes measures not included in the Settlement.

Table 2-1. Flow releases required by Vermont WQC for the Deerfield Project (releases are to bypassed reaches except at Somerset and as indicated).

Time Period	Minimum Flow Release (cfs)
Somerset Reservoir	
May 1 - July 31	12 (9)
August 1 - September 30	12
October 1 - December 15	30
December 16 - February 28 (29)	48
March 1 - April 30	30
Searsburg Station	
June 1 - September 30	35
October 1 - May 31	55
April 20 - May 15	175*
Harriman Station	
October 1 - June 30	70
July 1 - September 30	57
April 20 - May 15	175

* Releases provided to the tailrace.

2.3.1.1.1 Vermont WQC

(1) Operate the Deerfield Project in accordance with the minimum-flow schedules shown in Table 2-1.

(2) NEP shall measure instantaneous flows and reservoir levels and provide records of such measurements on a regular basis as per specifications of the VANR.

(3) NEP shall develop and implement a management plan to govern operation of the gates at Somerset Reservoir to meet the instantaneous flows and reservoir levels requirements for protection of loon nesting habitat. The plan is to be implemented no later than the first loon nesting season following license issuance.

(4) Impoundment fluctuation restrictions are specified for Somerset, Searsburg, and Harriman Reservoirs. Maximum gate release of 312 cfs, or inflow is specified for Somerset.

(5) NEP shall develop a Refined Watershed Model in cooperation with VANR in order to better predict the timing and volume of inflow and minimize reservoir winter drawdowns to only those levels necessary to capture spring runoff.

(6) At Searsburg Dam, up to 10 percent of the instantaneous inflow may be placed in storage and the downstream minimum flow requirement adjusted accordingly.

[1] See *Tunbridge*, 68 FERC ¶ 61,078.

(7) DO and temperature conditions shall be monitored at weekly intervals from June through October at three locations: 1) the river channel directly below Harriman Dam; 2) the penstock at Harriman Station; and 3) the Harriman tailrace.

(8) Upon request of the VANR, NEP shall design and implement measures as necessary to meet DO standards and/or raise the water temperature in the Harriman bypassed reach sufficiently to support high quality habitat for aquatic biota and fish, including the provision of a temperature regime that does not impair the growth rates of fish.

(9) NEP shall file with the VANR a plan to mitigate the detrimental effect of increased flows in the Harriman bypassed reach on the state threatened tubercled orchid (*Platanthera flava*). The plan shall include:

- Inventory the Searsburg bypassed reach above Vermont Route 9 in early to mid-July when the tubercled orchid is in flower.

- Locate tubercled orchid plants throughout the Harriman and Searsburg bypassed reaches in July when it is flowering and flag, if necessary, to facilitate re-identification in the fall.

- Releases minimum flows into the Harriman bypassed reach (70 cfs) and the Searsburg bypassed reach (35 cfs) after September 15, and locate and mark all inundated individuals of the tubercled orchid. At the same time potential new habitat would be identified and marked along the new edge of the bank.

- Create favorable habitat for the tubercled orchid in the areas previously identified along the new edge of the bank by removing alders and any other means as required.

- Collect seeds from the inundated tubercled orchids and sow along the new edge of bank using the best means available to insure germination.

- Attempt to move all of the tubercled orchids that will be inundated or harmed by whatever means available.

- Collect seeds from all of the musk flowers and sow in favorable habitat along the new edge of the bank.

- Attempt to move all of the musk flower plants to most favorable habitat along the new edge of the bank.

- Collect seeds from the inundated Canada buret plants and sow in favorable habitat along the new edge of the bank.

- Prior to the first mid-May and in coordination with the Agency, raise water levels up to the required minimum flows in the two bypassed reaches.

- Monitor the tubercled orchid populations on a yearly basis for the next five years and report results to the VANR.

(10) NEP shall provide the VANR with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within one year of the issuance of this WQC.

(11) NEP shall submit a plan for downstream fish passage at Searsburg Dam to be implemented upon request of the VDFW when VDFW determines that establishment of a migratory salmonid fishery in Harriman Reservoir is desirable.

(12) If a request for downstream passage facilities is not made, NEP shall submit a plan for measures to prevent fish impingement and entrainment at the Searsburg Dam intake. The plan may be waived if data on turbine entrainment and mortality shows that it is not necessary.

(13) NEP shall submit a plan for upstream fish passage at Searsburg Dam to be implemented upon request of the VDFW when VDFW determines that it is needed for migratory salmonids.

(14) Within 90 days of issuance of the WQC, NEP shall submit a plan for proper disposal of debris associated with project operation.

(15) Any proposals for project maintenance or repair work involving the river shall be submitted to the VANR for prior review and approval.

(16) NEP shall allow public access to the Deerfield Project area for utilization of public resources, subject to reasonable safety and liability limitations.

(17) Recreational facilities shall be constructed and maintained consistent with the proposed Recreation Plan (NEP 1993).

(18) The Recreation Plan shall be modified to include a portage at Searsburg Dam and a put-in on the river just below the dam.

(19) NEP shall install and operate a telephone flow notification system which informs callers as to approximate flow being released below Somerset Dam. The same system shall be provided when minimum flow releases are provided below Somerset and Harriman Dams.

(20) Upon request by VANR, NEP shall install erosion control measures as necessary to address erosion occurring as a result of use of project recreational facilities.

(21) NEP shall allow VANR to inspect the project area at any time to monitor compliance with certification conditions.

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

(23) VANR may request, at any time, that FERC reopen the license to consider modifications to the license necessary to assure compliance with Vermont Water Quality Standards.

2.3.1.1.2 Massachusetts WQC

(1) Operate the Deerfield Project in accordance with the minimum-flow and reservoir level management schedules shown in Table 2-2.

(2) Construct downstream fish passage facilities at Deerfield No. 4, 3, and 2 dams.

(3) Provide upstream fish passage for salmon at Deerfield No. 2 dam, when triggered by numbers of fish reaching the dam as defined in the Settlement.

(4) Operate projects so not to interfere with designated uses of the Deerfield River and to the maintenance of an integrated and diverse biological community.

(5) Operate the projects in accordance with the provisions included in the water quality certificates (WQC) for the Deerfield Project and any conditions contained in the Offer of Settlement that are related to water quality.

(6) Any construction activities at the projects shall be conducted in compliance with the Massachusetts Wetlands Protection Act.

(7) The applicants shall comply with Massachusetts waterway law.

(8) Conduct all maintenance and repair activity so as not to impair water quality.

(9) Construct and operate recreational facilities as described in the Comprehensive Recreation Plan for the Deerfield Project as described in the Offer of Settlement.

(10) Continue to provide telephone recorded flow information to support the recreational use of the Deerfield River.

Table 2-2. Flow releases required by Massachusetts WQC for the Deerfield and Gardners Falls Projects.

Time Period	Minimum Flow Release (cfs)
Deerfield No. 5	
Year round	73[1]
Deerfield No. 4	
October 1 - May 31	100[1]
June 1 - September 30	125[1]
Deerfield No. 3	
Year round	100[1]
Gardners Falls	
Year round	150[1]
Deerfield No. 2	
Year round	200

[1] Or inflow, whichever is less.

(11) Any modifications of the operation of the projects which would affect the conditions of these WQC's must be approved by MA DEP.

(12) MA DEP reserves the right to review, and modify if necessary, the conditions to ensure conditions are met or if changes are required as a result of the Vermont WQC that causes a non-compliance with these certificates.

(13) MA DEP reserves authority to request that FERC reopen the licenses to make modifications necessary to maintain compliance with the Massachusetts Surface Water Quality Standards.

2.3.1.2 Interventions

On October 29, 1992, a public notice was issued providing an opportunity for the filing of protests or motions to intervene in this preceding by the December 12, 1992, deadline. The following entities filed a motion to intervene in the proceeding:

Intervenor	Date of Motion
Deerfield River Watershed Association	02/12/92
Deerfield River Compact	09/18/92
State of Vermont (VANR)	11/06/92
U.S. EPA	11/12/92
DOI	12/10/92

Intervenor	Date of Motion
Town of Whitingham, VT	12/11/92
Windham Regional Commission	12/14/92
Town of Wilmington, VT	12/11/92
Town of Wardsboro, VT	12/11/92
Town of Readsboro, VT	12/14/92
Commonwealth of MA	12/11/92
CLF	12/15/92
VFSC	12/14/92
VNRC	12/14/92
NE FLOW, AR, AWA, and AMC	12/11/92
TU	12/14/92
American Whitewater Expeditions	3/5/96

TU and NE FLOW, *et al.* intervened in opposition.

2.3.1.3 Comments

Pursuant to the public notice issued March 9, 1994, various state and federal agencies, and NGOs provided comments on, recommendations for, and prescriptions of environmental measures at the Deerfield Project. Following the issuance of this DEIS, commenting parties are afforded the opportunity to revise their formal recommendations with the Commission. Public Notice of the Settlement was issued on October 19, 1994. The deadline for commenting on the Settlement was November 1, 1994.

The agencies, NGOs, and the dates of their comment letters for the Deerfield Project are listed below. All timely comments received from concerned entities become part of the record and are considered during the staff's analysis of the proposed actions. Letters commenting on the Settlement are indicated below by "*."

Commentor	Date of Comment Letter
Commonwealth of MA	04/26/94 & 10/05/94*
DOI	05/03/94 & 08/31/94 & 10/05/94*
AMC, *et al.*	08/30/94 & 10/06/94*
VNRC	10/04/94
State of Vermont (VANR)	10/04/94
Windham Regional Commission	10/05/94*
NE FLOW	12/28/94

2.3.1.4 Recommendations, including Comments on Settlement

Commonwealth of MA

- Adopts as its recommendations the terms and conditions in the Settlement.

DOI

- Supports the provisions of the Settlement with their Section 10(j) and 10(a) recommendations.

- Downstream permanent fishways and flows necessary to operate fishways at the Deerfield River No. 4, No. 3, and No. 2 stations.

- Upstream fish passage trapping and trucking facilities and flows needed for operation of the facility at the No. 2 Station.

- Reservation of authority to prescribe the construction, operation and maintenance of fishways under Section 18 of the FPA, 16 U.S.C., Section 81; and the right to modify its Section 18 Prescription as needed.

- Release flows in the bypassed reaches of the Searsburg, Harriman, No. 5, No. 4, and No. 3 Stations, and the downstream reaches below Somerset Reservoir, and the No. 2 Dam per Table 2-2.

- Release flows of 125 cfs guaranteed from storage below the Fife Brook Dam.

- Limit reservoir fluctuations to within ± 1 foot in Somerset Reservoir to facilitate common loon waterfowl nesting.

- Manage Harriman Reservoir to maintain a stable or rising reservoir elevation from May 1 through July 31 each year to facilitate spawning and early life stages of rainbow smelt and smallmouth bass. From June 16 through July 15, the reservoir elevation will drop no more than one foot per day.

- Prepare a plan for maintaining minimum flow releases.

- Reserve the authority to reconsider peaking operation of the Deerfield No. 2 development and issue and implement appropriate changes.

- Provide plans and schedules for upstream and downstream fishways which include operation, maintenance, and monitoring to ensure they operate as intended.

- Establishment the conservation easements and implement the Forest Management Guidelines specified in the Settlement.

- Incorporate provisions of the Settlement relative to recreational facilities, whitewater boating releases, the establishment of an environmental enhancement fund, and provisions for the future decommissioning of project should be included in any license for the project.

VNRC

- Eliminate annual peaking including appropriate limitation of reservoir drawdowns to restore lacustrine ecosystems in project reservoirs.

- Provide instream flow conditions necessary to restore and maintain aquatic and riparian habitat in the river sections impacted by project developments. VNRC recommends the following minimum flows:

    (1) Somerset reach: a) 19 cfs = May 1-Aug 30, b) 30 cfs = Oct 1-Dec 15, c) 48 cfs = Dec 16-Feb 28 (29), d) 30 cfs = Mar 1-April 30, e) maximum flows not to exceed 200 cfs unless inflow is greater, and f) sufficient ramping conditions should be provided;
    (2) Searsburg below dam: a) 45 cfs = May 16-Sept 30, and b) 90 cfs = Oct 1-May 15;
    (3) Searsburg below powerhouse: 175 cfs = April 20-June 15; and
    (4) Harriman below dam: a) 90 cfs = year-round, and b) flow is "or inflow" but 57 cfs is guaranteed.

- Provide upstream and downstream fish passage at the Searsburg development.

Windham Regional Commission

- Terms of the final WQC should be incorporated in Settlement.

NE FLOW

- Fully endorses Settlement.

2.3.1.5 Staff's Measures

Staff considered the following additional measures:

- Include appropriate measures to control erosion and sediment in plans for any upstream and downstream fish passage facilities which might be located on or would involve disturbance of the river bank or which would involve excavation or other disturbance of the river bed.

- Cooperate with appropriate agencies in conducting a regularly-scheduled program to monitor recreational use areas (picnic facilities, boat launches, trails, *etc.*) to identify and to implement appropriate maintenance and control measures for erosion, sediment, and bank problems that may arise.

- Implement a PA which the staff is developing and would execute with the Advisory Council, the Massachusetts SHPO, and the Vermont SHPO. NEP would be a concurring party. The PA, generally required under Section 106 of the National Historic Preservation Act [2] in cases of anticipated adverse effect, would require NEP to develop a CRMP which would provide for:

    - clarifying which project features would initially qualify as contributing and non-contributing elements of the potential Deerfield Project historic district

    - preparing and implementing an operation and maintenance plan designed to minimize adverse effects to the historic integrity of those project features which are contributing elements of the potential historic district

    - following-through by means of Phase 1B and other studies necessary for identifying and mitigating adverse effects to National Register-eligible prehistoric and historic archeological resources that may be under immediate threat from:

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[2] 16 U.S.C. § 470 *et.seq.*

- current and proposed project operation, recreational construction, recreational use, and logging activities, and

- future operational changes, construction, or activities in the Project's area of potential effect.

2.3.2 Gardners Falls Project

We analyze the effects of the provisions of the Settlement, the Massachusetts WQC, and recommendations from DOI, AMC, *et al.*, CLF, TU, and the MA DFW on project operations and economics at the Gardners Falls Project.

2.3.2.1 Water Quality Certificate

The WMEC requested issuance of a WQC on December 16, 1991, then reapplied in 1992 and 1993. MA DEP issued a WQC for the Gardners Falls Project dated December 1994 (letter from Andrew Gottlieb, Director, Office of Watershed Management, Commonwealth of Massachusetts, Department of Environmental Protection). Conditions of the WQC for the Gardners Falls Project are as follows:

(1) Release from Gardners Falls Dam a 150 cfs continuous minimum flow or inflow from NEP's Deerfield No. 3 Development if such inflow is lower than 150 cfs. Flow into the bypassed reach should be maintained at 150 cfs during high flow conditions if operationally possible.

(2) Provide downstream louver fish passage for Atlantic salmon smolts. Flows to operate the facility should be provided from April 1 to June 15 and September 15 to November 15. Submit plans to evaluate the effectiveness of the downstream fish passage facility to the MA DFW within one year from the date of issuance of the FERC license.

(3) Construction activities shall be conducted in compliance with the Massachusetts Wetland Protection Act.

(4) Conduct all maintenance and repair activities in a manner so as not to impair water quality.

(5) Construct and operate recreational facilities as presented in the FERC license application (WMEC 1991).

(6) Any modification of the operation of the project which would affect the conditions of this WQC must be approved by MA DEP.

(7) MA DEP can request that the FERC reopen the license to make modifications necessary to maintain compliance with the Massachusetts Surface Water Quality Standards.

(8) MA DEP reserves the right to review, and modify if necessary, the conditions of the WQC if the Vermont WQC (or future changes therein) results in non-compliance with the Massachusetts WQC.

2.3.2.2 Interventions

On January 23, 1992, a public notice was issued providing and opportunity for the filing of protests or motions to intervene in this preceding. The following entities filed a motion to intervene in the proceeding. TU intervened in opposition:

Intervenor	Date of Motion
Deerfield River Compact	9/11/92
Deerfield River Watershed Association	2/13/92
DOI	10/29/92
TU	11/4/92
US EPA	11/6/92
Commonwealth of MA	11/4/92

2.3.2.3 Comments

Pursuant to the public notice issued April 6, 1994, state and Federal agencies, and NGOs provided comments on, recommendations for, and prescriptions of environmental measures at the Gardners Falls Project. Following the issuance of the DEIS, commenting parties are afforded the opportunity to revise their formal recommendations with the Commission. The deadline for providing comments on the Gardners Falls Project was October 6, 1994.

The agencies, NGOs, and the dates of their comment letters for the Gardners Falls Project are listed below. All timely comments received from concerned entities become part of the record and are considered during the staff's analysis of the proposed actions.

Commentor	Date of Comment Letter
Commonwealth of MA	10/5/94
DOI	5/3/94, 10/05/94
CLF	5/20/94
AMC, *et al.*	9/6/94, 10/3/94
TU	10/06/94

2.3.2.4 Recommendations

Commonwealth of MA

- Provide appropriate salmon smolt bypass facility within two construction seasons of licensing.
- Provide a minimum flow of 150 cfs into the bypassed reach at the dam.
- WMEC should provide a $50,000 environmental enhancement fund.
- WMEC should continue to participate in implementing the Deerfield River Trail and place interpretative signs at all important natural resource, cultural, historic sites, and hydroelectric facilities throughout the project area.

- Provide recreation access to the west bank of the Deerfield River consisting of: a lead-in sign system be established from downtown Shelburne Falls/Buckland to the project; improve the fishing access at the north end of the picnic area; improve parking at the project dam; create and maintain a self-guided interpretative trail on the existing trail adjacent to the power canal; construct bog bridges across wet portions of the existing trail; and extend an existing path in front of the powerhouse to the shoreline.

- Maintain the Wilcox Hollow riverfront site; however, the site should not be overdeveloped. Provide and maintain toilets, handicapped access improving the entrance, safety improvements, and formalizing parking should be formalized.

- A school curriculum to go with the interpretive trail at the west side of the power canal should be developed and implemented.

DOI

- Reserve Section 18 authority to prescribe fishways, and modify its Section 18 Prescription as needed.

- Provide a minimum flow of 150 cfs into the bypassed reach at the dam.

- Provide a Plan for maintaining minimum flow releases.

- Provide appropriate permanent salmon smolt downstream bypass facility within two construction seasons of licensing, and provide proper flows.

- Provide plans and schedules for the operation, maintenance, and monitoring of fishway.

- WMEC should provide a $50,000 environmental enhancement fund.

CLF

- Consider both the Deerfield Project and the Gardners Falls Project together in the EIS.

AMC, *et al.*

- A lead-in sign system be established from Shelburne Falls/Buckland to the project. In addition, improve fishing access at the north end of picnic area; provide signs at pull-off parking area at dam; upgrade and provide signs at the path from the powerhouse; and improve access from Route 2 to Wilcox Hollow.

- Wilcox Hollow should not be overdeveloped and handicapped and safety improvements should be provided.

- WMEC should provide a $50,000 environmental enhancement fund.

- WMEC should provide a buffer zone around the impoundment for public access and protection of recreational and aesthetic values.

- WMEC should provide a minimum flow of 198 cfs or inflow.

- Downstream Atlantic salmon fish passage should be provided.

TU

TU opposes relicensing of the Gardners Falls Project but asks for no specific relief associated with denial of WMEC's license application. TU requests that the Commission consider: (1) river-wide cumulative impacts and pre-project environmental conditions; (2) current environmental effects of all hydropower projects on the Deerfield River in a river wide EIS; (3) alternatives to the WMEC proposed flow regimes which reduce fish habitat, endangers recreational users, and harms fish and macroinvertebrates; and (4) the impacts of the flows set forth in the Deerfield Settlement upon the operations at Gardners Falls Project. TU also offers the following recommendations:

- Provide minimum flow from the dam sufficient to enhance fisheries.
- Downstream Atlantic salmon passage should be provided.
- Wilcox Hollow should not be overdeveloped and handicapped and safety improvements should be provided.

2.3.2.5 Staff Measures

Staff also analyzed the following measures:

- Cooperate with appropriate agencies in conducting a regularly-scheduled program to monitor recreational use areas (picnic facilities, boat launches, trails, *etc.*) to identify and to implement appropriate maintenance and control measures for erosion, sediment, and bank problems that may arise.
- Implement a PA which the staff is developing and would execute with the Advisory Council and the Massachusetts SHPO. NEP would be a concurring party. The PA, generally required under Section 106 of the National Historic Preservation Act in cases of anticipated adverse effect, would require NEP to develop a CRMP which would provide for:

  - preparing and implementing an operation and maintenance plan designed to minimize adverse effects to the historic integrity of the project dam, power canal, and powerhouse,

  - identifying and mitigating adverse effects to National Register-eligible prehistoric and historic archeological resources that may be under immediate threat from:

  - current and proposed project operation, recreational construction, and recreational use, and

  - future operational changes, construction, or activities in the Project's area of potential effect.

2.3.3 Bear Swamp Project (Fife Brook Dam)

Other than measures in the Settlement (see Section 2.3.3), agencies and NGOs did not recommend enhancements. Staff analyzed the following:

- Include appropriate measures to control erosion and sediment in plans for any upstream and downstream fish passage facilities which might be constructed on or would involve disturbance of the river bank or which would involve excavation or other disturbance of the river bed.
- Include appropriate measures to control erosion and sediment in plans for any recreation-related construction.

- Cooperate with appropriate agencies in conducting a regularly-scheduled program to monitor recreational use areas to identify and to implement appropriate maintenance and control measures for erosion, sediment, and bank problems that may arise.

2.3.3.1 Comments and Interventions

Pursuant to public notice issued June 14, 1996, state and Federal agencies, and NGOs provided comments on the proposed amendment to the Bear Swamp Project. The deadline for providing comments on the Bear Swamp amendment was July 26, 1996.

The agencies, NGOs, and the dates of their comment letters for the Bear Swamp amendment are listed below. All timely comments received from concerned entities become part of the record. CLF. *et al.* also requested to intervene in the proceeding. None of the comments raised any new environmental issues. Procedural issues raised will be addressed in any Commission order issued.

Commentor	Date of Comment Letter
DOI	7/22/96
CLF, *et al.*	7/25/96
NEP	7/25/96

2.4 NO-ACTION ALTERNATIVE

The no-action alternative means that the projects would continue to operate as required by the original project licenses. If the projects are allowed to operate as in the past, there would be continued energy production at present levels and no additional protection or enhancement of existing environmental resources.

In the event of denial of license, or licenses, power (capacity and energy) to replace the loss of project hydropower would likely be purchased from service-area utility or non-utility sources. Purchased power to replace the loss of hydropower that would have been generated by one or more of New England's seven generating Deerfield River hydro facilities, would most probably be generated by fossil fuel-fired facilities or electricity imported from Canada. In the event of denial of a new license for WMEC's Gardners Falls Project, the lost hydropower generation would most probably be replaced by power generated by gas-fueled facilities. Under the no-action alternative the existing Bear Swamp license would not be amended.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER CONSIDERATION

We identified several other alternatives to the relicensing proposals but eliminated them from detailed study in this FEIS because they are not reasonable in the circumstances of this case. They are: (a) Federal government takeover of the projects; (b) issuance of nonpower licenses upon expiration of the original licenses; and (c) denial of the license applications, with surrender or termination of the existing licenses.

In accordance with §16.14 of the Commission's regulations (18 CFR), a Federal department or agency may file a recommendation that the United States exercise its right to takeover a hydroelectric power project with a license that is subject to Section 14 and 15 of the Federal Power Act (FPA). [3] No Federal agency has formally recommended that Federal takeover of the projects would be appropriate. We do not, in this case, consider Federal takeover to be a reasonable alternative.

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[3] 16 U.S.C Secs. 791(a) - 825(r).

Issuing nonpower licenses wouldn't provide a long-term resolution to the issues presented. No party has sought nonpower licenses and we have no basis for concluding that the projects should no longer be used to produce power. Thus, nonpower licenses are not a reasonable alternative to some form of new licenses with mitigation and enhancement measures.

Denial of the license applications leading to termination or surrender of the existing licenses would entail two alternatives which would require a departure from the *status quo*. The first alternative is surrender and termination of operation coupled with removal of the dams. No party has formally suggested that dam removal would be appropriate and we have no basis for recommending it. We don't regard this alternative as reasonable because it would result in the loss of substantial electric power generation in exchange for possible significant environmental impacts. For example, dam removal could result in sediments accumulated behind the dams to be washed downstream, lacustrine habitats could be converted to riverine habitats, and wetlands could be lost.

2.6 ECONOMIC COMPARISON OF ALTERNATIVES

The Commission's policy is to use current costs to compare the costs of projects and likely alternative power.[4] The assumptions we used in our economic analyses of the Deerfield River Projects are summarized in Appendix B.

Overview of Cumulative Hydropower Generation and Economics Studies

The proposed changes in the minimum flows and operating restrictions for each of the eight developments of the Deerfield Project, the one development of the Gardners Falls Project, and the Bear Swamp Pumped Storage Project would affect not only each development independently, but also all other downstream developments as well. The ten developments we studied for cumulative effects on the Deerfield River are Somerset, Searsburg, Harriman, Sherman, Deerfield Nos. 2 through 5, Gardners Falls, and Bear Swamp (see Figure 1-1).

Because of these inter-relational effects of operation modifications at the various developments, we have done a cumulative evaluation of the various combinations of environmental enhancement measures on power generation for all the projects in the Deerfield River Basin.

Various Operational Environmental Enhancements:

Environmentally beneficial changes in the various hydroelectric developments on the Deerfield River, such as increasing minimum flows and employing reservoir-fluctuation restrictions, would shift some of the developments' peak power production to off-peak hours, and would cause similar on-peak to off-peak power shifts at downstream developments.

We have selected five operational scenarios for the FEIS to present a picture of the economic effects of various proposed operational modifications and investment costs in enhancement measures. The first scenario is the current operating regime, labeled as the Baseline. The second scenario is that proposed in the Settlement by NEP and other agencies that was filed with FERC on October 6, 1994. The third scenario is the regime required by the two WQCs issued by the states of Massachusetts and Vermont, and is labeled WQC in the Tables, found below in this section. The fourth scenario is labeled VNRC, and shows the effects of the operational changes proposed by the VNRC, an NGO not party to the Settlement. The fifth and final scenario is labeled Staff, and is the regime that staff has adopted for licensing purposes.

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4 See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995).

Baseline Conditions

The baseline condition assumes that current hydro power operations in the Deerfield River Basin (including all projects and developments) remain in effect. It includes all pre-1995 minimum flow programs and assumes that none of the proposed mitigation and enhancement measures would be in effect. The median Water Year 1980 hydrologic distribution as modeled by NEP would yield a total river basin generation of about 724,735 MWh, with a 1995 total gross power value of about $65,528,000, and a net annual power benefit of about $29,461,000 (Table 2-5).

The baseline condition for the Deerfield Project alone, as modeled by NEP for the Median Water Year 1980, would yield a project generation of about 289,052 MWh, with a 1995 total gross power value of about $14,098,000 and a net annual power benefit of about $4,440,000.

The baseline condition for the Gardners Falls Project alone, as modeled by NEP for the Median Water Year 1980, would yield a project generation of about 16,800 MWh, with a 1995 total gross power value of about $903,040, and a net annual power benefit of about $104,260.

Deerfield Settlement

NEP's original license proposal was modified to conform to their Settlement; the conditions of the Settlement are those included in NEP's document filed with FERC on October 6, 1994. Under this scenario, total river basin generation would be reduced by 38,089 MWh per year. The gross value of this power loss would be $1,175,000.

Modifications to the Proposed Projects

WQC: The conditions contained in the two WQCs issued by the states of Vermont and Massachusetts are similar to those of the Settlement, but contain more restrictions on the operations of Somerset and Harriman Reservoirs. Total river basin generation would be reduced by 41,895 MWh per year. The gross value of this power loss would be $1,350,000.

VNRC: The conditions proposed by VNRC would require significant restrictions on the storage operations of Somerset, Harriman, and Sherman Reservoirs. Total river basin generation would be reduced by 90,126 MWh per year. The gross value of this power loss would be $2,968,000.

Staff Recommendations: For the Deerfield Project, staff's recommended conditions would consist of those proposed in the Settlement and the two WQCs for the Deerfield Project. For the Gardners Falls Project, staff's recommended conditions would consist of WMEC' proposal, the MA WQC, and minor staff modifications. For the cost of Staff recommendations, see Tables below.

Summary of Economic Scenarios

All the scenarios would reduce the total energy generation, and at the same time shift energy generation from peak to off-peak periods, and thereby reduce the value of the total generation.

We first evaluated the power generation impacts on all the Deerfield River Basin Projects that would be cumulatively affected by the five previously stated (see Section 2.7.1) proposed operational scenarios. Then we did a similar evaluation for the Deerfield Project alone, and the Gardners Falls Project alone, recognizing that their sensitivity to operational changes would be much greater than that of the river basin hydro resource as a whole, which is dominated by the 611.25 MW capacity of the Bear Swamp Pumped Storage Project.

In addition to the foregoing losses in energy generation, some of the proposed enhancement measures would increase the capital costs of the two projects, and thereby increase their annual debt service costs. Some would also increase the annual costs to operate and maintain the Deerfield and Gardners Falls Projects. In determining the costs of the energy losses and the various environmental enhancement measures contained in the five scenarios analyzed, we compared the difference between the net annual benefits for the baseline operational condition, and the net annual benefits of the five individual scenarios.

Table 2-3. Annual net power benefits (thousand $) for the Deerfield Project Only (Source: the Staff).

Proposed Operation	Gross Power Benefits	Production & Enhancement Expenses	Net Benefits	Percent Change in Net Benefits
Baseline	14,098	9,658	4,440	0
Proposed project *	13,002	10,871	2,131	-52.0
2 WQC's	12,854	10,871	1,983	-55.3
VNRC	11,516	10,871	645	-85.5
Staff	12,769	10,871	1,898	-57.3

* including the Settlement

Our studies show that all the Deerfield River Basin hydro powerplants would be subjected to the following cumulative changes to their peak and off-peak energy production levels; have the following changes to the cumulative value of the projects' power; and would be subjected to the following cumulative capital, operational, and maintenance costs, if the Deerfield and Gardners Falls Projects were to be subjected to the various alternative enhancement proposals.

2.6.1 Detailed Economics of Deerfield River and Gardners Falls

Once more using the water year 1980 as the close equivalent of a median water year, we calculated the gross power benefits of all Deerfield River Basin hydro stations, including peak energy, off-peak energy and dependable capacity. Our figures for operation and maintenance costs, taxes, and other annual costs were taken from data supplied by the licensees, both in their license applications, and their additional information filings, or in their annual FERC Form 1 filings.

2.6.1.1 Deerfield Project

Table 2-3 summarizes the net power benefits for the Deerfield Project alone. Net benefits for all five scenarios are positive, ranging upward from a minimum $645,000 in net benefits for the VNRC case. The Staff scenario would have net benefits of $1,898,000.

2.6.1.2 Gardners Falls Project

Table 2-4 summarizes the net power benefits for the Gardners Falls Project alone. All operational scenarios other than the baseline case show that Gardners Falls hydro power production and enhancement

Table 2-4 Annual Net Power Benefits (thousand $) for the Gardners Falls Project Only (Source: the Staff).

Proposed Operation	Gross Power Benefits	Production & Enhancement Expenses	Net Benefits	Percent Change in Net Benefits
Baseline	903	799	104	0
Proposed project *	844	873	-28	-127.3
WQC (MA)	841	873	-32	-130.4
VNRC	755	873	-118	-213.2
Staff	807	873	-66	-163.5

* including the Settlement

costs would exceed the current value of the project's power. This excess cost would range from $28,440 for the Settlement scenario to $117,970 for VNRC's proposed scenario. The staff scenario would make the project cost $66,000 more than the current value of the project's power.

2.6.1.3 Deerfield River Basin Hydro - Cumulative Effects

Table 2-5 summarizes staff's findings for the all-inclusive Deerfield River Basin cumulative hydro power net economic benefits, including the Deerfield, Bear Swamp, and Gardners Falls Projects. These net economic benefits are all positive, and range upwards from $25,219,000 for VNRC's proposed scenario.

Table 2-5. Annual net power benefits (thousand $) for all the Deerfield River Basin Projects (Source: the Staff).

Proposed Operation	Gross Power Benefits	Production & Enhancement Expenses	Net Benefits	Percent Change in Net Benefits
Baseline	65,528	36,067	29,461	0
Proposed project *	64,353	37,341	27,013	-8.3
3 WQC's	64,178	37,341	26,837	-8.9
VNRC	62,560	37,341	25,219	-14.4
Staff	64,051	37,341	26,710	-9.3

* including the Settlement

2.6.2 Environmental Enhancement Costs

For a summary of all environmental enhancement costs for the Deerfield and Gardners Falls Projects, see Table 5-5 and Table 5-6.

Both projects would bear certain increased expenses for enhancement measures to improve the environmental quality of the river basin during the term of the new licenses. These costs are relatively low when compared to the loss in power value that would result from decreased energy production and the shifting of energy generation from peak to non-peak periods. The increased enhancement expenses have already been included in the results presented in the previous Tables. But we consider it useful to enumerated those enhancement expenses separately from the losses in power benefits in this analysis. Recreational enhancement expenses are summarized in Table 5-5 and Table 5-6.

- The Deerfield Comprehensive Recreation Plan, described in Section 4.1.1.6, has a 1993 initial development expense of $1,290,590 and subsequent annual O&M expenses of $352,000.
- The costs of whitewater boating flow releases at Deerfield No. 5 and Fife Brook consist of the loss in power value of shifting generation from peak to non-peak periods. The program is described in detail in Section 4.1.1.6. NEP estimates the power-value-loss of this action as $151,400.
- NEP has proposed that it would set up a Deerfield River Enhancement Fund with an initial $100,000 to provide for miscellaneous improvements at its project.
- NEP, NGO and Staff have proposed an instream recreational safety study for the Deerfield Project. The study is described in Section 4.2.1.3. The estimated total cost would be $20,000.
- Installation of a canoe portage at Searsburg Reservoir as described in Section 4.2.1.3 could be accomplished for about $10,000.
- Staff proposes a Recreation Improvement Plan for the Gardners Falls Project. This plan is described in Section 4.1.2.6. The estimated 1993 development expense for the plan would be about $101,000, and

the annual O&M expense would be about $6,000

- DOI, Commonwealth of MA, and AMC recommended a $50,000 recreational enhancement fund for the Gardners Falls Project. It is described in Section 4.2.2.4, and its function would be similar to the Deerfield Project enhancement fund. Also, see Section 5.4 for staff's final recommendation on this proposed measure.

- The Staff and resource agencies have proposed that WMEC provide restroom facilities at the Gardners Falls Project at Wilcox Hollow. This proposal is described in Section 4.2.2.4. The total cost would be $10,000.

Table 2-6. Pollution abatement benefits as a result of continued operation of the Deerfield River Hydropower Projects (Source: the Staff).

	Deerfield	Gardners Falls
Avg. Ann. Generation (GWh)*	294.4	15.7
Coal[2,3] or Natural Gas Required/ Year (tons or Mill cu. ft.)	125,226[1]	162[5]
SOx Prod./Year[4] (tons)	2,42	<1
NOx Prod./Year (tons)	710	34
CO Prod./Year (tons)	58	3
CO2 Prod./Year. (tons)	288,014	9,665
Particulates Prod./ Year (tons)	7,705	NA
Cost of removing 95% of 203 tons. of SOx	$1,159,950	$23
Cost of removing 60% of 94 tons of NOx	$2670,106	$7,854
Cost of removing 100% of 622 tons of particulates	$112,145	NA
Pollution abatement benefits	$1,535,009	$7,877

* Average annual generation is somewhat lower under the Settlement.
[1] We assumed that pulverized bituminous coal would be the fuel used by the coal-fired facilities that would supply replacement power.
[2] We assumed the heat content of coal = 25.4 million BTu per ton.
[3] We assumed the heat rate of coal-fired facilities = 10,860 BTu per net kilowatt-hour.
[4] We assumed the sulfur content of coal = 1.0 percent. If sulfur content differs from 1.0 percent, the quantities of SOx produced per year, and the cost of removing 95% of SOx from the flue gases, should both be multiplied by the correct sulfur content--expressed in percent.
[5] The Gardners Falls computations are based on an assumed heat content of 1,032.8 million BTU per million cubic feet for natural gas; and on an assumed heat rate of 10,659 BTU per net kilowatt-hour for gas-fired, steam-electric, generating facilities.

2.6.3 Pollution Abatement Benefits

Since hydropower generation produces no atmospheric pollution, the hydroelectric projects with which we are concerned in these proposed actions provide pollution reduction benefits by displacing fossil-fueled generation with hydropower generation. These benefits are summarized in Table 2-6.

State-of-the-art pollution control technology is capable of removing approximately 95 percent of the oxides of sulfur (SOx), approximately 60 percent of the oxides of nitrogen (NOx), and nearly 100 percent of the particulates from the produced flue gases before the gases are released to the atmosphere. Carbon monoxide (CO) production can be reduced by improving combustion efficiency. After being produced by combustion, carbon dioxide (CO_2) is not controlled by electric utilities.

Published figures on costs of removing a ton of NOx range from $300 to $700. The costs of removing a ton of NOx range from $210 to $560. Using the mid-points of these ranges, the cost per ton for SOx becomes $500, and the cost per ton for NOx becomes $385.

Cost data were obtained from a manufacturer of electrostatic precipitator systems. Calculations based on these data suggest that a conservative range of costs for removing and disposing of a ton of particulates is $9.00 to $20. The mid-point of this range is $14.50.

3. AFFECTED ENVIRONMENT

3.1 REGIONAL RESOURCES

3.1.1 General Setting (Source: NEP 1991 and WMEC 1991, unless indicated otherwise).

The Deerfield River mainstem and its tributaries can all be characterized as shallow, rapid flowing mountain streams. The headwaters of the Deerfield River are in the Green Mountains in the Towns of Glastenbury and Stratton in the southern part of Vermont. The river flows rapidly for about 11 miles into the Searsburg impoundment where it is joined by the East Branch of the Deerfield River. The total river basin area to the confluence with the Connecticut River is 665 square miles (Figure 1-1).

The upper (Vermont) river basin is predominantly composed of well-drained soils with bedrock existing at depths between 16 and 28 inches. The shallow bedrock together with the steep slopes in the upper river basin contribute to the "flashiness" of the Deerfield River and its tributaries. The lower (Massachusetts) river basin contains soils, with characteristics similar to the upper river basin, that are well to moderately drained and are shallow to bedrock. Prominent features include rocky and stony hills, narrow steep-sided valleys with fast flowing mountain streams.

Most of the upper river basin is in the Green Mountains where land usage is primarily forest land. The forest land consists of a combination of deciduous and evergreen tree species. Agricultural land is primarily concentrated on the western border of the river basin, but is also scattered throughout the Green Mountains where topography is level. The majority of the urban land is located in the valley areas and consists of small towns.

The land cover in the lower river basin consists of deciduous and evergreen trees, with the former slightly predominating. Agricultural or open land consists primarily of crops or pastures and is centralized along the Deerfield River and its major tributaries. The only major urbanized region in the lower river basin is Greenfield, Massachusetts located at the confluence of the Deerfield and Connecticut Rivers.

Since the early 1900s, the Deerfield River's primary use has been for the generation of electricity. The steep gradients and narrow valleys mean that the dams necessary for hydroelectric power could be relatively small and economical. The Deerfield River Basin is sparsely populated, and few people reside in the areas impounded by the dams.

3.2 CUMULATIVE EFFECTS ANALYSIS

3.2.1 Water quality and quantity

In the late eighteenth and early nineteenth centuries activities such as the erection of grist mills and sawmills, tanneries, and later cotton, woolen, and paper pulp mills influenced water quantity and quality of the Deerfield River which had been largely pristine until that time. By 1880, the lower portion of the Deerfield River had been harnessed to provide hydromechanical power for 117 mills, but hydropower development was curtailed by the wild and flashy nature of the river--a feature that likely protected water quality and quantity from abuse and degradation.

The "flashiness" of the Deerfield River was tamed by dam construction and fluctuating flows from peaking operations at the hydropower facilities which caused significant changes in the water quantity of the Deerfield River. Today, about 19 percent of the 72-mile-long river has sections where water is diverted or bypassed from the main river channel for hydropower usage; many of these diverted stream reaches have no minimum flow requirements.

In the early 1960's, the YAEC was constructed on the Sherman reservoir, and in 1974 the Bear Swamp Project was also built on the Deerfield River. These two projects likely interacted with the Deerfield Project to cause problems in water quality and quantity. For many years the Sherman reservoir and downstream reaches of the Deerfield River have elevated stream temperatures that may have affected coldwater fish habitat because of the release of once-through cooling waters from the Yankee Atomic Power Plant. In February 1992, this facility stopped operating and thus ended the discharge of cooling waters to the Deerfield River.

Water quality has remained relatively good in the river basin, however, several areas of the Deerfield River have been downgraded from Class B coldwater and Class B warmwater, to Class C, because of the influence of wastewater effluent releases from municipal treatment facilities. The principal water quality problem has been from fecal coliform counts that exceed state standards, primarily in the lower portion of the Deerfield River. As recently as 1986, VDEC reported locations where untreated domestic sewage is being released to the Deerfield River, and one wastewater facility still releases raw waste to the river when heavy runoff exceeds treatment capacity.

Water quality in the Deerfield River has also been affected by large reservoir releases of cold, poorly oxygenated waters from the hypolimnion during the summer months. Other water quality parameters of concern include acidification of large reservoirs, where there is little natural buffering capacity for acidified precipitation. There continues to be significant non-point agricultural runoff contributing to high bacteria levels along many areas of the Deerfield River, but particularly in the Greenfield and Deerfield areas. Pollution from toxic discharges has not generally been a problem; however, several reports note high levels of copper bound in stream sediments. Groundwater contamination has not been a problem in the river basin.

No waters of the Deerfield River are used for public consumption. Three snow making facilities in the upper portion of the river basin seasonally remove water from private lakes or ponds for that use, which changes the annual hydrograph of flows into Harriman reservoir. Three permitted entities (Kendall Company, 0.89 mgd; Shelburne Falls Fire District No. 5, 0.21 mgd; Greenfield Water Department, 1.02 mgd) remove a combined total of about 2.12 mgd from groundwater and surface water tributaries to the Deerfield River. In addition, three farms in the lowermost portion of the Deerfield River remove a combined total of about 0.59 mgd, from ponds and from several sites on the Deerfield River. The farm withdrawals occur during the growing season, and nearby tributary input to the Deerfield River offsets much of the loss that occurs from these three farms.

The Deerfield River is classified by Vermont and Massachusetts state water quality standards and both states have similar designations according to intended use and water quality. The Deerfield River and its major tributaries are classified as Class B waters throughout its length. Both states classify the Deerfield River as a coldwater fishery from its origin to the confluence with the North River and as a warmwater fishery from this confluence downstream to where the river enters the Connecticut River as determined by water temperature. Several areas in the vicinity of the Harriman reservoir that were formerly designated as Class C waters because of the influence of the release of wastewater effluents, have been reclassified as Class B waste management zones by the state of Vermont (VANR 1995).

VANR (1995) indicates that several stream reaches of the Deerfield River don't meet their designated uses under Section 305(b) of the state water quality assessment standards.[1] The stream reaches in question include a 9.8 mile portion of the 28-mile-long stream reach between the headwaters of the East Branch of the Deerfield River to the head of Harriman reservoir. This 9.8-mile-long segment includes a 5.2-mile-long segment of the East Branch of the Deerfield River below Somerset reservoir and a 4.6-mile-long segment of the Deerfield

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[1] These standards specify high quality habitat for aquatic biota, wildlife, and a water quality that consistently exhibits good aesthetic value. Uses are public water supply with filtration and disinfection, irrigation and other agricultural use, swimming, and recreation.

River below Searsburg dam. Both of these stream segments have failed to meet their designated usage primarily because of flow alterations caused by hydropower projects.

The designated use criteria for these river reaches specify high quality habitat for aquatic biota, fish and wildlife, and a water quality that consistently exhibits good aesthetic value; uses are public water supply, irrigation, swimming and recreation (VANR 1995). The other stream reaches not meeting VANR's designated uses include the 3.5-mile-long stream reach of the Deerfield River between the head of Harriman reservoir and the Vermont/Massachusetts state line which bisects Sherman reservoir. This reach doesn't support the states' designated usage because of impairment caused by flow alterations and because of the lack of buffering capacity of the stream against acid precipitation events. The river reach between the Harriman dam downstream to where the West Branch enters the Deerfield River is specified as a non-attainment segment. The stream segment of the Deerfield River from the confluence of the West Branch to the Sherman reservoir is considered to only provide partial support of the designated usage because of flow alteration (VANR 1995).

3.2.2 Anadromous Fishery Resources

The historical record concerning the size of the Atlantic salmon runs up the Deerfield River is incomplete, but it is known that Atlantic salmon entered the Deerfield River and that spawning occurred in the mainstem of the river and in some of the tributaries. During periods of low flow, Atlantic salmon congregated below Shelburne Falls waiting for adequate flows before proceeding upstream (Franklin County Planning Department 1990).

Historical evidence from the records of the Massachusetts Colonial legislature, dated March 2, 1743, Chapter 261, shows that Atlantic salmon reached the base of what is now known as Shelburne Falls on the Deerfield River in the towns of Shelburne and Buckland, Massachusetts. Also, the furthermost upstream movement of Atlantic salmon in the Deerfield River is unknown, but Shelburne Falls would not have posed a serious obstacle to upstream passage for salmon (letter dated October 23, 1991, from Mark Zenick, Chair, The Deerfield River Compact, Greenfield, Massachusetts to Leo Sicuranza, Supervisor, Environmental Audits, New England Power Company, Westborough, Massachusetts, providing comments on the draft license application for the Deerfield Project; letter dated October 22, 1991, from Francis Smith, Chairman, Massachusetts-Rhode Island Council of Trout Unlimited, Wendell, Massachusetts, to Leo Sicuranza, Supervisor, Environmental Audits, New England Power Company, Westborough, Massachusetts, providing comments on the draft license application for the Deerfield Project).

Excluding landlocked Atlantic salmon that have been introduced into Somerset and Harriman reservoirs, and introductions of landlocked American smelt in the Somerset, Harriman, Searsburg, and Sherman reservoirs, the natural movements of anadromous migratory species are presently confined to the lower portions of the Deerfield River to the No. 2 development. Species such as American shad, blueback herring, and Atlantic salmon could easily reach this first dam on the Deerfield River from the Connecticut River, as would the anadromous sea lamprey.

There is an ongoing effort by federal, state, and private entities to restore Atlantic salmon in the Connecticut River and throughout the entire Connecticut River Basin. Surveys of the Deerfield River Basin indicate that there is considerable salmon nursery and spawning habitat in the watershed. Some parties have estimated that there are from 23,500 to 30,000 units of nursery habitat (one unit equals about 100 square yards) in the Deerfield River (letter from Gordon E. Beckett, Supervisor, New England Area Office, U.S. Fish and Wildlife Service, Concord, Massachusetts, to R.A. Reckert, Vice President, Northeast Utilities Service Company, Hartford, Connecticut, dated June 2, 1989; and letter from Andrew Raddant, Acting Regional Environmental Officer, Office of the Secretary, Department of the Interior, Boston, Massachusetts, to Lois D. Cashell, Secretary, Federal Energy Regulatory Commission, Washington, D.C., dated October 5, 1994). The *Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River Basin* indicates that about 13 percent of all Atlantic salmon nursery habitat in the Connecticut River Basin is within the Deerfield River watershed (Policy

Committee for Fisheries Management of the Connecticut River 1982). The MA DFW recent fisheries management plan entitled Draft Fisheries Management Plan, Deerfield River 1990-2010 (undated) emphasizes their plan to produce Atlantic salmon smolts in the watershed by planting Atlantic salmon fry. The MA DFW has found that producing Atlantic salmon smolts from planted fry is a proven cost effective way of generating higher returns of adult fish than by raising smolts from fry in a hatchery.

The MA DFW is planning on eventually stocking one million Atlantic salmon fry in salmon nursery areas including the Deerfield River and its tributaries (Franklin County Planning Department 1990). Several areas of the mainstem Deerfield River and several of its tributaries have been stocked with Atlantic salmon for several years. For the period 1983 to 1992, the number of Atlantic salmon stocked ranged from 22,500 to 81,400 annually. In 1993 the stocking increased to 336,500 and 62,877 in 1965. Plantings made in mainstem of the Deerfield River have occurred upstream from the No. 4 development. Biological monitoring of some of the plantings made in tributaries of the Deerfield River (*e.g.*, South, Bear, and Cold River, and Poland and Creamery Brooks) have demonstrated the ability of these habitats to produce high quality Atlantic salmon smolts (Franklin County Planning Department 1990; letter from John O'Leary, Anadromous Fish Restoration Project Coordinator, Massachusetts Division of Fisheries and Wildlife, Westboro, Massachusetts, to Richard Thomas, Senior Scientist, Northeast Utilities Service Company, Hartford, Connecticut, dated February 5, 1991). In the Fall of 1994, MA DFW conducted electro-fishing studies in the area of the mainstem of the Deerfield River above the lower Bear Swamp reservoir and above the No. 4 development to monitor the success of the experimental stocking of Atlantic salmon fry made there. The results showed that the stockings were not very productive.

Smolts originating from these stockings should begin their downstream migration one to three years from the date of stocking (most migrate at two years). Presently, the only downstream passage route on the Deerfield River is spillage over the dams or entrainment through the turbines.

The MA DFW's goal is to attain and support a spawning return run of at least 500 adult Atlantic salmon in the Deerfield River by the year 2010 (Franklin County Planning Department 1990).

3.2.3 Fisheries Habitat

Fisheries habitat, as in other New England streams, varies from reach to reach in the Deerfield River because of the glacial origin of the Deerfield River Basin. The historically flashy nature of the Deerfield River easily separated the finer material from the parental coarse glacial deposits laid down in the river basin and would leave the cobble and boulder components and moved the finer gravels needed for spawning downstream and out of the system. This natural system was further aggravated around the turn of the century when the first hydropower project was built at Shelburne Falls in 1897. This project was the first of a series of hydropower projects that would be built on the river, including the eight dams associated with the Deerfield Project and the large reservoirs that accompany them. While these reservoirs would form new lotic habitats for fish, the reservoirs would also become traps for fine sediments moving downstream and thereby further reduce the spawning habitat needed by fish to sustain populations. The reservoirs themselves, particularly the large Somerset and Harriman reservoirs, have become well armored and have reduced fisheries habitat along their shorelines. Water level fluctuations in these large reservoirs and some of the smaller reservoirs have also reduced fisheries habitat cumulatively by physically reducing the availability of habitat, particularly on a seasonal basis when spawning occurs.

Historically, Atlantic salmon used the Deerfield River for spawning and records show they reached Shelburne Falls. This indicates that there was some spawning habitat in the Deerfield River. In recent years there have been efforts to re-establish Atlantic salmon and landlocked Atlantic salmon in the river basin. There appears to be ample habitat for rearing Atlantic salmon smolts. For resident fish, spawning habitat appears to be somewhat limited to those stream reaches containing suitable gravel substrates, although the restrictions on establishing robust self-sustaining fish populations can be attributed to several factors including hydropower peaking operations and, to a lesser extent, intensive sport fishing.

Cumulative losses in fish habitat have occurred from hydropower and other development in the river basin. Nearly 19 percent of the 68-mile-long river has water diverted or bypassed from the main river channel for power production. These bypassed reaches have no water during some periods of the year and for many projects or developments there was no minimum flow required. Other development in the river that have contributed to cumulative losses of fish habitat include logging and dams for mill operations.

Fisheries habitat in the river basin has also been affected by other water usage. The YAEC, located on the Sherman reservoir, used large quantities of water for once-through cooling purposes. This type of use, and the discharge of warmer water, increased water temperatures in the reservoir and in stream reaches below the project, perhaps limiting trout habitat. Water temperatures have also increased in the long bypassed stream reaches, and the ponding of water in reservoirs has also increased temperatures. Warmer water temperatures caused by hydropower and nuclear projects likely influenced the proportion of habitats for warm- and coldwater fish. Other water usage in recent years, such as withdrawals for wastewater treatment, for agricultural or industrial purposes, has not had the impact on fisheries habitat that is attributed to the long-term hydropower development that has changed the Deerfield River into a controlled system.

3.2.4 Wetland Resources (Source: VANR 1988b, unless otherwise indicated).

The states of Vermont and Massachusetts have lost approximately 35 percent and 28 percent, respectively, of their wetlands within the last 200 years (Dahl 1990). According to VANR (1988b), Vermont has lost approximately 35 percent of its wetland resource base since this time, which represents about 70-80,000 wetland acres. Wetland loss in Vermont and Massachusetts is now a priority issue.

Past Effects on Wetlands

The cumulative impacts of this historical land use upon wetlands resulted in both long-term wetlands loss and short-term impacts upon the wetland resources. Vermont probably lost some wetlands due to the development of settlements (by 1810, Vermont's population had exceeded 200,000 people). Settlers cleared land for their cabins and grazing pastures. But extensive wetland loss resulted from draining and filling activities aimed at providing additional lands for crops and grazing activity. This loss probably occurred up to the early 1900s, and to a lesser extent still occurs today. Filling activities generally results in permanent wetlands loss. It is likely that extensive wetland resources were forfeited due to the expansion of agricultural activities throughout the state. Wetland loss by draining can be reversed and often its impact upon the wetlands resource is temporary.

The clearing of land likely resulted in an increase in soil erosion and deposition in surface waters, including lakes, rivers, and wetlands. The intensive timber harvesting activities which occurred throughout the 1800s probably had a dramatic effect upon the integrity of Vermont's wetlands. Wood was cut for the lumber market and to meet the demands for fuel. Timber harvesting in upland and lowland areas was largely unregulated and the environmental impacts were severe. The degree of siltation and sedimentation of surface waters resulting from disturbed forest soils was exacerbated by the agricultural clearing and associated soil erosion. While exact figures are not available, it is likely that some timber harvesting activities took place in wetland forests. Many of the impacts from timber harvesting activities resulted in only relatively short-term alteration of the various functions and values of affected wetlands.

Between 1880 and 1966, 1.7 million acres of farmland reverted to forest. During this time, Vermont's population became increasingly concentrated in small urban areas. Timber, however, continued to be harvested, and in 1889 the forest products industry peaked in Vermont. The demand for softwoods increased as pulp production expanded. Softwoods were taken from the upland and wetland areas. The timber harvesting industry slowed in the early 1900s and by the 1920s it had sunk to about half of its 1889 level. Forest land continued to reclaim the landscape and between 1945 and 1965, 45 percent of the land had reverted from cropland and treeless pasture to forest.

Since World War II, Vermont's population has continued to grow and become concentrated in small urban areas. Urbanization and, to a lesser extent, industrial development, has occurred throughout the state. These events have resulted in continued impact upon wetlands. Other activities which have resulted in cumulative effects to historical wetlands include: installing utility transmission corridors; constructing various structures and roads; filling wetlands; constructing dams, channels, and ditches; drainage; logging; and moorings and wharves (VANR 1988b).

Future Effects on Wetlands

Many factors may potentially influence the rate and direction of future wetland loss. Federal, state, and local land use policy have changed dramatically over the last 20 years and these changes have had an impact upon the wetland resource. As well, population growth and urbanization have occurred in certain areas more than others and the pressures of development have not been equal in all parts of the state. Agricultural and silvicultural activities continue to fluctuate with the marketplace, and the ups and downs of production have a major influence on the effect of these activities upon the wetland resources.

The annual wetland loss in Vermont is about 120 acres. This figure was derived from an analysis of the reported wetlands loss (taken from data reported to the Wetlands Office of the Division of Water Resources). This figure incorporates wetlands gains made through mitigation efforts by the wetlands office. Excluding these beneficial mitigation gains would probably mean that wetland losses in Vermont are approximately 200 acres annually.

3.2.5 Recreation and Land Use Resources

The Deerfield River is one of the most heavily used recreational rivers in the New England Region, and the principal recreational activities along the Deerfield River include both whitewater boating and angling. These recreational opportunities are cumulatively affected by hydroelectric development on the Deerfield River.

Whitewater Boating

Whitewater boating on the Deerfield River has developed over the past century with the most significant increase resulting from NEP's designated whitewater boating flows in the past decade. The Deerfield River provides opportunities for Class I through Class V whitewater within a 15-mile radius of Charlemont, Massachusetts.[2] Whitewater boating primarily occurs along two stretches of the Deerfield River in Massachusetts: a 3-mile stretch between the Deerfield No. 5 dam and the Bear Swamp reservoir (the Monroe Bridge Section), and a 5-mile stretch between the Fife Brook dam and Route 2 near the Zoar Gap area (the Fife Brook Section), Massachusetts.

Since 1991, NEP has provided scheduled flow releases suitable for whitewater boating at the Monroe Bridge and Fife Brook Sections. Boating use during a scheduled flow release weekend in 1991 averaged 600 visitor days at the Monroe Bridge Section and 300 visitor days at the Fife Brook Section (Land and Water Associates 1993c). The state of Massachusetts regulates participation by commercial rafts to a limit of 320 total patrons per day for the entire Deerfield River.

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[2] Based on the International Scale of River Difficulty, which defines six difficulty classes of whitewater: Class I-easy; Class II-novice; Class III-intermediate; Class IV-advanced; Class V-expert; and Class VI-extreme.

At high flows, occasional boaters float the six- miles of Class I and II whitewater along Deerfield River's East Branch tributary (Somerset reservoir down to the Searsburg impoundment). Additional Class II whitewater is offered below the Deerfield No. 2 development when this facility is generating. Currently, access limitations and the insufficient flows at these two sections in the upper and lower reaches of the Deerfield River inhibit whitewater boating opportunities.

Today, numerous rivers in the northeast provide whitewater opportunities ranging from Class II to V on the International Scale of Difficulty. Eleven of the 30 rivers in the eastern United States that are generally known for their commercial whitewater rafting are located in the New York/New England Region (Land and Water Associates 1993b). The availability of summer whitewater boating opportunities in the New England Region, however, is limited to the few rivers that have scheduled dam releases (Table 3-1). The majority of these summer whitewater reaches are on larger rivers with relatively steep gradients and are among the most technically difficult whitewater areas. These include the: Penobscot, Aroostook, Kennebec, Dead, Magalloway, and Rapid Rivers in Maine; the Androscoggin and Pemigewasset Rivers in New Hampshire; the Farmington River in Connecticut; and the Deerfield River in Massachusetts. Many of these rivers are popular for whitewater rafting and support commercial whitewater boating operations.

Within the New England Region only a few rivers offer intermediate level (Class III) whitewater boating in the summer, providing training opportunities for a variety of boating skills. These include the 5-mile Fife Brook Section of the Deerfield River, the 1.5-mile Bristol Section of the Pemigewasset, the 0.75-mile Errol Rapids Section of the Androscoggin River, and the 1.5-mile Tarriffville Gorge Section of the Farmington River.

Adventure Class (at least Class IV) whitewater stretches offering commercial boating are limited in the New England Region. The four Adventure Class whitewater stretches offering commercial boating in New England include: the Monroe Bridge Section of the Deerfield, the Kennebec, Moose, and the West Branch of the Penobscot. The Deerfield River's Monroe Bridge Section is considered one of the most significant whitewater stretches in southern New England for advanced intermediate and expert boaters. Also, the Deerfield River's free-flowing West Branch tributary is a Class V run, with the only navigable Class VI drop in New England.

The Deerfield River is unique in New England for two reasons: (1) it provides Class III and IV whitewater, which is relatively uncommon in the summer; and (2) it is near large populations. The Deerfield River is quickly becoming one of the premiere whitewater rivers in the United States resulting from the increase of whitewater flows and flow predictability at the Monroe Bridge and Fife Brook Sections. For example, the 1993 U.S. National Champion whitewater slalom and downriver races were held at the Monroe Bridge and Fife Brook Sections.

Land and Water Associates (1993c) estimated that the capacity for whitewater boating on the Monroe Bridge Section at 240 boaters in commercial rafts and 320 to 500 persons in individual boats. Similarly, whitewater boating capacity along the Fife Brook Section was estimated at ranges of 90 to 270 boaters in commercial rafts and 135 to 165 persons in individuals boats. [3]

Whitewater boating trends at rivers in New England with comparable whitewater opportunities have seen dramatic commercial rafting use increases in the past 10 years. Whitewater rafting on the Dead River in Maine grew by 20 percent annually between 1985 and 1987. Boating is the number three recreational management priority in Massachusetts, as there are 33,000 boaters greater than the supply of whitewater opportunity: a 16 percent deficit. This is a problem throughout New England and future predictions indicate

[3] These ranges in total users are dependant on the flow release schedule at the Monroe Bridge section (*i.e.*, when there is no flows at the Monroe Bridge section the capacity at Fife Brook is estimated at 270 persons in commercial rafts and 135 private boats).

Table 3-1. Class II-IV Whitewater Rapids in New England--Reliable Summer Runs (Source: AMC River Guides, in Land and Water Associates 1993b).

River	Class	Miles	Hours from Boston
ST. JOHN WATERSHED, ME			
Aroostook River (Ft. Fairfield-St. John)	IV	6	9
KENNEBEC RIVER WATERSHED, ME			
Dead River 2500 cfs, Spencer Str-Forks	III	16	5
Dead River @3500+ cfs, Spencer Str-Forks	IV	16	5
Kennebec River (Harris Station-Carry Brook)	IV	3.75	5
Kennebec River (E. Outlet-Indian Pond)	IV	3.5	5.5
ANDROSCOGGIN RIVER WATERSHED, ME/NH			
Androscoggin River (Errol dam-NH 26 Bridge)	III	.75	4.5
Magalloway River (Aziscohos dam-Wilson Mills)	IV	3.25	4.5
Rapid River (Middle Dam-Lake Umbagog)	IV	6	4.5
PENOBSCOT RIVER WATERSHED, ME			
W. Branch (Seboomook dam-Roll dam)	IV	3.5	7
W. Branch (McKay Station-Passamagamet Falls)	V	19.5	7
CONNECTICUT RIVER WATERSHED, MA/CT			
Farmington River (Tarriffville Gorge)	III	1.5	2.75
Deerfield River (Fife Brook)	III	5	2.5
Deerfield River (Monroe Bridge section)	IV	4	2.5
MERRIMACK RIVER WATERSHED, NH			
Pemigewasset River, Bristol Section	II-III	1.5	2.0

Note: This table does not include those rivers which are runable during "wet summers", or which have very limited dam releases, such as rivers with flood control dams.

that boating is likely to continue increasing in popularity (MA DEM 1988).

Future whitewater boating use on the Deerfield River is expected to increase at rates of at least 25 percent per year until 1998 and then by 10 percent per year until the area reaches its use capacity (Land and Water Associates 1993c). Cumulatively affected by the 10 locations where the Deerfield River is dammed, future use of this valuable recreational resource is dependent on scheduled whitewater flows, flow predictability, and adequate boating access (*i.e.*, parking capacity, designated put-in and take-out locations).

Angling

Angling opportunities along the Deerfield River include lake fishing (primarily in the Vermont portion of the river basin) and river fishing (primarily in the Massachusetts portion). Harriman reservoir receives the greatest amount of angling use in the river basin; angling use on an average summer weekend at Harriman is estimated at 230 visitor days (Land and Water Associates 1993c). During the winter months, ice fishing is popular at the Deerfield River impoundments and particularly popular at the Harriman reservoir; angling registration at an annual ice fishing tournament on the Harriman reservoir is typically about 1,000 contestants.

Historically, dam construction along the Deerfield River has adversely affected angling use opportunities by diminishing an anadromous fishery. The Deerfield River below Shelburne Falls once supported an Atlantic salmon fishery that was essentially eliminated from the river as a result of dam development in the early 19th century. While dams still obstruct the upstream movement of salmon, recent surveys indicate that a significant amount of spawning and nursery habitat still exists throughout the Deerfield River Basin for Atlantic salmon (Policy Committee for Fisheries Management of the Connecticut River 1982).

The *Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River Basin* identifies the Deerfield River as a tributary to the Connecticut River that is critical to the success of the salmon restoration effort (Policy Committee for Fisheries Management of the Connecticut River 1982). In this strategic plan the federal and state agencies' goal statement is "to provide and maintain a sport fishery for Atlantic salmon in the Connecticut River Basin and to restore and maintain a spawning population in selected tributaries." As part of this effort to restore salmon to the Connecticut River, the Deerfield River is now managed as a rearing area for small Atlantic Salmon. One of MA DFW's management strategies for the Deerfield River is to "designate Atlantic salmon fishing areas and open the Atlantic salmon sport fishing season as soon as sufficient fish are returning to meet management objectives" (MA DFW, undated).

Development and operation of hydropower along the Deerfield River have also cumulatively affected resident fish angling opportunities as a result of tailwater ramping rates and bypassed reach flow reductions. Peaking operations of the river's hydropower developments results in rapid, unnatural, flow fluctuations of the river. Gradual ramping rates and/or effective warning signals below the developments are essential to alert anglers to the danger of rising waters. Warning horns/sirens are currently used below NEP's No. 3 development and WMEC's Gardners Falls Project.

Only four of the 10 hydroelectric developments on the Deerfield River have minimum flow releases: Somerset, Deerfield No. 5, Deerfield No. 2 developments, and Bear Swamp Project's Fife Brook dam. While trout angling opportunities exist below these developments, minimum flow increases could significantly improve the trout fishery at these developments. Additional trout angling potential exists at the bypassed reaches of the Searsburg, Harriman, and the Deerfield No. 4 developments, but is currently restricted by the lack of minimum flow releases.

Future efforts to restore an Atlantic salmon fishery on the Deerfield River would cumulatively benefit angling opportunities in the river basin. Atlantic salmon are an important recreational fish in the New England Region and efforts to restore an Atlantic salmon fishery along the Deerfield River could lead to a substantial increase in recreational fishing pressure. In addition, modifying hydropower operations along the Deerfield could improve the trout fishery in selected bypassed reach sections, cumulatively benefiting angling opportunities in the river basin.

Land Use

Extensive portions of the forested land in the Deerfield River Basin were once logged or cleared for agriculture during the 19th century. Acquisition of land and timber rights for the Green Mountain National Forest, formally established in 1932, provided controls and management of the forest resources within the region. Other land portions within the river basin have reforested since NEP's land acquisitions for hydropower development in the early part of the 20th century.

Today, NEP owns a significant portion of the shore land along the Deerfield River and their land management practices cumulatively affects land use and development along the river. NEP owns a total of

15,736 acres of project land bordering the river in Vermont, which accounts for most of the Deerfield River shore land from Somerset to the Massachusetts border. In Massachusetts, NEP owns 2,619 acres of land bordering the river (includes the Bear Swamp Project and non-project land).

NEP's forestry activities on their properties in the river valley date back to the 1940's and professional forest management began in 1962. The company's current forestry program "New England Electric Forest Management Plan" was developed in 1984. The plan emphasizes that multiple-use of various forest resources and project lands are managed primarily to protect watershed yield, provide erosion control, and provide a sustainable yield of quality forest products. NEP also manages its lands to include recreational uses, scenic values, fish habitat, and wildlife habitat.

While the lands surrounding the Deerfield River are primarily rural and residential, the current local zoning laws in Massachusetts offer little protection against future development along this stretch. Only two areas along the Massachusetts stretch of the Deerfield River offer protective zoning: (1) a 1.5-mile stretch between Route 91 and Deerfield, Massachusetts is designated as an aquifer protection district; and (2) Greenfield, Massachusetts has a set-back requirement for development along the river and its tributaries (Franklin County Planning Department 1990).

NEP's Deerfield Project boundary currently provides an extensive buffer zone along most of the river corridor in Vermont and significant portions of the river corridor in Massachusetts. NEP owns significant segments of Deerfield River shore land that has potential development value, and these properties are likely to increase in value due to the river basin's growing tourism industry. Continued protection of these properties from future subdivision, shore land development, inappropriate forestry practices, and agricultural activities would help prevent adverse cumulative effects on the river basin's fisheries, wildlife, aesthetic, and recreation resources.

3.2.6 Aesthetic Resources

While the Deerfield River is considered a hardworking river regarding hydroelectric power production, it's proved an exception to the rule of highly developed New England waterpower resources. In 1880, the river supported little industrial development due to the fluctuating, wild, and unrestrained character of the river. Other obstacles to development included the narrow river valley which confined the ability to develop villages, and the area's steep slopes, boulders, and rocky soils hinder early farming development (Cook, *el al.* 1991).

The lack of commercial or industrial development in the river basin has protected aesthetic resources, and today NEP manages their lands bordering the Deerfield River to protect scenic values. Continued protection and management of NEP's and WMEC's properties along the Deerfield would cumulatively benefit aesthetic resources by protecting the river basin's scenic views and undeveloped land.

Project impoundment level management, flow diversion in the bypassed reaches, and tailwater flow reduction cumulatively affect scenic views along the Deerfield River. At Somerset and Harriman scenic views are affected by the drawdowns of these reservoirs, exposing substrate along the shoreline. Average water-level drops at Somerset between May and December average about five feet. During the same eight-month period, average water-level drops at Harriman are about 12 feet. Water-level drops at Somerset and Harriman during the peak summer recreation period (June 1 to August 30) are four and six feet, respectively. Drawdowns of this range disrupt the viewshed at these scenic reservoirs.

While minimum flows releases are currently provided at several of the developments along the Deerfield, the bypassed reaches at Searsburg, Harriman, and at Deerfield No. 4 lack minimum flow releases. The total combined length of these bypassed reached sections is nearly 9 miles, and flows along these sections are often limited to leakage and drainage from tributaries. Future operation of these developments without minimum flow releases in the bypassed reaches would continue to cumulatively affect scenic views along the Deerfield River.

3.2.7 Hydroelectric Generation

Changing power generation technology has had a dramatic impact in the valley and especially on the Deerfield River itself. The first change was the development of larger, more efficient dams and water-power wheels, and then turbines, which resulted in the damming of larger streams, and the construction of larger factories (Franklin County Planning Department 1990).

In 1897, the first electrical power plant in the Deerfield River valley was built in Shelburne Falls. It was powered by a water wheel driven generator. The water power for this plant was replaced with a steam turbine in 1908. The steam plant was abandoned when the Gardners Falls dam and power plant were completed in 1904 by the Greenfield Electric Light and Power Company (the company's name was later changed to WMEC). Since that time, the waters of the Deerfield River have been harnessed to create the highest concentration of hydroelectric generating facilities in New England (Franklin County Planning Department 1990).

In 1910, the NEP was formed in order to acquire water rights on the Deerfield River and construct a number of dams and plants to meet the rapidly increasing demand for electric power. NEP began to buy up the smaller electric power enterprises that existed along the Deerfield River. Three developments (Deerfield Nos. 2, 3, and 4) were built in Shelburne Falls in 1912 and 1913. In 1915, Deerfield No. 5 was completed on the Deerfield River between Monroe and Rowe, replacing the steam generator used to power the electric trains going through the Hoosac Tunnel. In the 1920's, the Searsburg and the Harriman hydroelectric power plants were completed on the upper reaches of the Deerfield River in Vermont, and the Sherman plant was completed in Monroe. In 1960, Yankee Atomic Power Plant was built adjacent to the Sherman plant's pond. In 1974, the Bear Swamp Pumped Storage Plant was completed with a new Deerfield No. 5 built at the head of its pond. The Yankee Atomic Power Plant worked in conjunction with Bear Swamp Pumped Storage Plant for maximizing the use of its energy production. A new hydro plant was completed at Fife Brook in 1974 (Franklin County Planning Department 1990).

The Deerfield River is one of the principal tributaries of the, 280-mile-long, Connecticut River Basin. The Connecticut River Basin has a total drainage area of approximately 11,265 square miles. Seventy-nine existing hydroelectric plants are licensed in the basin and another 45 plants are under exemptions issued by the Commission as of July 1996.

3.3 SITE SPECIFIC RESOURCES

3.3.1 DEERFIELD PROJECT (Source: NEP 1991, 1992, and 1993, unless otherwise indicated).

3.3.1.1 Geology and Soils

The Deerfield River area is underlain by metamorphic rocks varying in age from 1.1-billion-year-old (Grenville Age) pre-Cambrian metamorphic rocks to 395 to 345 million year old Devonian-age metasediments. Grenville gneisses and quartzites, which comprise the core of the Green Mountains, occur in the northern, upper, part of the Project area at Somerset reservoir, the upper reaches of the Deerfield and East Branch Deerfield Rivers, and parts of the Harriman reservoir area. Downriver, the rocks generally become progressively younger, and include: Cambrian-age schists, quartzites, micaceous quartzites, marbles, and amphibolites; Ordovician-age shales, phyllites, quartzites, schists, amphibolites, and greenstone; and Devonian-age phyllites, greenschists with tight knots of magnetite or garnet, micaceous quartzites, amphibolites interbedded with quartzites, marble interbedded with quartz-mica schists, and some interbedded gneisses. Some arkose sandstones occur below the hydroelectric reach at the lower end of the Deerfield River in Deerfield.

Except for some reworked alluvial deposits along the Deerfield River and other streams, the unconsolidated deposits in the Deerfield River Basin consist primarily of very coarse glacial tills containing high percentages of cobbles and boulders, as well as sand, gravel, pebbles, and clay-size particles. The tills, particularly on uplands, are generally thin, and contain high amounts of cobbles and boulders. Thicker till deposits occur at Somerset and Harriman reservoir areas.

Unconsolidated deposits on the narrow valley floors consist of coarse alluvial deposits which contain high percentages of cobbles and boulders. Some of these deposits have low percentages of gravel and little or no sand component. They formed from coarse glacial till parent material. The finer component sands and sometimes the finer gravels tend to be washed away due to the high flow velocities of the steep-gradient Deerfield River.

Unconsolidated deposits at the reservoirs began as submerged tills and alluvial deposits when the reservoirs were first filled. Now, the shoreline deposits often appear similar to the alluvial deposits on the valley bottoms and river beds in that most of the reservoir shorelines are commonly covered (or "armored") with a layer of coarse material -- cobbles, boulders, and gravels -- cobbley, bouldery glacial tills from which the fine sand components have been washed by wave action, to some extent enhanced by fluctuating reservoir levels.

Several minor, inactive bouldery rockslides also occur along the Somerset reservoir shoreline. At the Harriman reservoir, some minor, active bank erosion, with some collapses and slumping in steeper areas, occurs along the north shoreline at the north end of the reservoir between the Deerfield River and North Branch Deerfield River inlet arms, at the NEP picnic areas along the west shore at the north end of the reservoir and along the east shore near Wards Cove, and at the boat launch area in the southeast arm of the reservoir near Whitingham. These areas are also partially armored with cobbles. The Searsburg reservoir shoreline is free from landslides or bank collapse areas.

At the Somerset reservoir, the surrounding forest comes almost to the normal pool waterline around most of the reservoir. In some areas away from exposure to wave action, vegetation is well established even in areas which were cleared prior to initial reservoir filling.

Some parts of the reservoirs' banks are also benched. At the bench fronts are rocky shorelines and at the back the exposed roots of the front line of trees are visible. At the Searsburg reservoir, some areas in front of the benches are heavily vegetated in addition to areas being covered with rocks. A second growth of trees has begun to grow in front of some of the benches at the Harriman reservoir. The east shore of the Harriman reservoir also has several steep bedrock outcrops, several of which are highly fractured and which, in some cases, have become partially undermined; a few have collapsed as small, local rock slides.

Several mudflats, totalling about 0.76-mile in length, occur in small coves along the west Somerset reservoir shoreline and at the extreme northeast and northwest arms of the reservoir, the result of alluvial deposition from inflowing streams. Also scattered around the Somerset reservoir are sand and gravel beaches in areas which aren't subject to wave action or where upland soils have been eroded and alluvial fans have formed where the drainage courses enter the reservoir. Several alluvial fans also occur along the east shoreline of the Harriman reservoir where natural drainage courses enter the reservoir, including the stream inlets formed by No. 9 Brook and the Sadawga Lake outlet stream in the southeast arm of the reservoir. When exposed during draw-downs, erosion rills or low-height benches sometimes occur on the fans due to rain and wave action.

3.3.1.2 Water quality and quantity

3.3.1.2.1 Somerset

The Somerset reservoir is a large (1,623 acre surface area) oligotrophic impoundment, low in productivity, draining an area of about 30 square miles. The reservoir has a mean depth of 24 feet, a maximum depth of 92 feet, is about 5.6 miles long, and about 1.1 miles wide. Shoreline slopes are steep to moderate, there are several islands during full pool, and 10 streams enter the reservoir. Coarse gravel/cobble/boulder covers much of the shoreline bottom of the reservoir.

The reservoir is used for seasonal storage, providing the predominant flow regulation for the watershed. The Somerset reservoir functions to retain most flow during spring runoff, enhance peaking operations for hydropower projects located downstream, which also results in augmented summer flows to enhance recreational boating and fishery activities.

To accommodate seasonal storage, the Somerset reservoir is normally drawn down about 5 feet over the summer/fall period, and an additional 10 feet is drawn off during the winter (from mid-December through mid-March). During mid-July through October, the reservoir is drawn down about 4 feet on the average, but has been drawn down as much as 19 feet, based on the records from 1973 to 1993 (VANR 1995). The reservoir levels are rapidly restored following spring runoff (Table 3-2). Management of the reservoir is highly variable from year to year because of the seasonality of the water sources. In anticipation of higher-than-normal spring runoff from snowmelt and/or precipitation, the reservoir is drawn down to lower levels, and the opposite action occurs when there are drier conditions with less rainfall or snowmelt.

Results of water quality sampling conducted by NEP in 1991 are similar to data collected in earlier studies. In general, water quality of the Somerset reservoir meets the Vermont state standards. Because of a lack of natural buffering materials in the river basin, the pH, tends to be acidic and ranges from 5.2 to 6.0. The reservoir, like others in Vermont, including Harriman and Sherman reservoirs, is sensitive to acidic inputs from melting snow (Clarkson 1982). Water temperatures support coldwater fish (preferring temperatures around 21°C) and DO levels remain near saturation above the thermocline, but it does stratify during the summer months, with DO levels declining in the deeper parts of the reservoir. However, despite low DO levels in the bottom waters of the reservoir, waters released into the Deerfield River from the Somerset reservoir have high DO because the type of release mechanism at Somerset aerates the water as it is released. The water intake is located about 25 to 30 feet below the surface (the dam crest is at 2,133.58 feet msl) and draws cooler but less oxygenated water from below the thermocline.

Water quality and quantity below the Somerset reservoir

The Deerfield River below the Somerset development has been classified as Class B waters by the state of Vermont (Vermont Water Resources Board 1991). Water quality usually meets the Vermont state standards for the 6-mile stream reach between the Somerset dam and the Searsburg development (Somerset Reach). Temperature and DO levels range from 10 to 12°C and 9.1 to 13.0 mg/l, respectively, for July, August, and September. However, DO and temperature levels can fluctuate because of alterations in flows caused by project operation.

Since 1963, NEP has voluntarily released a continuous minimum flow of 3.9 to 4.7 cfs from a half-gate opening of a 6-inch pipe. The amount of water released is influenced by the water elevation in the reservoir. This minimum flow is provided for the purpose of improving the fisheries potential of the East Branch of the Deerfield River. During the winter drawdown period, NEP normally releases about 120 cfs from the Somerset reservoir to maintain the downstream Searsburg on-line and to prevent the Searsburg penstock from freezing. Under median water year conditions (using 1980 as the median water year), total average daily flows in the stream reach were 91 cfs and the median August and September flows were 8 cfs. Five brooks also enter this 6-mile river reach, augmenting flow released by the development (VANR 1988c).

3.3.1.2.2 Searsburg

The Deerfield River at the Searsburg development is classified as Class B waters by the state of Vermont (Vermont Water Resources Board 1991), and as presently operated, meets the state water quality standards. The bypassed reach can experience changes in DO concentrations and temperature, usually as a result of flow alterations caused by project operation.

The Searsburg reservoir is a small, steep-sided shallow, riverine impoundment, draining a watershed of about 90 square miles. It has a surface area of about 28.5 acres, is about 1 mile long, and ranges in depth from five to 20 feet with the deepest point at 39 feet just above the dam. Because of the riverine nature of the reservoir, water quality changes little as flows pass the project, and it is doubtful that a thermocline forms during the summer months. The discharge from the Searsburg powerhouse enters the Deerfield River about 1 mile upstream from Harriman reservoir. No water quality sampling has been conducted in the impoundment.

Table 3-2. Typical reservoir management of the Somerset Reservoir between 1973 and 1993 (Source: NEP 1993).

Period	Water Level (feet msl)		Change in stage (in feet)
	Start	End	
May - July	2,131	2,128	-3
August - October	2,128	2,124	-4
November - December	2,124	2,126	+2
January - early March	2,126	2,116	-10
March - April	2,116	2,131	+15

Bypassed reach and area immediately below the powerhouse

During the summer months the water temperatures typically increase by about 3°C between the upper reaches and the lower reaches of the 3.5-mile-long bypassed reach. Low flow, rocky substrate, warm air temperature, and channel exposure are factors causing increased temperatures. The downstream effects of the temperature increase are quickly reduced at the confluence of the bypassed reach with the cooler water discharged from the powerhouse. There is currently no minimum flow release required to the bypassed reach, and flows released from the powerhouse range from 65 to 130 cfs.

3.3.1.2.3 Harriman

The Harriman reservoir is a large (surface area of 2,039 acres) meso-oligotrophic impoundment that is relatively low in productivity. The reservoir drains an area of 184 square miles, is about 9 miles long and 0.78 miles across at its widest point, has a mean depth of 34.5 feet and a maximum depth of 180 feet. Shoreline slopes are generally steep, there are several islands present during full pool, and fourteen tributaries enter the reservoir. Coarse gravel/cobble/boulder covers the floor of the reservoir.

The reservoir is used for seasonal storage, functioning to retain most flow during spring runoff, enhance peaking operations for hydropower projects located downstream and in augment summer flows to enhance recreational boating and fishery activities.

For seasonal storage, the Harriman reservoir is normally drawn down about 14 feet over the summer/fall period (from spring levels) and an additional 25 feet during the winter, with reservoir water levels restored by spring runoff. Reservoir management is highly variable from year to year because of the seasonality of the water sources. In anticipation of higher-than-normal spring runoff from snowmelt and/or precipitation, the reservoir is drawn to lower levels and the opposite occurs during drier conditions. During the mid-July through October period, the reservoir is drawn down about 7 feet on the average (VANR 1995) (Table 3-3).

Results of water quality sampling conducted by NEP in 1991 are similar to data collected in earlier studies. In general, water quality of the Harriman reservoir meets the Vermont state standards. Because of a lack of natural buffering materials in the river basin, the pH tends to be acidic and ranges from 6.4 to 5.9, and is sensitive to acidic inputs (Clarkson 1982). Temperatures support coldwater fish, and DO levels remain near saturation throughout the water column. All DO concentrations measured below the outlet structure for the Harriman reservoir met the Vermont state criteria (6 mg/l or 70 percent saturation) for coldwater streams, with one exception. On September 28, 1989, under a powerhouse full gate discharge of 1,600 cfs, DO saturation dropped slightly below the state standard. The reservoir usually stratifies with respect to temperature during the summer months. The Harriman water intake is located deep in the reservoir, about 108 feet below the surface (at maximum elevation of 1,497.66 feet msl), and therefore passes cooler water from below the thermocline.

Table 3-3. Typical reservoir management of the Harriman reservoir between 1973 and 1993 (Source: NEP 1993).

Period	Water Level (feet msl)		Change in stage (in feet)
	Start	End	
late May--mid July	1,494	1,487	-7
mid July--October	1,487	1,480	-7
Nov.--early December	1,480	1,482	+2
Dec.--early March	1,482	1,455	-27
March--early May	1,455	1,494	+39

Until a recent VANR (1995) reclassification, the Deerfield River had three areas classified as Class C waters: (1) the lower 1.4 miles of the North Branch of the Deerfield River that enters the Harriman reservoir, (2) a 0.41 acre section of the Harriman reservoir near the Whitingham municipal wastewater treatment facility discharge, and (3) a portion of the bypassed reach below Harriman dam between the confluence of the West Branch and the Harriman powerhouse. The Harriman drainage area shows impacts on water quality from increased housing density, land conversion to agricultural use, and from wastewater treatment plant effluent. These activities have elevated total phosphorus concentrations in the reservoir. Studies conducted by EPA in 1972-73 and by the VANR in 1985, showed increases in total phosphorus concentrations and chlorophyll "a" values over time, indicative of enrichment.

Water quality and quantity below the Harriman dam

The bypassed reach currently receives leakage from Harriman dam, flow from intervening tributaries, and flow from the West Branch, which empties into the lower portion of the reach. Water quality samples collected in the bypassed reach under flow conditions of less than 1 cfs, showed water temperatures to be 21°C, with DO levels at 7.8 mg/l. Identical parameters measured below the confluence of the West Branch, where flow increased to 10 cfs, showed cooler water temperature (17°C) and similar DO (9 mg/l). There is no free flowing river segment below the Harriman powerhouse, as the Harriman tailrace discharges directly into the Sherman reservoir. Flows released from the powerhouse usually range from 520 to 1,600 cfs.

3.3.1.2.4 Sherman

The Sherman reservoir is a relatively small (surface area of 218 acres), shallow reservoir, about 2 miles long and 1,300 feet wide at its widest point, draining 236 square miles. The reservoir straddles the state borders of Vermont and Massachusetts. The majority of the inflow to Sherman reservoir is determined by outflows from Harriman reservoir, with additional unregulated inflow from the West and South Branches of the Deerfield River. The South Branch of the Deerfield River discharges directly into the Sherman reservoir. The powerhouse discharges into the Deerfield No. 5 reservoir, which backs up to the Sherman tailrace.

The Sherman reservoir is typically operated on a weekly drawdown basis and operates in a daily peaking mode. The water level is drawn down daily behind the 4-foot flashboards, and occasionally 7-foot drawdowns occur to meet peak power demands or to create storage in anticipation of high runoff.

The Deerfield River at the Sherman development is classified as Class B waters by Vermont and Massachusetts, and presently meets state water quality standards for both states. Water quality appears to be well suited to support a coldwater fishery. Limited water quality sampling has noted water temperatures under 20°C at depths below 10 meters, and DO was excellent at all depths. The reservoir stratifies with respect to temperature during the summer months. Water quality studies conducted by MA DEQE in 1988 classified the Sherman reservoir as a relatively stable, poorly buffered, oligotrophic system with no evidence of water quality problems other than its susceptibility to acid precipitation.

3.3.1.2.5 Deerfield No. 5

The No. 5 reservoir is a small (8.2 acre surface area), shallow (depths of 5 to 10 feet), riverine impoundment that is about 2,400 feet long and about 100 to 175 feet wide, draining 90 square miles. Cover and aquatic vegetation are sparse, and substrate varies from sand to boulders.

The Deerfield River at the No. 5 development is classified as Class B waters by the state of Massachusetts (Massachusetts Division of Water Pollution Control 1990). The development presently meets state water quality standards. Water quality is good with DO near saturation from top to bottom in the reservoir and water temperatures less than 20°C. During the summer, water temperatures may become marginal for coldwater species. Water quality samples collected in 1988 for Dunbar Brook, upstream from the No. 5 diversion structure, showed water temperature and DO were suitable for coldwater fish at flows of 2 cfs. Similar sampling in the Deerfield River upstream from the confluence with Dunbar Brook, at flows of 62 cfs, recorded water temperatures considerably higher.

Water quality and quantity in the bypassed reach and below the powerhouse

Flow in this 2.6-mile-long bypassed reach includes leakage from the dam, local drainage, and a continuous minimum flow release of 25 cfs from the dam as per an agreement between NEP and the state of Massachusetts. NEP's commitment to release 25 cfs at the dam was to maintain water quality in the Deerfield River and to offset any pollution caused by discharges into the river by the Deerfield Specialty Products Company. This company is no longer in business, and therefore, the effluent discharges have been terminated, but NEP has continued to release the 25 cfs.

Water quality in the bypass reach appears to meet Class B state standards. Temperature, DO, and saturation were well within the limits set by Massachusetts for coldwater fish (Massachusetts Division of Water Pollution Control 1990). Some elevation of temperature would be expected with reduced flows in the bypassed reach, and increases of 2°C between the upper and lower ends of the bypass reach have been observed. Water quality below the powerhouse is good and meets state standards for Class B waters, with only one observed exceedance.

3.3.1.2.6 Deerfield No. 4

The No. 4 reservoir is a shallow, riverine (surface area of 75 acres) impoundment about 7,400 feet long, 300 to 500 feet wide, draining about 404 square miles. About 2/3 of the reservoir is less than 10 feet deep. The reservoir has a storage area of about 432 acres feet at full pool when the 8 foot flashboards are installed and 284 acre feet when the 6 foot flashboards are used. Cover and aquatic vegetation are sparse, the substrate varies from sand to boulders, and there are several small islands.

The Deerfield River at the No. 4 development is classified as Class B, coldwater fishery by Massachusetts (Massachusetts Division of Water Pollution Control 1990). The development presently meets state water quality standards. Where the North River enters the bypass reach of the No. 4 development, the Deerfield River is classified as Class B, warmwater fishery waters to the confluence with the Connecticut River. Water quality is good in the reservoir with DO and temperature normally within acceptable ranges. Summer water temperatures throughout the water column may exceed the tolerance of coldwater species in the reservoir. The reservoir does not tend to stratify.

Water quality and quantity in the bypassed reach and below the powerhouse

Flow in the 1.5-mile-long bypassed reach below the No. 4 dam, includes leakage from the dam, local drainage, and contributions from the North River, which enters the bypassed reach 0.8 mile below the dam. A 0.45-mile-long segment of the Deerfield River between the No. 4 powerhouse and the No. 3 impoundment is subject to leakage and drainage flows from the North River during periods of non-generation. The bypass reach consists of riffle/runs divided by pools. The substrate is primarily boulders over bedrock. Below the confluence of the North River the bypassed reach broadens out to one sand and cobble substrate pool that extends downstream to the No. 4 powerhouse.

Water quality is good for supporting coldwater species in the bypassed reach, with the exception of summer water temperatures which could exceed tolerance ranges. DO levels are excellent and meet state standards for Class B waters (Vermont Water Resources Board 1991). Water temperatures below the powerhouse are not suitable for coldwater species during the summer months as temperatures exceed 20°C.

3.3.1.2.7 Deerfield No. 3 Development

The No. 3 reservoir is a shallow, riverine impoundment about 5,000 feet long and 130 to 300 feet wide, with a surface area of about 11.4 acres. Most of the reservoir is less than 6 feet deep. Overhanging riparian tree cover is good, but aquatic vegetation and instream cover for fish is sparse, and substrate is predominantly coarse materials.

The Deerfield River at the No. 3 development is classified as Class B waters (Massachusetts Division of Water Pollution Control 1990), and presently meets state water quality standards. DO and pH are excellent supporting a warmwater fishery, but summer water temperatures probably limit year round trout residency. The reservoir does not tend to stratify.

Water quality and quantity in the bypassed reach and below the powerhouse

The 0.4-mile-long bypassed reach receives flow from local drainage and spill over the dam when flows exceed the powerhouse capacity. Flows released from the powerhouse range from 150 to 1,490 cfs. Water temperature at times exceeds 20°C below the powerhouse and in the bypassed reach.

3.3.1.2.8 Deerfield No. 2 Development

The No. 2 reservoir is a small (63.5 acre surface area), shallow riverine impoundment. The reservoir is about 7,900-feet-long and varies in width from 300 to 500 feet. Most of the reservoir has depths less than 15 feet. The substrate is predominantly sand/silt/organic material with some boulder/cobble, and there is little bank cover. There is no bypass reach associated with this development.

The Deerfield River at the No. 2 development is classified as a Class B, warmwater fishery (Massachusetts Division of Water Pollution Control 1990), and presently meets state water quality standards. Water quality is generally good in the reservoir. Summer water temperatures probably exceed desirable limits for supporting coldwater species.

Water quality and quantity below the powerhouse

From the powerhouse, it is about 13.2 miles downstream to the confluence of the Deerfield River with the Connecticut River. About 9 miles downstream from the dam, the Deerfield River begins to show a backing up of water from the Connecticut River.

The upper 6.5-mile-long section of the Deerfield River below the powerhouse has an average width of from 100 to 125 feet, a relatively steep stream slope, and a sequence of repeating riffle/pool habitats. The lower 2.5-mile-long section of the affected stream reach has less change in elevation, increased stream widths, and numerous islands. Several sizeable tributaries enter the 9-mile-long affected reach below the dam, including the South and Green Rivers.

DO is good in the 9-mile-reach affected by the development, but water temperatures in the summer could limit trout residency in this stream reach. Water temperatures below the confluence of the South River also would be limiting for supporting a coldwater fishery.

3.3.1.3 Fishery Resources

3.3.1.3.1 Somerset Development

The Somerset reservoir is managed by the VDFW primarily for coldwater fish. For many years the state has stocked brook, brown, and rainbow trout in an attempt to develop a salmonid fishery in the reservoir. There has been only limited success with the establishment of a brook trout sport fishery and that has evolved into a put-and-take fishery supported by annual plantings of legal sized fish. Landlocked Atlantic salmon and rainbow smelt were planted for seven years and in 1977-1978, respectively. They have not been planted since. A moderate sport fishery has developed in the reservoir, primarily for trout (Land and Water Associates 1991, Franklin County Planning Department 1990, letter from Kenneth Cox, District Fisheries Biologist, North Springfield Regional Office, Pittsford, Vermont, to Milton Anderson, Supervisory Fish and Wildlife Biologist, New England Power Service Company, Westborough, Massachusetts, February 2, 1987).

Popular warmwater fish species caught by anglers include smallmouth bass, chain pickerel, yellow perch, rock bass, pumpkinseed, and brown bullhead. Yellow perch and white suckers dominate the warmwater fish population by numbers (perch) and by weight (suckers). The warmwater fish are considered to be the secondary fisheries management objective of the state, with the primary emphasis by the state centered on brook trout management in the reservoir. The warmwater fishery has never developed into anything more than a marginal sport fishery, although there was an increase in the numbers of smallmouth bass reportedly caught by anglers in creel surveys conducted by the VDFW in 1991 and 1992 (VANR 1995).

The 1983 fish netting data collected by VDFW for the reservoir indicate the warmwater and coolwater fish populations are not robust and fish tend to be relatively small when compared to normal sizes for age and growth of similar species from other locations. The yellow perch population exhibits characteristics of stunting, that is they show a slow growth rate and have a low condition factor (VDFW 1987). Similarly, VDFW said the yellow perch population appears to be abundant but stunted in Somerset reservoir (letter from Kenneth Cox, District Fisheries Biologist, North Springfield Regional Office, Pittsford, Vermont, to Milton Anderson, Supervisory Fish and Wildlife Biologist, New England Power Service Company, Westborough, Massachusetts, February 2, 1987).

Fishery Resources below the Somerset Reservoir to Searsburg

As mentioned earlier, water quality in this 6-mile-long reach is excellent for trout. Quantity of water is the greatest habitat limiting feature. Habitat in this stream reach is primarily riffle/run and riffle/pool with a substrate of boulder and cobble interspersed with pockets of sand and gravel. The river drops about 260 feet in elevation from the Somerset dam to the Searsburg reservoir. Average stream width is from 30 to 40 feet. There are four pool/meadow areas that total about 1.6 miles of this 6-mile-long Somerset reach.

The Somerset reach supports a self-sustaining population of wild brook trout. There is also some immigration of brook trout into this reach from those fish stocked in the downstream Searsburg reservoir. Vermont is also considering this stream segment as potential nursery habitat for stocking landlocked Atlantic salmon fry in the future, contingent on the final management plans for the Harriman development.

For the Somerset IFIM study, NEP and the resource agencies agreed to use brook trout and landlocked Atlantic salmon as the representative fish species for the Somerset reach. The effects of various flow releases on fish and habitat involving the life stages of adult, juvenile, and late fry for each species would be analyzed. However, adult and juvenile landlocked Atlantic salmon weren't included in the analysis because adult fish were not likely to reach or be stocked in this reach and the WUA curves for juvenile Atlantic salmon were very similar to WUA curves for juvenile brook trout which showed decreases in habitat under high flows (both juvenile life stages showed peak WUA occurring at 100 cfs). For these reasons, the resource agencies agreed that juvenile brook trout would be the representative species for study under peaking flow conditions for the Somerset reach. Similarly, NEP and the resource agencies also agreed to exclude spawning and incubation life stages of all fish species in the IFIM analysis for the Somerset, Searsburg, Deerfield Nos. 2 and 4 developments.

3.3.1.3.2 Searsburg

The Searsburg reservoir contains warmwater and coldwater fish and has been managed for brook trout since 1975 when the state began stocking the reservoir. Brown trout were also stocked in the reservoir between 1970 and 1975. Fish species occurring in the reservoir are similar to those occurring in the Somerset reservoir (see Somerset Fisheries, Section 3.3.1.3.1). VDFW's netting activities in the reservoir in 1989 collected large numbers of yellow perch and white suckers, small numbers of brown bullhead, and one brook trout and longnose sucker.

<u>Fishery Resources in the bypassed reach and area immediately below the powerhouse</u>

The 3.5-mile-long bypassed reach provides some coldwater fish habitat when flows are high, however, for a part of the year, flows in the bypassed reach are reduced to leakage from the dam and water temperatures become elevated and are not conducive for trout. The bypassed reach is predominantly riffle/pool and riffle/run with rocky substrate. The substrate is dominated by boulders with some cobble and gravel in the voids. The average width of the river in the bypassed reach is from 50 to 75 feet; and varies from 100 to 200 feet in width in the 1.6 mile reach between the Searsburg powerhouse and the downstream Harriman reservoir.

No fish collection efforts were conducted in the bypassed reach, but any fish present there are likely to be the same as those species occurring in the Somerset and Harriman reservoirs. Large numbers of any species would not be expected because of the lack of sustained flows.

The 0.7-mile-long segment of the Deerfield River below the Searsburg powerhouse provides excellent trout habitat. DO and water temperatures are excellent for trout. Legal sized yearling brook trout are stocked annually in this area. In the past, there has also been immigration of landlocked Atlantic salmon and brown trout to the area from the downstream Harriman reservoir. Rainbow smelt have also travelled to this stream area from Harriman reservoir during their spawning run.

Future management of the 3.5-mile-long bypassed reach and the 0.7-mile-long tailrace area of the Searsburg development is closely tied to the future management of the Harriman reservoir. For example, the success of spawning smelt in these two Searsburg affected stream areas could prove beneficial as a food base source for any successful establishment of a landlocked Atlantic salmon population in the Harriman reservoir.

However, at present there are no populations of Atlantic salmon above the Searsburg development and few landlocked Atlantic salmon have been caught from plantings made in the Harriman reservoir.

3.3.1.3.3 Harriman

The Harriman reservoir is managed by the VDFW primarily for coldwater fish. For many years the state stocked lake trout, landlocked Atlantic salmon, brown trout, and rainbow trout in an attempt to develop a salmonid fishery in the reservoir. Rainbow smelt were also introduced in 1954-55 and the early 1970's and have established a self-sustaining population. There has been only limited success with the establishment of a salmonid fishery. Landlocked Atlantic salmon were stocked in the reservoir by VDFW from 1975 to 1986. The effort produced a poor quality fishery because there were few fish caught and fish exhibited slow growth. There have been some residual holdovers of fish in the reservoir from these early plantings. As part of the continuing experimental efforts, yearling landlocked Atlantic salmon were once again stocked directly into the Harriman reservoir in 1993 and 1994 (VANR 1995). Currently, a fair, put-and-take fishery has been established for rainbow and brown trout with yearlings planted each year. Maintenance plantings of brown trout supplement wild populations that exist in the reservoir and in major tributaries to the reservoir. There is also a good winter sport fishery for smelt, brown trout, and yellow perch (over 1,000 ice fishing shanties have been observed during the winter). In general, Harriman reservoir experiences greater recreational fishing pressure than Somerset reservoir and has a more productive fishery.

Popular warmwater sport fish caught in the reservoir include smallmouth bass, chain pickerel, rock bass, and brown bullheads. Like the Somerset reservoir, fish abundance in the Harriman reservoir is dominated by three species: yellow perch, smelt, and white suckers.

Rainbow smelt and smallmouth bass both spawn in shallow near-shore zones within the reservoir. The timing of when water level drawdowns occur, could affect the spawning, incubation, and fry rearing (overall reproductive success) of these two species. VDFW personnel and several members from the Deerfield River Valley Sportsmen's Club have observed the negative impacts of reservoir drawdowns on smelt eggs. Shore-spawned smelt eggs were destroyed by short-term drops in water levels of several inches to about 4 feet that had coincided with smelt spawning occurring on or around: 1990, 1991, and 1992 (letters from Ken Cox, District Fishery Biologist, Vermont Department of Fish and Wildlife, North Springfield, Vermont, to Mark Wamser, Project Engineer, Stetson-Harza, Concord, New Hampshire, November 16, 1992 and to Thomas Sullivan, Gomez and Sullivan Engineers, Dunbarton, New Hampshire, July 14, 1993). VDFW observations of smelt spawning activities in the reservoir in 1993 didn't report any impacts to smelt eggs from reservoir drawdowns. From several years of observation of smelt spawning activities in the reservoir, it appears that smelt spawning activities are of short duration (five to six days) and occur in late April to early May (April 29 to May 13) when water temperatures approach 48°F.

The VDFW has not monitored smallmouth bass spawning activities in Harriman reservoir as they have done for smelt. However, based on information from other water bodies in the state, VDFW says that smallmouth bass typically spawn in relatively shallow water (to depths of 12 feet) near the shoreline (from 10 to 15 feet from the water's edge) during the spring (from late April to early June) depending on the water temperature (November 16, 1992 letter from Ken Cox to Mark Wamser, cited above). This spawning information by VDFW is similar to other spawning data on smallmouth bass that reports spawning occurring over a period of from six to 10 days (Scott and Crossman 1973) during May or June (Smith 1985; Werner 1980) in near shore waters ranging in depth from about two to 20 feet (Scott and Crossman 1973), when water temperatures are between 61 to 65° F (Scott and Crossman 1973). These spawning requirements would make smallmouth bass susceptible to adverse effects from drawdowns occurring during times of spawning and rearing.

The yellow perch population appears to be abundant but the fish are small. VDFW believes the fish production potential of the Harriman reservoir is limited by water level fluctuations, loss of smelt from the reservoir from entrainment at the hydropower intake, and loss of nutrients as a result of reservoir drawdowns (DesMeules and Parks 1988).

VDFW believes that while fish populations in Harriman reservoir are not robust, smelt are abundant and could provide a forage base for coldwater fish management (VANR 1991). Water quality is good for coldwater fish and despite the lack of aquatic vegetation and dewatering of the littoral zone; there is good potential for coldwater fish management in the reservoir.

Fishery resources in the bypassed reach and area immediately below the powerhouse

The 4.4-mile-long bypassed reach provides some coldwater fish habitat when flows are high, however, after years of periodically reduced flows, portions of the stream channel, in the area above the confluence with the West Branch, have become braided and overgrown with trees and shrubs. The bypassed channel is narrow with moderate slopes. The drop in elevation between the Harriman dam and the powerhouse is 210 feet. The average stream width is about 30 feet in the reach above the confluence with the West Branch and about 100 feet below the confluence. Habitat is riffle/run/pocket pool, with a variety of substrates from cobble to sand and organic material, but is dominated primarily by boulder and cobble. No fish collections were made in the upper reaches of this bypassed section.

Flows in the bypassed reach consist of about 3 cfs leakage from the dam and some runoff from local drainage. The West Branch enters the bypassed reach about 3.25 miles below the dam. VDFW has characterized the lowermost part of the stream reach as marginal for trout.

Frost and Easte's (1977) study of aquatic macroinvertebrates for several areas of the Deerfield River, including study sites in the upper, coldwater reaches of the river and in the lower, warmwater reaches, show a diversity and abundance of species indicative of a healthy river.

3.3.1.3.4 Sherman

The Sherman reservoir is managed by VDFW and MA DFW for brown trout. Both states annually stock the reservoir with yearling brown trout. Brown trout and smallmouth bass provide the major sport fishery. Large, trophy-sized brown trout have been caught in this reservoir. Brown trout weighing around 20 pounds have been caught in the reservoir in 1952, 1967 (Davis and MacPherson 1974), and 1990 (Letter from Jeffrey Cueto, Principal Hydrologist, Vermont Agency of Natural Resources, Waterbury, Vermont, to Lois Cashell, Secretary, Federal Energy Regulatory Commission, Washington, D.C., dated April 19, 1996). Other fish caught in the reservoir include chain pickerel, yellow perch, rainbow smelt, rock bass, brown bullhead, bluegill, pumpkinseed, white sucker, longnose sucker, golden shiner, fallfish, and creek chub as reported by NEP (1991) and from information obtained from the Yankee facility between 1975 and 1988 and from the MA DFW in 1988. Smelt likely entered the reservoir after being entrained from the upstream Harriman development. There is no evidence of a self-sustaining population of smelt in the reservoir. The Sherman tailrace empties directly into the No. 5 reservoir.

3.3.1.3.5 Deerfield Number 5

The No. 5 reservoir contains several fish species, but the MA DFW doesn't manage the reservoir for any particular species. Fish sampling by IA (1990) collected 119 fish representing eight species from the reservoir. Species collected include rainbow trout, smallmouth bass, rock bass, pumpkinseed, and white sucker.

Fishery resources in the bypassed reach and immediately below the powerhouse

The 2.6-mile-long bypassed reach between the No. 5 dam and the normal high backwater of the downstream lower Bear Swamp reservoir is a repeating sequence of riffle/run habitats with relatively deep pools between them. The substrate is dominated by boulders with interspersed sand, gravel, and cobble. The river drops 170 feet in elevation between the No. 5 dam and the powerhouse. The average stream width is about 50 feet.

Fish samples were not collected in the bypassed reach. Fish species diversity would probably be similar to those species present in the No. 5 reservoir or the downstream No. 4 development. Flows in this bypassed reach are heavily regulated. Trout are likely present when there are sufficient flows and water temperatures are cool. MA DFW's management goal is to establish self-sustaining populations of brook and brown trout in this stream reach. If spawning habitat for these species is not available, the alternate plan is to stock yearling brown trout to support a put-and-take year-round fishery.

3.3.1.3.6 Deerfield Number 4

The No. 4 reservoir contains several fish species, but the MA DFW doesn't manage the reservoir for any particular species (rainbow trout, brown trout smallmouth bass, rock bass, white sucker, fallfish, and spottail shiner). Fish sampling in the reservoir by IA, in 1990, collected 210 fish representing seven species. The rainbow and brown trout captured in the reservoir are most likely (based on their size) from stockings made upstream in reservoirs and in the Deerfield River. A creel survey by the MA DFW between 1972--1976, found that 90 percent of the trout captured were from hatchery trout stocked directly into the mainstem of the Deerfield River and the other 10 percent were a combination of wild and stocked fish moving downstream from tributaries in the river basin.

<u>Fishery resources in the bypassed reach and immediately below the powerhouse</u>

The 1.5-mile-long bypassed reach provides minimal fish habitat during project operation. The uppermost mile of the bypassed reach experiences the most variability in habitat because there are many water level changes, whereas, some flow is provided to the lowermost 0.5-mile-long section by the entry of the North River about 0.8 miles below the No. 4 dam. During periods of nongeneration, the 0.45-mile-long segment between the No. 4 powerhouse and the backwater of the No. 3 impoundment near the Route 2 Bridge is subject to leakage from the development and drainage from the North River. The 1-mile-long stream reach below the dam only receives leakage during periods of low flow *(i.e.,* non spilling periods).

Habitat in the bypassed reach consists of a repeating sequence of riffle/runs divided by pools. The substrate is primarily boulders over bedrock. The bypassed reach is about 50 feet wide above the confluence of the North River and about 150 feet wide below the confluence. Much of the bypassed reach below the confluence with the North River consists of a pool that extends downstream to the No. 4 powerhouse. This pool has a substrate dominated by sand and cobble. There is a 100-foot-long riffle area below the powerhouse that becomes a pool/run to the Route 2 bridge crossing. The backwaters from the No. 3 impoundment occur near the Route 2 bridge crossing.

No fisheries data were collected for the bypassed reach or for the stream reach immediately below the powerhouse. However, the same species found in the Nos. 3 and 4 reservoirs are most likely to occur in the bypassed reach. Because temperatures increase in about two-thirds of the bypassed reach during the summer months, the conditions would be marginal for some trout species. The higher water temperatures in the bypassed reach are modified in the lowermost reach of the bypassed reach because of flows entering from the North River.

3.3.1.3.7 Deerfield Number 3

The No. 3 reservoir contains several fish species, but the MA DFW doesn't manage the reservoir for any particular species. Fish sampling by IA (1990) in the reservoir collected 5,196 fish representing six species (brown trout, smallmouth bass, rock bass, pumpkinseed, white sucker, and fallfish). Water temperatures (20.5 C) in the reservoir are best suited for warmwater fish.

The occurrence of brown trout in the reservoir probably reflects mixed entry from several sources. These trout could be the result of stockings made above the reservoir in other reservoirs or in the mainstem of the Deerfield River, or could be the offspring from some natural reproduction occurring in the river basin.

Fishery resources in the bypassed reach and immediately below the powerhouse

The 0.4-mile-long segment of the Deerfield River between the No. 3 dam and the powerhouse has minimal fish habitat during periods of nongeneration when waters are supplied by leakage from the dam and from the intermittent drainage.

The Deerfield River drops 10 feet in elevation between the dam and the powerhouse. Other than the plunge pool at the base of the dam, the entire bypassed reach is composed of riffle/run habitat. The average width of the stream in the bypassed reach is 200 feet and the substrate is dominated by large boulders interspersed with large cobble. The riffle/run habitat in this 0.4-mile-long reach meets the backwater created by the Gardners Falls Project at a point about 500 feet upstream from the No. 3 powerhouse.

Fish sampling was not conducted in the bypassed reach or in the tailrace. Fish species diversity would probably reflect those species present in the upstream No. 3 and downstream Gardners Falls reservoirs. Flows in the bypassed reach are heavily regulated. The plunge pool at the base of the dam has good DO concentrations but summer water temperatures are limiting trout residency.

3.3.1.3.8 Deerfield Number 2

The No. 2 reservoir contains several fish species, but the MA DFW doesn't manage the reservoir for any particular species. Fish sampling in the reservoir by IA (1990) collected 104 fish representing 13 species. Species collected include rainbow, brook, and brown trout, smallmouth bass, yellow perch, white sucker and banded killifish. The three trout captured in the reservoir are most likely from stockings made upstream in reservoirs and in the Deerfield River or could be offspring from some natural reproduction occurring in the river basin. Summer water temperatures (21.0 C) limit trout success for over wintering in the reservoir.

Fishery resources below the powerhouse

During periods of nongeneration, there is a 9.0-mile-long segment of the Deerfield River that is affected by project operation. This reach extends from the No. 2 dam downstream to an area where the Deerfield River forms a backwater with the Connecticut River. During periods of nongeneration, flow in this reach is from leakage and runoff from several tributaries that enter the river below the dam. A daily average flow of 100 cfs is released below the powerhouse during periods of nongeneration as required in an agreement between NEP and the state of Massachusetts. NEP meets this 100 cfs minimum flow requirement by generating during nonpeak periods with no project shutdown lasting longer than four hours.

The river drops 90 feet in elevation between the dam and the backwater area. Fish habitat is mixed in this 9-mile reach. In the 6.5-mile-long gorge area between the No. 2 dam and the downstream Stillwater Bridge, the stream slope is steep, the average stream width is about 100 to 125 feet, and the segment is a sequence of repeating riffle/pool habitats under low flows and riffle/run habitat under higher flows. The substrate is mixture of boulders and cobble with exposed bedrock forming the bottom of some of the deeper natural pools. In the 2.5-mile-long stream reach below the Stillwater Bridge to the backwater area in the Deerfield River, there is less slope than in the upper part of the river reach, the river widens to average between 150 and 175 feet, and the substrate continues to be boulders and cobble.

No fish data was collected in the tailrace or downstream areas. Fish present are likely to reflect the same species caught in the Deerfield No. 2 reservoir or those occurring in the downstream Connecticut River, since fish could swim uninterrupted from the Connecticut River to the No. 2 dam. Summer water temperatures limit the success of trout in stream reaches below the No. 2 dam. Trout would only be able to holdover in this reach if deep, coolwater refuges were available in the stream (*e.g.*, from very deep pools or stream areas that are supplied by cool spring discharges). The MA DFW says they frequently stock the river reach between the development and the Connecticut River with rainbow and brown trout in the spring and that this stream reach is heavily fished for trout in the spring (Land and Water Associates, *et al.* 1991). The MA DFW also identified the lower portions of the Deerfield River near the confluence with the Connecticut River as having one of the best smallmouth bass populations in all of the river segments with an active sport fishery in the area for smallmouth (Land and Water Associates, 1991). The area near the mouth of the river where the smallmouth bass are caught by anglers is not affected by project operations.

3.3.1.4 Vegetation and Wildlife Resources

Vegetation

The botanical resources of the Deerfield Project area include: (1) coniferous and deciduous forests, (2) open meadows, (3) riparian shrub vegetation, and (4) wetlands. Coniferous and Deciduous Forests consists of white pine, fir, and sugar maple. Open meadows consists of herbaceous vegetation. Riparian shrub vegetation consists of aspen, birch, dogwood, and willow trees.

NEP owns approximately 19,715 acres of forest land in Vermont and Massachusetts adjacent to the Deerfield River. NEP has a long history of diverse forestry activities on these properties dating back to the 1940's, and professional forest management since 1962. NEP's Forest Management Plan was developed to restructure the New England Electric System (NEES) Companies Forest Management Program. The current New England Electric Forestry Management Plan was developed in December 1984. The program emphasizes multiple-use of various forest resources; production of higher quality timber for saw logs and other wood products, passive recreation, and wildlife management.

Locally Rare Plants

The Deerfield River Basin contains several plant species that Vermont and Massachusetts have identified and classified according to state-listed rarity categories. The MA NHP reports that the project area has potential habitat for six Massachusetts and Vermont state listed rare, special concern, and threatened plant species: mountain alder, roundleaf shadbush, muskflower, barren strawberry, pale green orchid, and leafy white orchid.

According to studies conducted along the river bypassed reach downstream of Harriman Reservoir, two populations of the tubercled orchid (*Platanthera flava* var. *herbiola*), also known as the pale-green orchid, a Vermont and Massachusetts listed threatened species were found. Tubercled orchids are also found at Searsburg Station. At Harriman, the tubercled orchid occurs on turfy hummocks atop boulders within the old river bed. One population had about twenty flowering stems; the other population had about fifteen, according to NEP (December 1991). Other populations of the tubercled orchid probably occur, scattered along the area. However, according to VANR (1995), the Harriman bypassed tubercled orchid population contains over 130 stems at 35 different locations and is the largest known population of this plant in Vermont. Three other populations of the tubercled orchid are known outside of the Deerfield River Basin yet these other populations only contain a few plants. The existing population of tubercled orchid in the Searsburg bypassed reach consists of at least 90 stems at two or more locations. All of the tubercled orchid plants observed occur along the edge of the riverbank; a group of 82 stems occur in the Searsburg bypassed reach and a group of eight stems occur in the tailrace reach.

The tubercled orchid is a facultative wetland species (*i.e.*, 67 to 99 percent are found in wetlands and only occasionally in uplands (Reed 1988)) and flowers in June - July (Tiner 1988). Since 1978, only eight occurrences of this orchid have been verified in Massachusetts; the populations are mostly small and only two sites have over 100 plants. However, prior to 1978, 57 occurrences of tubercled orchid were vouched, many of them from wet meadows, habitat once more abundant. The tubercled orchid is rare in many states because of habitat loss. The tubercled orchid grows in sunny to semi-shaded habitats where soils are generally rich, moderately acidic and wet, and where periodic flooding occurs. These habitats range from lowland forested stream side swamps and floodplains with a sparse shrub-herb under story and moderate tree canopy dominated by red maple, American elm, and white ash, to open river shores with alder, willow, smooth rose, purple loosestrife, and occasionally ragged fringed orchid. It also occurs in open, wet habitats, under powerlines where meadow-sweet, ferns, and sedges are the dominant vegetation. Historically, the tubercled orchid occurred on pond shores and more commonly in wet meadows, habitats, which like river shores and floodplains favor species that tolerate some disturbance in exchange for reduced competition from other species and increased sunlight. Pond shores are periodically exposed and inundated, whereas meadows are commonly kept open by grazing or mowing (Commonwealth of Massachusetts 1990).

Wetlands

Wetlands were inventoried within and adjacent to the Deerfield Project boundaries. Four different wetland cover types occur in the Deerfield Project area, to include: (1) palustrine forested wetlands, (2) palustrine scrub/shrub wetlands, (3) palustrine emergent wetlands (marshes), and (4) mud or sand flats colonized by low annual herbs. [4]

At Somerset reservoir, there are 10 wetlands identified by the NWI, although the survey indicates that no hydrophytic plants are found at the mapped wetland areas on the eastern shore, north of the boat launching area, resulting in nine wetland areas. With one exception, the nine existing wetlands are essentially uniform in their plant community. Wetlands consist predominantly of two species of rush. These wetlands of primarily annual species are found in a narrow band on a sandy substrate. The noted exception is a wet meadow wetland located along the western edge of Somerset reservoir. Along with the other plant species encountered in the other wetlands; this like all of the other wetlands, lacked emergent aquatic species such as cattails, pickerelweed, and burreed. Dominant wetland species along the Somerset reservoir include: woolgrass, swamp candles, sweet gale, cudweed, water horsetail, various rushes, sedges, and grasses. The ten different wetland areas located along the Somerset reservoir total approximately 48.1 acres.

There are also three wetlands identified along the reach of the East Branch of the Deerfield River below the Somerset reservoir. One of these three wetlands is 250 acres in size. Wetlands along the East Branch consist of alders, rice cutgrass, woolgrass, rattlesnake grass, red maple, grasses, and sedges.

The Searsburg reservoir contains one wetland. The Harriman reservoir contains nine different wetlands located on both sandy and mud substrates. Dominant wetland species along the Harriman Reservoir include: swamp candles, spike rush, quillwort, water plantain, leatherleaf, cranberry, asters, ferns, sedges, and rushes. The nine different wetland areas located along the Harriman reservoir total approximately 52 acres.

<u>Floating-leaved or Submerged Aquatic Vascular Plants</u>: These plants are present only in small quantities and are limited mostly by the extent of suitable shallow water. Pondweeds, float-grass, water lillies, and other floating-leaved plants constitute small communities. Needle spike rush and mud rush are the most abundant species.

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4 Wetland nomenclature follows Cowardin, *et al.* 1979.

Potential Nuisance Plants: Several vascular plant species are noted in Vermont as potential nuisance species. Among these are: common reed, purple loosestrife and broad-leaved cattail, as well as aquatic weeds such as Eurasian water milfoil. These species are all vigorous colonizers that often form pure strands to the exclusion of other, more valuable plant species. With the exception of a few cattails, no such potential nuisance species were noted in the Somerset or Harriman reservoir. Potential habitat for all but the purely aquatic species is limited by the steep drop-off along most of the river shoreline. The relatively high elevation of the reservoirs may also be a factor in the lack of these nuisance plant species.

Wildlife

Big game species within the Deerfield River Basin include: wild turkey, white-tailed deer, moose, and black bear. Moose are protected in Vermont. White-tailed deer is the only big game species in the river basin with known special habitat requirements in the form of winter shelter known as "deer yards." [5] An extensive deer yard is located in Somerset immediately below the Somerset reservoir on the East Branch of the Deerfield River. Another large deer yard complex is located along the main branch of the Deerfield River where Rake Branch enters. Additional deer yards exist along the North Branch of the Deerfield River, and the west shore of the Harriman reservoir in Wilmington; a major deer yard borders the Deerfield River just below Harriman reservoir in Readsboro and Whitingham; and a smaller deer yard on the Tobey Brook tributary in Whitingham. In all, there are 11 separate deer yards along the various branches and tributaries of the Deerfield River in Vermont.

Deer yards in Massachusetts have been mapped along the East Branch of the North River in Colrain and on the mainstem in East Deerfield River. Deer yards have not been mapped elsewhere on the Deerfield River in Massachusetts, but it is thought that the steeper south and west facing slopes along the river may hold deer in the winter. Deer yards become less of a limiting factor to white-tail populations and are utilized with less frequency in the milder region of central Massachusetts.

Furbearers are prevalent throughout the river basin. The more prominent species likely to be found are beaver, mink, muskrat, and otter, with the eastern coyote and bobcat occurring on the upland sites. Other mammals likely to inhabit the project areas are the red and gray fox, marten, river otter, meadow jumping mouse, woodland jumping mouse, and various voles.

Although not directly on the Lake Champlain or coastal branches of the Atlantic Flyway, the waterways and wetlands of the Deerfield River Basin provide resting and feeding habitats for migrants, breeding, and brood rearing habitats for a variety of waterfowl and shore birds. Birds likely to inhabit the river basin are: common loon, great blue heron, Canada goose, black duck, mergansers, rails, flycatchers, swallows, warblers, and sparrows, black-capped chickadees, tufted titmice, scarlet tanagers, American robins, song sparrows, and common grackles.

The importance of protecting the common loon at this project site lies in the fact that the Somerset reservoir is the only nesting site for common loons in the southern portion of Vermont. Common loon populations have declined and since 1987 it has been legally designated as an endangered species in Vermont. According to VANR (1995), Vermont has supported 13 to 16 pairs of nesting common loons since 1989. Predominant causes of nest failure in Vermont over the period 1978 through 1993 include: (1) nest flooding, (2) predation, and (3) nest stranding. Nest flooding and predation each accounted for 26% of the nest failures. Nest stranding accounted for about 6% of the nest failures during that time period in Vermont (Renfrew and Rimmer 1993, found in VANR January 1995).

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[5] Deer "Yarding" areas of heavy cover serve as areas where deer accumulate for food, as well as, for protection from storms.

Common loons have been observed on the Somerset reservoir since 1977. During the 17-year period of 1978 through 1994, common loons nested on Somerset reservoir in 13 of 17 years and were successful (young survived through August 31) in seven years, producing 11 chicks total (within seven years), or totalling 6 percent of the known state production. The mean annual number of surviving common loon chicks per nesting pair is 0.91 for Somerset reservoir, slightly less than the state average of 1.00 chick/nesting pair. A chick was produced at Somerset reservoir in 1995 as well (VANR 1995, NEP 1991, 1993).

Common loons set up breeding territories in large lakes. These large birds use the open water, along with mergansers and cormorants, to dive for fish (Benyus 1989). The common loon's adaptations for diving significantly reduces its mobility on land and restricts its nest building to the water's edge. Therefore, common loon nest success is sensitive to water elevation changes (Fair 1992). The common loon nests on ground with water nearby and nest site selection and building typically begin in early May. Egg laying and the start of the 28-day incubation period should begin about mid-May. Chicks leave the nest within hours of hatching. Common loons may nest again if the first nesting attempt fails; however, if re-nesting is later than July 15, the chick(s) would be unlikely to mature sufficiently to migrate in the fall (VANR 1995). Common loons migrate in small flocks; most fly to the coast (Robbins *et al.* 1966).

Species such as the Eastern American toad, bullfrog, and greenfrog are probably residents in the Deerfield impoundments and wetlands, although they are not abundant. The streams that empty into the impoundments and the wooded slopes offer some habitat for stream and woodland salamanders, as well as snake species.

3.3.1.5 Threatened and Endangered Species

The USFWS (letter from Willie Taylor, Acting Director, Office of Environmental policy and Compliance, Office of the Secretary, Washington, D.C., dated October 5, 1994) reports with the exception of occasional transient individuals no populations of Federally listed or proposed threatened or endangered species are known to occur in the Deerfield Project area.

NMFS (letter from Sandra Arvilla, Environmental Protection Assistant, Habitat and Protected Resources Division, Gloucester, MA, dated January 5, 1995) reports that the Federally listed, endangered shortnose sturgeon (*Acipenser brevirostrum*) inhabits the mouth of the Deerfield River.

The shortnose sturgeon has access to the Deerfield River from the Connecticut River. In 1992, ten shortnose sturgeon that had been radio tagged by the USFWS as part of a study underway on the Connecticut River, were observed in the lower 1.3-kilometer-section of the Deerfield River from April 10 to June 9, 1992. Between 1992 and 1995 about 108 shortnose sturgeon have been radio tagged by the USFWS for study. Around 25 individual fish from this tagged group have been followed under a wide variety of river conditions over the years of the study including their movements in and around the Deerfield/Connecticut River area. Based on these tagging studies, researchers believe that shortnose sturgeon occasionally use the lower portions of the Deerfield River as a resting area--as a refuge or place to escape from the high flows occurring during April and May in the Connecticut River--as they travel up the Connecticut River toward their spawning sites located about 5 km upstream from the mouth of the Deerfield River. A couple of shortnose sturgeon were detected in the lower part of the Deerfield River (not more than ½ km upstream and staying only a week or two) in 1994 and none were detected there in 1995. From the data collected thus far no changes in the use pattern of the lower Deerfield River by the shortnose sturgeon are expected (personal communication from Boyd Kynard, Section Leader, Fish Behavior, Conte Anadromous Fish Research Center, U.S. Fish and Wildlife Service, Turners Falls, Massachusetts, September 11, 1995).

3.3.1.6 Recreation and Land Use Resources

NEP's Deerfield Project provides a wide variety of recreational facilities and contributes to the diversity of recreation opportunities available within the Deerfield River Basin. The Deerfield Project is particularly important because it contains the principal water resources in the region and provides a largely undeveloped corridor through the heart of the river basin. Most of the property within the river basin that is owned and managed by NEP (19,715 acres) is open to the public, providing access for both water- and land-based recreation opportunities, such as hunting, hiking, skiing, fishing, and boating. NEP currently maintains 26 recreation areas at the Deerfield Project which include: six "multi-use" sites (for boating, swimming, picnicking); 10 picnic areas; nine hiking trails; six formal boat ramps; one carry-in access site; two beaches; and one visitor center.

Factors that combine to make the Deerfield River a noteworthy whitewater boating river include: its proximity to users, accessibility, navigability, predictability of flow, length of season, scenery, public land, good water quality, availability of adequate stopover points, and availability of associated recreational activities such as camping, fishing, and wildlife observation (Vermont Agency of Environmental Conservation 1986). The diversity of whitewater along the Deerfield River is an asset to meet the needs of a variety of users: flatwater boaters, intermediate whitewater boaters, and advanced whitewater boaters.

NEP initially opened four recreational facilities in the Deerfield River Basin in 1954, and they estimated use of these facilities at over 20,000 users. By 1963, recreation use at the Deerfield Project increased to about 72,000 visitors at seven recreation areas within the project boundary. Total recreational use at the Deerfield Project in 1991 was estimated at over 500,000 visitor days, and over 80 percent of this use occurs during the spring and summer (Table 3-4). Harriman reservoir received the most recreational use among the Deerfield Project developments and accounted for over 30 percent of the total recreational use at the Deerfield Project (over 170,000 visitor days). Sport fishing was the most popular recreational activity at the project (over 100,000 visitor days) and primarily occurs in Massachusetts below Fife Brook dam (over 80 percent).

Project-related recreational use during the winter primarily takes place in the northern portion of the river basin at the Harriman and Somerset reservoirs (4,048 and 3,215 visitor days respectively). Primary winter recreational activities at these developments include ice fishing, snowmobiling, and cross-country skiing. Hunting was the dominant fall recreational activity at the project (over 20,000 visitor days); however, fall foliage viewers were considered under represented in the recreation use study results. Sightseers/foliage viewers stop only briefly at the project facilities and made it difficult to accurately estimate their use at the project. Northern Economic Planners estimates over 250,000 visitors drive through the Deerfield River Basin in October to view the fall foliage (Land and Water Associates, *et al.* 1992).

NEP identified six distinct zones within the project area that characterize the existing recreational use (Figure 3-1). These zones were defined by their accessibility, current use patterns, the surrounding development patterns, and the predominant land forms and physical features of the Deerfield River Basin. These zones are:

Somerset Zone: Grout Pond south to Route 9 bridge
Harriman Zone: Route 9 bridge south to Harriman dam
Readsboro/Sherman/Zoar Zone: Harriman dam to Zoar Gap
Charlemont/Mohawk Trail Zone: Zoar Gap to Shelburne Falls
Shelburne Falls Zone: Route 2 boat launch to No. 2 dam
Bardwell Zone: No. 2 dam to Stillwater Bridge

Table 3-4. Seasonal recreation use* at the Deerfield Project during 1991 (Source: Land and Water Associates, *et al.* 1992).

Activity	Spring & Summer	Fall	Winter	Total
Fishing	102,735	10,633	1,413[1]	114,781
Boating	68,646	17,308	0	85,954
Picnicking	52,506	3,563	0	56,069
Snowmobiling	0	0	4,310	4,310
XC Skiing	0	0	1,540	1,540
Hunting	0	21,415	0	21,415
Other activities[2]	224,195	32,122[3]	0	256,317
Totals	448,082	85,041	7,263	540,386

* Total of individuals visiting the site for recreational purposes during any portion of a 24-hour period.
[1] Ice Fishing
[2] Other activities: hikers, walkers, sightseers, photographers, tubers, and swimmers.
[3] Many sightseers/foliage viewers use the project area that were not included in this conservative estimate

Somerset Use Zone

Largely surrounded by Green Mountain National Forest, the Somerset Use Zone provides primitive and semi-primitive [6] recreation opportunities. This segment extends from Grout Pond in the Green Mountain National Forest to the Route 9 bridge just north of Harriman reservoir. NEP owns over 9,000 acres within this use zone, and these lands surround the Somerset reservoir (1,623 surface acres) and the Deerfield River's East Branch. Road access to the Somerset reservoir is limited to a 10-mile-long gravel road (Somerset Road) off of Route 9. Near the Somerset dam, the steep and narrow gravel road serves to restrict boating use of this area to small boats.

NEP manages this area to provide a remote recreational experience and traditional types of recreational use include canoeing, fishing, hunting, hiking, cross-country skiing, and picnicking. The principal sport fishery at the Somerset Use Zone is brook trout, and the reservoir is typically stocked with brook trout each year. Somerset picnic area, located on the southeastern shore of the reservoir, is the primary recreational facility in the area, providing parking, picnic tables, and an unimproved boat ramp. Additional recreation facilities in this segment of the river basin include three maintained trails, a remote picnic area accessed by hiking 2.3 miles, and an informal boat launch at the Searsburg impoundment.

The East Branch of the Deerfield River from Somerset reservoir down to the Searsburg impoundment offers 6 miles of Class I and II whitewater. This river reach is almost entirely undeveloped and is suitable for advanced beginners and beginning intermediate boaters. Flow releases from the Somerset reservoir into the East

[6] "Primitive" areas provide opportunities to experience solitude and remoteness in a primitive setting. The areas appear entirely natural, have no roads, no timber harvesting, and few visitors. "Semi-primitive" areas have few open roads and appear almost entirely natural. Wildlife and timber management activities are selected, scheduled, and located to ensure that back country recreation is protected (U.S. Forest Service 1986).

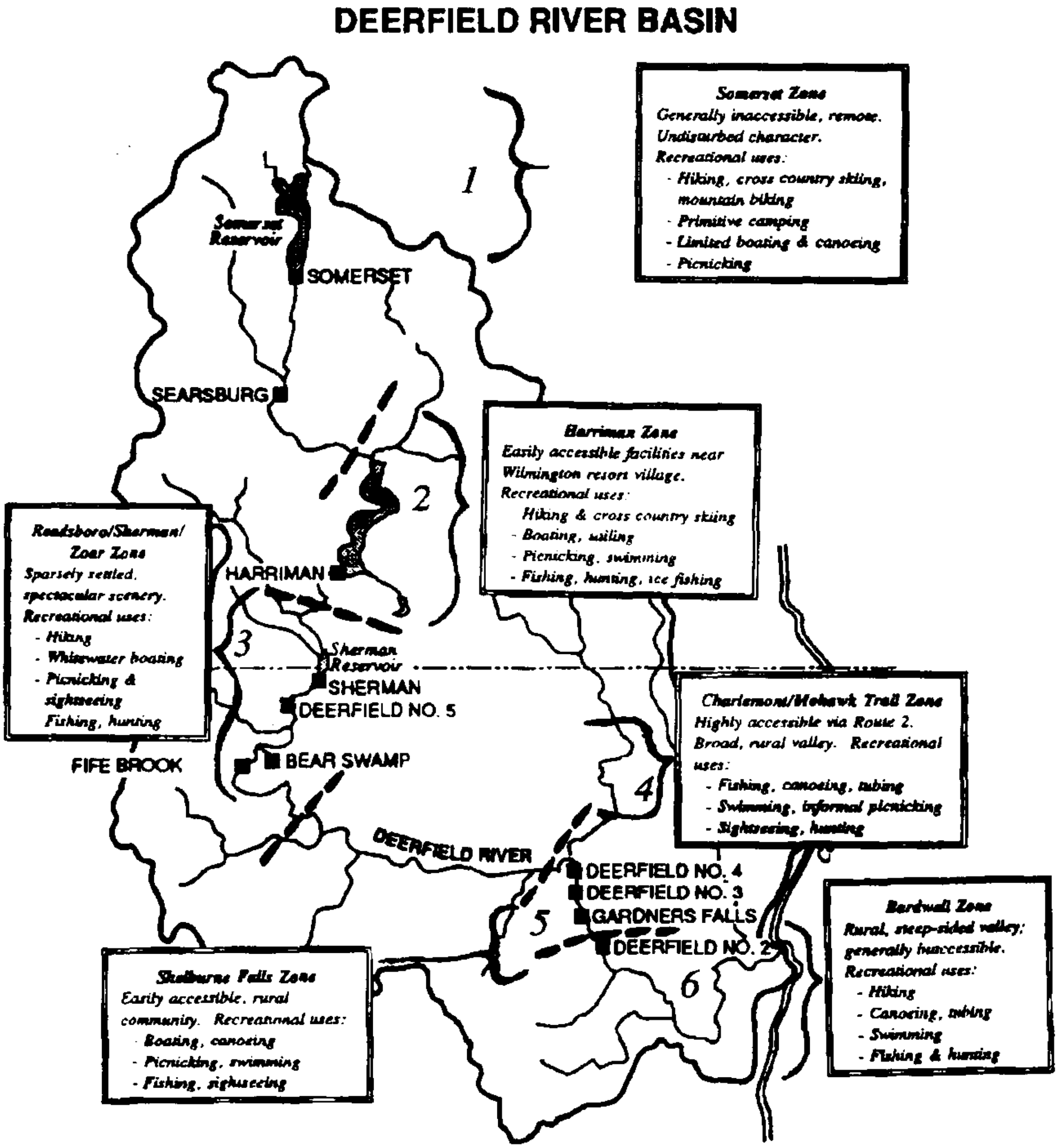

Figure 3-1 Deerfield Project recreation zone map (Source: Land and Water Associates 1993a).

Branch are as high as 300 cfs and the reach is boatable at flows as low as 150 cfs. [7]

Harriman Use Zone

While the Harriman reservoir is also a highly scenic lake with largely undeveloped shoreline, it is the most heavily used recreation use segment along the Deerfield River. Located in the towns of Wilmington and Whitingham, Vermont, the reservoir is easily accessible by major state highways. Summer use at the reservoir includes swimming, picnicking, fishing, and boating (tour, motor, and sail boats). The most frequent winter recreational uses at Harriman are ice fishing, snowmobiling, and cross-country skiing. The reservoir is stocked with landlocked salmon, lake trout, brook trout, brown and rainbow trout, but also provides a smallmouth bass, yellow perch, and rainbow smelt recreational fishery.

NEP provides six picnic facilities at Harriman and the largest of these are Mountain Mills East Picnic Area and Jacksonville Picnic Area with 1991 annual use figures of 46,871 and 66,362 visitor-days, respectively (Land and Water Associates 1993c). Both of these facilities provide swimming areas and have full-time attendants during summer between Memorial Day through Columbus Day. Mountain Mills East also offers the best boat ramps on the reservoir and these ramps are capable of launching large boats. Three maintained trails are located along Harriman that are part of both the Vermont Association of Snow Travellers snowmobile trail system (VAST) and the Catamount cross-country ski trail system.

Readsboro/Sherman/Zoar Use Zone

South of Harriman dam to Zoar Gap, Massachusetts, the Readsboro/Sherman/Zoar Use Zone is characterized by a narrow, steep-sided valley. Including Sherman, Deerfield No. 5, and the Bear Swamp Project, this river segment is the most popular destination among visitors seeking river fishing and whitewater boating opportunities. Angling is particularly popular below Fife Brook dam where the MA DFW manages two highly valued "catch and release" trout fishing areas. [8] This reach of the Deerfield is widely considered one of the premier trout streams in Massachusetts.

Monroe Bridge (below Deerfield No. 5) and Fife Brook (below Fife Brook dam) whitewater sections offer boating opportunities ranging from Class II to IV rapids (for further discussion on these sections, see whitewater boating discussion, Section 3.2.5). NEP currently schedules whitewater release flows at these reaches and also supplies a flow information telephone service which provides flow levels below the whitewater sections of the river. [9] Factors that combine to make this zone a good whitewater boating stretch include its proximity to users, its accessibility, navigability, the predictability of flows, scenery, and good water quality. The diversity of whitewater in this segment is also an asset to meet the needs of a variety of users, particularly intermediate and advanced whitewater boaters.

Table 3-5 shows parking capacity and whitewater boating use at both the Monroe Bridge and Fife Brook Sections during the scheduled whitewater releases in 1991 (May through October).

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[7] NEP releases stored flows into the East Branch throughout the year whenever precipitation and natural flows are low; however, typical flows at this reach are limited to the existing 4 cfs minimum flow requirement at Somerset reservoir and instream flows from drainage (drainage area from Somerset dam to the Searsburg impoundment).

[8] MA DFW typically stocks between 3,500 and 5,000 trout (both rainbow and brown) in the Deerfield River in Charlemont, MA and another 3,500 to 4,500 in Florida, MA.

[9] Currently, NEP provides 4 hour whitewater releases, 20 days per year at the Monroe Bridge Section (scheduled between May-October).

Recreational facilities provided by NEP within this use zone include the Sherman Picnic Area and the Dunbar Brook Picnic Area. The Sherman Picnic Area, located off River Road in Whitingham, Vermont, provides picnicking, boating, and angling access to the Sherman impoundment. Lake angling for large, trophy-size brown trout at this impoundment is popular among local residents. The Dunbar Brook Picnic Area, also located off River Road, offers 139 parking spaces and serves as a downstream shuttle parking area for the Monroe Bridge Section.[10] In 1991, annual recreational use for the Sherman Picnic Area and the Dunbar Brook

Table 3-5. Whitewater Boating Use in 1991: Deerfield River Whitewater Boating Access Points (Land and Water Associates 1993c).

Whitewater reach	Parking capacity	Number of scheduled releases	Boating use [1]
Monroe Bridge Section	Put-in: 4 cars	6	1,561
	Take-outs: 139 cars 4 cars		
Fife Brook Section	Put-in: 6 cars	64	11,930
	Take-outs: 6 cars 98 cars		

[1] Total of individuals visiting the site for recreational purposes during any portion of a 24-hour period.

Picnic Area was 20,381 and 3,383 visitor-days, respectively (Land and Water Use Associates, 1993c). Across the road from Dunbar Brook Picnic Area, NEP maintains the Dunbar Brook trailhead, providing parking and access to 9 miles of trail in Monroe State Forest. Access for the Fife Brook Section is provided below the Fife Brook dam at an informal area off River Road.

Charlemont/Mohawk Trail Use Zone

Below Zoar Gap the river valley broadens and the river becomes more slow flowing. Characterized by rural development, the shoreland along this Charlemont/Mohawk Trail Use Zone is mostly privately owned. Recreational use within this segment includes fishing, canoeing, tubing, and picnicking. Unlike the segment upstream, there is no requirement for anglers to return trout to the river along this stretch. Route 2, which is part of the Mohawk Trail and one of Massachusetts' scenic highways, runs along the river the entire length of this use zone. Providing numerous informal access sites along the river, Route 2 attracts large numbers of tourists, particularly during the autumn foliage season.

NEP, which has little land ownership along this reach, maintains two picnic areas in this segment that currently receive heavy use: 1991 annual recreation use at Zoar Gap Picnic Area was 39,363 visitor-day (Land and Water Associates 1993c). The picnic area, located on Zoar Road in Charlemont, Massachusetts, provides a take-out area for boaters floating the Fife Brook Section. This area also serves as a put-in for canoeing and tubing the slower (Class II) downstream river stretch. The remaining picnic area in this segment, the East Charlemont Picnic Area, is located on Route 2 and primarily serves as a rest area for motorists, but also provides angling access to the river.

[10] The Monroe Bridge Section put-in is an undeveloped site below Monroe Bridge in the towns of Monroe/Rowe and provides limited parking.

Shelburne Falls Use Zone

The Shelburne Falls Use Zone is characterized by urban/rural development and includes Deerfield dams Nos. 4, 3, and 2. The principal visitor attraction in this segment is the two scenic New England villages of Shelburne Falls and Buckland, Massachusetts. NEP currently provides two recreational sites along this stretch: a boat launch on the Deerfield No. 4 impoundment and an informal park overlooking the Deerfield No. 3 dam in Buckland, Massachusetts.

Recreational use along this segment includes fishing, informal swimming, and short canoe trips. While recreational use is moderate to low in this zone, there are two informal areas that receive large numbers during warm weather months. One of these areas is an easily accessible site located at the confluence of the North River and the Deerfield River. A large pool at this confluence below exposed bedrock and cascades attracts swimmers, sunbathers, and tubers. Immediately below Deerfield No. 3 dam, the remaining site is known as the "Potholes" and is an area of exposed bedrock with glacial potholes. Access to this area is provided by stairs from downtown Shelburne Falls, and the site is used for swimming and sunbathing.

Bardwell Use Zone

Below Deerfield No. 2 dam to the Stillwater Bridge (about 7 miles below the dam), the Bardwell Use Zone is a remote reach and is distinguished by a gorge-like valley with undeveloped shorelines. While access is limited along this segment due to the steep banks, the remote character and scenery attract canoeists, tubers, anglers, and hikers. The first 3.5 mile river stretch below Deerfield No. 2 dam is Class I and II whitewater, offering paddling for canoeists and beginning kayakers. Angling opportunities in this segment include a rainbow and brown trout fishery that is stocked yearly.

Boaters access the reach below the Deerfield No. 2 dam primarily by putting-in at WMEC's Wilcox Hollow recreation site located just upstream of the Deerfield No. 2 impoundment and then portaging around the Deerfield No. 2 dam. [11] NEP's only recreational site along this segment is the Deerfield River Trail, which begins at Wilcox Hollow and ends about 8 miles downstream at the Stillwater Bridge. Additional access along this segment includes informal parking at Bardswell Ferry Bridge (about 2.5 miles downstream of Deerfield No. 2 dam) and a state-owned parking area at the Stillwater Bridge. The Stillwater parking area accommodates about 13 vehicles and serves as a take-out area for canoeists or tubers and as a trailhead for the Deerfield River Trail.

3.3.1.7 Aesthetic Resources

NEP evaluated the scenic values on 11 segments of the Deerfield River within the context of the western Massachusetts region and the southern Vermont region (Land and Water Associates 1991). The scenery on each of the 11 segments was evaluated using a methodology which considered: (1) adjacent land forms; (2) the importance of water in the landscape; (3) vegetative diversity; (4) color; (5) mid-range views; (6) distant scenery; (7) special features, *e.g.*, waterfalls; and (8) cultural impact.

The scenic survey results showed that Somerset reservoir offered the most exceptional views in the Deerfield River Basin. Characterized by undeveloped shore lands in an undeveloped setting, Somerset reservoir offers broad panoramic views that were considered unusual in the region. Located at the Deerfield River's headwaters, the Somerset reservoir is within the river basin's most remote and primitive area. Somerset reservoir, with a surface area of 1,623 acres, is surrounded by over 6,000 acres of NEP land and thousands of

[11] NEP currently provides no formal canoe portage at the Deerfield No. 2 dam and this particular dam requires a difficult portage down a steep embankment.

Green Mountain National Forest acreage, one of the largest isolated and primitive tracts of land and water in the southern Vermont region

Other segments along the river that were considered highly scenic included Harriman reservoir, the reach between Deerfield No. 5 dam and Route 2, and the reach between Deerfield No. 4 and Deerfield No. 3. While Harriman reservoir's remoteness is parted by nearby residential and commercial development, its undeveloped shoreline with a backdrop of forested mountains offers unique scenic views. Scenic conditions below Deerfield No. 5 include highly picturesque vistas that feature exposed ledge and bedrock, steep mountains, and a gorge-like river valley. Between Deerfield No. 4 and No. 3 the river valley is more developed and land use is dominated by agriculture, commercial, and residential uses. Significant aesthetic resources within this reach include the two scenic New England villages and glacial potholes below the Deerfield No. 3 dam.

3.3.1.8 Cultural Resources

Prehistoric Archeological Resources

The Deerfield Project development areas have a potential to contain prehistoric sites ranging from small lithic scatters or isolated find spots to both low and high elevation multi-function encampments; such sites could represent single-event, seasonally-occupied, and/or temporary, task-specific camps. From the PaleoIndian through the Late Woodland and Contact Periods, groups of prehistoric hunters/gatherers used the Deerfield River Basin. They would have been particularly attracted by such favorable attributes (characteristics) as moderately to well-drained terraces and flats within 200 m of freshwater sources such as upland streams, wetlands, and ponds. This includes existing as well as freshwater sources that were present in the paleoenvironmental setting, but are no longer visible.

Except where ground-disturbing activities have occurred in historic times, there are numerous such upland and dewatered areas throughout all eight of the Deerfield Project developments which are likely to contain prehistoric archeological resources. [12] The potential for quarry and rock shelter sites along with spiritual places offering points of view is more likely at the higher elevations within the northern project developments; settings also likely to contain prehistoric archeological resources are cliff overhangs which could have provided shelter, and areas having an abundance of quartzite outcrops and boulders which could have served as lithic source materials.

Archeological sites are fragile. Changing, damaging, or destroying them damages or destroys the spatial and temporal relationships of their archeological values, and may also severely affect the self identity of groups that may ascribe traditional cultural values to the sites. The most varied and damaging forces on archeological sites are caused by human actions (vandalism, looting, theft, recreation, noise, vibration, ignorance, lack of knowledge, *etc.*).

Appropriate handling of prehistoric archeological resources will be taken care of via the Deerfield Project PA, which will contain provisions for identifying the type of and degree to which prehistoric archeological information, if any, will be made available to the general public.

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[12] An "archeological resource" is any material remains of human life or activities which are at least 100 years old, and which are of archeological interest. To be "of archeological interest" means to be capable of providing scientific or humanistic understandings of past human behavior, cultural adaptation, and related topics. 43 CFR at Section 7.3.

Historic Archeological Resources

The Deerfield Project development areas have potential to contain a wide variety of historic archeological sites, including: domestic home/farmsteads; small (cottage) and large-scale industries and commercial enterprises (*e.g.*, saw mills, grist mills, tub factories, marble quarries, lime kilns, chair shops, box factories, lumber camps); public/institutional structures and features (*e.g.*, schoolhouses, cemeteries); and transportation-related structures (*e.g.*, bridges, railroad lines and spurs).

However, because archeological sites are fragile and the informational value of archeological sites depends on how intact their information content is, appropriate handling of historic archeological resources will be taken care of via the Deerfield Project PA, which will contain provisions for identifying the type of and degree to which historic archeological information, if any, will be made available to the general public.

Historic Architectural Resources

In the course of its Phase 1A and Supplemental Phase 1A surveys of the Deerfield Project, NEP identified 38 buildings and 23 structures within the eight development project areas. NEP evaluated the buildings and structures with reference to the National Register criteria of eligibility. The eight Deerfield Project developments were found to meet the National Register criteria of eligibility as contributing components to a potential historic district.

Of the 61 buildings and structures at the project's developments, 48 were determined to be contributing elements within the potential historic district. The Deerfield Project PA will contain provisions to determine whether particular features, such as reservoirs, should or will ultimately be considered as "structures" or contributing elements.

The Supplemental Phase 1A Survey reports the Deerfield River Hydroelectric System (comprising all eight developments) to be significant under National Register Criteria A, B, and C (36 CFR Section 60.2):

Criterion A

- for its associations with the development of hydroelectric power on the Deerfield River in Vermont and Massachusetts
- for its contribution to twentieth century patterns of industrial, economic, and social development of Vermont and western Massachusetts (it provided most of the electricity consumed in Vermont and western Massachusetts from 1913 through the 1940s)

Criterion B

- for its associations with Malcolm Chase and Henry Harriman, industrialists and speculators who were pioneers in the development of NEP's hydroelectric facilities along the river and whose contributions to the hydroelectric industry subsequently contributed to the industrial, economic, and social development of Vermont and western Massachusetts

Criterion C

- for its works of engineering and architecture designed and built (between 1911 and 1927) for a specific purpose

- a multi-component system conceptualized and designed by the engineering firm of Charles T. Main in association with J.G. White & Company of New York, H.K. Barrows of Massachusetts Institute of Technology, and Frederick P. Stearns, and

- structures designed and constructed by NEP (also created by NEP).

- for each development, when constructed, being in the forefront of hydropower production; each was highly sophisticated and expensive, and employed state-of-the-art-technology

The Supplemental Phase 1A Survey also found the Deerfield River Hydroelectric System may also be significant under Criteria D:

- it may likely yield information related to the construction camps important to understanding the history of the system

- subsurface testing and additional documentary research would be necessary to support this designation

3.3.1.9 Socioeconomic Resources

NEP conducted economic studies to determine the importance of their Deerfield River recreational facilities on the regional economy (Land and Water Associates, *et al.* 1991). Table 3-6 provides recreational spending within 20 miles by users of NEP's recreational facilities. Based on the economic studies, annual recreational use at the Deerfield River Projects was estimated at over 650,000 visitors days and these recreational users contribute $7.3 million to the river basin's local economy each year. [13]

3.3.2 Gardners Falls Project (Source: WMEC 1991, 1992, and 1993, unless otherwise indicated).

3.3.2.1 Geology and Soils

The Gardners Falls Project is underlain by Devonian-age metasedimentary rocks, which are commonly steeply dipping and tightly folded. Unconsolidated deposits include coarse (bouldery and cobbley) glacial kame deposits along the river banks and terraces, and clean, almost entirely sand-free boulders and cobbles in the bypassed reach to the river between the dam and the tailrace.

The geology and soils resources at the Gardners Falls Project as they pertain to aquatic, terrestrial, recreational, and aesthetic resources are discussed in sections pertaining to those resources, either in the cumulative effects discussions and/or in the site-specific discussions.

3.3.2.2 Water quality and quantity

The Gardners Falls reservoir is a shallow, riverine impoundment. The reservoir varies in width from 250 to 350 feet and has an average depth of nine feet with much of the reservoir at six feet deep or less. Much of the western half of the reservoir is dominated by a shallow shoal area (four feet deep or less). There is little vegetative cover for fish in this shoal area or other parts of the reservoir. The shoreline is moderately to steeply sloped with patches of open and wooded slopes forming good overhead cover. Substrate is primarily sand and silt with some coarse rocky material. The reservoir doesn't stratify and waters in the reservoir have a short retention time, whether the project is storing water or releasing water. Several small intermittent streams empty

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[13] Land and Water Associates assumed that the data contained in Table 3-6 represented 71 percent of all visitor days and spending.

into the impoundment (Terrestrial Environmental Specialists, Inc. 1989)

The mean annual discharge from the project is about 1,286 cfs. The maximum recorded flow at a USGS gage located about 7.2 miles downstream (Gage # 01170000) was 48,500 cfs on December 31, 1948 and the minimum flow was 28 cfs recorded on July 29, 1962. The peak flow of 78,500 cfs at the project occurred on September 21, 1938.

Table 3-6. Recreational spending by users of NEP's recreational facilities, January 1 to September 4, 1991 (Source: Land and Water Associates, *et al.* 1991).

Use	Visitor Days	Spending /Visitor Day	Total Spending
Ice Fishing	413	$8.88	$12,550
Snowmobiles	4,310	$11.64	$50,170
X-Country Ski	1,540	$21.23	$32,690
Summer Fishing	102,735	$13.58	$1,395,140
Boaters	77,259[1]	$10.93	$844,440
Picnickers	52,506	$7.48	$392,740
Other activities[2]	224,195	$11.04	$2,475,110
Total	463,958	$11.21	$5,202,840

[1] Includes 8,613 fall boaters.
[2] Other activities includes: hikers, walkers, sightseers, photographer, tubers, and swimmers.

The WWTF discharges into the Gardners Falls reservoir near the reservoir's midpoint. Discussions between KA and the MA DEQE (KA 1990a) revealed that the discharge from the wastewater treatment facility has a negligible impact on water quality in the reservoir because of the relatively small quantity of effluent. Historically, operation of the wastewater facility has occasionally had some adverse effects on water quality during storm events. During these times, nutrients have been added to the river because of problems with the infiltration system that allowed mixtures of storm water and untreated sewage to enter the river.

There are no diversions of water for irrigation, reclamation, or municipal supply purposes, and the storage capacity of the reservoir is too small to be used for flood control.

Water quality is good in the reservoir with DO ranging from 8.4 to 8.7 mg/l and pH was 6.8. Temperatures are conducive to warmwater fish (22.0 to 22.8°C) (Table 3-7). Nutrients, such as phosphorus, and nitrate (as N) concentrations were low and meet the state water quality standards for these parameters. The nutrient levels generally reflect a natural, unimpaired water quality condition.

Water samples collected by MA DEQE in 1988 from sites in the Deerfield River above and below the reservoir found that metals concentrations in the water column were less than the limits set for freshwater by the EPA with the exception of copper. Copper was detected at the level of 0.0200 mg/l in 1988. KA also found copper concentrations of 25.3 mg/kg in sediment samples collected in 1989 from the bottom of the reservoir and below the outfall for the wastewater facility.

The high copper levels in the sediments could be from two sources: natural deposits in the river basin or from the repeated use and settling of treated effluents released from wastewater treatment facilities on the Deerfield River. Copper minerals are probably present in some of the bedrock, and subsequently, in some of the unconsolidated deposits (glacial till, alluvium, *etc.*) in the Deerfield River Basin, as well. Thus, it is likely that some copper would occur naturally in sediments in the area. In addition, about 2.25 pounds of copper were released with effluents from the WWTF facility on July 5 and 6, 1983, and on November 15 and 16, 1983 (memorandum from Jeffrey Allen, Senior Fishery Biologist, Kleinschmidt Associates, Pittsfield, Maine, to Brandon Kulik, Fishery Biologist, Kleinschmidt Associates, Pittsfield, Maine, dated November 11, 1990).

Water quality and quantity in the bypassed stream reach and below the powerhouse

Water quantity is heavily regulated in the 1,400-foot bypassed stream reach. There is no minimum flow in the bypassed reach and flows consist of leakage from the dam, local drainage, and spills over the dam during periods of high water runoff. About 80 percent of the time there is no flow released into the bypassed reach except leakage. During the summer months, the leakage ranges from 30 to 50 cfs.

The river channel in the bypassed reach is about 200 feet wide and has a relatively steep slope of about 2 percent. Habitat types in the bypassed reach consist of moderately deep pools, runs, and steep rapids from the toe of the dam downstream to the tailrace. Pools and runs are separated by rapids and ledge drop offs creating a terraced profile. There are pools at the toe of the dam and at the tailrace that average four to six feet deep depending on flow. Boulder and rock substrate predominate throughout the bypassed reach. High flow releases and steep gradients scour any sand and gravels from the area.

Table 3-7. Water quality parameters for the Gardners Falls Project in the reservoir, bypassed stream reach, and below the powerhouse (Source: MA DEQE 1988 and KA 1990a).

Location	Date	Water Temp (°C)	Dissolved oxygen (mg/l)	Flows
In reservoir	8-23-89	22.8	8.4	----
"	8-24-89	22.0	8.7	none
In bypass	8-23-89	23.0	8.3	none
"	8-24-89	21.1	8.9	none
Below powerhouse	8-23-89	23.0	8.3	leakage
"	8-24-89	20.7	8.7	none
"	7-19-88	76 (°F)	6.8	----

Note: pH measured at a depth of 1 meter at a midstream location was 6.8 on 8-24-89.

The powerhouse discharges into the pool created by the Deerfield No. 2 dam, located about 1.5 miles downstream. The pool is created by a backwater effect whenever the No. 2 reservoir is at the normal full headpond elevation of 294.65 feet msl. Whenever the Deerfield No. 2 reservoir is drawn down to elevation 291.7 feet msl or less, there are rapids in the tailrace area that extend about 215 feet downstream. The inundation of the rapids in the tailrace area typically occurs in the May to October period when the flashboards are raised at the No. 2 dam. From November to April, when the flashboards are lowered at the No. 2 dam, the water recedes and once again there are rapids in the Gardners Falls tailrace area.

Water quality in the bypassed reach and below the powerhouse is similar to that found in the reservoir (Table 3-7). DO level remain good throughout the project area, but temperatures become increased in the bypassed reach and immediately below the powerhouse, probably reflecting the effects of reduced flows in both areas. The increased temperatures throughout the Gardners Falls Project area can be marginal for trout species. The water temperatures meet state standards for Class B warmwater species. The nutrient levels (nitrates and phosphorus) are similar to that occurring in the upstream reservoirs and are relatively low levels.

3.3.2.3 Fishery Resources

The Gardners Falls reservoir contains several fish species, and the MA DFW usually stocks adult rainbow trout (and sometimes brown trout) about four times each spring to support a put-and-take fishery. About 1,000 fish are stocked in the reservoir throughout April and June. MA DFW believes most fish are harvested by the conclusion of the fishing season. Most rainbow trout fail to over winter and seldom attain large sizes (Mugsford 1969). Fish sampling in the reservoir by KA (1990) in August 1989, collected 32 fish representing seven species.

The reservoir was dominated by white sucker during this summer sampling period. The assemblage of all species reflects a warmwater fish community. MA DFW doesn't have an active management plan for the warmwater species in the reservoir. In contrast, MA DFW does actively manage the put-and-take coldwater trout fishery in the reservoir. Trout are present in the spring when they are stocked in the reservoir by the MA DFW and would likely remain in the reservoir until they are removed by fishermen or travel downstream to escape increasing water temperatures in late summer (July and August).

Fishery resources in the bypassed reach and immediately below the powerhouse

The 1,400-foot-long bypassed reach provides minimal fish habitat during project operation. This reach is composed of well-defined pools, rapids, and runs that extend from the toe of the dam downstream to the project tailrace. These habitat types generally range in length from 100 to 500 feet and the Deerfield River in this reach ranges from 100 to 120 feet wide.

No fish sampling was conducted in the bypassed reach. Fish species are likely to be the same as those reported in the Gardners Falls reservoir and in the downstream Deerfield No. 2 reservoir.

The MA DFW also stocks adult trout (brown and rainbow trout) about 300 feet downstream of the Gardners Falls powerhouse in that portion of the Deerfield No. 2 reservoir (Deerfield River) known as Wilcox Hollow. As in the Gardners Falls reservoir, the MA DFW stockings of brown and rainbow trout in Wilcox Hollow are in support of a put-and-take sport fishery for the period between April and June. The river is about 180 feet wide in this area and has a moderate slope of about 1 percent. Some recreational fishing occurs in the pool at on the downstream side of the dam and in the power canal.

3.3.2.4 Vegetation and Wildlife Resources

Vegetation

The Gardners Falls study area is approximately 72 acres with 3.7 acres of developed land. Seven vegetative cover types can be found in the undeveloped study area to include: (1) shrub upland, (2) deciduous forest, (3) mixed forest, (4) open water habitat, (5) unconsolidated shore, (6) emergent wetland, and (7) shrub wetland. The upland and forest vegetation cover located at Gardners Falls is not significantly different from that at the Deerfield Project (see Section 3.3.1.4).

Open water includes the Gardners Falls impoundment, tailrace, power canal, and a portion of the bypassed reach. Aquatic vegetation is very sparse in the impoundment, although pondweed, elodea, and arrowhead are found in shallow areas. The swift water below the Gardners Falls dam and tailrace keeps the river bed unvegetated.

Unconsolidated shore occurs below the Gardners Falls dam. This area is composed of large rocks and gravel, and has a fair amount of vegetation. A number of stunted tree and shrub species occur in this cover type. Vegetation consists of gray birch, hemlock, red maple, shadbush, elderberry, lowbush blueberry, meadowsweet, speckled alder, staghorn sumac, and willow. Common herbaceous species are boneset, bur-reed, Canada goldenrod, various grasses, Joe Pye-weed, purple loosestrife, sedges, and rushes.

Emergent wetlands occur at the eastern end of the Gardners Falls impoundment. Purple loosestrife, sedges, rushes, and cattails are the most common wetland species found in this cover type.

Finally, two small areas of shrub wetlands occur in the Gardners Falls study area; one shrub wetland is on the south side of the power canal and the other shrub wetland is on the northeast end of the impoundment. These shrub wetland areas contain dense stands of speckled alder, willow, silky dogwood, and winterberry.

These areas are moist to saturated and some areas contain standing water. Sensitive fern, cinnamon fern, tall meadowrue, and swamp milkweed, are common herbaceous species in these shrub wetlands.

Wildlife

Species such as the Eastern American toad, bullfrog, and greenfrog are probably residents in the impoundment and wetlands, although they are not abundant. The streams that empty into the impoundment and the wooded slopes offer some habitat for stream and woodland salamanders, as well as some snake species. However, the steep slopes along the impoundment, the small amount of land area within the Gardners Falls Project boundary, and the relatively high frequency of human recreational use of portions of these wooded slopes, limit the value of available habitat. The east shoreline and adjacent wooded slopes offer better habitat than the west side of the impoundment.

The Gardners Falls Project area supports a variety of breeding bird species. Song sparrows are common along the edge of the impoundment, as well as along shrub edges near developed portions of the Gardners Falls site. Each small drainage that empties into the impoundment also contains a pair of northern waterthrushes. The other most abundant bird species are the swallows (tree, northern roughwinged, and barn swallows) which forage for insects over the water in the power canal, the impoundment, and the tailrace area.

The shrub wetland adjacent to the power canal contains several pairs of common yellowthroats, cedar waxwings, eastern kingbirds, and gray catbirds. Single pairs of other bird species were also observed at Gardners Falls.

The forested area along the impoundment power canal and tailrace provided habitat for red-eyed vireos, black-capped chickadees, tufted titmice, scarlet tanagers, and other bird species. Ground nesting bird species, such as veeries and ovenbirds, are generally absent from the wooded areas within the project boundary because of the steep slopes. In areas where herbaceous, shrub, and under story vegetation is greatly reduced, such bird species would not be expected. American robins, song sparrows, and common grackles, were observed foraging in these areas. No waterfowl was observed in the Gardners Falls impoundment during the surveys, although transient individuals can be expected to occur.

Few large mammals would have their entire home range within the Gardners Falls Project area because of the steep slopes and resulting limits of the project boundaries. Only some small mammals would find enough wildlife habitat within the developed and wooded portions of the project site.

The only mammal species observed during the field survey were the eastern gray squirrel and a cottontail rabbit. Signs of beaver cuttings and mole tunnels were also noted. Overall, the project area could provide wildlife habitat for a variety of mammals, although only a small number of individuals would be expected to permanently reside within the Gardners Falls Project boundary.

3.3.2.5 Threatened and Endangered Species

The DOI reports no known populations of federally listed endangered, threatened, proposed, or rare species to occur in the Gardners Falls study area (letter from Andrew Raddant, Acting Regional Environmental Officer, DOI, Office of the Secretary, Boston, MA, October 5, 1994). However, the MA NHP reports that the area of the Deerfield River under investigation contains potential habitat for six rare plant species. These six rare species are: (1) mountain alder (state special concern), (2) roundleaf shadbush (state special concern), (3) muskflower (state threatened), (4) barren strawberry (state special concern), (5) pale green orchid (state threatened), and (6) leafy white orchid (state threatened). However, during field investigations, only mountain alder (*Alnus viridis* spp. *crispa*) was found on the west side of the Gardners Falls bypassed reach in the unconsolidated shore vegetation cover type. None of the other state-listed rare plant species were observed.

The USFWS and the MA NHP report no known populations of threatened, endangered, or rare species to occur in the Gardners Falls Project area, and none were found during the field surveys.

3.3.2.6 Recreation and Land Use Resources

Recreation

Since 1967, WMEC has provided and maintained designated recreational access areas at the Gardners Falls Project. To further provide convenient river access, WMEC purchased a tract of land during the 1970's that is located between Route 2 and their project boundary below the Gardners Falls powerhouse. WMEC donated these lands to the Commonwealth of Massachusetts and the parcel is now designated as the Wilcox Hollow State Forest. WMEC's tailwater access area, known as Wilcox Hollow, is adjacent to the state forest and accessed directly from Route 2 via a gravel road.

Fishing is the primary outdoor recreational activity that occurs at Gardners Falls, while other recreational uses at the project include hiking, sightseeing, picnicking, and canoeing. WMEC estimated that the recreational use at the project in 1990 at about 2,050 recreation days; fishing accounted for nearly half of this use (see Table 3-8). Most of the angling activity at the project takes place in the reach below the powerhouse (about 60 percent).

The MA DFW historically has stocked the Gardners Falls impoundment and the river segment downstream of the powerhouse with adult rainbow and brown trout during the spring months to support a put-and-take fishery. To accommodate day-use river access demands at Gardners Falls, WMEC provides a picnic facility along the impoundment and tailrace access at Wilcox Hollow. WMEC's picnic area is located on a bluff overlooking the impoundment providing parking for 15 to 20 vehicles, tables, raised charcoal grills, garbage barrels, and pit toilets. From the picnic area, angling access to the impoundment is provided via a foot trail (timber stairs and a timber foot bridge) that descends the bluff to the river. Angling access to the impoundment is also provided at an informal parking area near the dam and canal headgates off the powerhouse access road.

Wilcox Hollow, located about 300 feet downstream of the powerhouse, provides an informal access to the east bank of the river which is used primarily by anglers. The Wilcox Hollow access road entrance and sign are inconspicuous, and therefore, the access is used primarily by local residents familiar with the area. The gravel access road leads to a small turnaround near the river's edge providing hand-carried boat and angling access to both the Gardners Falls tailrace and the Deerfield No. 2 impoundment. Rugged terrain physically limits access to both sides of the river, and Wilcox Hollow provides one of the few access points along the 12-mile section of the Deerfield River from Gardners Falls to its confluence with the Connecticut River.

Wade fishing and boat fishing in the tailrace are influenced by both instream flows from the powerhouse and bypassed reach and from the backwater effect of the Deerfield No. 2 impoundment. WMEC determined that wade fishing in the tailrace is suitable at flows up to 80 cfs, while flows above 80 cfs impede wade fishing due to water depth, velocity, and turbulence. Boat fishing in the tailwaters is suitable at flows about 100 cfs, but turbulence and water velocity begin to limit boat angling above 100 cfs. Backwater effects from NEP's Deerfield No. 2 impoundment can inundate most of the tailrace permitting both wade and boat fishing, particularly when instream flows from Gardners Falls are under 80 cfs (for further discussion on tailrace flows, see Section 3.3.2.2). Shoreline angling in the tailrace is suitable at both low flow and high flows.

Because of the variation of flows below the powerhouse, WMEC currently maintains a warning system that sounds prior to the start-up of each turbine unit. Signs explaining the purpose of the siren are located along the shoreline and along major river access areas. The four powerhouse turbines are activated sequentially allowing flows to increase and stabilize before another unit begins to operate. WMEC also maintains a boat barrier on the impoundment to keep boats a safe distance from the dam and canal headgate structure.

While fishing is popular at the tailrace, the bypassed reach receives low use levels among anglers. Rugged terrain limits access to the bypassed reach to either climbing down an eight-foot-high retaining wall and walking across ledge outcrop or a path beginning near the powerhouse which descends a steep embankment. In addition to the access limitations, low flows in the bypassed reach under the existing project operation regime may affect angling quality (*i.e.*, required experience level, fishability, attractiveness to anglers, aesthetic quality, *etc.*) and contribute to the reach's limited angling use. Based on WMEC's IFIM study, angling in the bypassed reach is suitable at flows ranging from 50 cfs to 100 cfs; above flows of 100 cfs the reach is too deep and turbulent for wading and shoreline angling (for further discussion on the bypassed reach, see fisheries resource Section 3.3.2.3).

Table 3-8. Seasonal recreation use[1] at Gardners Falls (Source: WMEC 1992).

Activity	Spring	Summer	Fall	Winter	Total
Fishing	400	200	300	0	900
Walking/Hiking	150	150	250	0	550
Sightseeing	40	40	150	0	230
Canoeing	50	50	50	0	150
Picnicking	30	40	30	0	100
Other activities[2]	15	75	30	0	120
Totals	685	555	810	0	2,050

[1] Recreation use is defined as each visit by a person to a development for recreational purposes during any portion of a 24-hour period.
[2] Other activities includes the following recreation uses: nature study, sunbathing, swimming, and hunting.

In addition to the picnic area and Wilcox Hollow, WMEC provides a nature trail along the western bank of the project canal with parking for five to six vehicles, a pit toilet, and a garbage barrel. Although the nature trail receives low use levels, the powerhouse access road is frequently used by local residents for leisure walking or jogging for exercise.

Presently there are no formal access facilities for boating at Gardners Falls, although both Wilcox Hollow and the parking area near the dam afford car-top boat access (canoes and kayaks). Boating use at the project is generally associated with angling on either the Gardners Falls or Deerfield No. 2 impoundments. While Gardners Falls does not offer whitewater conditions, occasional kayakers and canoeists put-in at the Wilcox Hollow area to access the whitewater reach below the Deerfield No. 2 dam. After portaging at the Deerfield No. 2 dam, about 7,900 feet downstream from the Gardners Falls powerhouse, boaters can travel to the mouth of the Connecticut River (some 12 miles downstream).

Land use

Located at about river mile 15.8 between Deerfield No. 2 and Deerfield No. 3, the Gardners Falls Project area includes 48.9 acres of land. The land area surrounding the project is predominantly rural with some residences in the vicinity. Land topography in the immediate area includes steep sloped hillsides above a narrow floodplain vegetated by deciduous forest.

3.3.2.7 Aesthetic Resources

Prominent aesthetic resources in the project area include the impoundment, the bypassed reach, and the project facilities. With its heavily forested shoreline the 21-surface-acre-impoundment provides scenic views from WMEC's picnic area and from adjacent roadways. The well-preserved 20th-century hydroelectric structures (dam, canal, and powerhouse) are considered aesthetic resources due in part to their inclusion in the Buckland Historical District (see Section 3.3.2.8). Viewed from the powerhouse access road the structures are unobtrusive in the landscape setting due to their low profile and their construction of primarily natural materials (brick, stone, and wood).

The 1,400-foot-long bypassed reach is characterized by several deep pools, short segments of rapids, well-scoured rock and boulder substrate, and ledge outcrops. Scenic views of the bypassed reach are primarily confined to vistas from the powerhouse access road due to the limited access to the shoreline. Spillage into the bypassed reach currently occurs when flows exceed the project's hydraulic capacity (1,420 cfs). In addition, the bypassed reach receives leakage flows that frequently equal or exceed 50 cfs during most of the summer period.

3.3.2.8 Cultural Resources

Prehistoric and Historic Archeological Resources

The archeological reconnaissance survey of the Gardners Falls Project area found that the area has a potential to contain a variety of prehistoric and historic archeological sites (McBride 1990). These types of sites are similar to those which might be expected at the Deerfield No. 2 and No. 3 developments.

However, because archeological sites are fragile and the informational value of archeological sites depends on how intact their information content is, appropriate handling of prehistoric and historic archeological resources will be taken care of via the Gardners Falls PA, which will contain provisions for identifying the type of and degree to which prehistoric and historic archeological information, if any, will be made available to the general public.

Historic Architectural Resources

By letter dated April 3, 1990, the Massachusetts SHPO determined that the Gardners Falls dam, power canal, and powerhouse are eligible for inclusion in the National Register. This is based on the historic use of the project as an early twentieth century hydroelectric facility; its well-preserved site integrity; and its architectural features (Valerie Talmage, Executive Director, State Historic Preservation Officer, Massachusetts Historical Commission, Boston, Massachusetts).

4. ENVIRONMENTAL CONSEQUENCES

4.1 PROJECTS AS PROPOSED

4.1.1 Deerfield Project (Settlement and CRMP)

4.1.1.1 Geology and Soils

Project Operation

Continued operation of the eight developments as proposed by NEP would not cause any new erosion, sediment runoff, or shoreline instability of the impoundment shorelines or the bypassed reach and downstream river channels.

- NEP's proposed minimum flow releases at Somerset dam and in the Searsburg and Harriman bypassed reaches would have a negligible effect on erosion compared to the high natural flows which periodically pass through the reaches without effect under the project's current operation. Thus, these minimum flows would not cause erosion or instability of the coarse bed and bank deposits in the bypassed reach channels and banks.

- No shoreline effects would result from the proposed impoundment fluctuation limits at Somerset reservoir (to facilitate loon nesting) and the proposed restrictions on raising and lowering of the Harriman reservoir level (to support fish spawning and early life stages); water levels under NEP's proposals would be within the current operating range.

- No erosion would be expected due to the 1,000 cfs recreational flow releases through the Deerfield No. 5 bypassed reach because of the coarse bed and bank deposits in the channel and banks.

Fish Passage Construction

Fish passage construction at the Deerfield Project would have only minor, short-term erosion and sediment effects. Some excavation would occur in bedrock and cobbley, bouldery deposits in the right bank of the river below the dam during construction of the plunge pool and flume portion of the Deerfield No. 4 downstream fish passage facility. Some rock excavation would occur during construction of the plunge pool and flume portion of the Deerfield No. 3 downstream fish passage in the river bed below the dam.

No ground-disturbing and land-clearing activities would occur during construction of the plunge pool and flume portion of the Deerfield No. 2 downstream fish passage facility. All construction activities would take place on the crest and downstream face of the dam.

Recreational Facilities

Some erosion and sediment runoff would be caused by land-clearing and ground-disturbing activities during construction and enhancement of each of new and existing recreation facilities, respectively (see Section 4.1.1.6).

Erosion and sediment runoff control measures are proposed at three of the development sites. We conclude that they would be effective, however, they are limited to specific exiting problems which have developed and need to be remedied, and don't incorporate consideration of possible control measures for land-clearing or ground-disturbances associated with proposed improvements or new construction. These measures include:

- At the Molly Stark Picnic Area on the north shore of Harriman reservoir, the proposed development includes installation of riprap to stabilize 100 feet of steep, eroding, and slumping bank.

- At the Jacksonville Picnic Area on the east shore of Harriman reservoir, the proposed development includes stabilizing and restoring 300 feet of eroding bank near the beach with rock and boulder riprap, and back-filling with soil and seeding with grass. Two jetties which help protect the Jacksonville Picnic Area beach would be enlarged, and sand would be added to the beach. Some sediment runoff would occur during installation of the riprap and placement of the sand. However, the existing shoreline is naturally rocky, and the imported sand would probably need replenishment over time.

- At the Searsburg Trail, the proposal includes making repairs to the old railroad bed where erosion has occurred or ditching is needed.

4.1.1.2 Water quality and quantity

4.1.1.2.1 Somerset Development

Somerset Reservoir

Maintaining a stable reservoir elevation to facilitate common loon nesting during the period of May 1 through July 31 each year would improve water quality by reducing bank erosion and turbidity caused by the suspension of sediment, as well as enhance aquatic habitat availability and suitability (discussed further in Section 3.3.1.4). During other times of the year, the reservoir would continue to fluctuate to capture flows for release during the summer, fall, and winter months and for flood protection purposes.

A 1991 study examined project operation and other factors affecting reservoir fluctuation that might cause increased erosion of the shoreline banks (*e.g.*, prevailing winds, wave action, topography of the shoreline, climatic effects, *etc.*). The study concluded that the annual cycle of reservoir drawdown and refilling doesn't significantly change the existing Somerset shoreline. Over the years the reservoir shoreline has become armored with rocks from eroded glacial till, resembling poorly graded riprap around much of the reservoir. We believe that the elevation changes required by the Settlement would have minimal effect on water quality in the reservoir. Under the existing operating regime, there appears to be no water quality problem resulting from bank erosion in the reservoir.

Water quality data from Somerset reservoir shows that seasonal stratification occurs within the reservoir. The changes in water levels proposed in the Settlement would not alter the stratification that presently occurs within the reservoir, but stabilizing water levels during the summer months could act to extend the duration of the stratification. The potential extension of the depth and duration of the stratified waters is not likely to cause significant decreases in DO or water temperatures; levels of both variables are likely to remain similar to those levels occurring in the reservoir prior to implementation of the Settlement. This poorly oxygenated water would subsequently be released through the low-level water intake into Somerset Reach.

Somerset Reach

The Settlement requires various flow releases below the Somerset reservoir into the 6-mile-long stream reach (Somerset Reach) between the reservoir and the Searsburg Development. Depending on water levels and the degree of stratification within the reservoir, low-level coldwater releases from the reservoir have the potential to create high quality tailwater fisheries. Deep water discharges, however, also can impact fish growth and production, if the poorly oxygenated water is not rapidly re-aerated in the tailrace area.

The increased flow releases required by the Settlement, that would be released from May 1 to September 30 (9 to 12 cfs), would ensure water quality would continue to meet Vermont state water quality standards for this reach. The 9 to 12 cfs release would be an enhancement over the voluntary 4 cfs minimum flow NEP presently releases into this reach, and under the Settlement, the minimum flow would be guaranteed from storage for the May 1 to July 31 period (9 cfs would only be released if it is needed to maintain reservoir elevations). In addition, the flow from five tributaries entering the Somerset reach would continue to supplement the increased flow releases made by NEP under the Settlement. Tributary inflow, combined with the proposed flow releases, would improve the potential of meeting the state's designated usage (principally supporting aquatic biota) for this reach.

The DO concentration and water temperature in the Somerset reach as measured at various locations below the Somerset outlet show that these two parameters don't create water quality problems from project operation, and meet state standards for a Class B coldwater fishery (Vermont Water Resources Board, 1991). The continuous monitoring of DO and percentage of DO saturation below the Somerset outlet during the summer critical period shows rapid re-aeration of the coldwater releases occurs immediately below the development. The Settlement flow releases into the 6-mile Somerset Reach should further enhance water quality overall by increasing the quantity and continuity of flows for this reach. Currently, fluctuating flows and the quantity of flow release in the Somerset reach has led VANR to classify this reach as not supporting its designated uses, but proposed flow enhancements would likely allow the stream reach to support the designated uses.

4.1.1.2.2 Searsburg

Searsburg Reservoir

Water quality changes little as flows pass through Searsburg reservoir. The reservoir can fluctuate up to 8 feet (using flashboards) on a daily basis, and the VANR has expressed concern about potential bank erosion and stability caused by these daily fluctuations, and the resultant impact on water quality. The Settlement proposed operation would not change how the reservoir fluctuates on a daily basis.

The banks along the Searsburg reservoir have become stabilized over the years of development operation. Dense vegetation extends to the waterline and erosion caused by wave action has been minimal, possibly due to the small reservoir size. No bank collapse or landslides were apparent during studies conducted in 1990, indicating that neither fluctuating water levels nor wave action are causing degradation of water quality via bank erosion. We believe that continued operation of the reservoir with daily fluctuations from five to 8 feet would not likely cause further erosion and, therefore, under the terms of the settlement, water quality would continue to be maintained at state standards.

Bypassed Reach and Area Below the Powerhouse

The Settlement requires flow releases of 35 cfs (or inflow) from June 1 to September 30, and 55 cfs (or inflow) from October 1 to May 31, for fishery enhancement purposes (see Section 4.1.1.3). However, these minimum flows would also improve water quality conditions, particularly for DO and temperature. Since there is presently no minimum flow required nor released into the bypassed reach, the release of a minimum flow as required under the Settlement would provide better year-round water quality and increase habitat for fish and other aquatic biota. In addition, since portions of the Searsburg stream reach affected by the project have channel widths that are relatively wide (from 100 to 200 feet) and open, the low or intermittent flows that are currently released into the bypassed reach are subject to increased temperatures caused by the exposure to warm air temperatures during the summer months.

Vermont doesn't set a specific upper temperature limit for cold or warmwater fishery water bodies, but does specify a 1.0° F limit on temperature increases over ambient levels. Data indicates that during the summer months when flow in the bypassed is reduced or intermittent, water temperatures can elevate by as much as 3°C by the time the water reaches the confluence with the tailrace, where it is cooled by 4 to 7°C when mixing occurs with the tailrace waters. These increases in temperature, combined with the existing intermittent bypass flows, were factors that led the state to identify this reach as not meeting its state designated uses (VANR 1995). Under the terms of the Settlement, the minimum flow release to this reach should enhance water quality, both in terms of temperature and flow continuity.

4.1.1.2.3 Harriman

Harriman Reservoir

The Settlement requires that NEP operate the reservoir to manage and support rainbow smelt and smallmouth bass spawning and early life stages. To meet this objective, the Settlement requires the reservoir level to be stable or rising during the period from May 1 to June 15 each year. From June 16 to July 15, the reservoir elevation would fluctuate no more than one foot per day. No other restrictions would be placed on reservoir levels or operation by the Settlement. The Harriman reservoir water level typically fluctuates seasonally, rising from 1,455 to 1,494 feet msl from March to early May and falling from 1,480 to 1,455 feet msl from December to early March, and could continue to do so under the terms of the Settlement (Table 3-3).

VANR has expressed concern about the effects of reservoir fluctuations on erosion and stability of the reservoir banks, which could impact water quality. Bank erosion could affect water quality (turbidity and sediment loading) in the reservoir, as discussed for Somerset reservoir. The shoreline along the Harriman reservoir has become armored in much the same manner as the Somerset reservoir, and has poorly graded riprap along the shoreline composed of cobble and sand. Additionally, several shoreline areas with alluvial fans have formed where various streams enter the reservoir, and a few mud flat areas exist. Minor bank collapse and bank slumping has been noted at three areas, primarily on the northern shore near the Deerfield River inflow, near picnic areas on the northwest shore and near Wards Cove, and near the boat launch by Whitingham. These erosion sites are not large, and do not appear to be caused by reservoir fluctuation. We believe that implementing provisions of the Settlement would provide greater stability to the reservoir and would minimally reduce shoreline erosion.

We anticipate no significant changes in water quality from project operation that would occur according to the Settlement. Water quality in the Somerset reservoir would continue to meet state water quality standards. The stabilization of water levels during the summer months could act to extend the depth and duration of the seasonally present stratification.

Bypassed Reach and Area Immediately Below the Powerhouse

The Settlement requires 70 cfs and 57 cfs flow releases October 1 to June 30 and July 1 to September 30, respectively, below the Harriman dam into the 4.4-mile-long bypassed reach. In the past, this reach has received only leakage (about 3 cfs) from the dam. Coolwater releases would continue to be made from the low-level water intake via a new valve mechanism designed to increases aeration. The increased volume of coolwater would enhance habitat suitability in the bypass reach, reducing ambient water temperature.

Currently, this lower portion of the bypassed reach is classified as Class B Wastewater Management Zone. The VANR (1995) believes the proposed minimum flows would provide sufficient dilution to remove the risk of a conflict with the assimilation of the Readsboro Wastewater Treatment Facility discharge. Under 7Q10 flows at present, the dilution ratio is less than 9:1, but VANR (1995) says the proposed 57 cfs release is on the order of four times the river's 7Q10 flow, which is the basis for the wastewater treatment plant design. We believe the Settlement required minimum flow releases would help to attain state usage standards, because one of the reasons the bypass reach did not meet its designated usage was because of flow alterations.

4.1.1.2.4 Sherman

Sherman Reservoir

The Settlement requires no operational changes at the Sherman development. The Settlement seasonal minimal flow releases of 57 and 70 cfs from the Harriman development upstream, along with other tributary inflow, would ensure that reservoir water quality continues to meet state standards. The release of a minimum flow at Harriman would enhance water quality of the inflow to Sherman reservoir by decreasing ambient water temperature. Recent improvements to reservoir water temperatures have already occurred due to the elimination of the once-through cooling withdrawal at the Yankee Atomic Facility, and we expect further minor enhancements to water quality within Sherman reservoir from the proposed upstream flow re-allocations. Since the Sherman development typically doesn't operate from June through September, inflow during these months passes through the Sherman reservoir, and we anticipate little effect on this time-period from the Settlement.

4.1.2.2.5. Deerfield No. 5

Deerfield No.5 Reservoir

Although the Settlement requires no operational changes at Deerfield No. 5 reservoir, we expect a minor enhancement in water quality in the reservoir, as a recipient of water quality improvements upstream. Since the operation of Deerfield No. 5 closely follows the operational mode of the Sherman development upstream, we expect similar water quality enhancements from the flow re-allocations that would occur upstream under the Settlement.

Bypassed Reach and Area Below the Powerhouse

The Settlement proposed minimum flow release of 73 cfs or inflow below Deerfield No. 5 dam would enhance water quality in the bypass reach. Ambient water temperature would be reduced in the bypassed reach because less incidental warming would occur as flow passes through the bypassed reach during the low flow periods of late summer and early fall. Enhancements to DO levels would also occur.

4.1.1.2.5 Deerfield No. 4

Deerfield No.4 Reservoir

No operational changes are required by the Settlement at Deerfield No. 4, and the development would continue to operate in a daily peaking mode. We anticipate no significant change in reservoir water quality, which would continue to meet state standards. Inflow to the reservoir would be a combination of minimum flow releases from Fife Brook dam (which under the Settlement would be guaranteed at 125 cfs) and unregulated inflow from several small tributaries upstream. The upstream enhancements to water quality via augmented flow releases could slightly improve water quality at the reservoir.

Bypassed Reach and Area Below the Powerhouse

The Settlement minimum flow of 100 cfs from October 1 to May 31 and 125 cfs from June 1 to September 30 would enhance water quality and quantity in the bypassed reach. Previously, flow in the bypass reach was limited to leakage from the dam or spill during high runoff periods. Continuous minimum flows would reduce the warming of water as it travels through the bypassed reach, especially during the low flow periods of late summer and early fall. The steady quantity of water released should also improve habitat for aquatic biota.

4.1.1.2.6 Deerfield No. 3

Deerfield No.3 Reservoir

There are no Settlement requires changes to the existing operation of the Deerfield No. 3 development that would affect water quality in the reservoir. Since the operation of the development closely follows the operational mode of the Deerfield No. 4 development upstream, we expect similar water quality enhancements from the Settlement flow re-allocations that would occur upstream.

Bypassed Reach and Area Below the Powerhouse

In the past, flow in the 0.4-mile-long bypassed reach consisted only of dam leakage, local drainage, and spill over the dam during high runoff periods. The Settlement minimum bypass flow of 100 cfs or inflow would enhance water quality in the bypassed reach. The minimum flow release would reduce the warming of water during travel through the bypassed reach, especially during the late summer and early fall when total flow is low. Cooler water temperatures would also enhance DO levels, which along with steady flows would benefit aquatic biota.

4.1.1.2.7 Deerfield No. 2

Deerfield No.2 Reservoir

There are no Settlement required changes to the existing operation of the Deerfield No. 2 development that would affect water quality in the reservoir, and the development would continue to operate in a daily peaking mode. Water quality in the Deerfield No. 2 reservoir would be minimally enhanced by the aggregate flow re-allocation and water quality enhancements implemented at the upstream developments.

9-mile Affected Stream Reach Below the Deerfield No. 2 Dam

The Settlement minimum flow release of 200 cfs to the bypass reach would improve water quality and habitat for aquatic resources in the Deerfield River below the Deerfield No.2 development. We anticipate a minor enhancement via a slight reduction in water temperature during the late summer and early fall low-flow periods when incident warming of the relatively low instream flow would be greatest. The Settlement flow release would also minimize flow fluctuations in the upper portion of the 9-mile reach below Deerfield No. 2. The enhanced release (representing an increase of from 100 to 200 cfs over existing), would enhance and stabilize habitat for aquatic biota.

4.1.1.3 Fishery Resources

4.1.1.3.1 Somerset development

Somerset Reservoir

The Settlement's proposal to stabilize the reservoir elevation at ± 1 foot from May 1 to July 31 to protect nesting loons would also provide benefits to the reservoir's warmwater fish populations. Holding the reservoir elevation stable during the period from around May 1 through July 15 would help promote successful smallmouth bass and panfish spawning and fry development by providing habitat and by providing for the temporary colonization of the littoral zone by aquatic macroinvertebrates until the late summer drawdown. The smallmouth bass and panfish nest in shallow near shore zones in the spring and would likely be through nesting by the time the water levels are either raised and lowered by July 31. We note that the VDFW manages the reservoir primarily for a put-and-take brook trout fishery--this fishery would not be affected by fluctuating water levels within the reservoir. Other factors, such as low nutrient levels, low pH, low alkalinity, and low DO concentrations in portions of the reservoir seasonally (personal communication between representatives from New England Power Company and Kenneth Cox, Fishery Biologist, Vermont Agency of Natural Resources 1987) may have more of an effect on the reservoir's warmwater fishery than does water level fluctuations.

Stream Reach Below Somerset Dam

The Settlement requires that NEP release minimum flows into the Somerset reach below Somerset dam of 30 cfs from October 1 to December 15, 48 cfs from December 16 to February 28, 30 cfs from March 1 to April 30, and 12 cfs from May 1 to September 30. The Settlement also allows for a reduction from 12 to 9 cfs in the minimum flow required from May 1 to July 31 if it becomes necessary to maintain the reservoir elevation. This minimum flow releases would help to meet VANR's goal of establishing a self-sustaining population of brook trout in the Somerset reach. The release of these minimum flows into the Somerset reach would also accommodate any future secondary fisheries management objective of VANR, to manage the reach as nursery habitat for landlocked Atlantic salmon. Under the latter scenario, if landlocked salmon management were resumed in Harriman reservoir, the Somerset reach would be stocked with landlocked salmon fry to produce juveniles that would migrate downstream past the Searsburg development into the Harriman reservoir where they would grow into adults and support a reestablished sport fishery. In 1992, VDFW resumed annual experimental stocking of Atlantic salmon in Harriman Reservoir by stocking yearling landlocked Atlantic salmon. The VDFW believe that stocking larger yearling fish and reducing the total numbers of other salmonids stocked in the reservoir will improve the chances for Atlantic salmon to become established in the reservoir. However, previous experimental plantings of Atlantic salmon in the Harriman Reservoir have all been unsuccessful. We also note that in 1994, VDFW has resumed annual planting of lake trout in Harriman Reservoir to establish a sport fishery.

The amount of fishery habitat in the 6-mile-long Somerset reach has been reduced in several areas over the years by the store-and-release, seasonal operating mode of the Somerset development. Typically, water is stored and released from the Somerset reservoir to supply a reliable source of water to other hydropower developments located downstream. Water is stored during the spring runoff (March, April, and May) and once the reservoir is refilled in May, water is then released slowly as the reservoir is drawn down until December. Then there is a steady release of about 120 cfs during the winter months (December, January, February) until refill begins again in March. As discussed earlier, NEP has voluntarily released 4 cfs during the spring refilling of the reservoir for fishery purposes and released about 120 cfs during the winter months. The 120 cfs-release during the winter is to facilitate the continued operation of the downstream Searsburg development during the winter months by preventing ice build-up in the Searsburg penstock.

To gain some insight into the fishery habitat potential of the Somerset reach under increased minimum flow releases required by the Settlement, NEP conducted an IFIM study in 1990 in the Somerset reach after consulting with the agencies. These results are discussed below. NEP and the resource agencies also agreed on four computer production runs that would be used to model flows and determine habitat duration curves for all Somerset developments.

The lack of spawning and incubation habitat and early fry habitat for brook trout in the Somerset Reach is shown in Figure 4-1and Figure 4-2 is representative of the situation observed for these life stages for other species examined in IFIM studies at other developments on the Deerfield River.

Analysis of WUA Findings for Somerset Reach

The results of the PHABSIM for the 6-mile-long Somerset reach at various flows (see Figure 4-1 through Figure 4-4) shows there is a variance in habitat area created by different flows for different species and life stages. WUA for brook trout adults shows a steady increase in area when flows increase between 4 to 48 cfs and a peak in WUA occurring at around 250 cfs. Higher flows, on the other hand, tend to reduce the total amount of WUA for brook trout late fry. WUA for brook trout late fry shows an increase at flows between 4 and 20 cfs, and then WUA levels-off between 20 and 25 cfs, and begins to decrease at flows above 25 cfs. Under high flow conditions above 48 cfs, WUA for late fry continues to decrease until flows of about 150 cfs are reached, whereby the WUA continues to increase beyond flows of 250 cfs. The decrease in WUA is probably caused by in-channel velocities being outside the suitable range for late fry and as the flow increases above 150 cfs, there is likely an increase in wetted area as the flows encroach on the stream bank and create more suitable low-flow habitat for late fry.

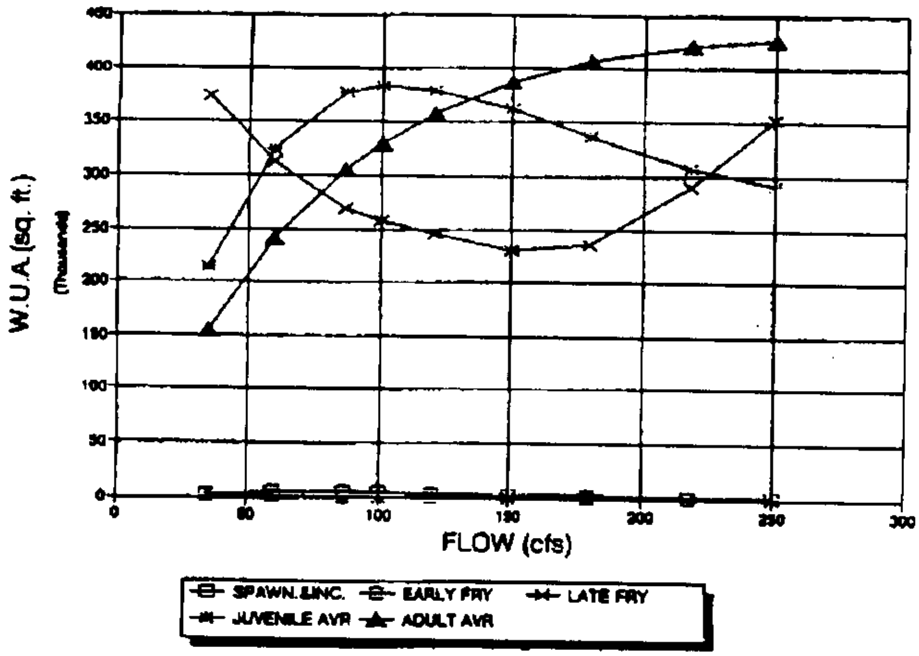


Figure 4-1. Weighted useable area (WUA) versus flows for brook trout life stages in the Somerset Reach under high flows (Source: Stetson-Harza 1991b)

WUA for juvenile brook trout shows an increase from about 10 cfs to 48 cfs under low flow conditions and under high flows peak WUA levels are reached at about 100 cfs. Landlocked Atlantic salmon juveniles and late fry experienced similar trends in changes in the amount of WUA for the same life stages of Brook trout under high and low flow conditions in the Somerset Reach with the exception of late fry which experience decreasing WUA at flows above 250 cfs.

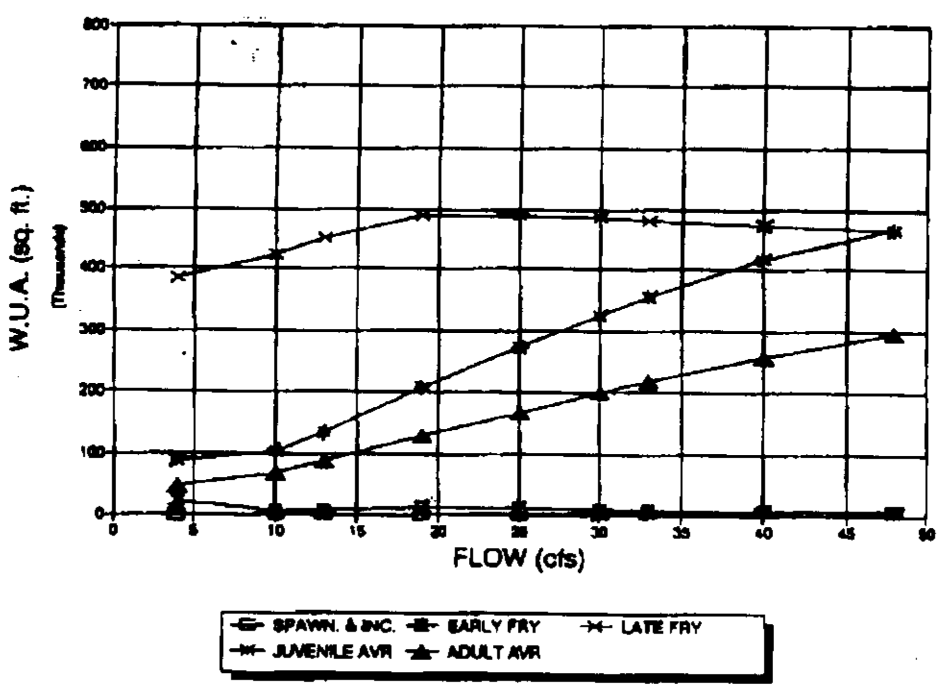


Figure 4-2. Weighted useable area (WUA) versus flows for brook trout life stages in the Somerset Reach under low flows (Source: Stetson-Harza 1991b).

Habitat Duration Analysis

To determine the duration of fishery habitat associated with the existing and proposed project operations under the four flow scenarios, (the flow scenarios examined included some flows that ultimately were approved in the Settlement), NEP conducted a habitat duration analysis. Specifically, NEP analyzed the duration of habitat for brook trout juveniles and late fry and landlocked Atlantic salmon late fry as agreed to by the study team. The study team also agreed to use the reasonably conservative representative months (for flow purposes) of January, May, June, and September.

Two components are necessary to develop a habitat duration curve: (1) flow (cfs) versus time (hours) and (2) WUA (in square feet) versus flow. The habitat duration analysis was generated from the WUA and flow data developed in the IFIM and PHABSIM and from data generated from using an enhanced version of the U.S. Army Corps of

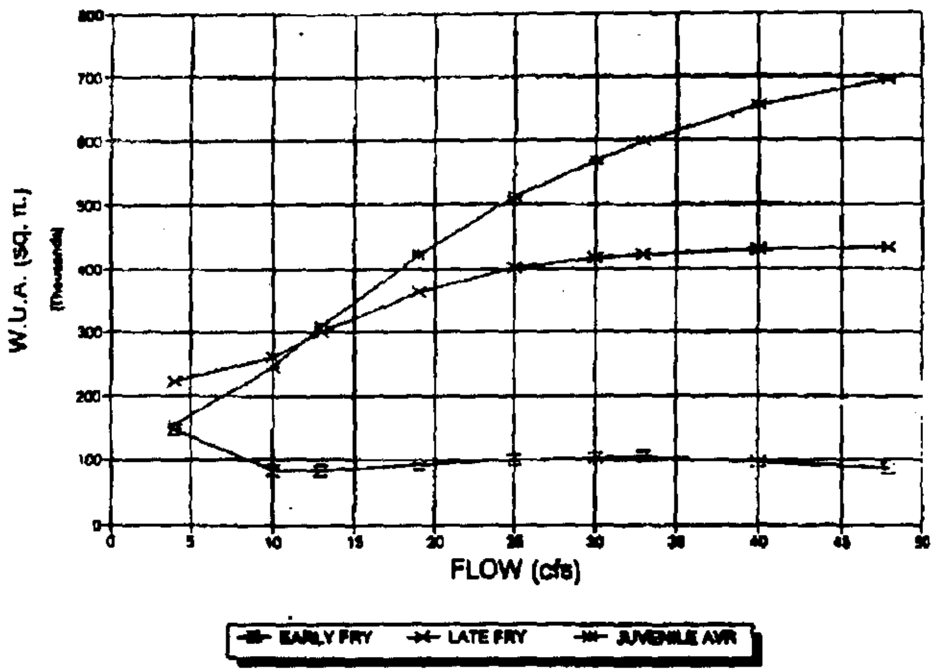


Figure 4-3. Weighted useable area (WUA) versus flows for landlocked Atlantic salmon juveniles and late fry for the Somerset Reach under low flows (Source: Stetson-Harza 1991b).

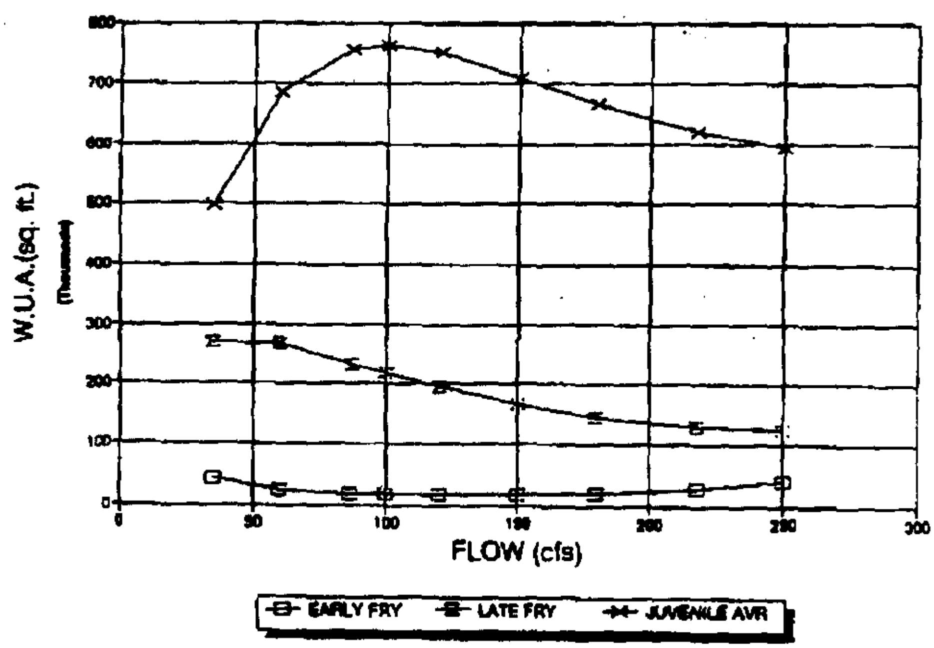


Figure 4-4. Weighted useable area (WUA) versus flows for landlocked Atlantic salmon juveniles and late fry for the Somerset Reach under high flows (Source: Stetson-Harza 1991b)

Engineers - HEC-5 Model. HEC-5 is a detailed operations model of the Deerfield River Basin that includes all hydroelectric facilities in the River Basin.

Habitat duration curves were prepared for the selected species and life stages under different operating scenarios (flows) for four different months and the area of habitat between 20 percent and 90 percent exceedance under the duration curves was determined for each operating scenario and plotted for comparison purposes. The 20 to 90 percent exceedance range was selected to eliminate extreme events and to show how a given flow has "smoothed out" the duration of habitat occurrence. The analysis of a range between 20 and 90 percent allows staff to determine what flows are reasonable. Bovee (1982) recommends that the area under the habitat exceedance curve in the 50 to 90 percent range is the most important portion of the curve for determining biological effects. Bovee also says that the median value (50 percent exceedance) is of significance because it represents a measure of central tendency, while the 90 percent exceedance value represents extreme conditions.

During January, there is little change in WUA for brook trout late fry and landlocked Atlantic salmon late fry at the 50 percent exceedance level. Maximum WUA of 587 thousand square feet for juvenile trout occurs at lower flows of 120 cfs in January at the 50 percent exceedance level. An increase of flows to 200 cfs in January reduced the WUA by 16 percent at the 50 percent exceedance level.

Peak WUA for juvenile brook trout of 587 thousand square feet occurred at flows around 120 cfs, usually occurring during the winter release period. However, WUA approaching 75 percent of the total habitat (at the 50 percent exceedance level) was achieved for juvenile brook trout with a release of 48 cfs during May. Flow releases of 19 cfs created maximum WUA of 491 thousand square feet (at the 50 percent exceedance level) for brook trout late fry when measured for releases made in June and September. Landlocked Atlantic salmon late fry experienced maximum WUA of 433 thousand square feet during flow releases of 48 cfs made in May. Juvenile landlocked Atlantic salmon experienced peak WUA of 780 thousand square feet at flows of 100 cfs which usually occurred in the winter months (Figure 4-4). However, with flow releases of 48 cfs, the landlocked Atlantic salmon juveniles would receive about 89 percent of maximum WUA (Figure 4-4).

The spawning period for brook trout in the Deerfield River is around September 15 to November 1. The brook trout eggs would incubate during the winter with emergence of the fry from the redds sometime in April. Any reduction in flows during incubation could dewater some redds or subject them to freezing and ice damage depending on their location in the stream and the magnitude of the reduction.

The purpose of the flows specified in the Settlement is to improve the self-sustaining capability of brook trout in the Somerset Reach. The minimum flows of 30 to 48 cfs required in the Settlement would provide from about 47 to 71 percent, respectively, of the maximum WUA available for adult brook trout (Figure 4-2). These same flows would provide brook trout juveniles about 54 to 81 percent, respectively, of maximum WUA and from 65 to 94 percent respectively of the maximum WUA for brook trout late fry. Similar quantity of habitat is provided to landlocked Atlantic salmon juveniles and late fry under these Settlement flow releases of 30 to 48 cfs (Figure 4-3). The percent of total WUA provided by these flow releases for landlocked Atlantic salmon juveniles would range from 75 to 89 percent respectively, and from 95 to 100 percent, respectively for Atlantic salmon late fry.

The minimum flow releases of 9 to 12 cfs from May 1 to July 31 under the Settlement would be an improvement over the existing minimum flow release of 4 cfs for most life stages of brook trout (including adults shown in Figure 4-2 and landlocked Atlantic salmon late fry shown in Figure 4-3). Since the Settlement allows some variation (from 9 to 12 cfs) during the months of May to July, if flows of 12 cfs were released during that period, there would likely be another 1 or 2 percent improvement of total WUA produced by the existing flows of 4 cfs and increases in WUA over the proposed 9 cfs release. The 9 to 12 minimum flow release required in the Settlement would be close to ideal for brook trout late fry since maximum WUA occurs at a flow of 19 cfs.

Summary

We concur with the flows recommended by the Settlement for the Somerset Reach. We believe the flows would greatly enhance existing aquatic habitat conditions in the reach, improve the stream conditions, and support the resource agency goals of establishing self-sustaining populations of brook trout in the reach. The minimum flows would also enhance the nursery capability of the reach if the resource agency decided at some later date to introduce landlocked Atlantic salmon into the reach. These flows specified in the Settlement represent reasonable enhancement flows needed by the fishery resources.

4.1.1.3.2 Searsburg development

Searsburg Reservoir

The Settlement would not change how the reservoir fluctuates on a daily basis from project operation. Resident fish would continue to be adversely impacted by water level fluctuations of from 5 to 8 feet daily. Warmwater and coldwater fish populations are likely to remain at current levels under continued project operations. The put-and-take brook trout fishery maintained in the reservoir by the VDFW would not change from continued project operation as proposed by NEP.

Bypassed Reach and Stream Reach Below the Powerhouse

The Settlement requires that NEP release minimum flows into the Searsburg bypassed reach of the lesser of 35 cfs or inflow from June 1 to September 30, and 55 cfs or inflow, from October 1 to May 31. The purpose of the minimum flow releases is to meet VDFW's goal of providing quality habitat for establishing self-sustaining populations of brown trout and to provide sufficient flows for rainbow smelt spawning and incubation in the stream reach below the powerhouse. The smelt reach the site from populations established in Harriman reservoir. Smelt presently are known to spawn in areas near the Medburyville Bridge and the Route 9 ford when water conditions are favorable. Both these sites are in the 0.7-mile-long stream reach between the powerhouse and the upper end of Harriman reservoir.

The secondary fishery management objective of VDFW is to provide flows in the stream reach below the powerhouse that would facilitate continued annual stocking of brook trout yearlings and allow for the seasonal use (spring and fall) of the area by landlocked Atlantic salmon. There is limited holding pool habitat in the bypassed reach to support over wintering adult landlocked Atlantic salmon in the future. Landlocked Atlantic salmon, like smelt, have free access to the bypassed and lower stream segment from the Harriman reservoir. Once minimum flows are provided to the Searsburg bypassed reach, the VDFW proposes to initiate plantings of Atlantic salmon fry.

The amount of fishery habitat in the 3.5-mile-long bypassed reach and the 0.7-mile-long reach below the powerhouse has been reduced over the years by project operations. The heavily regulated flows in both stream reaches have curtailed the development of self-sustaining fish populations, particularly in the bypassed stream reach. About the only time that water was steadily released into the stream reach below the powerhouse occurred during the winter months (from December 1 to March 31) when 120 cfs was released from the upstream Somerset development to keep the Searsburg penstock from freezing.

As mentioned earlier, an IFIM was conducted at the Searsburg development to try and gain some insight into the amount of potential fishery habitat that would occur with increased flow releases into the bypassed reach and the lower stream reach below the powerhouse. The IFIM was conducted in 1989 with agency cooperation. The four flows regimes (analyzed for Searsburg included flows of 28, 45, 80, and 270 cfs) and four months (Jan., May, June, and September) examined in the IFIM were the same as those used in the other IFIM studies conducted on the other Deerfield developments.

For the Searsburg IFIM study, NEP and the resource agencies agreed to use brook trout late fry as the representative fish species and life stage. All life stages except late fry for brook trout, brown trout, and landlocked Atlantic salmon, had nearly linear increasing habitat with increasing flows and the entities agreed that its selection of brook trout as the target species would be conservative as its late fry life stage shows a decrease in habitat as flows increase. As was done for the other developments where the IFIM was conducted, spawning and incubation life stages for brook trout, brown trout, and landlocked Atlantic salmon were also eliminated for consideration because of the availability of "pocket water."

Rainbow smelt were also eliminated from the PHABSIM analysis in favor of on-site field investigations. The field investigations indicate that smelt spawning appears to last about a week and usually occurs around the last week in April or the first week in May. VDFW's field reports didn't indicate whether flows from the Searsburg development, at the time of their observations, were adversely affecting smelt spawning activities or habitat. The fact that spawning occurs shows that water levels in the lower stream reach in late April and early May, have been sufficient in some years to allow smelt spawning. The concern is that an untimely drop in water levels could be detrimental and expose smelt eggs or strand young fish and cause losses, as has occurred to smelt in the Harriman reservoir when water levels were lowered after spawning had occurred.

The Settlement would provide a continuous minimum flow of 55 cfs or inflow from October 1 to May 31. This minimum flow would be provided during the peak of smelt spawning and incubation period (smelt eggs usually hatch in about two to three weeks (Scott and Crossman 1973)). In addition to the minimum flows required by the Settlement, flows typically released from the Searsburg powerhouse during the April and May spawning period average about 145 cfs for the month of May (using calculations made by NEP for the 1980 water year). Under a 4 cfs release from the Somerset reservoir in May, water accumulating from natural runoff occurring in the drainage basin for the Searsburg development, would be a flow of around 160 cfs in the bypassed reach and would be exceeded about 50 percent of the time. The combination then, of natural runoff during the month of May, and the minimum flow of 55 cfs required by the Settlement, should provide adequate protection for the spawning and hatching of smelt in the lower stream reach of the Searsburg development.

Analysis of WUA Findings

The maximum WUA of about 640,000 thousand square feet was met at a flow of 100 cfs for brook trout late fry, as determined using PHABSIM and modelling the combined bypassed and powerhouse stream reaches. However, the major incremental increase in WUA occurs as flows are increased from 20 to 40 cfs. At flows greater than 40 cfs, the incremental increases in WUA are diminished. The flow of 100 cfs would also maximize the WUA for late fry brown trout, and landlocked Atlantic salmon. Staff notes that adult landlocked Atlantic salmon habitat is limited in the 3.5-mile-long Searsburg stream reach by the amount of holding pool habitat available for over wintering. There is only one large pool immediately downstream from the Route 9 bridge that would be likely to hold Atlantic salmon over winter and this pool is maintained over a wide range of flows and is not subject to reduced flows as frequently as in the upper bypassed reach. The concern, however, is primarily for the other species, as there are no immediate plans to re-establish landlocked Atlantic salmon populations in Harriman reservoir.

The spawning season for brown trout and landlocked Atlantic salmon usually occurs during the months of October and November with brook trout spawning occurring from September 15 to November 1. For spawning and incubation to be successful in the river, there should be a constant flow level maintained on or about September 15 through November 30 and then remain near that level until around June 1 when fry emerge from the redds. The two flows specified in the Settlement would improve spawning conditions and protect late fry and juveniles. These flows of 35 and 55 cfs would provide 78 and 94 percent respectively of the maximum WUA for brook trout late fry.

The habitat duration curves (not shown here) showed that there would be little change in WUA for brook trout late fry in the month of January when Somerset would release new minimum flows required under the Settlement ranging from 30 to 48 cfs. However, Somerset would also continue to release a minimum flow of about 120 cfs, during the January through March period as they have in the past, to keep the Searsburg penstock from freezing. Therefore, little change in WUA for brook trout late fry is expected under the Settlement for January. However, there are significant improvements in habitat for brook trout late fry under the Settlement as compared with existing conditions.

In the months of May, June, and September, the minimum flows required in the Settlement would increase brook trout late fry habitat, especially as there were no flows in June and September for 90 percent of the time under the existing conditions (Table 4-1). Flow releases ranging from 11 to 28 cfs from Somerset would produce brook trout late fry WUA's that are 11 to 21 percent of the maximum habitat created at flows of 100 cfs. Furthermore, these flows of 11 to 28 cfs would be exceeded over 50 percent of the time in June and September and are a marked improvement over existing conditions (Table 4-1).

Summary

The Settlement-required flows for the Searsburg bypassed reach and lower stream reach would greatly improve habitat for brook trout, smelt, and landlocked Atlantic salmon. In addition, the flows provided by the Settlement increase the potential for the expansion of smelt into the bypassed reach. These flows specified in the Settlement represent reasonable enhancement flows needed by the fishery resources. However, staff's concurrence at this point in the analysis doesn't constitute balancing these flow needs with economics or other resource issues, such as wildlife and recreation. The final flow recommendations for the Searsburg development will be made in the Comprehensive Development and Recommended Alternative Section (Section 5.4).

Table 4-1. Estimated maximum WUA (x 1000 feet^2) for brook trout late fry for the Searsburg reach under median (50%) and extreme (90%) exceedance conditions for existing and other flows (Source: NEP 1993).

Month	Existing flows (4 cfs release at Somerset)[1]		Settlement flows (9 cfs release at Somerset)[2]		Other study flows (200 cfs release at Somerset)[3]	
	50%	90%	50%	90%	50%	90%
January	160(192)[4]	0	154(158)	131(28)	154(220)	135(28)
May	168(160)	0	157(158)	57	150(210)	114(18)
June	0	0	70(11)	57	129(19)	120(19)
September	0	0	135(28)	57	120(19)	113(18)

[1] A flow of 4 cfs is released from Somerset except for January when 120 cfs is released. A flow of 120 cfs released from Somerset in January creates a flow of about 192 cfs at Searsburg in January.(Baseline production run #1).
[2] A flow of 9 cfs is released from Somerset except for January when 120 cfs is released. A flow of 9 cfs from Somerset in June creates a flow of about 11 cfs at Searsburg. (Production run #2 proposal)
[3] A flow of 200 cfs is released from Somerset in January and other flows of 12, 18, 19, 48, and 120 cfs were released from Somerset under production run number 4 used in the model. (Production run #'s 3&4)
[4] The numbers in parenthesis represent actual flows measured

4.1.1.3.3 Harriman development

Harriman Reservoir

Current water level management in the Harriman Reservoir, that of refilling the reservoir from March to May (to full pool) and drawing the reservoir down from 11 to 14 feet during the summer months, has the potential to adversely affect fishery resources, especially those species that are spawning and rearing young in near shore areas during that critical time period. Reservoir fluctuations can also affect habitat suitability and the production of food in the littoral areas which are expanded under normal full pool reservoir levels.

Rainbow smelt and smallmouth bass both spawn in shallow near-shore zones within the reservoir. The timing of water level drawdowns could affect the spawning, incubation, and fry rearing (overall reproductive success) of these two species.

The Settlement would provide for a stable or rising reservoir level during smelt and smallmouth bass spawning. We agree that this reservoir regulation should provide adequate protection for spawning smelt and smallmouth bass, since it will limit the short term reservoir drawn downs of several inches to four feet which have caused adverse effects on smelt and bass eggs. With the exception of heavy precipitation events during times when the reservoir is full and NEP might have to release water to protect the integrity of the dam and prevent uncontrolled downstream discharge, the reservoir would be drawn down slowly under the terms of the Settlement from June 16 through July 31 at no more than 1 foot per day. We also believe the 1 foot per day reservoir drawdown from June 16 through July 31 would protect young fish rearing in the shoreline areas and would allow them to move safely into cover in deeper waters.

The put-and-take fishery for rainbow and brown trout in the Harriman reservoir would not be adversely affected by the water level management required by the Settlement because many of these fish don't over winter or spawn in the reservoir. The mixture of planted and wild brown trout that do survive and over winter in the reservoir would not be adversely affected by the drawdowns and would continue to spawn in several tributaries entering the reservoir.

Harriman Bypassed Reach

The Settlement requires that NEP release minimum flows into the bypassed reach below Harriman dam of 70 cfs from October 1 to June 30 and 57 cfs from July 1 to September 30. These minimum flows would be guaranteed by NEP, even if it means releasing water from storage. The purpose of the minimum flow releases is to meet VDFW's goal of establishing and maintaining self-sustaining wild brown and brook trout populations of sufficient size to support a sport fishery in this 4.4-mile-long bypassed reach. VDFW also wanted the minimum flows to provide an aesthetic fishing experience for anglers (Section 4.1.1.6, Recreation). Past fisheries management practices in this bypassed reach had been minimal because the power generating operation of the development had left little water available for release into the bypassed with the exception of the lowermost one-third of the bypassed reach which receives flows naturally from the West Branch of the Deerfield River. The lowermost section of the bypassed receiving the natural flows from the West Branch was considered by VDFW as having marginal habitat for brook trout.

Several flow releases for the bypassed reach were examined by NEP (including GSE contracted to do the work for NEP and CRA consultant to NEP on fisheries issues), state resource agencies, USFWS, VDFW, and TU before concluding that the minimum flows of 57 and 70 cfs would be acceptable to all participants to the Settlement. These parties to the Settlement ultimately agreed that the following three methodologies or techniques would be used to determine what flows were needed in the bypassed reach to establish self-sustaining populations of brook and brown trout: (1) Aquatic Base Flow (ABF) analysis, (2) qualitative habitat demonstration flows, and (3) WWA.

Aquatic Macroinvertebrates

Several resource agencies are concerned about potential adverse impacts on macroinvertebrate populations of the Deerfield River caused by the Deerfield Project's peaking mode of operations. As discussed in the ramping discussion for Fishery Resources (Section 4.2.1.1.1, Somerset), macroinvertebrates are subject to the same types of impacts caused by rapidly fluctuating flow levels that fish are. Macroinvertebrates, like small fish, are generally assumed to be immobile and would be subjected to downstream flushing by whatever minimum flow is released into their living space. Immobile or poorly mobile macroinvertebrates would not be able to relocate in response to peaking operation--other than being washed downstream (Power and Parker 1995). However, the establishment of minimum flows would stabilize the habitat for macroinvertebrates because flows would provide habitat that is almost always wetted and would reduce the opportunity for macroinvertebrates to become established in areas that are subject to extreme fluctuating flows.

Summary

We believe the seasonal management of water levels in Harriman reservoir and the release of minimum flows into the bypassed stream reach below Harriman dam, as specified in the Settlement, offer a reasonable approach that would benefit fishery resources and aquatic macroinvertebrates of the Deerfield River. We concur with these proposals as they would provide adequate enhancement for the fishery resources of the Deerfield River. However, since these flow proposals and water level regulations can affect other resources (*e.g.*, the state-threatened tubercled orchid) and can affect the economics of the project, we defer our final recommendations on this issue to the Comprehensive Development and Recommended Alternative Section (Section 5.4).

4.1.1.3.4 Sherman development

Sherman Reservoir

The Settlement doesn't require any changes to the mode of operation for the Sherman development. Further, the Settlement doesn't include measures to enhance the fish resources of Sherman Reservoir. Water levels in the reservoir would continue to fluctuate on a daily basis, with a weekly drawdown of water levels of about 4 feet behind the 4-foot flashboards. Occasionally, 7-foot drawdowns occur to meet peak power demands or to create storage in anticipation of high runoff from the 236 square mile watershed area for the Sherman reservoir. Water level drawdowns in the range of from 4 to 7 feet weekly, can adversely affect fishery resources by reducing spawning habitat, dewatering fish eggs, stranding fry and juvenile fish, and subjecting fish to increased predation caused by reduced cover (Hunter 1992, Cushman 1985).

The continued operation of the Sherman development as it has been operating should not cause any changes in meeting the existing fishery management objectives of the resource agencies. The cooperative management objectives for VDFW and MA DFW are to manage the Sherman reservoir for brown trout. There should continue to be a good brown trout fishery in the reservoir--a fishery that is sustained by fish plantings. There is a potential for fish enhancement in the reservoir caused by several factors: (1) water quality might improve slightly from implementing the Settlement-required releases of 57 and 70 cfs from the upstream Harriman reservoir; (2) there would no longer be the release of once-through cooling waters into the reservoir from the Yankee Atomic facility, nor would there be a commingling or use of these waters in the reservoir; and (3) improved habitat conditions for smelt at the Harriman and Searsburg developments could lead to increased numbers of smelt entering Sherman reservoir which would increase the forage base in the reservoir and make conditions better for sustaining the trout fishery. However, no fish entrainment and mortality studies were conducted at Harriman and the numbers of live and dead fish entering the Sherman reservoir through the Harriman Powerhouse discharge is uncertain and there may be little overall change in their contribution to the forage base with continued project operation.

Warmwater species should also be maintained at their present level or could also experience limited enhancements under the proposed scenario for this development where operations would remain the same but implementing the Settlement flow releases could improve water quality. Water level fluctuations during the spawning season for several of these warmwater fish species would continue to prevent maximum development of a warmwater fishery in the reservoir. However, since the management objective by the resource agencies for the reservoir is primarily for brown trout, the continued operation of the Sherman development in the same mode should not change the moderate sport fishery for smallmouth bass nor curtail the development of a sport fishery for other warmwater species.

Stream Reach Below Sherman Dam

Since the tailrace below Sherman dam empties into the Deerfield No. 5 reservoir, we expect minimal to no impact on the fishery resources from the continued operation of the Sherman development under the Settlement. However, fish species in this upper reach of the Deerfield No. 5 reservoir should be enhanced during the June through September period when minimum flows released from the Harriman development would be provided by the implemented Settlement. In the past, there were no flows released into the Deerfield No. 5 reservoir from the Sherman powerhouse during this period.

4.1.1.3.5 Deerfield No. 5

Deerfield No. 5 Reservoir

The Settlement doesn't require any changes to the mode of operation for the Deerfield No. 5 Development and it would continue to generate power on a daily basis following the generating pattern of the upstream Sherman Development. Further, the Settlement doesn't provide any fishery enhancement measures for Deerfield No. 5 Reservoir on a daily basis. The minimum flow release of the lesser of 73 cfs or inflow, that is required in the Settlement, would not perceptively change the water level fluctuations in the impoundment. Daily water level drawdowns in the range of 5 feet can adversely affect fishery resources by reducing spawning habitat, dewatering fish eggs, stranding fry and juvenile fish, and subjecting them to increased predation caused by reducing cover (Hunter 1992, Cushman 1985).

The MA DFW presently doesn't manage the reservoir for any particular fish species. MA DFW has concentrated its management objectives on improving the bypassed reach immediately below the Deerfield No. 5 dam. The size ranges of the fish captured in the reservoir indicates that natural reproduction is occurring, except perhaps for the rainbow trout that probably entered the impoundment from upstream stocking efforts. The population levels presently occurring in the impoundment would likely continue under the Settlement. There is also the potential for some improvement in water quality in this small 8-acre impoundment as a result of the release of minimum flows from upstream developments and the fact that the YAEC facility is closed and would no longer be causing increased water temperatures in the Deerfield River downstream from the Sherman reservoir. Any adverse impact on the fish populations in the Deerfield No. 5 reservoir is likely to be offset by the benefits that would accrue to the fishery resources in the bypassed reach achieved from minimum flows released there under the terms of the Settlement.

Bypassed Reach and Stream Reach Below the Powerhouse

The Settlement requires that NEP release a minimum flow of the lesser of 73 cfs or inflow into the 2.6 mile-long bypassed reach. The Settlement also states that at no time shall the inflow be less than the 57 cfs minimum flow released from the upstream Harriman development, a flow that is to be released from Harriman storage if necessary to meet the requirements of the Settlement.

The purpose of the minimum flow release is to meet MA DFW's management objective of providing quality habitat for establishing self-sustaining populations of brook and brown trout in the bypassed reach between the Deerfield No. 5 dam and the downstream Bear Swamp reservoir. If spawning habitat is not available in the bypassed reach, then MA DFW's secondary management objective is to stock brown trout yearlings to grow to an adult size to support a year-round put and take fishery.

The amount of fishery habitat in the 2.6-mile-long bypassed reach has been reduced over the years by project operations. The heavily regulated flows in this reach have curtailed the development of self-sustaining fish populations, with particular emphasis on the yearly limitations caused during the period from June through September, when flows were reduced to minimum levels of 25 cfs.

During the summers of 1989 and 1990, an IFIM study was conducted in the Deerfield No. 5 bypassed reach in conjunction with the resource agencies who agreed with the study methodologies, study sites and transects, and the selection of representative fish species and life stages. Three study reaches were selected to represent the Deerfield No. 5 bypassed in the IFIM study. All life stages of brown and brook trout were selected to be representative fish species for the IFIM study.

For brook and brown trout early fry and spawning and incubation habitat, the IFIM study showed that WUA is limited over all flows modelled (from 30 to 250 cfs) and that habitat for this life stage or activity was maximized at flows of around 30 cfs (Figure 4-5 and Figure 4-6). These results are not surprising based on the overall lack of spawning gravels observed when mapping the three study reaches for the Deerfield No. 5 bypassed reach. However, as with the bypassed reaches associated with upper developments, "pocket waters" or scattered small pools and back eddies likely occur throughout the 2.6-mile-long bypassed reach and these areas would allow for some limited spawning and early fry survival.

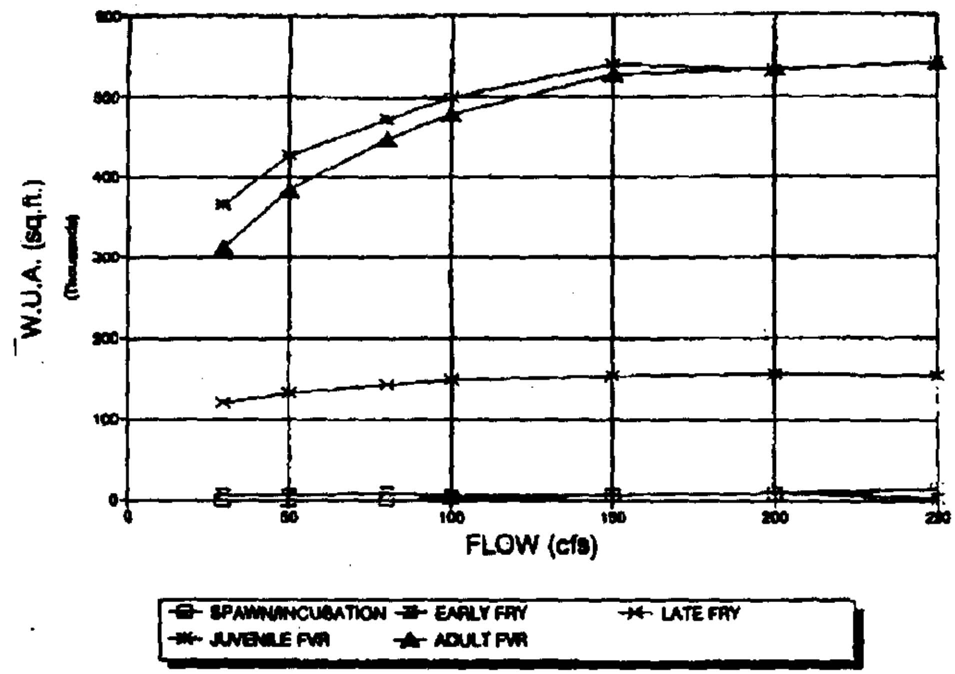


Figure 4-5. Weighted useable area (WUA) versus flows for various life stages of brown trout under low flows for two segments of the bypassed reach at Deerfield No. 5 (Source: Stetson-Harza 1991b).

At a flow release of 73 cfs under the Settlement, around 8,240 square feet of habitat would be created for brook and brown trout early fry. This is about 87 percent of the maximum habitat available in reaches 1 and 3 for early fry of both species. Brook trout early fry would be expected to use this habitat during the months of April and May and similarly brown trout early fry would use the habitat during the months of May and June. Present releases (in the form of spills), and even those flows released under the Settlement into the bypassed reach exceed ideal habitat for early fry of both species.

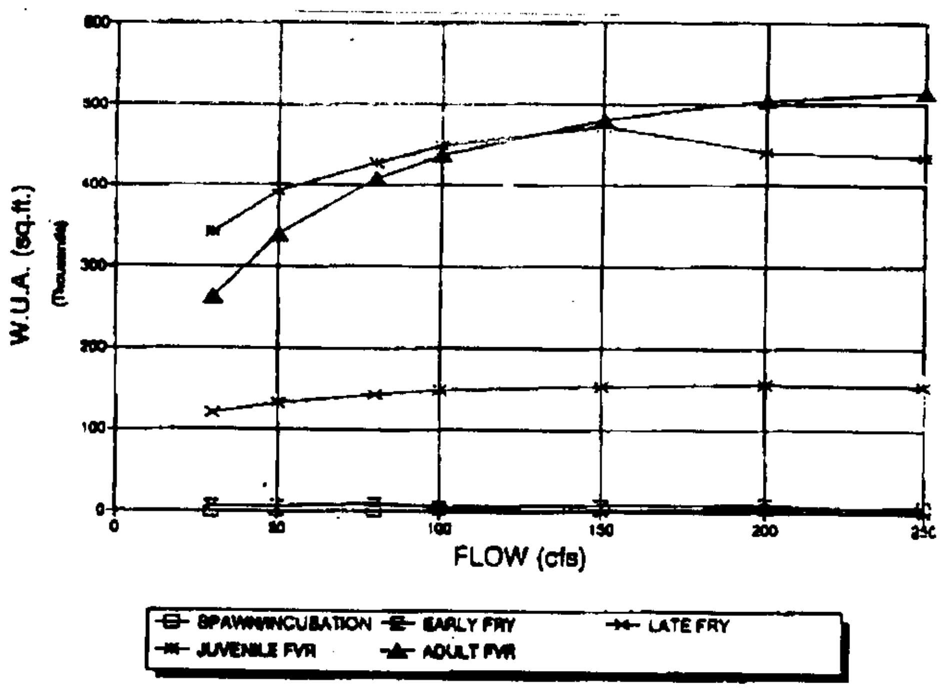


Figure 4-6. Weighted useable area (WUA) versus flows for various life stages of brook trout under low flows for two segments of the bypassed reach at Deerfield No. 5 (Source: Stetson-Harza 1991b).

Historically, the low flow period occurs below the Deerfield No. 5 dam during the months of June through September; during this period there would be a small 30 day window where flows would be increased to either 57 or 73 cfs in the bypassed reach by the Settlement and these minimal flows could benefit brown trout early fry that would be present there in June. However, in looking at this total picture of trying to meet the resource agencies management objective of establishing a self-sustaining brook and brown trout fishery for the Deerfield No. 5 bypassed, there must be sufficient flows to: (1) provide over wintering habitat for fish, (2) allow successful spawning, and (3) enable the survival of brook and brown trout during the low flow periods that have historically occurred from June through September. The staff believes the summer low-flow period has been an important factor limiting the establishment of self-sustaining fish populations in this segment of the Deerfield River.

Figure 4-5 and Figure 4-6 show the WUA at various flows for brown and brook trout in two reaches (1 and 3) of the Deerfield No. 5 development under low flows. Maximum WUA for brown trout late fry, juveniles, and adults is achieved at flows of around 150 cfs (Figure 4-5). Maximum WUA for brook trout is similar to late fry and juveniles with peak WUA occurring at flows around 150 cfs (Figure 4-6). Adult brook trout receive maximum WUA at flows of around 250 cfs, although the percent increase in the amount of WUA between 150 and 250 cfs is slight (less than 5 percent) and there is very little gains in habitat between the two flows. The implementation of the Settlement minimum flows of 57 and 73 cfs, in comparison with existing conditions, would produce marked improvements in habitat in the Deerfield No. 5 bypassed reach for all life stages of brook and brown trout, except for early fry of both species. Minimum flow releases of 73 cfs would produce about 78 percent of maximum WUA for brown and brook trout adults. In addition, based on a hydraulic model of reaches 1 and 2, a minimum flow of between 60 to 70 cfs would provide water about 2.6 feet deep over the majority of the channel and that depth meets the optimum depth levels for brook and brown trout.

Summary

The staff concurs with the flows recommended by the Settlement for the Deerfield No. 5 development. The staff believes the minimum flows would greatly enhance the existing aquatic conditions in the bypassed reach and support the resource agency goals of establishing self-sustaining populations of brook and brown trout in this reach. From staff's perspective, the flows specified in the Settlement represent reasonable enhancement flows needed by the fishery resources, however, concurrence at this point in the analysis is premature because it doesn't constitute the staff's balancing of these flow needs for fishery resources with the other resource issues, such as wildlife or recreational whitewater boating. The final flow recommendations for the Deerfield No. 5 bypassed reach would be made in the Comprehensive Development and Recommended Alternative section (see Section 5.4).

Proposed Whitewater Flow Releases Into the Deerfield No. 5 Bypassed Reach

The analysis above looked at which minimum flows would provide the best habitat in the bypassed reach to meet the MA DFW objective of establishing self-sustaining populations of brook and brown trout in the bypassed reach. This analysis looked at Settlement flows of 57 and 73 cfs with a minimum flow of 57 cfs guaranteed from storage at the upstream Harriman Reservoir. However, the Settlement also requires that flow releases that average 1,000 cfs be released into the bypassed reach below the Deerfield No. 5 dam to support whitewater boating activities. These 1,000 cfs whitewater flow releases would occur 32 times a year, primarily on weekends, during the recreational boating season from April 1 through October 31. Each release would last from four to five hours.

The 32 annual whitewater flow releases into the bypassed stream reach below the Deerfield No. 5 dam has the potential to adversely affect trout by causing stranding or inadvertently flushing fish and macroinvertebrates downstream during the start-up and shutdown of development operations. Rapidly decreasing water levels and reduction in flows can reduce fish spawning success and strand fish, subjecting them to desiccation and predation from terrestrial predators as they become stranded in isolated pools (Cushman 1985, Orth 1987, Bain and Boltz 1989, Hunter 1992). Rapidly fluctuating flows can also adversely affect aquatic macroinvertebrates by causing stranding, reducing populations, and limiting recolonization (Perry and Perry 1986, Trotzky and Gregory 1974).

GSE conducted a ramping and stranding study for the Deerfield No. 5 bypassed reach. The stream reach selected for the study was Reach Deerfield No. 1. Three ramping scenarios (the same rates were used for up ramping and down ramping) were evaluated by GSE and are characterized as follows:

(1) Ramping from NEP's proposed 73 cfs minimum flow to the 1,000 cfs whitewater flow release with a single 10 minute gate operation.

(2) Ramping from NEP's proposed minimum flow of 73 cfs to 1,000 cfs in four steps (150, 300, 600, 1,000 cfs), pausing 20 minutes at each step.

(3) Ramping from NEP's proposed minimum flow of 73 cfs to 1,000 cfs in two steps (450, 1,000 cfs), pausing 40 minutes at the intermediate 450 cfs level.

Stranding

To determine the stranding potential for the various flows, the team walked the entire length of the Deerfield No. 5 bypassed reach from the Deerfield No. 5 dam to the Bear Swamp reservoir on November 22, 1993. The bypassed reach was divided into habitat sections (*e.g.*, riffles, pools) and the percent length of each river bank in each section that was considered to have stranding potential was estimated. The team determined that about 27 percent of the entire bypassed reach (22,170 feet) had stranding potential (*e.g.*, areas such as flat boulder and cobble fields, grassy hummock areas, and small pools associated with a gradient condition).

The habitat maps indicated that there was useable and continuous cover for late fry, juvenile and adult life stages of brook trout throughout the range of flows from 73 to 1,100 cfs. However, available habitat for spawning, incubation, and early fry life stages was limited in the study reach and in fact throughout the bypassed reach.

The analysis of the three ramping rates showed that fish would be susceptible to stranding in the bypassed reach, (for all three proposals) particularly in the seven areas containing rather extensive flat boulder, rock, and cobble fields. No matter which down ramping rate was used, several potential stranding areas identified in the bypassed reach would be dewatered rapidly. For example, when a flow was reduced from 1,000 cfs to 73 cfs there was no drop in water levels for the first two to three minutes but a constant decrease of two to 3 feet over the next 18 minutes, with a final drop of about 1/2 foot in another 10 minutes. The total drop of about 3 feet in about 30 minutes is quite rapid, particularly in an area like the flat boulder field.

Up ramping

There is considerable usable habitat in the bypassed reach and there would not be any interruption of fish travel lanes (directional movement) under flow releases of from 73 to 1,000 cfs tested in the up ramping schedule. With the exception of spawning/incubation and early fry life stages, there is considerable usable habitat for trout over the range of study flows, including the 1,000 cfs whitewater rafting release. Because of the existence of useable, continuous cover throughout much of the study reach, the mobile life stages (late fry, juveniles, and adults) would receive little value from up ramping the proposed whitewater releases.

An analysis of when the whitewater flows would be released into the bypassed reach in comparison with the life stage of fish present and normal flows occurring during that time showed that up ramping impacts would likely be minimal. Spawning and incubation occurs during the month of October when only two releases would be scheduled (eight to 10 hours). Whitewater flow releases would not affect spawning adult fish because there is currently little spawning habitat and the spawning that does occur would be in areas where there is constant flow (not in the newly wetted areas or in areas expanded because of unscheduled spillage).

Early fry life stages would be present in the bypassed reach during May and early June. A maximum of four to six releases (up to 30 hours total) would be made during this period. The habitat maps indicate there would be little habitat in this stream reach for early fry at flows above 225 cfs. While there are no natural spills into the bypassed reach every year during May and June, frequently there are spills and these typically exceed 225 cfs. For example for the 15 days that spills were made into the bypassed reach in 1989, all but two releases were over 225 cfs and the average daily flow was about 778 cfs. It should be noted that for seven of the 17 days in May 1989, flows exceeded 1,000 cfs (three of these seven flows averaged nearly 2500 cfs). So, up ramping would not be very critical in protecting the early life stages because of the high natural flows and the paucity of habitat for early fry under higher flows.

Down ramping

Down ramping typically helps to reduce the impacts associated with stranding. As was mentioned above, the proposed down ramping associated with the whitewater boating flows has the potential to cause stranding in about 27 percent of the bypassed reach and particularly in seven areas of the bypass. However, the extent of the impact of stranding can only be speculated because we don't know to what extent fish would move into those areas that are wetted from increased flows, how fast various species might move out of these areas once water levels begin to drop, and there currently is no self-sustaining fishery in the bypassed reach to accurately measure these potential impacts. Based on the three ramping rates evaluated with the whitewater releases, stranding would be likely to occur.

Summary

The whitewater flow releases into the bypassed reach for the Deerfield No. 5 development have the potential to adversely affect trout by causing stranding. Even with ramping rates there is still the potential for stranding to occur. The extent of the impact on fishery resources can't be determined until a fish population is established in the bypassed reach under the minimum flows that would be released under the Settlement. Whether a self-sustaining population of trout is established under the Settlement-provided minimum flows or whether a put-and-take fishery is ultimately selected by the MA DFW is a decision that would have to be made after several years of observing the effects of the minimum flow releases. The fact that this stream reach lacks good spawning habitat, regardless of flows that are released, places limitations on creating successful, self-sustaining trout populations. A put-and-take fishery would likely do well in this reach in conjunction with the recreational whitewater flow releases because adult and juvenile fish would be able to survive the occasional high flow releases.

Whether fish mortality occurs from stranding caused by project operations is uncertain--but it is likely that some stranding could occur based on the studies conducted by the GSE and the team, particularly for smaller fish. However, the existing fishery is a put-and-take fishery involving large fish that would likely escape the effects of stranding. Macroinvertebrates populations have likely been reduced from the operating procedures in the bypassed reach and ramping rates are likely to provide benefits to macroinvertebrates that would be similar to those received by smaller fish. Implementation of a ramping rate would be a simple and inexpensive means of ensuring that unforeseen problems do not occur, however, there are still several uncertainties about whether a self-sustaining trout fishery can be established in this bypassed reach. Implementation of a fish monitoring program could determine whether the proposed whitewater releases are actually causing the stranding of fish. Any decision about the implementation of a fish monitoring study should consider other fishery management objectives in the Deerfield River and how far the Settlement goes in meeting these objectives. It appears that there could continue to be a conflict between resource use at this development--is the priority for the bypassed reach to be primarily for recreational whitewater boating, for a recreational put-and-take fishery, or for establishing a self-sustaining brook and brown trout fishery.

4.1.1.3.6 Deerfield No. 4

Deerfield No. 4 Reservoir

NEP doesn't propose to change the mode of operation for the Deerfield No. 4 development and it would continue to generate power on a daily peaking schedule from 7 a.m. to 11 p.m., Monday through Friday. The impoundment level would continue to fluctuate six to 8 feet on a daily basis depending on the season and river flows. The minimum bi-seasonal flow releases of the lesser of 100 and 125 cfs, or inflow, that would be implemented by the Settlement, would not perceptively change the amount of water level fluctuations in the impoundment. The Settlement doesn't require specific measures to enhance fishery resources in the Deerfield No. 4 reservoir.

The MA DFW presently doesn't manage the reservoir for any particular fish. MA DFW has concentrated its fishery management objectives on improving conditions for fish in the bypassed reach immediately below the dam (see discussion below) and in providing downstream passage for fish (downstream passage is discussed in Section 4.1.2.3, Fishery Resources) in the Deerfield River at this location. The size ranges of the fish captured in the impoundment indicates that natural reproduction is occurring, except perhaps for rainbow and brown trout that probably entered the impoundment from upstream stocking efforts. The fish population levels presently occurring in the impoundment would likely continue under the Settlement. Any adverse impacts on the fish populations in the Deerfield No. 4 impoundment are likely to be offset by the benefits that would accrue to the fishery resources in the bypassed reach achieved by minimum flows released there and by installing fish passage facilities to improve conditions for fish moving downstream. Both improvements would be implemented under the terms of the Settlement.

Bypassed Reach and Stream Reach Below the Powerhouse

The Settlement requires that NEP release a minimum flow of the lesser of 100 cfs, or inflow, from October 1 to May 31 and the lesser of 125 cfs, or inflow, from June 1 to September 30. The primary objective of the MA DFG is to: (1) establish a self-sustaining population of brown trout in the bypassed reach, and (2) ensure the bypassed reach provides nursery and rearing habitat for Atlantic salmon and facilitates the downstream passage of Atlantic salmon smolts. The MA DFG's secondary objective is to maintain flows in the bypassed reach that are needed to support a put and take fishery with stocked adult trout (9 to 18 inch brown trout, 9 to 16 inch brook trout, and 11 to 18 inch rainbow trout: letter dated August 24, 1989 from Joseph Bergin, Aquatic Biologist, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts, to Leo Sicuranza, Senior Environmental Analyst, New England Power Service Company, Westborough, Massachusetts).

The amount of fishery habitat in the 1.5-mile-long bypassed reach and the 0.45 mile long reaches below the powerhouse, has been reduced over the years by project operations. The heavily regulated flows in both stream reaches have curtailed the development of self-sustaining fish populations, particularly in the bypassed stream reach. There was no minimum flow released into the bypassed reach. Flows in the bypassed reach, at least for the reach above the point where the North River enters the bypassed, are subject to greatly reduced flows during periods of low flow (June through September) when flows consist of leakage at the dam and occasional spillage over the dam during heavy runoff from rainstorms.

The 0.45-mile-long reach below the powerhouse also has had great fluctuations in flows. While this reach would receive flows from the North River during the low flow months of June through September, flows in the North River are also low during these months. For example, the North River flows were 98 cfs on July 21, 1989 and 6 cfs on August 23, 1988, with mean flows reported at the USGS gage on the North River of around 31 cfs for July and August in 1985 (Gadoury, *et al.* 1987) and 45 and 19 respectively, for the same months in 1980 (USGS 1981) with the median monthly flows below the Deerfield No. 4 powerhouse estimated to be 400 cfs in June, July, and September, and 0 cfs in August. These wide fluctuations in flows create adverse conditions for resident fish.

In June, July, and August of 1990, an IFIM study was conducted in the Deerfield No. 4 bypassed reach in conjunction with the resource agencies who agreed with the study methodologies, study sites and transects, and the selection of representative fish and life stages. All life stages of brown trout, Atlantic salmon fry and juveniles, and adult brook trout and rainbow trout were selected by the team (composed of state and federal resource agencies and NEP) to be representative fish for the IFIM study. A Habitat Time Series Analysis was also conducted using the HEC-5 Model for the Deerfield River in conjunction with the WUA developed from the IFIM study.

For brown and rainbow trout adults, maximum WUA is achieved at a flow of around 960 cfs and brook trout adults achieve maximum WUA at a flow of around 640 cfs in the powerhouse reach Figure 4-7. WUA was shown to increase uniformly for adults of all three species under low flows in the bypassed reach. The same linear relationship occurred for increasing habitat for rainbow, brown and brook trout when increased flows occurred under the low flow scenario for the powerhouse segment. Flow releases of 125 cfs into the bypassed reach under the Settlement would provide about 60 percent of maximum WUA for brown trout and 64 and 53 percent WUA respectively for brook and rainbow trout. These minimum flows would provide a significant increase in flows over what currently occurs in the bypassed reach. The water levels in the bypassed reach between the Deerfield No. 4 dam and where the North River enters the bypassed would be greater than 2.6 feet deep based on a hydraulic model for this reach using flows of between 40 and 70 cfs. A depth of 2.6 feet provides optimum depth levels for brook, brown, and rainbow trout.

Maximum WUA for brown trout early and late fry occurs at flows of around 260 cfs in both the site below the bypassed reach (Figure 4-8) and below the powerhouse. Maximum WUA for brown trout early fry was about 30,000 square feet and was about 240,000 square feet for brown trout late fry. Flow releases of 125 cfs into the bypassed reach under the Settlement would provide about 33 percent of the maximum WUA for early fry and about 86 percent of the maximum WUA for late fry.

For the bypassed reach and below the powerhouse, the relationship between brown trout juveniles and brown trout adult habitat and flows was nearly linear for all low flows modelled through 500 cfs. Maximum

WUA of about 225,000 square feet occurs for brown trout juveniles at a flow of around 640 cfs and then decreases as flows increase while adult brown trout habitat continues to increase with increasing flows to a maximum WUA at around 940 cfs. Flow releases of 125 cfs into the bypassed under the Settlement would provide about 68 percent of the maximum habitat in the bypassed reach for brown trout juveniles.

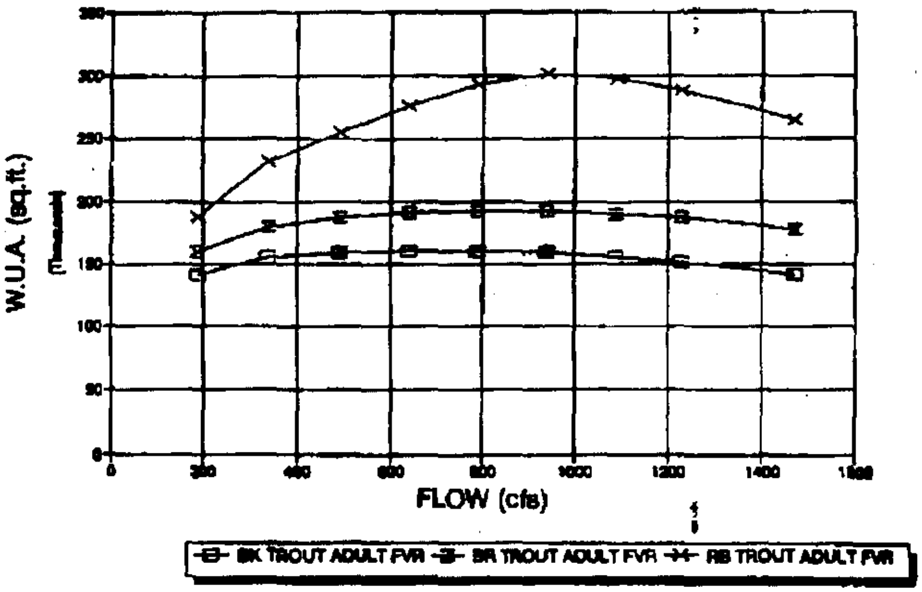


Figure 4-7. Weighted useable area (WUA) versus flows for adult brook, brown, and rainbow trout under high flows for the bypassed reach at Deerfield No. 4 (Source: Stetson-Harza 1991b).

The WUA versus flow relationship for Atlantic salmon fry and juveniles is shown in Figure 4-9. The low flow analysis for the bypassed and powerhouse reaches shows a nearly linear relationship for juvenile habitat over the range of flows modelled (from 90 to 510 cfs). For Atlantic salmon juvenile habitat under the low flow scenarios, the amount of habitat steadily increased as the amount of flows increased (Figure 4-9). Maximum WUA for Atlantic salmon juvenile habitat was about 710,000 square feet at a flow of 510 cfs in the bypassed reach. Atlantic salmon late fry habitat is

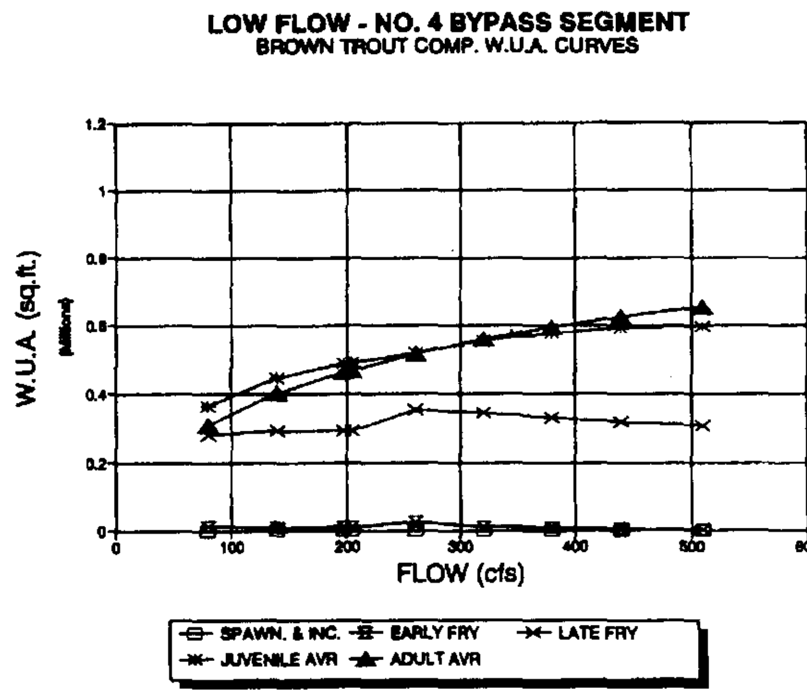


Figure 4-8. Weighted useable area (WUA) versus flows for various life stages of brown trout for the bypassed reach at Deerfield No. 4 (Source: Stetson-Harza 1991b).

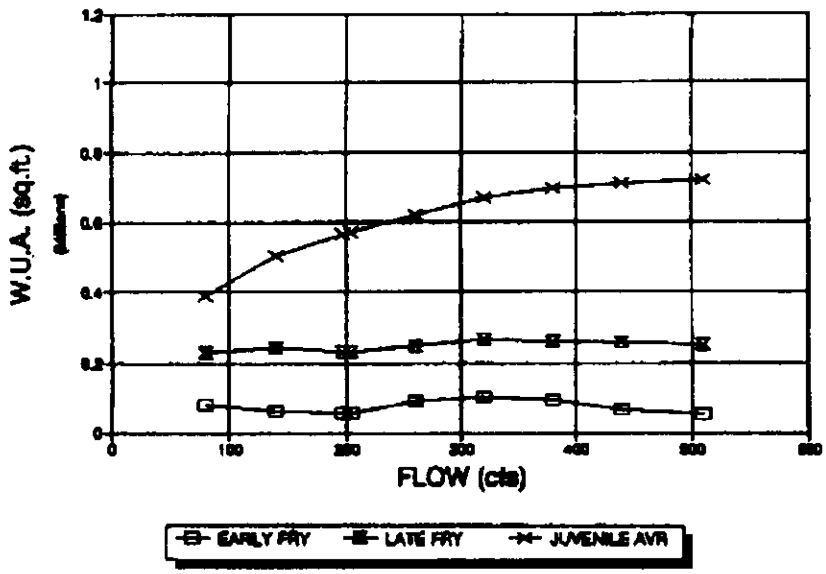


Figure 4-9. Weighted useable area (WUA) versus flows for various life stages of Atlantic salmon under low flows for the bypassed reach at Deerfield No. 4 (Source: Stetson-Harza 1991b).

maximized at 320 cfs with little change in the amount of WUA over the range of flows modelled up to 510 cfs. Atlantic salmon early fry habitat is maximized at a flow of 320 cfs in the bypassed reach and at a flow of around 475 cfs in the powerhouse reach (Figure 4-9 and Figure 4-10, respectively). The high flow analysis for the powerhouse reach shows that Atlantic salmon juvenile habitat is maximized at a flow of 1,100 cfs, early fry habitat at about 500 cfs, and late fry habitat at flows less than 200 cfs (Figure 4-10). As has been shown for other upstream developments, the Deerfield No. 4 appears to lack early fry habitat for Atlantic salmon and brown trout. The staff expects pocket waters to exist at the Deerfield No. 4 as it has for all the other upstream developments and that these pocket water areas would provide some additional refuge for early fry and some potential spawning areas for adults.

The implementation of the Settlement flow of 125 cfs would provide 20, 92, and 70 percent respectively of the maximum WUA for Atlantic salmon early fry, late fry, and juveniles in the bypassed reach (Figure 4-9).

Table 4-2. Availability of WUA under the habitat duration curve between the 20 to 90 % exceedance levels (in square feet²-hours) for Deerfield No. 4 under specific flows (Source: NEP 1993).

	June			September		
	Existing (no min flow)	Settlement (125 cfs flow)	change (%)	Existing (no min flow)	Settlement (125 cfs flow)	change (%)
Brown trout						
(late fry)	92,581,547	134,526,541	45.3	98,272,370	135,164,309	37.5
(juvenile)	95,541,043	119,418,935	25.0	99,888,782	120,092,707	20.2
Atlantic salmon						
(late fry)	70,274,058	101,176,279	44.0	74,673,836	100,293,087	34.3

Habitat duration analysis was conducted for the Deerfield No. 4 development as it was for the upstream Somerset and Searsburg and the downstream Deerfield No. 2 development. Brown trout late fry and juveniles and Atlantic salmon late fry were examined in the habitat duration analysis. The staff concentrated on data generated for June and September out of the four months examined in the habitat duration study because those two months are representative of the lowest flow months of June through September at the Deerfield No. 4 development.

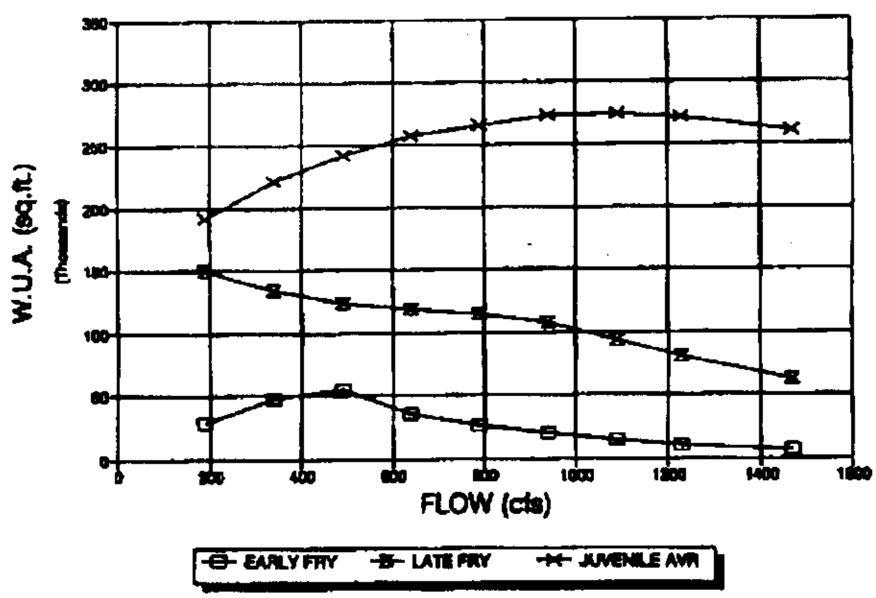


Figure 4-10. Weighted useable area (WUA) versus flows for various life stages of Atlantic salmon under high flows for the powerhouse reach at Deerfield No. 4 (Source: Stetson-Harza 1991b).

The habitat duration analysis involved measuring the area under the habitat duration curve between 20 and 90 percent exceedance values (Table 4-2). As was stated above, the purpose of limiting the analysis of the area under the habitat duration curve to the 20 to 90 percent area of the duration curves eliminates extreme events which would be considered outliers and could skew the results. By looking at the band between 20 and 90 percent exceedance, a measurement is made as to how a given flow proposal has "smoothed out" the duration of habitat occurrence at the site. This area under the duration curve becomes the indicator variable for the habitat benefits that would accrue with various flow scenarios.

Table 4-2 shows how much of an improvement, by percent, that would occur in WUA between the existing baseline condition (no minimum flow release) for the Deerfield No. 4 development and for the Settlement minimum flow release of 125 cfs.

Summary

The staff concurs with the flows recommended by the Settlement for the Deerfield No. 4 development. The staff believes the minimum flows would greatly enhance the existing aquatic conditions in the bypassed reach and support: (1) the resource agency goals of establishing self-sustaining populations of brown trout in this reach, and (2) improve conditions for Atlantic salmon nursery habitat for fry and for juveniles (smolt) that would pass through the area from stocking efforts made upstream. From staff's perspective, our concurrence with the flows specified in the Settlement represents reasonable enhancement flows needed by the fishery resources, however, concurrence at this point in the analysis is premature because it doesn't constitute the staff's balancing of these flow needs for fishery resources with the other resource issues, such as wildlife or recreational whitewater boating. The final flow recommendations for the Deerfield No. 4 bypassed reach will be made in the Comprehensive Development and Recommended Alternative Section (Section 5.4). The economics associated with the implementation of the Settlement flows is discussed in the Economic Evaluation of the Proposed Action and Alternatives Section (Section 5.3).

Fishways

NEP would construct a downstream fishway at the Deerfield No. 4 dam under the Settlement to provide safe downstream passage for Atlantic salmon smolts stocked above the dam. The design of this downstream fishway has been modified by NEP to meet suggestions made by the USFWS and has been incorporated into the Settlement. The Settlement specifies that NEP would (1) construct the fishway within two construction seasons of issuance of the license; (2) prepare a plan for evaluating the effectiveness of the fishway prior to operating it; and (3) provide a copy of the plan to the USFWS and MA DFW for their review and comment prior to operating the fishway.

Under the MA DFW (undated) Fisheries Management Plan, for the Deerfield River, 1991-2010, the MA DFW would initiate and maintain the production of about 100,000 Atlantic salmon smolts via a combination of natural production and the annual release of one million salmon fry into the basin. The stocking of Atlantic salmon fry upstream from the Number 4 Development is already occurring. Under the Settlement and with the proposed fishway for the Gardners Falls Project, Atlantic salmon smolts would be able to freely travel through the lower Deerfield River to the Connecticut river with the proposed fishways.

We believe NEP's operation of the Number 4 Development and other upstream Deerfield Project Developments under the Agreement would enhance habitat for the successful rearing of Atlantic salmon fry and juveniles by establishing minimum flows in bypassed stream reaches. Therefore, we see the need and we support the installation of the downstream fishway at the Number 4 Development and believe this action would provide positive reinforcement of the state's comprehensive management goal for this species in the Basin.

We also agree in general with the specifics of certain features in the Settlement concerning such things as the timing of the construction of the fishway, the preparation of a plan evaluating its success, and the consultation by NEP with the resource agencies in developing the fishway plan prior to operating the facility. These aspects of the Settlement concern the successful operation of the downstream fishway at the Number 4 Development and in general we agree with their intent and their ultimate goal of trying to provide successful passage for Atlantic salmon smolts migrating downstream past the Development.

4.1.1.3.7 Deerfield No. 3

Deerfield No.3 Reservoir

The Settlement doesn't require any change to the mode of operation for the Deerfield No. 3 development and it would continue to generate power on a daily peaking schedule that follows the generating pattern of the upstream Deerfield No. 4 development. The reservoir level would continue to fluctuate over a 6-foot range on a daily basis with water stored in the reservoir during the weekends. The minimum flow release of the lesser of 100 cfs, or inflow, that would be implemented by the Settlement, would not perceptively change the amount of water level fluctuations in the reservoir. The Settlement doesn't require specific measures to protect the fishery resources in the Deerfield No. 3 reservoir. Daily water level drawdowns in the range of 6 feet can adversely affect fishery resources by reducing spawning habitat, dewatering fish eggs, stranding fry and juvenile fish, and subjecting them to increased predation caused by reducing cover (Hunter 1992 and Cushman 1985).

The MA DFW presently doesn't manage the reservoir for any particular fish. MA DFW has concentrated its fishery management objectives on improving conditions for fish in the 0.4-mile-long bypassed reach immediately below the dam (see discussion below) and in providing downstream passage for fish (downstream passage is discussed in a separate section entitled Fish Passage) in the Deerfield River at this location. The size ranges of the fish captured in the reservoir (see Section 3, Fisheries) indicates that natural reproduction is occurring, except perhaps for brown trout that probably entered the reservoir from stocking efforts made in the area. The fish population levels presently occurring in the reservoir would likely continue under the Settlement. Any adverse impacts on the fish populations in the Deerfield No. 3 reservoir are likely to be offset by the benefits that would accrue to the fishery resources in the bypassed reach achieved by minimum flows released there and by installing fish passage facilities to improve conditions for fish moving downstream. Both improvements would be implemented under the terms of the Settlement.

Bypassed Reach

The Settlement requires that NEP release a minimum flow of the lesser of 100 cfs, or inflow, from the dam into the 0.4-mile-long bypassed reach. The primary management objective of the MA DFW is to: (1) establish a self-sustaining population of brown trout, and (2) provide nursery habitat in the bypassed reach for Atlantic salmon and to facilitate the downstream movement through the area of Atlantic salmon smolts. MA DFG's secondary objective is to support and maintain flows needed for a put and take fishery by stocking adult trout (9 to 14 inch brown trout, 9 to 12 inch brook trout, and 9 to 15 inch rainbow trout; letter dated August 24, 1989 from Joseph Bergin, Aquatic Biologist, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts, to Leo Sicuranza, Senior Environmental Analyst, New England Power Service Company, Westborough, Massachusetts), if self-sustaining population of brown trout are unsuccessful.

The amount of fishery habitat in the 0.4-mile-long bypassed reach has been reduced over the years by project operations. About a 500-foot-long portion of the bypassed reach consists of water backed up from the pool formed by the downstream Gardners Falls Project. The fishery habitat in the bypassed reach, except for the plunge pool at the base of the dam, consists of a long riffle/run habitat that is subject to extreme fluctuations in water quantities. There is currently no minimum flow released into the bypassed reach. During the low flow months of June through September, for example, there was not enough water in the stream to generate power in August for water year 1980. When flows are too low to generate power (the minimum turbine generating capacity is 100 cfs), flows in the bypassed reach are likely to be less than 100 cfs. These wide fluctuations of flows in the bypassed reach create adverse conditions for resident fish. For example, providing the minimum flow of 100 cfs required by the Settlement, could make a significant difference in the bypassed for those times of the year when flows are around 140 cfs, because it would mean that all 140 cfs would be released into the bypassed reach rather than 40 cfs (turbine capacity of 100 cfs minus total flow). The staff notes, however, that the nearly 200 foot wide bypassed channel would require considerable flow to fill the channel and thereby might be limited under some circumstances in producing large amounts of suitable habitat for some life stages of fish.

In June 1990, an IFIM study was conducted in the Deerfield No. 3 bypassed reach in conjunction with the resource agencies who agreed with the study methodologies, study sites and transects, and the selection of representative fish and life stages. One study reach, about 84 feet long, was selected to represent the affected stream reach for the IFIM study. The team (composed of state and federal resource agencies and NEP) selected all life stages of brown trout and smallmouth bass, adult brook and rainbow trout, and Atlantic salmon fry and juveniles to be representative fish for the IFIM study.

The relationship between composite WUA values for the adult of brook, brown, and rainbow trout are nearly linear for flow versus habitat. As flow increases, habitat increases for each species. The minimum flow release of 100 cfs into the Deerfield No. 3 bypassed reach would provide about 44, 47, and 41 percent of maximum WUA, respectively, for brook, brown, and rainbow trout adults in the bypassed reach. However, it should be noted that even at a flow of 350 cfs, because of the 200-foot width of the stream channel, water depths would range from 1.3 to 1.4 feet, which is substantially below the optimum depth for all three species (which was around 2.6 feet).

The composite WUA values for Atlantic salmon early and late fry, and juveniles shows that there is relatively little habitat available for early fry in comparison to the other two life stages (Figure 4-11). The calculated WUA habitat values reflect accurately the habitat available for early fry in the bypassed reach. From actual observation there is little to no fry habitat because of the abundance of large boulders and lack of gravel substrate required for spawning or for in-gravel incubating for early fry. Atlantic salmon juveniles show an increase in habitat with an increase in flows in much the same manner that was shown for adult trout studied for this development. The data verifies once again that it takes considerable flows to create habitat in this wide bypassed reach. The minimum flow of 100 cfs would provide about 50, 75, and 56 percent of maximum WUA respectively for Atlantic salmon early and late fry and juveniles. The fry and juvenile life stages are slightly favored, in terms of having a higher percentage of WUA, over the adult trout habitat created by a release of 100 cfs.

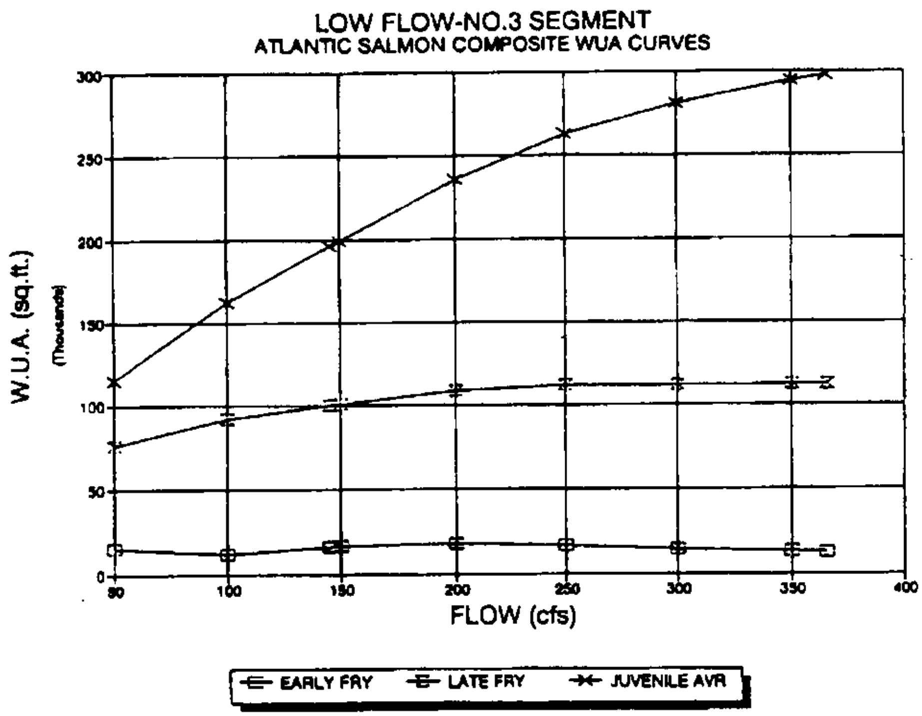


Figure 4-11. Weighted useable area (WUA) versus flows for various life stages of Atlantic salmon under low flows for the bypassed reach at Deerfield No. 3 (Source: Stetson-Harza 1991b).

The composite WUA values for all life stages of smallmouth bass shows there is little habitat for all life stages of smallmouth bass, except juveniles, in the bypassed reach under all flows modelled between 50 and 365 cfs. These results are expected given the habitats available in this bypassed reach--a wide boulder strewn stream channel with a substrate lacking in gravels. This type of stream habitat under various flows has shown to have different effects on the juvenile and adult smallmouth bass. Substantial gains in WUA for juvenile smallmouth bass relative to the other life stages are probably caused by several factors. Juvenile smallmouth bass prefer a boulder substrate and they are more tolerant to higher velocities than the other three younger life stages. The increase in WUA for juvenile smallmouth bass showed a linear increase with increased flows (there was some increase for the other life stages of smallmouth bass too, but not to the extent seen for juveniles). As with the adult trout, increased WUA for juveniles reflects the increase in habitat as the wide channel fills with water from an increase in flows. Conversely, the slight increase in habitat for smallmouth bass adults compared to the increased habitat with flows for juveniles is likely caused by a low suitability of depth for this range of flows. Optimum depth for adult smallmouth bass is 4 feet or greater and as Staff mentioned earlier, even at a flow of 350 cfs, the stream depth in the bypassed reach would only be around 1.4 feet, much less than the depths preferred by smallmouth bass adults. There is no current plan by MA DFW to manage smallmouth bass in the area, however, smallmouth bass do presently occur in the project area and downstream and based on their size range, appear to be successfully reproducing. Based on habitat in the bypassed reach and its short length, smallmouth bass reproductivity is likely occurring upstream from the Deerfield No.3 development.

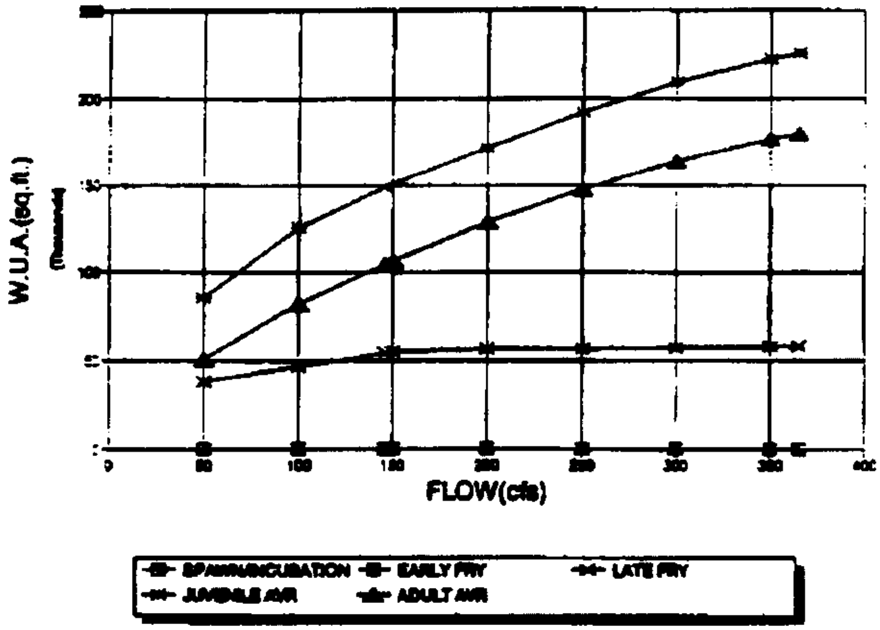


Figure 4-12. Weighted useable area (WUA) versus flows for various life stages of brown trout under low flows for the bypassed reach at Deerfield No. 3 (Source: Stetson-Harza 1991b).

The WUA for all life stages of brown trout are shown in Figure 4-12. As was observed for early life stages of smallmouth bass, the WUA increases for brown trout early life stages are minimal with increases in flows. The absence of gravels greatly reduces spawning habitat in the bypassed reach for early life stages of brown trout, as it did for smallmouth bass. The linear increase of WUA with increased flows for brown trout adults and juveniles shows the effect of how filling the wide channel with water increases the habitat for both life stages. The minimum flow release of 100 cfs required by the Settlement would provide about 47 percent of the maximum WUA for brown trout adults, 56 percent for juveniles, and 87 percent of brown trout late fry.

Summary

The staff concurs with the flows recommended by the Settlement for the Deerfield No. 3 development. The staff believes the minimum flow would greatly enhance the existing aquatic conditions in the bypassed reach and support: (1) the resource agency goals of establishing a self-sustaining population of brown trout in this reach, (2) improving conditions for Atlantic salmon nursery habitat for fry and for juveniles (smolts) that would pass through the area from plantings made upstream (see discussion on Fishways below).

Fishways

NEP would construct a downstream fishway at the Deerfield No. 3 dam under the Settlement to provide safe downstream passage for Atlantic salmon smolts stocked above the dam. The design of this downstream fishway has been modified by NEP to meet suggestions made by the USFWS and has been incorporated into the Settlement. The Settlement specifies that NEP would do the same three things that are discussed in the first paragraph for fishways for the Deerfield No. 4 Development (e.g., timing of construction and specific items for a fishway plan).

As was mentioned in the discussion of fishways for the Deerfield No. 4 Development, the installation of a fishway supports the MA DFW Fisheries Management Plan and stocking efforts in the mainstem of the Deerfield River that are already underway. The installation of fishways at the Deerfield No. 3 Development and at the dam above (Deerfield No. 4) and at the two dams below the Deerfield No. 3 Development should enhance Atlantic salmon smolt movement downstream to the Connecticut River.

We believe NEP's operation of the Number 3 Development and other upstream Deerfield Project Developments under the Settlement would enhance habitat for the successful rearing of Atlantic salmon fry and juveniles by establishing minimum flows in bypassed stream reaches. Therefore, we support the installation of the downstream fishway at the Number 3 Development and believe this action would provide positive reinforcement of the state's comprehensive management goal for this species in the Basin.

We also agree in general with the specifics of certain features in the Settlement concerning such things as the timing of the construction of the fishway, the preparation of a plan evaluating its success, and the consultation by NEP with the resource agencies in developing the fishway plan prior to operating the facility. These aspects of the Settlement concern the successful operation of the downstream fishway at the Number 3 Development and in general we agree with their intent and their ultimate goal of trying to provide successful passage for Atlantic salmon smolts migrating downstream past the Development.

4.1.1.3.8 Deerfield No. 2

The Settlement doesn't require any change to the mode of operation for the Deerfield No. 2 development and it would continue to generate power on a daily peaking basis following the operating mode of the Deerfield No. 3 development except during non-peaking periods when it releases the 100 cfs required by the WQC. The impoundment level would continue to fluctuate over a 6-foot range on a daily basis with stored water released every four hours to meet the requirements of the WQC. The Settlement minimum flow release of 200 cfs, to be guaranteed from storage, if necessary, would not perceptively change the amount of water level fluctuations in the impoundment. The Settlement doesn't require specific measures to protect the fishery resources in the Deerfield No. 2 impoundment. Daily water level drawdowns in the range of 6 feet can adversely affect fishery resources by reducing spawning habitat, dewatering fish eggs, stranding fry and juvenile fish, and subjecting them to increased predation caused by reducing cover (Hunter 1992 and Cushman 1985).

The MA DFG presently doesn't manage the reservoir for any particular fish. MA DFW has concentrated its fishery management objectives on improving conditions for fish in the 9-mile affected stream reach below the dam and in providing upstream and downstream passage for Atlantic salmon (see salmon passage in the Fish Passage discussion below) in the Deerfield River at this location. The size ranges of the fish captured in the reservoir (Section 3.3.1.3) indicates that natural reproduction is occurring, except perhaps for the trout that likely entered the reservoir from stocking efforts made in the area and in the reservoir near the Wilcox Hollow area. The fish population levels presently occurring in the reservoir would likely continue under the Settlement. Any adverse impacts on fish populations in the Deerfield No. 2 reservoir are likely to be offset by the benefits that would accrue to the fishery resources in the 9-mile project affected reach below the dam and as a result of installing upstream and downstream fish passage facilities. The fish passage facilities and minimum flows would be implemented under the terms of the Settlement.

<u>Stream Reach Below the Deerfield No. 2 Dam</u>

The Settlement would require that NEP release a minimum flow of 200 cfs, and that this flow be released from storage, if necessary, to meet the requirements of the Settlement. The purpose of the minimum flow release is to meet MA DFG's primary management objectives of establishing a self-sustaining brown trout population in the river below the dam, providing nursery habitat for Atlantic salmon, and allowing passage of Atlantic salmon smolts downstream. A trapping facility would be constructed under the Settlement to allow adult Atlantic salmon to be captured and taken to the hatchery for propagation. MA DFG's secondary objective is to provide a put and take fishery in the 9-mile reach below the dam by stocking brook and rainbow trout (9 to 12 inch brook trout and 9 to 15 inch rainbow trout; letter dated August 24, 1989 from Joseph Bergin, Aquatic Biologist, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts, to Leo Sicuranza, Senior Environmental Analyst, New England Power Service Company, Westborough, Massachusetts).

The amount of fishery habitat in the 9-mile reach below the Deerfield No. 2 dam has been reduced over the years by project operations. Project operations have caused water level fluctuations that are adverse to aquatic resources. The biggest changes in water levels would occur in the tailrace area and the amount of change would be moderated as one moves downstream in the 9-mile affected reach. For the most part, the first 6.5-mile reach below the dam is in a steep gorge where the river is relatively narrow and there are repeating riffle/pool habitats. Under fluctuating flows, the riffle areas may become greatly reduced and fish would become confined in pools and be subject to increased stress and predation. Habitat is similar in the last 2.5-mile portion of the 9-mile affected reach, except that there are numerous islands in the river and the stream is wider and has less slope.

In June 1990, an IFIM study was conducted in the 9-mile reach below the Deerfield No. 2 dam. The study was conducted in conjunction with the resource agencies who agreed with the study methodologies, study sites and transects, and the selection of the representative fish and life stages. Two study reaches were selected to represent the affected stream reach for the IFIM study. The team (composed of state and federal resource agencies and NEP) selected all life stages of brown trout and Atlantic salmon, and adult brook and rainbow trout to be representative fish for the IFIM study. A Habitat Timed Series Analysis was also conducted for the Deerfield No. 2 development using brown trout late fry and juveniles.

The composite WUA values for adult brook, brown, and rainbow trout for the study reach were all determined to be fairly similar from the IFIM studies. The adults for all three species show a nearly linear relationship between flow and habitat-, as flow increases, so does habitat. The curves for brook and brown trout were nearly identical. The adult rainbow trout showed that more habitat area became available at higher flows than occurred for brown or brook trout adults. Rainbow trout showed a preference for higher flows then did brook and brown trout. Peak WUA for all three trout species adults occurs at flows around 825 cfs, but the difference in total WUA is almost twice as much habitat for rainbow trout as there is for brook and brown trout at the same flow. A minimum flow of 200 cfs, under the Settlement, would provide about 80, 72, and 56 percent of maximum WUA respectively for brown, brook, and rainbow trout. It should be noted, however, that habitat for rainbow and brook trout would not be that important if MA DFW's goal is to support a put-and-take fishery in the area. Under those circumstances, to have a successful stocking program, it would not be necessary to maximize WUA, but flow releases would be needed that provide an aesthetic experience for anglers and would maintain depths and velocities over the majority of the stream channel that are favorable to these species.

The composite WUA values for various flows (high and low flows) for Atlantic salmon appear in Figure 4-13 and Figure 4-14. As has been the case for other salmonids in the Deerfield River, the data indicates there is little spawning and incubation habitat for Atlantic salmon early fry at any flows. There is an abundance of cobbles and boulders in this stream reach and a paucity of optimum gravel substrate thereby reducing habitat for adults and early fry. However, as with the other Deerfield developments, the staff has assumed that there would be some pocket water areas that would provide some refuge and some potential spawning areas for adults.

WUA values for Atlantic salmon adults, juveniles, and late fry show increases in habitat with increases in flows (Figure 4-13), with the exception of late fry that show decreases in habitat as flows increase above 200 cfs. Juvenile Atlantic salmon show the greatest increases in habitat with increases in flows and have the greatest amount of habitat available among all the life stages for Atlantic salmon. Peak WUA occurs for Atlantic salmon juveniles at flows of around 700 cfs (Figure 4-14). Juvenile Atlantic salmon prefer the cobble and boulder habitat and are more tolerant of higher velocities and depths than are early fry of this species. The difference in habitat between the adult and juvenile Atlantic salmon created at different flows also reflects the fact that juvenile Atlantic salmon prefer an optimum stream depth at around 3 feet while adult Atlantic salmon prefer an optimum stream condition at depths greater than 5 feet. The Deerfield No. 2 development stream reach might prove to be very attractive to Atlantic salmon smolts moving through the area from their stocking sites located upstream. The minimum flow of 200 cfs, required by the Settlement, would provide 100, 80, and

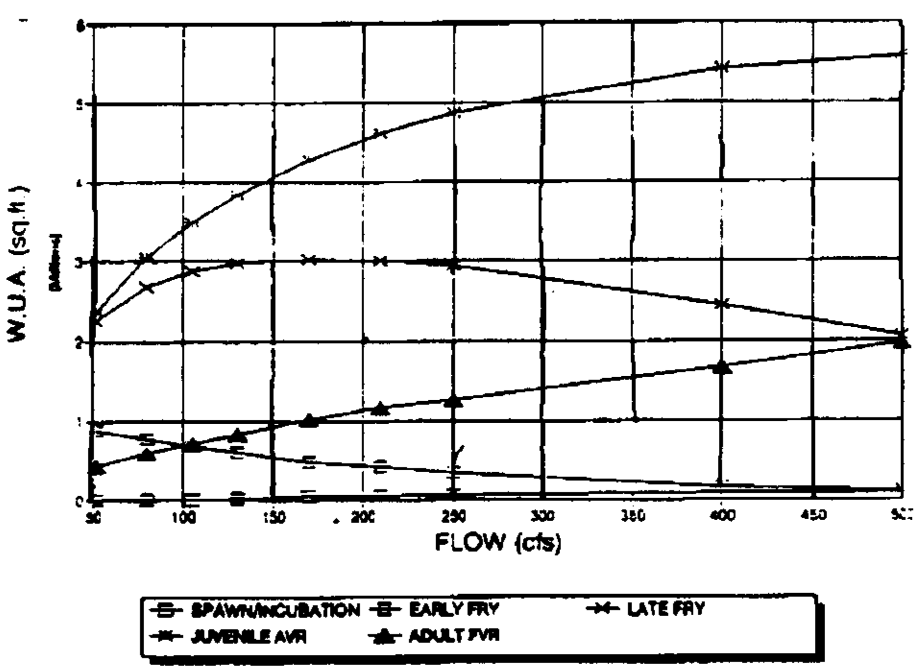
Table 4-3. Availability of WUA under the habitat duration curve between the 20 to 90% exceedance levels (in feet^2 -hours) for Deerfield No. 2 under specific flows (Source: NEP 1993).

	June			September		
	Existing (100 cfs)	NEP Proposal (157 cfs)	change (%)	Existing (100 cfs)	NEP Proposal (157 cfs)	change (%)
Brown trout						
(late fry)	1,105,361,593	1,966,498,470	77.9	1,282,174,628	1,949,041,710	52.0
(juvenile)	1,907,146,188	2,604,727,228	36.6	2,066,169,600	2,448,725,760	18.5

55 percent of maximum WUA respectively for Atlantic salmon late fry, juveniles, and adults.

The WUA for all life stages of brown trout is shown in Figure 4-15. The situation for brown trout spawning and incubation and early fry habitat appears to be limited for this stream reach below the Deerfield No. 2 dam. As was the situation for many of the upstream Deerfield developments, the absence of a gravel substrate reduces spawning habitat although there is likely some habitat for limited spawning and hatching success. Maximum WUA for brown trout adults, late fry, and juveniles occurs, respectively, at flows of around 500 cfs, 110 cfs, and 400 cfs (Figure 4-15). A minimum flow release of 200 cfs, under the Settlement, would provide about 78, 93, and 86 percent of maximum WUA respectively, for brown trout adults, early fry, and juveniles (Figure 4-15).

Habitat duration analysis was conducted for the Deerfield No. 2 development as it was for the upstream Somerset, Searsburg, and Deerfield No. 4 developments. Brown trout late fry and juveniles were examined in the habitat duration analysis. The staff concentrated on data generated for June and September out of the four months examined in the habitat duration study because those two months are representative of the lowest flow months at the Deerfield No. 2 development.



NOTE: FLOWS LESS THAN 130 cfs AND GREATER THAN 328 cfs ARE OUTSIDE THE U.S.F.W.S. RECOMMENDED EXTRAPOLATED RANGE OF FLOWS.

Figure 4-13. Weighted useable area (WUA) versus flows for various life stages of Atlantic salmon under low flows at Deerfield No. 2 (Source: Stetson-Harza 1991b).

Table 4-3 shows how much of an improvement, by percent, that would occur in WUA between the existing baseline condition (100 cfs minimum flow release) for Deerfield No. 2 development and for the early NEP proposal of 157 cfs. Table 4-3 doesn't reflect the Settlement minimum flow release of 200 cfs, but we may assume that the overall amount of habitat would increase with increasing flows and that the habitat at the 157 cfs flow would be similar to the habitat that would be created under 200 cfs, as there is only a difference of 43 cfs. Each summation (Table 4-3, e.g., 1,105,361,593 for brown trout late fry) reflects the effect of the stated flow scenario on the month's habitat availability measured in square feet-hours.

Smallmouth bass are present in the Deerfield No. 2 reservoir and in the 9-mile reach below the dam. A smallmouth bass sport fishery exists in the Deerfield River below the project affected stream reach and near the mouth of the Connecticut River. However, MA DFG presently does not have any management objectives for this species at the Deerfield No. 2 development.

Summary

The staff concurs with the flows recommended by the Settlement for Deerfield No. 2 development. The staff believes the minimum flow would greatly enhance the existing aquatic conditions in the 9-mile affected stream reach below the dam by: (1) helping to meet the resource agency goals of establishing a self-sustaining population of brown trout in this reach, (2) improving conditions for Atlantic salmon nursery habitat for fry and smolts, (3) facilitating the passage of smolts through the area from plantings made upstream, and (4) improving the ability of adult salmon to move upstream to the Deerfield No. 2 dam from the Connecticut River.

Fishways

NEP would construct a downstream fishway at the Deerfield No. 2 dam under the Settlement to provide safe downstream passage for Atlantic salmon smolts stocked above the dam. The design of this downstream fishway has been modified by NEP to meet suggestions made by the USFWS and has been incorporated into the Settlement.

As was mentioned in the discussion of fishways for the Deerfield No. 4 Development, the installation of a fishway supports the MA DFW Fisheries Management Plan and stocking efforts in the mainstem of the Deerfield River that are already underway. The installation of downstream fishways at the two Developments and Gardners Falls Project located above the Deerfield No. 2 Development should enhance Atlantic salmon smolt movement through the lower Deerfield River to the Connecticut River.

We believe NEP's installation and operation under the Settlement of downstream fishways and the release of minimum flows in bypassed stream reaches (including these same actions occurring at the Gardners Falls Project) would enhance nursery habitat for the successful rearing of Atlantic salmon fry and juveniles and would provide safe passage for the downstream migration of Atlantic salmon smolts past these four dams to the Connecticut River. Therefore, we support the installation of the downstream fishway at the Number 2 Development and believe this action would provide positive reinforcement of the state's comprehensive management goal for this species in the Basin.

We also agree in general with the specifics of certain features in the Settlement concerning such things as the timing of the construction of the fishway, the preparation of a plan evaluating its success, and the consultation by NEP with the resource agencies in developing the fishway plan prior to operating the facility. These aspects of the Agreement concern the successful operation of the downstream fishway at the Number 2 Development and in general we agree with their intent and their ultimate goal of trying to provide successful passage for Atlantic salmon smolts migrating downstream past the Development.

Under the Settlement, NEP would also install upstream fish passage facilities at the Number 2 Development under a phased approach. A trap and truck facility would be built at the Number 2 Development

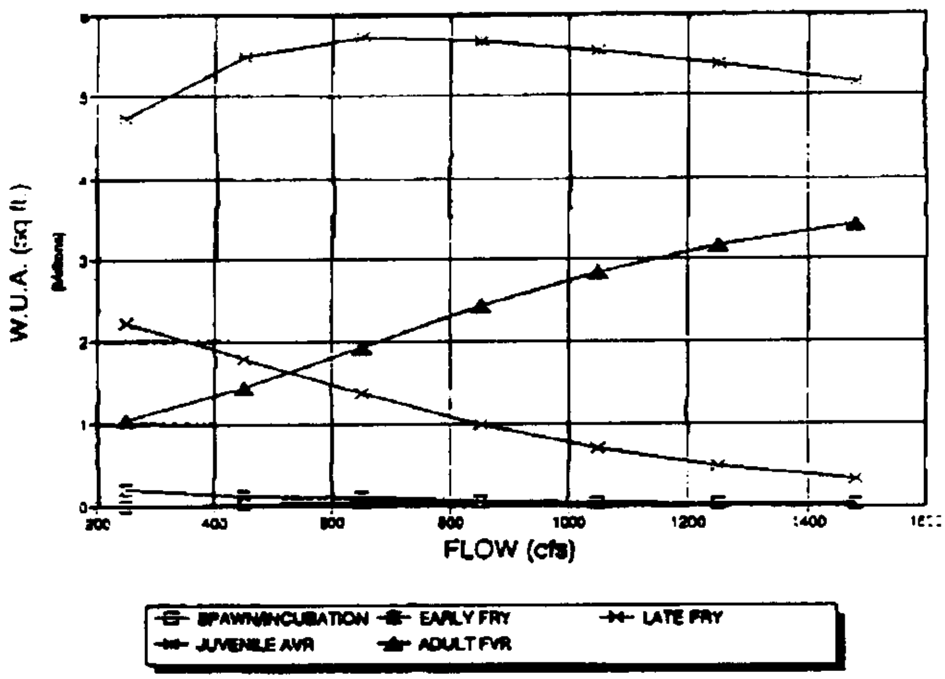


Figure 4-14. Weighted useable area (WUA) versus flows for various life stages of Atlantic salmon under high flows at Deerfield No. 2 (Source: Stetson-Harza 1991b).

when a specified number of adult Atlantic salmon reach the downstream side of the dam or occur in the Deerfield River below the Development for two consecutive years. To help determine when the required numbers of fish are present to trigger construction activities for building the fishway, under the Settlement, NEP would work with MA DFW, USFWS, and the Connecticut River Atlantic Salmon Commission in developing a plan for radio-tagging adult Atlantic salmon at the Holyoke Dam Fishway. The radio-tagging study would be initiated during the first migration season after issuance of a new license and would continue annually until the target numbers of adult Atlantic salmon reach the Deerfield No. 2 dam or are reported in the Deerfield River below the dam.

The design of this upstream fishway has been modified by NEP to meet suggestions made by the USFWS and has been incorporated into the Settlement. The Settlement also specifies that NEP would (1) construct the fishway within two construction seasons once the trigger numbers (either 12 adults reported during interim use of trapping facilities or four adults reported in the river without using interim trapping procedures) of Atlantic salmon adults are reported at the Development for two consecutive years, and (2) develop an alternative upstream passage system in consultation with MA DFW and USFWS in the event that the radio-tagging study is discontinued and parties can't reach agreement on the ratio of the numbers of fish tagged and released at Holyoke Dam Fishway with the numbers of fish required to reach the Deerfield River.

We agree with the general concepts associated with the proposed upstream fishway for the Number 2 Development and believe this action supports the overall objectives of trying to re-establish Atlantic salmon in the Deerfield River Basin. Minimum flow releases made at the Number 2 Development would also encourage the success of the upstream and downstream movement of Atlantic salmon in the Deerfield River. The trigger numbers of returning adult Atlantic salmon that would be needed to initiate construction activities for the upstream fishway also appear to be reasonable and reflect agreement among parties involved in re-establishing Atlantic salmon in the Basin.

We also agree with the intent of the other specific items associated with the development of the upstream fishway in the Settlement. In general, we believe these measures are supportive of the state's overall goal of re-establishing Atlantic salmon in the Deerfield River Basin and we support them.

4.1.1.4 Vegetation and Wildlife Resources

Vegetation

Flows

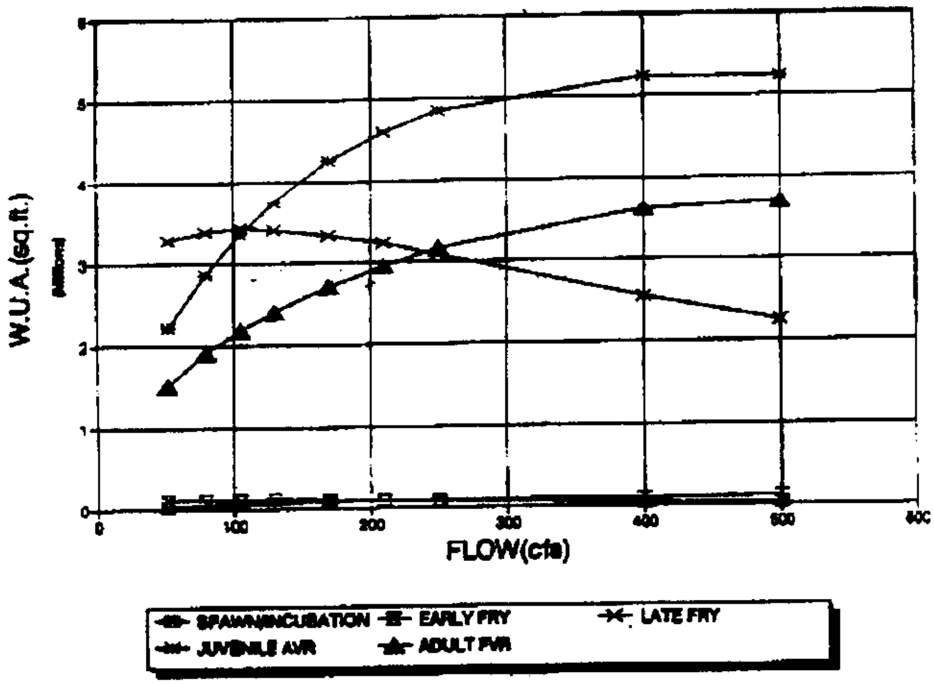


Figure 4-15. Weighted useable area (WUA) versus flows for various life stages of brown trout under low flows at Deerfield No. 2 (Source: Stetson-Harza 1991b).

Extremely high flows are known to wipe-out, up-root, and cause scouring of some vegetation. The loss of shoreline vegetation results in habitat loss or degradation, food loss, diminished water quality, and often increased erosion. However, increasing the minimum flows from most of the Deerfield reservoirs (Table 2-1 and Table 2-2) is not likely to adversely affect most wetland vegetation. Wetlands are most abundant at the Somerset and Harriman reservoirs. Existing vegetation at Somerset and Harriman reservoirs currently experiences average annual inflows of about 53 cfs and 340 cfs, respectively. The proposed operation would not result in significant average changes to annual inflows at Somerset and Harriman reservoirs. Flows of this magnitude are not likely to adversely affect most wetland vegetative resources on site, with the exception of a rare orchid (see below, Rare Plants) because most of the other wetland species are tolerant of these flows. Likewise, the proposed project operation is not likely to adversely affect riparian or upland vegetation along the Deerfield River because of the steep banks and high elevation which protects the narrow zone of riparian habitat.

Whitewater boating releases would average 1000 cfs from May through October 31 in accordance with a monthly allocation schedule released from the Deerfield No. 5 development and flows of at least 700 cfs would be provided 106 days annually from April through October at the Fife Brook Dam. The Deerfield No. 5 development currently fluctuates about 5 feet per day with a constant minimum discharge of 25 cfs which flows into the bypassed reach at the Deerfield No. 5 dam through a low level outlet. Although this time period (April through October) overlaps with the growing season for many vegetative species, these flow releases would not be severe enough to adversely affect the vegetation at the Deerfield No. 5 and Fife Brook developments.

Rare Plants: The proposed release of 70 cfs from October 1 to June 30 and 57 cfs from July 1 to September 30 to the Harriman 4.4-mile-long bypassed reach to develop a year-round coldwater fishery, and to release the lesser of: (a) 35 cfs or inflow from June 1 to September 30; and (b) release 55 cfs or inflow from October 1 to May 31 downstream of the Searsburg dam (Table 2-1), would affect some rare plant species.

No species specific measures to protect the state threatened tubercled orchid are proposed. NEP states that in the Harriman bypassed reach, habitat for the tubercled orchid has developed subsequent to the construction of the reservoir (*i.e.*, the vegetated boulder-tops in the stream bed) and would probably be lost if the river were to return to natural flow conditions. Therefore, according to NEP, this rare plant species would not be threatened by continued operation of the projects (NEP 1991); however, we disagree. The baseline conditions for the Harriman bypassed reach would change under the proposed flow. Currently, little water is released into most of the Harriman bypassed reach, except for natural flows from the lowermost part connecting to the West Branch Deerfield River.

Table 4-4. Tubercled orchid mortality under various flow regimes at the Harriman bypassed reach (Source: VANR 1995, modified by Staff).

Flow (cfs)	Plant mortality (%)
30	40
57	60
72	75
92	90

Studies conducted during September 1993 to examine the effects of various flows reveal that flows of 70 cfs from October through June 30, could result in approximately 75 percent mortality of the tubercled orchid (Table 4-4). Likewise, flow releases of 57 cfs starting July 1 could kill approximately 60 percent of the tubercled orchid population growing there. VANR (1995) states that the study conducted probably underestimates the actual tubercled orchid mortality since the observations were solely based on the numbers of individual plants inundated at each test flow. Additional plants, not inundated, but located slightly above the water level would also be adversely affected by the higher water levels.

Reservoir Drawdowns/Fluctuations

Wetlands at Somerset and Harriman Reservoirs, where the wetlands are best developed, are limited by seasonal drawdown operation of the reservoirs to some degree. The Somerset Reservoir is drawn down in the winter (December 1 through April 1) an average of 15 feet and in the summer an average of 5 ft. However, management varies from year to year. NEP proposes no change in these seasonal drawdowns at Somerset. Spring and, to some extent, summer is the critical time for vegetation growth. Therefore, April through October, severe inundation and desiccation resulting from fluctuations should be minimized whenever possible to best protect these wetland species and to maximize plant productivity.

The Somerset reservoir contains ten wetland areas. These wetlands appear to be of moderate value and diversity. There is little emergent aquatic vegetation and few shrub species. Plant dormancy occurs during the 15-foot winter drawdown and helps to minimize adverse effects. At least one of the ten wetlands (wetland site number 1, four acres in size) is exposed during low water level conditions; however, NEP believes it receives a sufficient amount of ground water to maintain the plant community even when the reservoir is drawn down. The proposed continuation of the timing and the degree of the summer drawdown would continue only minor adverse effects on the existing wetlands.

The Harriman reservoir also functions as seasonal storage. Typically, inflow is stored during the spring snowmelt and flow is released during the summer and winter (Table 3-3). The reservoir contains nine wetland areas, most of which are dominated by annual rush species and sand or mud substrate. Water surface elevation fluctuations in project reservoirs and associated tributaries can cause shoreline erosion and scouring of bottom sediments. Lack of deposition and accumulation of organic matter prevents successful establishment of wetland vegetation and associated aquatic invertebrate communities (Plosky 1983). Also, seasonal reservoir drawdowns may adversely affect wetland vegetation by desiccation (Beard 1983).

NEP would continue to drawdown the two reservoirs seasonally, however, the fluctuations of the Somerset Reservoir would be limited to ± 1 foot for common loons (see below, for effects on common loons) from May 1 to July 31, thereby, providing some enhancement to wetland vegetation. At Harriman, maintaining the reservoir water level stable or rising from May 1 to June 15 includes the critical growth period for wetland species. Therefore, we conclude that the proposed operational changes at Somerset and Harriman would provide some minor level of enhancement to existing wetlands at these two reservoirs over existing conditions.

Forest Management and Conservation Easements

Under the Settlement, Forest Management Guidelines for NEP's timber management programs at the Deerfield Project would protect riparian zones, visual quality within important viewsheds, limit the use of vegetative clear cutting, reduce soil erosion, site productivity and nutrient depletion, and protect and manage wildlife habitat.

Commercial thinning since 1984 has resulted in approximately 900 acres of land being placed under management for future quality timber growth, desirable advance regeneration, and wildlife habitat enhancement or protection. These enhancements would continue if the project is licensed as proposed in the Settlement. In addition, approximately 2,000 acres of more recently purchased land such as at Bear Swamp, Fall Mountain, and alternate power plant sites forest lands have not been managed in the past. The remaining forest land properties generally associated with transmission and distribution facilities have also never been managed or examined. Therefore, this Forest Management Plan is an enhancement because it would enhance more forest land and habitat.

The Forest Management Plan in conjunction with conservation easements on lands along the Deerfield River is important to the protection of terrestrial species. The management of these lands minimizes developmental potential. This enhancement measure directly benefits wildlife and other terrestrial resources by: (1) minimizing terrestrial habitat fragmentation that is used by a diverse group of wildlife species, (2) minimizing development that results in habitat loss, (3) imposing restrictions of clear cutting thereby protecting trees that could be utilized as cavities and perch sites by cavity nesting birds, such as wood ducks, (4) minimizing adverse effects to the water quality of the river basin through sedimentation, and (5) minimizing human disturbances in terrestrial habitats. In addition, the proposal is consistent with both Vermont and Massachusetts' Deerfield River Comprehensive Plan. For these reasons, we conclude that the proposed Forest Management Plan and conservation easements would enhance terrestrial resources.

Effects of Installing Recreational Facilities

Proposed recreational facilities (see Section 4.1.1.6), would result in: (1) short-term disturbance and displacement to some areas of vegetation and some wildlife species, and (2) removal of some vegetation on recreational sites. These effects would be minimized with the timing of the disturbances and/or with re-vegetation of all practicable areas (with native vegetative species whenever possible) as soon as possible after any such disturbance.

Wildlife

Since vegetation is a key component of wildlife habitat, effects on vegetation and measures to protect and enhance of vegetation generally extend to wildlife populations throughout the project area. Discussion of specific effects on wildlife and wildlife enhancement measures follows.

Common Loons and Reservoir Fluctuations

The link between common loons (a Vermont listed endangered species) and the Deerfield Project is that water level elevations on the Somerset reservoir would continue to adversely affect the nesting success rate and productivity of a regionally important species. Although the Settlement proposes to stabilize the water levels at ± 1 foot during loon nesting, that results in water level fluctuations up to 2 feet, which is better than the current 3 foot drop in normal water level elevation during May through July. Fair (1992) showed that loons can be severely affected by: (a) water elevation increases of 6 inches or more which commonly flood or ruin nests, and

(b) water elevation decreases of 1 foot which strand incubating adults from their nests and increase opportunities for egg predators. Therefore, operation at the Somerset reservoir resulting in ± 1 foot water surface elevation fluctuation is not expected to significantly enhance the loon nesting success rate.

Further, operation of the Somerset reservoir, as proposed, could result in adverse effects on loon nesting by shoreline changes each year. For example, if a pair of loons builds a nest on land 3 feet from the shoreline one year, due to a change in shoreline, that same nest site may be located 9 feet away from the shoreline the next year. This poses two problems for loons. First, since common loons usually return each year to a well defined territory to nest on a preferred, traditional nest site, the adults may waste time by searching for the traditional nest whose location relative to the shoreline has changed and/or having to build a new nest. Secondly, since loons are not very mobile on land, they only land to copulate and to incubate their eggs (Fair 1995), the greater the distance required to walk to a nest from the water, the greater the chance that the adults will be unable to return to their traditional nest which decreases the nesting success. The level of enhancement expected from the proposed operation of the Somerset reservoir has not been quantified, but is expected to be moderate for these reasons.

Limiting reservoir surface elevation fluctuations would also benefit other species of wildlife, such as beaver and muskrat because this timing enhances the reproductive success of these species.

Loons and Recreation Use

Loon biologist, Rosalind Renfrew (letter dated September 1, 1993) says that new campsites at Somerset Reservoir would likely impact loon nesting and chick-rearing. Assuming that some of these campsites would be accessed by canoe or other boat, there would be more traffic on the reservoir. Loons have nested on the northern half of the Somerset reservoir, which is likely to become more travelled with the establishment of campsites. While hand-powered boats do not impact common loon chicks as much as motorboats, they do have a greater impact on common loon nests. Hand-powered boats can come in close to nests and tend to linger longer than motorboats, which is more likely to cause an incubating common loon to abandon its nest. Therefore, we would recommend that the placement of the proposed campsites at Somerset (see Section 4.1.1.6, Recreation), be located away from loon traditional and artificial nest sites.

Waterfowl Enhancements

At the Somerset reservoir, installing various artificial nesting structures would enhance existing waterfowl habitat. The seasonal drawdowns at the Somerset reservoir currently adversely affect waterfowl. The rising reservoir level each spring/summer likely results in the inundation of some waterfowl nests which would result in reduction in the productivity of existing waterfowl in the Somerset reservoir.

Wood duck Boxes: Installation of 55 wood duck boxes in nine different locations around the Somerset reservoir is proposed. Wood ducks feed from the water or along the banks of streams and ponds and nest in hollow tree cavities near the water (Benyus 1989). Since much of the project area is forested, enhancing wildlife habitat for tree nesters, such as wood ducks, is both practical and beneficial. Other factors potentially affecting current wood duck nesting are the tree composition, tree condition, and the number of existing cavity trees. However, artificial nesting structures could be constructed to enhance nesting as recommended by the Settlement. Since wood ducks take readily to nesting boxes (Kortright 1967), and since much success has occurred with wood ducks in the northeast, we anticipate that the installation of the wood duck boxes as proposed would be beneficial to enhancing wood duck habitat at the Deerfield Project. The forest management plan proposed by NEP would also enhance wood ducks habitat by maintaining cavity trees for nesting.

Wood ducks are early migrants, heading to inland ponds of the southern States in early September to early October. Wood ducks reappear just after ice-out conditions. Therefore, proposed wood duck boxes should be installed in the winter when the birds fly south to avoid disturbance. During winter when ice is well established and snow is deep, it is also easier to install the wood duck boxes since snowmobiles and sleds can carry personnel and materials to the Somerset reservoir sites.

Black duck baskets: Installation of 24 black duck nesting structures, baskets, at nine different locations around the Somerset reservoir is proposed. Black ducks nest on the ground and feed from the surface of water (Benyus 1989). Black ducks prefer to nest concealed among willows and cattails on the edges of ponds. There are three potential problems associated with baskets: (1) use is often low, with approximately 20 percent or less of installed black duck baskets being used by black ducks; (2) when black ducks don't use the baskets, mallards and other waterfowl use them; and (3) the loss of young from these artificial baskets through predation (*i.e.*, generally from raccoons) is high (NEP 1993). Despite the potential problems, even low use of baskets by black ducks often benefits populations. Also, resource agencies support the wildlife enhancements proposed in the Settlement. We believe the installation of 24 black duck baskets would be beneficial.

Common loon rafts: As noted above loons nest on treeless ground. Loon rafts, which were first developed in the midwest, have become a common means of providing nesting habitat. Loon rafts can enhance loon productivity if used correctly or can be dangerous loon traps, if not situated properly. Loon rafts are only successful in those cases for which they were specifically designed, where loon breeding pairs have attempted and failed at nesting due to: (1) shoreline predation or (2) water level fluctuations. In these two cases there must be a suitable raft site in the loon pair's territory, in water of feasible depth and clarity, and located out of wind and boating areas (Fair 1989). Hensen (in NEP 1993) recommends installing loon rafts at the Somerset reservoir before the water freezes each fall and re-installing them each spring. However, before the installing loon rafts, Fair (1992) lists three things to: (1) accurate assessment of the loon breeding populations, its productivity, and nesting success, including mapping of breeding territories; (2) application of the basic principles behind the use of this management tool; and (3) an experienced approach with which to blend the two factors above with considerations of each reservoir physiography.

Before, installing loon rafts the operation of the reservoir where the loons are located should be assessed. These artificial nesting structures can be an enhancement in some situations; however, the rafts do not fully mitigate or compensate for the effects of water level changes on common loon nest success. Loon rafts do not attract new pairs of loons and about one half of the loon pairs offered an artificial raft will use it (Fair 1989, 1992). Reservoir water level stabilization during loon nesting, mid-May through July, benefits 100 percent of loon pairs. Some of the benefits of stabilizing the water level over artificial raft replacement include: (a) stabilized water levels allow loons to nest on natural sites which are generally more secluded and less noticeable than artificial nesting islands, which may be attractive also to lake users; (b) artificial nesting islands are more susceptible to disturbance by boaters, and (c) since common loons prefer small islands as nest sites, improper or ill-advised raft placement is an area later subject to boat traffic or fishing may also lure common loons onto artificial nest sites more prone to failure than a natural nesting site, thereby diminishing productivity instead of enhancing productivity.

Based on the best available information, we conclude that limiting the reservoir fluctuation during the nesting season, would do more to enhance loon nesting habitat than installing three loon rafts. With reservoir surface elevation fluctuations of ± 3 inches required by the WQC, loon rafts would not be necessary.

Osprey nesting platforms: The proposal to install four artificial osprey platforms based on U.S. Army Corps of Engineers designs but mounted on trees, on site, is expected to benefit osprey. Ospreys are state listed endangered species in Vermont and Massachusetts (Franklin County Planning Department 1990). Ospreys nest in the tree canopy or shrubs around the Somerset reservoir and feed on fish.

We agree with mounting the four platforms on trees instead of on poles. Osprey platforms erected on poles do not provide the same habitat component as trees. In addition, young birds raised in nests on poles, rather than trees, often imprint on poles and will begin to choose poles rather than trees to nest when they become sexually mature. Use of pole nests, increases the chances that ospreys will tend to choose to nest on powerline poles .

Consistency with North American Waterfowl Management Plan: Settlement proposals would protect wetlands, improve forest management, protect habitat with conservation easements, and enhance waterfowl nesting habitat. Consequently they are consistent with the North American Waterfowl Management Plan (see Section 5.4.3).

Beaver Management

A Beaver Management Plan to maintain six active beaver flowages in beaver ponds surrounding the Somerset reservoir is proposed. The primary objective of the beaver management plan is to maintain current beaver populations so that existing beaver ponds remain in their present condition. The general approach of the management plan is to manage habitat through silvicultural practices, specifically patch cuts, to enhance the beaver food supply in the riparian zone. Factors considered in this beaver management plan include: (a) the width of the riparian zone around the beaver pond to be managed, (b) patch sizes and shapes, (c) patch location, (d) the rotation schedule of the patch cuts, (e) the type and size of existing trees, and (f) the present timber harvest roads on the property. In exploring beaver management options, NEP also expects to: 1) monitor beaver populations on a regular basis at each site and to regulate trapping if it appears to threaten the longevity of the resident beaver population, 2) not resort to physical engineering improvements to the natural dams, and 3) actively manage the forest stands, with patch clear-cuts, within 300 feet of the open water in the beaver ponds so as to create a relatively permanently source of food for beavers.

Beavers currently utilize the Deerfield Project site and appear unaffected by the current operation of the Somerset reservoir. Preferred beaver habitat is along streams and banks with trees or alders on the banks. Beavers' preferred food is aspen, poplar, birch, maple, willow, and alders. The proposed management of beaver habitat along the Somerset reservoir would improve and ensure continued adequate habitat for the beaver. We agree with implementing the proposed beaver management plan.

4.1.1.5 Threatened and Endangered Species

Since the DOI determined that except for occasional transient individuals, no Federally listed or proposed endangered or threatened species are known to exist in the Deerfield Project impact area (Section 3.3.1.5), no biological assessment or further Section 7 consultation with DOI under the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required at this time. Should project plans change, or additional information on listed or proposed species becomes available, DOI's determination may be reconsidered.

As noted in Section 3.3.1.5 shortnose sturgeon inhabits the mouth of the Deerfield River. Operation of the Deerfield No. 2 development is not expected to impact the shortnose sturgeon for several reasons: (1) shortnose sturgeon appear to be an occasional visitors to the Deerfield River and use an area in the lower 1 km section of the river upstream from the mouth as a resting area only during high flows in the Connecticut River, (2) the project is likely to be operating continuously mode and spilling flows because of naturally high river flows during times when shortnose sturgeon are likely to enter the river in response to flow and water temperature, and (3) there is some doubt that any shortnose sturgeon would swim the nearly 12 miles upstream from the mouth of the Deerfield River to the project because of the nature of the past usage of the river by the shortnose sturgeon (for resting). However, should any shortnose sturgeon reach the powerhouse, it is unlikely they would enter the draft tubes because of the force of water exiting the tubes. Even if shortnose sturgeon were able to enter the draft tubes when the project was not operating, they would not be subject to injury from blade strikes because the configuration of the turbines has the blades nearly 20 feet above the water level of the tailwater.

We conclude that continued operation of the Deerfield and Gardners Falls Projects is not likely to adversely affect shortnose sturgeon.

4.1.1.6 Recreation and Land Use Resources

The Settlement provides for NEP to implement a Comprehensive Recreation Plan that includes installing, operating, and maintaining existing and proposed recreational facilities along the Deerfield River (Table 4-5 summarizes the proposed recreation facilities). The recreation plan was designed to recognize the recreational use zones along the Deerfield River that offer distinct recreational opportunities not found elsewhere in the river basin. For example, NEP's management goals for the Somerset use zone emphasize recreation values that are compatible with the remote wilderness character of this area. At the Readsboro/Sherman/Zoar use zone, management goals emphasize expanding opportunities for whitewater boating, fishing, and hiking. Developed to acknowledge the physical characteristics at each recreational use zone, NEP's recreation plan includes the carrying capacity and site limitations at the proposed facilities.

Recreational facilities included in NEP's plan primarily fall into three categories: 1) picnicking, 2) boating, and 3) hiking. Facilities falling under one of these categories would serve additional recreational activities, such as, hunting, fishing, and swimming. Under the proposed recreation plan, NEP would provide 14 picnic areas at the Deerfield Project with a total of 201 picnic tables (Table 4-5). Boating at the Deerfield Project is primarily concentrated at the Harriman use zone, where NEP plans to upgrade four boat launches and provide two new boat launches. NEP's trail system would consist of 45 miles of existing trails within the Deerfield Project and another 21 miles of proposed trails, providing a 38.7-mile-long uninterrupted trail from Grout Pond to Zoar Gap. In addition to providing recreation facilities, NEP intends to provide whitewater boating flow releases from the Deerfield No. 5 dam and the Fife Brook dam.

NEP's proposed recreation enhancement program involves 38 separate projects, and NEP intends to complete 14 of these projects within three years, another 16 projects within five years, and the final eight projects within 10 years of receiving a new license. New recreational amenities proposed in NEP's plan include:

- 60 new picnic tables, for a total of 215;
- 115 new grills or fire pits, for a total of 201;
- 16 new toilets, for a total of 48;
- 68 new car parking spaces at picnic sites, for a total of 645 spaces;
- 41 new car/boat trailer parking spaces, for a total of 151 spaces;
- 45 new accessible parking spaces [1]; and
- 19 new trail head parking spaces.

Based on Land and Water Associates (1993c) carrying capacity study, the proposed Deerfield Project recreation facilities would meet the projected recreation demand to the year 2010, except with regards to whitewater boating. [2] Projected growth rates by recreational activity were based on analysis of various recreational trends and projections developed for the United States, the New England Region, and the Deerfield River Basin (Table 4-6).

In most cases, the carrying capacity at the Deerfield Project recreational facilities is dependant on the amount of parking capacity available. Despite a total of 300 parking spaces at the Monroe Bridge and Fife

1 Parking spaces designed to comply with the national standards established by the Architectural and Transportation Barriers Compliance Board (*Federal Register*, Vol. 56, No. 144).

2 Carrying capacity is defined as the maximum use at recreational facilities which can be accommodated at any one time.

Table 4-5. New or improved recreation facilities along the Deerfield River, as proposed by New England Power Company (Land and Water Associates 1993a).

Types of Facilities	Existing-no Improvements needed	Existing-Improvements planned	Proposed New	Total	% of gain[1]
Camping Sites	0	0	5	5	100
Picnic Areas	2	10	2	14	86
Boat Launches	2	5	2	9[2]	77
Whitewater Put-in/take-outs	1	3	2	6	83
Portage Trails	0	1	2	3	66
Hiking/Ski Trails	4	7	5	16	75
Total Facilities	9	26	18	53	83

[1] Percentage increase in improvements and new facilities
[2] Represents 9 locations but a total of 12 actual launch ramps

Brook whitewater boating sections, Land and Water Associates concludes that the parking capacity may not sufficiently meet potential use. Along these whitewater sections, resource limitations would serve to control use pressure at these sites and prevent NEP from expanding the parking capacity beyond what is proposed. Projected use at NEP's 14 existing/proposed picnic areas would occupy at about half capacity by 2010. Further, total average projected fishing and boating demands on the Somerset, Searsburg, Harriman, and Sherman Reservoirs would not exceed the resource/parking capacity through the year 2010.

Barrier-free Access

Most of NEP's existing recreational facilities along the Deerfield River were developed prior to the Americans with Disabilities Act (ADA), and also predate the national standards for disabled access established by the Architectural and Transportation Barriers Compliance Board in 1991. While several recreational facilities at the Deerfield Project contain elements that make them partially accessible for persons with disabilities (accessible parking, toilets, *etc*.), none of the facilities conform fully to the national standards for accessibility.

As part of NEP's proposed recreation plan, they plan to improve 17 of the existing recreation facilities along the Deerfield River. Ten of these facilities would fully accommodate individuals with disabilities, and NEP would improve the remaining seven facilities to accommodate individuals with disabilities to the extent practical. Constraints that would prevent full accessibility at these seven existing sites include prohibitive cost factors associated with the natural setting of the facility (*i.e.*, terrain, slopes, soils, and other physical conditions).

Most of the disability access improvements involve designated parking, accessible pathways, picnic tables, and toilets. Additional accessibility improvements at the Harriman recreational use zone include a disabled access boat dock at the Mountain Mills East Picnic Area and an accessible beach area at the Jacksonville Picnic Area. Along the Charlemont/Mohawk Trail use zone, NEP plans to improve the Route 2 boat launch by providing an accessible fishing platform and access ramp. The only new recreation facility proposed by NEP that would lack barrier-free features is the proposed portage trail at the Deerfield No. 2 dam.

Surveys conducted for both Massachusetts' and Vermont's state recreation plans showed that residents consider recreation opportunities for individuals with disabilities as a high priority issue (MA DEM 1982; VANR 1988a). Removing architectural barriers at recreational facilities provides significant public benefits, realizing that about 43 million Americans (one in every five) have disabling conditions that interfere with their life activities (PLAE, Inc. 1993). In addition to improving recreation opportunities for individuals with disabilities, NEP's proposed facilities would also benefit elderly residents with mobility limitations.

We conclude that NEP's proposed recreation plan would provide a broad spectrum of recreation opportunities for persons with disabilities which are currently lacking along the Deerfield River. Providing barrier-free recreation facilities along the Deerfield River is particularly significant due to the project's close proximity to large population centers including Boston, Massachusetts, and New York City, New York. NEP's barrier-free recreation facilities would not only improve opportunities for people with disabilities in this region, but would also benefit the many elderly individuals in the region.

Table 4-6. Projected rates of growth in recreational activities at the Deerfield River Project, 1990-2000 and 2000-2010 (Source: Land and Water Associates 1993c).

Activity	Area of Project	% Annual Increase 1990 to 2000	% Annual Increase 2000 to 2010
Fishing	Vermont	1.25	1.5
	Massachusetts	3.5	4.0
Motor Boating	Harriman Zone	1.0	2.0
	All other Zones	0.6	0.8
Whitewater Boating	Readsboro/ Sherman/Zoar Zone	25.0 to 1996 10.0 after 1996	10.0 or until capacity reached
Picnicking	Vermont	0.6	0.9
	Massachusetts	0.7	0.9
Swimming	Harriman Zone	1.0	1.5
Sightseeing	All Use Zones	1.4	1.9
Hiking	Somerset to Zoar	3.0	4.2
	Below Zoar	2.4	3.4
X-Country Skiing	Somerset to Monroe Bridge	4.5	3.0

<u>Whitewater Boating</u>

In 1990, NEP examined the whitewater boating suitability of six reaches along the Deerfield River (Clark Management Associates, Inc. 1990). [3] Further, Land and Water Associates (1993b) conducted a whitewater boating analysis at the Harriman bypassed reach. Based on these whitewater suitability studies and related economic analysis, NEP concludes that two river reaches are best suited for scheduled whitewater boating flow releases: (1) the Monroe Bridge Section and (2) Fife Brook Section. These two reaches were selected due to their suitability for commercial whitewater outfitters; their level of difficulty and river characteristics (*i.e.*, waves, eddies, hydraulics); conflicts with aquatic biota in other reaches; their accessibility; the lack of capital improvements necessary to provide water; and the cost/benefit ratio regarding lost generation.

NEP proposes to implement a schedule of 26 weekend or holiday whitewater releases and 6 Friday whitewater releases annually from Deerfield No. 5 (Monroe Bridge Section), as specified in Table 4-7. Flow levels for these releases range from 900 to 1,100 cfs (averaging 1,000 cfs). NEP would provide these flows at a duration of at least four continuous hours on Fridays and Sundays and a duration of five hours on Saturdays.

In addition to flow releases, NEP plans to provide whitewater related facilities to enhance this resource (i.e., launch platforms, access stairs, parking areas, take-outs, changing rooms, picnic areas, and whitewater boating spectator areas). The Dunbar Brook Picnic Area currently serves as a central parking area for

[3] These six river reaches included the river reaches below Somerset; Searsburg; Deerfield No. 5; Deerfield No. 4; Deerfield No. 2; and the Fife Brook dam, which is a development of NEP's Bear Swamp Project (FERC No. 2669).

whitewater rafters and kayakers floating the Monroe Bridge Section. Here, NEP plans to improve the picnic area by providing 13 new picnic tables, 25 new fire pits or grills, an upgraded water system, new changing rooms, and a spectator trail along the Deerfield River. NEP also plans to improve the put-in area below the Deerfield No. 5 dam by providing stairs, a launch platform, and a steel rail ramp to lower rafts and kayaks to the water. At the Monroe Bridge Section boating take-out, NEP plans to gravel the path and parking area.

Table 4-7. Proposed schedule for 32 whitewater boating releases below Deerfield No. 5 dam (Source: NEP 1994b).

Month	Allocation
April	No releases
May	2 weekend days
June	5 weekend days and 2 Fridays
July	6 weekend days and 2 Fridays
August	7 weekend days and 2 Fridays
September	4 weekend days
October	2 weekend days

At the Fife Brook Section, NEP proposes to implement a schedule of 50 weekend and 56 weekday whitewater releases annually (see Table 4-8). NEP would provide a minimum flow level of 700 cfs at these releases with a duration of at least three hours. Whitewater related facilities that NEP plans for the Fife Brook Section include improving the put-in area below the Fife Brook dam by providing stone and concrete stairs, a launch platform, improved parking, and changing rooms. NEP would also improve the existing take-out above Zoar Gap by graveling the access path and adding four parking spaces.

NEP would cooperatively develop the whitewater flow release schedule with representatives from NE FLOW [4], and then issue a public notification of the anticipated flow schedule by January of each year. Finally, NEP would continue to provide their whitewater flow information telephone service; this service estimates anticipated flows below Somerset, the Deerfield No. 5 dam, the Fife Brook dam, and the Deerfield No. 2 dam.[5] The Deerfield Project WQC stipulates that NEP should also include in the whitewater flow information telephone service anticipated flows at Scarsburg. We agree.

Land and Water Associates (1993c) determined that whitewater boating use at the Monroe Bridge and Fife Brook Sections would undergo a rapid use increase over the next several years, resulting from NEP's facility improvements and scheduled flow releases. They anticipate that the Monroe Bridge Section, which is in its early stage of development as a whitewater resource, would grow at a rate of at least 25 percent per year from 1990 to 1996 and by 10 percent thereafter. The Fife Brook Section is expected to grow by a rate of 10 percent per year until it reaches its use capacity.

Summer whitewater boating opportunities are limited in the New England Region to a few rivers that have scheduled dam releases. NEP's proposed whitewater flows would include the Deerfield River among the rivers offering dependable boating opportunities during the summer (for further discussion on regional whitewater boating opportunities, see Section 3.2.5). We conclude that NEP's proposed whitewater boating enhancements would prove to offer a unique opportunity for the thousands of boaters from the nearby metropolitan areas of New York, Boston, and Albany.

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[4] New England Flow is a coalition of regional and national organizations dedicated to protecting and enhancing riparian environments in New England in order to maximize whitewater recreation opportunities.

[5] NEP's proposed mode of operations for the Deerfield Projects would continue to provide boatable flows below Somerset (especially during July and August) and below Deerfield No. 2 (when this development is generating).

Under NEP's proposal, both the Monroe Bridge and Fife Brook Sections offer high-quality whitewater runs in a highly scenic area. Because the Deerfield River offers a variety of whitewater for boaters with varying levels of skill and experience, NEP's proposed enhancements would benefit a large public segment. The concentration of quality whitewater resulting from NEP's proposal would not only make the Deerfield River a significant whitewater resource in the New England Region, but would make this resource comparable to premier whitewater areas in North Carolina, West Virginia, and Tennessee.

Table 4-8. Proposed schedule for 106 whitewater boating releases below Fife Brook dam (Source: NEP 1994b).

Month	Allocation
April	3 weeks of Wed. through Sun. releases
May	2 weeks of Wed. through Sun releases, plus 2 weeks of Sat. and Sun. releases
June	2 weeks of Wed. through Sun releases, plus 2 weeks of Sat. and Sun. releases
July	3 weeks of Wed. through Sun releases, plus 1 week of Sat. and Sun. releases
August	4 weeks of Thur. through Sun. releases
September	3 weeks of Wed. through Sun releases
October	3 weeks of Wed. through Sunday releases
Holidays	May be substituted for weekend days upon agreement before April 1 of each year

Operational Effects on Angling

The Settlement reflects a compromise river basin-wide approach, where certain reaches of the river were enhanced for whitewater boating while others enhanced fisheries and angling. For example, whitewater releases at the Monroe Bridge and Fife Brook Sections would compromise angling opportunities by affecting fisheries habitat, resulting from the magnitude and fluctuation of flows (for further discussion see Fisheries Section 4.1.1.3). Whitewater boating activities at these reaches would also displace anglers to other sections of the river, or anglers would avoid fishing these reaches during scheduled whitewater flows. NEP's proposed minimum flows for the Deerfield Project would, however, significantly enhance angling opportunities along river segments that would compromise potential whitewater boating opportunities.

Whitewater boating flow effects on angling opportunities are minimized at Monroe Bridge Section due to its relatively short length (3.5 miles) compared with other river segments, such as river reaches below the Somerset, Searsburg, Harriman, Fife Brook, and Deerfield No. 2 dams. To further minimize the effects of whitewater flow releases on fisheries and angling, NEP plans to schedule boating releases at mid-day. This schedule scenario for flows would not interfere with the majority of anglers who prefer to fish the river during the morning and evening insect hatches. Further, releases provided during the warmer mid-day hours would serve to cool the river and provide some benefits to fisheries.

NEP's minimum flow proposals to enhance fisheries below the Somerset, Searsburg, Harriman, Deerfield No. 3, and Deerfield No. 2 dams compromise boating interests since these river reaches are potential boatable segments (for further discussion on minimum flows, see Section 4.1.1.3). Based on NEP's whitewater boating suitability studies, these river segments hold potential boating opportunities, particularly Harriman's bypassed reach. While Harriman's bypassed reach was considered the second most important whitewater stretch on the river, scheduled whitewater flows at this reach would cause conflicts with aquatic biota and require significant capital costs and energy losses. [6]

Insufficient flows below the Deerfield Project developments have restricted the fishery potential and angling opportunities at these reaches (for further discussion on minimum flow effects on fisheries, see Section

[6] Providing whitewater releases at Harriman would require a capital investment to modify the dam that NEP estimates at $450,000. Whitewater opportunities at Deerfield No. 5 and Fife Brook require no initial capital cost to provide boatable flows.

4.1.1.3). Flows within the bypassed reach sections at Searsburg, Harriman, and Deerfield No. 4 are currently limited to leakage/local drainage. The total combined length of these reaches is nearly 9 miles, and under the existing conditions these reaches lack suitable angling opportunities. NEP's proposed minimum flows within these river segments would significantly improve angling opportunities.

We conclude that the NEP's proposed minimum flows and scheduled whitewater flows represent a reasonable balance among fisheries interests and whitewater boating opportunities. While whitewater boating flows would affect angling opportunities at selected reaches, angling potential would improve along significant stretches of the Deerfield River. NEP's minimum flow proposals below all the Deerfield Project developments would cumulatively enhance trout angling. Minimum flows proposed at Searsburg and Harriman, which currently lack suitable fish habitat, would particularly provide potential for high quality trout fishing.

Drawdown Effects on Recreation

Drawdowns at the Somerset and Harriman reservoirs currently affect seasonal recreation activities including lake boating, swimming, and ice-fishing. Facilities affected by these drawdowns include boat ramps, docks, and beaches. Recreational use at these reservoirs is at high levels between July and August when drawdowns are generally about 4 feet at Somerset and 6 feet at Harriman. During this period, the existing boat ramps and docks accommodate these fluctuations and reservoir drawdowns at Harriman expose beach areas without compromising swimming opportunities. In the winter months, ice fishing is the primary recreational use at these reservoirs, and winter drawdowns affect anglers due to ice shifting, cracking, and occasionally exposing open water along the shoreline.

Over a period from 1940 to 1993, average winter and summer drawdowns at Somerset were 15 feet and 5 feet, respectively, while average winter and summer drawdowns at Harriman were 42 feet and 11 feet, respectively (for further drawdown discussion, see Section 2, Project Operation). NEP proposes to continue their existing drawdown management at both the Somerset and Harriman reservoirs, except during the spring and early summer. From May 1 to July 31, NEP proposes to maintain the Somerset reservoir elevation within ± 1 foot during the common loon nesting season. At Harriman, NEP proposes to maintain the reservoir so that the water-level is stable or rising from May 1 to June 15 and ensure that the reservoir level doesn't drop more than 1 foot per day from June 16 to July 15.

While drawdowns have the potential to affect recreational use at the Somerset and Harriman Reservoirs, we conclude that NEP's reservoir management would result in minimal recreational inconveniences. Boating and swimming facilities would remain accessible during the summer months when these reservoirs receive heavy boating use. Boating facilities at these reservoirs are currently popular during the summer season, indicating their usefulness to boaters during the heavy use season. NEP's proposed boating facilities at Harriman would provide for boat docking through Labor Day when the water level is still relatively high (about 1,475 feet msl). Winter conditions would require caution among those ice fishing; however, this circumstance is generally true for most lakes in New England.

Conservation Easements

NEP voluntarily agreed to grant conservation easements on over 18,000 acres along the Deerfield River. The easements would ensure continued preservation of these lands and protect scenic, forestry, and natural resources from inappropriate development and subdivision. The majority of the lands subject to the easements are already within the Deerfield Project boundary, currently including 15,736 acres in Vermont and 941 acres in Massachusetts. Additional acreage would include 1,056 acres within the Bear Swamp Project boundary and 622 acres of river corridor lands located below Deerfield No. 2 to Stillwater and Fife Brook dam to Zoar Gap.

The conservation easements call for: (1) implementing NEP's forest and wildlife management plan, (2) providing maintenance of soil productivity; (3) conservation of water quality, wetlands, and riparian zones;

(4) sustainable yields of timber resources; (5) protection of scenic quality; (6) conservation of important habitats; and (7) continued opportunities for hunting and back country recreation.

NEP's Forest Management Guidelines are intended to ensure the continued multiple use value and productivity of the Deerfield River Basin's forestry resources. Further, NEP's forestry management guidelines include stipulations that prohibit: harvesting within specified distances of the Deerfield River, including all reservoirs; excessive cuts within the viewshed of major public areas that would impact aesthetic qualities; and clear cutting beyond specified acreages.

DOI agrees with NEP's conservation easements and their Forest Management Guidelines, as specified in the Settlement. DOI recommends implementing these measures for the protection of fish and wildlife habitat and the quality and quantity of watershed flows.

NEP's conservation easement proposal ensures protection of important nondevelopmental values within the river basin including recreation, fisheries, wildlife, and water quality. Protecting these properties from subdivision and development, the conservation easements would protect: the river basin's scenic quality, the river's water quality from sedimentation impacts, wildlife habitat from fragmentation, and preserve land and water resources that are currently accessible to the public. Shore lands subject to the easements currently retain valuable developmental potential, and the future value of these properties would likely increase due to the river basin's growing tourism industry, proximity to large population centers, and natural resources.

Protecting these properties provides a buffer zone around project waters that is consistent with the Commission's Regulations. Section 2.7 of the Commission's Regulations states, in part, that the Commission "expects licensees to acquire in fee and include within the project boundary enough land to assure optimum development of the recreational resources afforded by the project." The purpose of this Commission regulation is to preserve aesthetic qualities and ensure that the public has recreational access to project waters and surrounding lands. NEP currently owns the lands subject to the conservation easements which provide an extensive buffer zone along most of the river corridor in Vermont and significant portions of the river corridor in Massachusetts.

Finally, goals and objectives established from both Vermont's and Massachusetts' Deerfield River Comprehensive Plans are directly achieved by NEP's proposed conservation easements. Vermont's plan includes goals to restrict subdivision and development activities within the Deerfield River's East Branch watershed and within the direct drainage of Harriman Reservoir (Vermont Department of Environmental Conservation 1992). Franklin County Planning Department's Comprehensive Plan (1990) includes three of the seven goals and objectives that are pertinent to the conservation easements: (1) improve and protect water quality throughout the river basin; (2) protect open space within the river basin in order to protect habitat, and the rural character of the communities; and (3) guide residential, commercial, and industrial development through zoning and other appropriate measures to protect resources and to ensure that new development does not exceed the infrastructure of the towns.

We conclude that NEP's conservation easements along the Deerfield River ensure long-term public benefits, protecting aesthetic resources and access to project waters and surrounding land. The easements would also serve as a riparian buffer zone, protecting natural resources along the river corridor from effects related to excessive and inappropriate development. NEP's Forest Management Guidelines for properties subject to the proposed easements would continue to protect riparian zones, aesthetics, soils, aquatic, and wildlife resources.

Enhancement Fund

The Settlement proposes a Deerfield River Basin Environmental Enhancement Trust Fund (enhancement fund) in the amount of $100,000 (1994 $). A three-member committee would administer the enhancement fund and determine the investment strategy for the fund and the appropriate distribution of funds each year.[7] The committee would distribute funds to eligible projects on a 50 percent matching basis. Eligible projects for the enhancement fund would include projects that contribute to the goals of enhancing low impact recreational, environmental education, or environmental protection opportunities directly related to the Deerfield River watershed. While NEP's proposed recreation plan would meet existing recreational demands in the river basin, the enhancement fund proposal was designed to meet unidentified and unforeseen needs in the future, in response to changing societal needs. As discussed elsewhere in this document, we find that other terms of NEP's proposal and the Settlement provide an appropriate level of recreational enhancement. However, NEP agrees to provide the enhancement fund and parties to the Settlement desire that this measure be made a part of the license. The Commission has included measures in a license agreed to in a settlement but beyond those required by the comprehensive development standard of Section 10(a)(1) of the FPA.[8] We therefore recommend that the enhancement fund be included in any license issued together with the terms needed to enable enforcement of the measure.

Recreation Resources Summary

We find that NEP's proposed recreation plan provides the opportunity to enhance a diversity of recreational activities along the Deerfield River and represents a balance of competing needs. Implementing the recreation plan would continue to protect the remote wilderness character at the river basin's headwaters, while expanding boating, picnicking, and angling opportunities along more heavily used reaches. NEP's proposed trail system would cumulatively benefit hiking opportunities within the river basin by improving access to trail heads, upgrading an existing 45 miles of trails, and developing an additional 21 miles of trails.

NEP's enhancements would cumulatively enhance recreational opportunities for individuals with disabilities by providing barrier-free picnicking, boating, and angling facilities that are currently limited along the river. Whitewater boating use along the Deerfield River has significantly grown since NEP's initial whitewater releases in 1991, and NEP's proposed release schedule would cumulatively benefit this resource. Implementing NEP's proposed minimum flows would cumulatively enhance angling opportunities along the Deerfield River by significantly improving trout habitat within the Deerfield Project's bypassed reaches. Finally, we find that NEP's proposed conservation easements would cumulatively benefit recreational resources by ensuring long-term access to project lands and waters, while protecting natural resources along the river's corridor.

4.1.1.7 Aesthetic Resources

NEP's Settlement would affect aesthetic resources as a result of implementing their proposed reservoir drawdown management, minimum flows, land management practices, and construction activities.

Harriman and Somerset reservoirs are significant aesthetic resources within the river basin due to their large surface area, undeveloped shore land, and the surrounding topography. Scenic views at these reservoirs are currently disrupted by drawdowns that expose substrate along the shoreline. The current dewatered zone for Harriman is defined as the area between elevation 1,416.3 and 1,491.66 feet msl while the dewatered zone for Somerset is defined as the area between elevation 2,100.44 and 2,131.5 feet msl (NEP 1994a). Average drawdowns at Harriman and Somerset, however, during the peak summer recreation period (June 1 to August 30) are about 6 feet and 4 feet, respectively. During the spring, views at the reservoirs are typically

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[7] The Enhancement Fund Committee would include a representative of NEP, a designee of the Secretary of the State of VANR, and a designee of the Secretary of Massachusetts Executive Office of Environmental Affairs.

[8] See *City of Seattle, Washington*, 75 FERC ¶ 61,319.

characterized by full-reservoir conditions, while typical fall drawdowns offer views characterized by extensive exposed shoreline areas. [9]

While NEP's proposed drawdown management plan would continue to affect scenic views at Harriman and Somerset, NEP would minimize these aesthetic effects by limiting drawdowns during the spring and early summer (see Section 4.1.1.2 regarding these proposed drawdown limits). We further conclude that drawdown effects on aesthetic resources at these reservoirs are minimized because the maximum drawdown limits occur during the winter months. Snow and ice cover the exposed shoreline during extreme drawdowns and recreational use is limited at these reservoirs during the winter period.

NEP (1994a) conducted an aesthetic evaluation of minimum flows that considered the (1) visual observation, (2) audible qualities of flows, (3) the degree of public exposure, (4) the surrounding landscape, and (5) the cost of providing flows. Observations were made from two locations below each of the Deerfield Project dams and below the Fife Brook dam. Viewing locations were considered the most likely points for public exposure, and NEP's analysis included observing a range of flows at the selected locations. In all cases, NEP concluded that flows of 0.31 cubic feet per second per square mile of drainage (cfsm) would adequately enhance aesthetic views below each development. NEP's minimum flow proposal generally matches or exceeds 0.31 cfsm (for further discussion on minimum flows, see Section 4.1.1.2).

Upon reviewing NEP's aesthetic evaluation video coverage, we find that views of the Deerfield Project's bypassed reach segments under existing conditions often lack defined characteristics, turbulence, riffles, or aeration. Further, the viewshed along river sections, where flows are currently limited to leakage and local drainage provides a wetted appearance with dewatered sections of boulder and gravel substrate. These river sections include the bypassed reaches at Searsburg, Harriman, Deerfield No. 4, and Deerfield No. 3.

We conclude that NEP's proposal to provide minimum flows at these developments would cumulatively enhance scenic views of the Deerfield River. Likewise, NEP's proposal to increase minimum flows at Somerset, Deerfield No. 5, Deerfield No. 2, and Bear Swamp Project's Fife Brook Dam would further benefit the aesthetic views of the Deerfield River. Based on NEP's aesthetic evaluation video, flows above NEP's minimum flows generally provides similar visual/audible conditions and would provide minimal incremental gain in aesthetic quality.

We also conclude that NEP's proposed conservation easements along the Deerfield River would cumulatively benefit aesthetic resources. This extensive buffer zone, that includes a significant portion of the river corridor in both Vermont and Massachusetts, would prevent inappropriate development along the Deerfield River and protect the river basin's scenic views (for further discussion on NEP's Conservation Easements, see Section 4.1.1.6).

Finally, project-related construction activities that would affect aesthetic resources include developing NEP's proposed recreation enhancements and installing fish passage facilities at the Deerfield Nos. 2, 3, and four developments. Implementing these proposed measures would disrupt the viewshed at the localized sites; however, we conclude that these aesthetic effects are short-term and minor. NEP proposes no new development at the Deerfield Project that would affect aesthetic resources, in addition to the above mentioned enhancements. Since 1912, the project-related structures have been part of the river basin's landscape and continued maintenance and operation of these facilities would not result in adverse aesthetic effects.

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[9] Maximum drawdown limits at the Harriman and Somerset reservoirs occur during the winter, where drawdowns levels are directly related to the forecast for runoff (calculated by water content in the snow fall and average anticipated precipitation).

4.1.1.8 Cultural Resources

Historic architectural properties

NEP proposes to prepare and implement a CRMP in consultation with the Vermont and Massachusetts SHPOs (for further discussion on NEP's cultural resource measures see Section 2.2.1). Inasmuch as the Deerfield Project is a potential historic district, issuing a license to continue operating and maintaining the Project's works under the protection afforded by Section 106 of the NHPA, might generally be considered to have a beneficial effect on the historic integrity of those project features which are contributing elements of the potential historic district (for further discussion of cultural resource section 3.3.1.8).

Prehistoric and historic archeological resources

NEP's Phase 1A and Supplemental Phase 1A reports contain suggestions concerning potential (historic) archeological districts at the eight project developments, and recommendations for a Phase 1B survey as the next step in identifying and taking into account National Register-eligible archeological properties which may be affected by the project. Project operation, project-related construction, including fish passage facilities and improvement of recreational facilities, and recreational use at all eight of the Deerfield Project developments have the potential to cause adverse effects on prehistoric and historic archeological resources which may be present in the Deerfield Project's area of potential effect. Several factors can potentially threaten, compromise, or destroy the integrity of prehistoric and historic archeological resources at the Deerfield Project.

Prehistoric and historic archeological resources along project river reaches can be subjected to natural bank erosion. Operation-related erosion and other effects may also occur along river and reservoir shorelines and within reservoir drawdown zones. Proposed modifications to project operation should not cause any major threat to such sites along the river reaches; flows in those reaches under the existing conditions and proposed flow regimes are less than high flows which would otherwise occur under unregulated conditions. Although most project operation-related reservoir and drawdown erosion probably took place during the first 20 years following creation of the reservoir pools (Stetson-Harza 1991a), any archeological resources along reservoir shorelines would continue to be subjected to project-related erosion that may occur due to reservoir pool fluctuations, wave action, and ice scouring.

Mining of sites, that were potentially used by native Americans, by NEP or other entities for sand and gravel can destroy archeological resources. Grading of access roads and other land-clearing and ground-disturbing activities associated with logging on project lands can also affect archeological resources.

Our Recommendation: In order to protect archeological and historic resources, we are developing a PA, pursuant to Section 106 of the NHPA and in consultation with the Council, the Massachusetts SHPO, the Vermont SHPO, and NEP. The PA would contain a CRMP and include monitoring of historical and archeological sites. We would execute the PA with the Council, the Massachusetts SHPO, and the Vermont SHPO.

The PA would require NEP to design a plan to minimize adverse effects to the historic integrity of those project features which are contributing elements of the potential historic district. It would also require NEP to develop a CRMP which would include a mechanism for follow-through by means of Phase 1B and other studies necessary for identifying and mitigating adverse effects to National Register-eligible prehistoric and historic archeological resources that may result from current and proposed project operation, recreational construction, and recreational use, and, ultimately, for any future proposals, as well. We recommend, therefore, that any license issued for the Deerfield Project incorporate the PA and its stipulations.

Summary of Cultural Effects

There would be unavoidable adverse effects on cultural resources at the Deerfield Project. However, mitigation of impacts to those resources would be provided through implementation of measures such as those proposed by NEP (see Section 2.2.1) and which would be included in the stipulations of the Deerfield Project PA .

4.1.1.9 Socioeconomic Resources

Land and Water Associates (1991) estimates that existing recreational use at the Deerfield Project contributes $7.3 million annually to the river basin's local economy. This economic value would significantly increase as a result of NEP's proposed enhancements. Specifically, NEP's proposed whitewater boating flow releases, minimum flow releases, and recreational facility enhancements would increase the recreational use capacity at the Deerfield Project.

Whitewater boating use in 1991 on the Monroe Bridge Section during six scheduled flow releases averaged 260 boaters per release and use on Fife Brook Section during 64 releases averaged 111 boaters per release (see Recreation and Land use, Section 3.3.1.6). Land and Water Associates (1991) estimates the net present value over the license term for one boating day on the Monroe Bridge and Fife Brook Sections at $251 and $205, respectively. Based on the average use per scheduled release in 1991, we estimate the annual value of whitewater boating on the Monroe Bridge Section with NEP's proposed 32 releases at $2,088,320. Our estimated value for the Fife Brook Section with NEP's proposed 106 scheduled releases is $2,412,030. These values are likely conservative since future use at the Monroe Bridge Section is expected to increase at a rate of at least 25 percent per year from 1990 to 1996, while boating use at Fife Brook is expected to grow by a rate of 10 percent per year.

Angling use is currently the most prominent recreational use at the Deerfield Project and contributes annually over $1,395,000 to the local economy (1991 dollars). NEP's proposed minimum flows would provide flows within about 9 miles of bypassed reach segments that currently lack suitable habitat for the trout fishery (for further discussion, see Fisheries Section 4.1.1.3). These river sections would offer additional trout angling opportunities that are not available under NEP's current mode of operation. NEP's proposed recreational facilities would further enhance angling opportunities in the river basin by improving access to the river and increasing the parking and boating capacity. We expect that the quality and quantity of angling opportunities on the Deerfield River would significantly increase the economic value of this resource, particularly since angling use is expected to increase along the Deerfield River.

Windham Regional Commission, by letter dated October 5, 1994, expressed concern that NEP's proposed conservation easements would possibly result in a loss of property tax revenues for the affected communities (letter from Melissa M. Reichert, Senior Planner, Windham Regional Commission, Brattleboro, Vermont). NEP municipal property tax payments for the Deerfield Project amount to about $462,161 in Massachusetts and $1,237,509 in Vermont (1992 dollars). Further, NEP's municipal property tax payments for the Bear Swamp Project amount to about $1,162,207 (1992 dollars).

While NEP's conservation easement proposal could potentially decrease the valuation of their land holdings due to use restrictions, we conclude that the value of these easements would offset any loss in municipal tax revenues. NEP's proposed conservation easements are critical to ensure the protection of scenic, aquatic, terrestrial, and recreational resources within the Deerfield River Basin (for further discussion on the conservation easements, see Section 4.1.1.6). NEP clarified, however, during the Deerfield Project scoping meeting that they do not intend to request any reassessment of the Deerfield Project's property value as a result of the proposed conservation easements (FERC 1994).

We conclude that NEP's proposed mode of operation and recreational enhancements at the Deerfield Project would cumulatively increase recreational opportunities. Increased recreational use would yield greater revenue sources to the river basin's tourism industry. Tourism plays a major role in the Deerfield River Basin economy, and currently the tourism industry relies heavily on winter recreational use, including alpine skiing and cross-country skiing. NEP's proposed minimum flows for fisheries and whitewater boating flows could significantly benefit the tourism industry by expanding recreation use in the river basin during the summer season

4.1.2 Gardners Falls

4.1.2.1 Geology and Soils

Continued operation of the Gardners Falls project as proposed by WMEC would not cause any new erosion, sediment runoff, or shoreline instability of the impoundment shorelines or the bypassed reach and downstream river channels. The proposed minimum flow releases from the dam through the boulder-lined bypassed reach would be negligible compared to the high flows that flow through the reach without effect under the project's current operation, and thus would not cause erosion or instability of the bypassed reach channel and banks.

No ground-disturbing and land-clearing activities would occur during construction of the downstream fish passage facility for out-migrating Atlantic salmon smolts. All construction activities would take place on the dam crest and downstream face adjacent to right abutment of the dam.

Implementation of WMEC's (1993) proposed "Soil Erosion and Sediment Control Plan" would minimize erosion and sediment runoff caused by ground-disturbing and land-clearing activities during construction and enhancement of the proposed recreation facilities. Only minor, short-term effects would occur during and immediately following the construction period.

4.1.2.2 Water quality and quantity

Gardners Falls Reservoir

There are no proposed changes to the existing operation of the Deerfield No. 3 development that would affect water quality in the reservoir. The project would continue to operate in a daily peaking mode, in response to inflow from the Deerfield No. 3 development. Since the operation of the Gardners Falls Project closely follows the operation of Deerfield No. 3 upstream, we expect similar water quality enhancements from the Settlement flow re-allocations that would occur upstream. Existing project operation doesn't affect temperature, DO, or effluent assimilation in the Deerfield River, and we expect no change in project induced effects. We believe the continued operation of the project, as it has been operated, would not reduce existing water quality and would continue to meet state water quality standards.

Bypassed reach and stream reach immediately below the powerhouse

Presently, there is no required minimum flow release at Gardners Falls, and about 80 percent of the time only leakage of 30 to 50 cfs is available.

WMEC proposes to release a 50 cfs minimum flow into the bypassed reach through an automated gated structure that would be built in the crest of the dam. WMEC also proposes to release a 100 cfs supplemental flow from a sluice gate near the powerhouse during April, May, and June of each year to enhance the existing spring and early summer put-and-take trout fishery established seasonally below the powerhouse. WMEC would give priority to the 50 cfs bypass reach minimum flow, with the secondary priority being the release of supplemental flows at the powerhouse sluice gate during non-generation.

The proposed release of a minimum flow at the dam and during April through June at the powerhouse, should slightly enhance water quality in the bypass and the stream reach below the powerhouse. We expect slight reductions in water temperature below the dam, especially during high solar radiation low-flow summer periods. Upstream water quality improvement from Settlement enhancements would be passed downstream, especially during the summer months when river flows are low and temperatures are normally elevated. We believe WMEC's proposed minimum flows would slightly improve water quality and would continue to meet state water quality standards for the Project area.

4.1.2.3 Fishery Resources

Effects of project operation on fish habitat in the reservoir

As discussed in the Water Quality section above, WMEC doesn't propose to change how the project is operated. Therefore, the water levels in the reservoir would continue to fluctuate over a 1.8-foot range during peaking operations. WMEC's proposed minimum flow releases at the dam and at the powerhouse would also not change the existing fluctuations in water levels in the reservoir.

Daily water level drawdowns affect spawning habitat by dewatering fish eggs, stranding fry and juvenile fish, and subjecting them to increased predation caused by reducing cover (Hunter 1992; Cushman 1985). Some of these impacts would continue to occur to resident fish in varying degrees under the proposed operation of the project. However, MA DFW's present management of the reservoir for a put-and-take trout fishery would not be adversely impacted by the continued daily drawdowns.

As was mentioned earlier, MA DFW doesn't manage the warmwater fish community in the reservoir. The present warmwater community doesn't appear to be robust, based on the relatively small numbers of fish collected in the samples. In addition, there are several other factors that lead staff to believe that the 1.8-foot daily drawdowns would not be detrimental to aquatic resources in the reservoir. The data presented in the bathymetric mapping of the reservoir, the paucity of rooted aquatic vegetation and cover, and the extensive shoal areas comprising nearly half of the reservoir are other characteristics of the reservoir that are not conducive to productive fish communities. The MA DFW and USFWS similarly conclude that reservoir fluctuations would not cause impacts to fishery resources because of the narrow band of shoreline affected by the changes in elevation (Minutes of a meeting held by Northeast Utilities on December 20, 1989, in Westboro, Massachusetts).

Effects of flow releases on fish habitat in the bypassed reach

WMEC has proposed to release a minimum flow of 50 cfs into the bypassed reach. The resource agencies recommended the establishment of a minimum flow in the bypassed reach to protect and enhance fish habitat there.

The amount of fishery habitat in the 1,400-foot-long bypassed reach has been reduced over the years by project operation. The heavily regulated flows associated with peaking have curtailed the development of self-sustaining fish populations in the bypassed reach. There are currently no required minimum flow releases to the bypassed reach. Flows in the bypassed reach are subject to greatly reduced flows during the low-flow periods of July through September when flows consist of leakage of from 30 to 50 cfs through the flashboards and occasional spillage over the dam during heavy runoff from rainstorms and seasonally from winter snowmelt.

In June 1990 an IFIM study was conducted in the Gardners Falls Project bypassed reach in conjunction with the resource agencies (USFWS and MA DFW) who agreed with the study methodologies, study sites and transects, and the selection of representative fish and life stages. Two reaches were analyzed separately in the IFIM because of their inherent differences in physical characteristics and sources of inflow. All life stages of brown trout, juvenile Atlantic salmon, and adult rainbow trout were selected by the team to be representative fish for the IFIM study. The completed IFIM report was given to the resource agencies in October 1990.

However, MA DFW modified their Deerfield River Fisheries Management Plan in 1991 to include managing the Deerfield River to maintain self-sustaining populations of brown trout. In December 1991, WMEC agreed to modify the results of the 1990 IFIM study by including data for all life stage of brown trout.

The IFIM study assessed habitat available over a range of flows from 50 to 500 cfs for the bypassed reach and downstream from the powerhouse. Three types of habitat were included in the transects selected by the team for the bypassed reach: steep rapids, pool/run, and run. Figure 4-16 shows the total WUA for all three species for all transects combined for various flows in the bypassed reach.

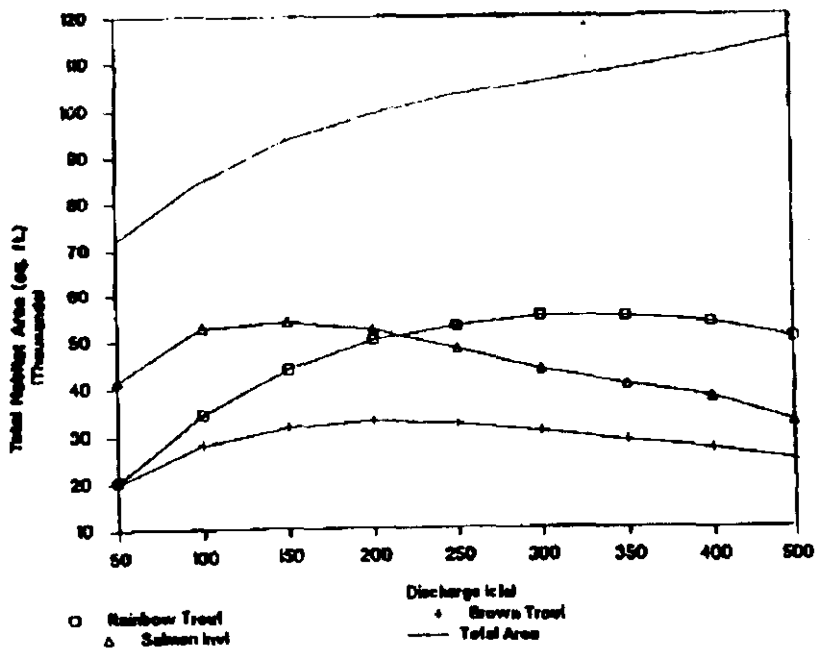

Figure 4-16. Weighted usable area (WUA) versus flows for adult brown and rainbow trout and juvenile Atlantic salmon in the bypassed reach for the Gardners Falls Project (Source: KA 1990).

For adult rainbow trout and brown trout, maximum WUA is achieved at flows of around 300 and 200 cfs respectively in the bypassed reach (Figure 4-16). Maximum WUA for juveniles of Atlantic salmon occurs in the bypassed reach at flows of about 150 cfs (Figure 4-16). Maximum WUA for brown trout juveniles and fry occurred in the bypassed reach at flows of 150 cfs and 50 cfs respectively (Figure 4-17). Excluding brown trout fry, and taking an average of those flows that created maximum WUA for each species and life stage, a flow of around 200 cfs would provide the most WUA overall for the bypassed reach.

WMEC's proposal to release a minimum flow of 50 cfs into the bypassed reach would provide about 79, 61, and 37 percent of the maximum WUA for Atlantic salmon juveniles, and adult brown and rainbow trout, respectively. The 50 cfs flow would also provide 100 percent of the maximum WUA for brown trout fry and 73 percent of the maximum WUA for juvenile brown trout.

Rainbow and brown trout

Rainbow and brown trout are stocked in the Gardners Falls reservoir and in the Wilcox Hollow area of the Deerfield No. 2 development reservoir located downstream from the powerhouse. The MA DFW stocks these two areas from April through June each year to support a put-and-take fishery. Some of these stocked trout are subject to being washed into the bypassed reach during periods of spill. Other trout stocked in the area below the powerhouse could enter the lower portion of the bypassed reach under favorable water levels. There is no proposal to stock trout in the bypassed reach. All stocked trout are usually caught and removed from the reservoir and powerhouse reach by July.

WMEC says that the bypassed reach is seldom fished with the exception of the pool at the base of the dam. However, WMEC believes there may be an increased interest among anglers to fish in the bypassed reach once there is a minimum flow established there.

The resource agencies have recommended a minimum flow of 150 cfs into the bypassed reach which would provide 80 and 96 percent, respectively of the maximum WUA for brown and rainbow trout in the bypass.

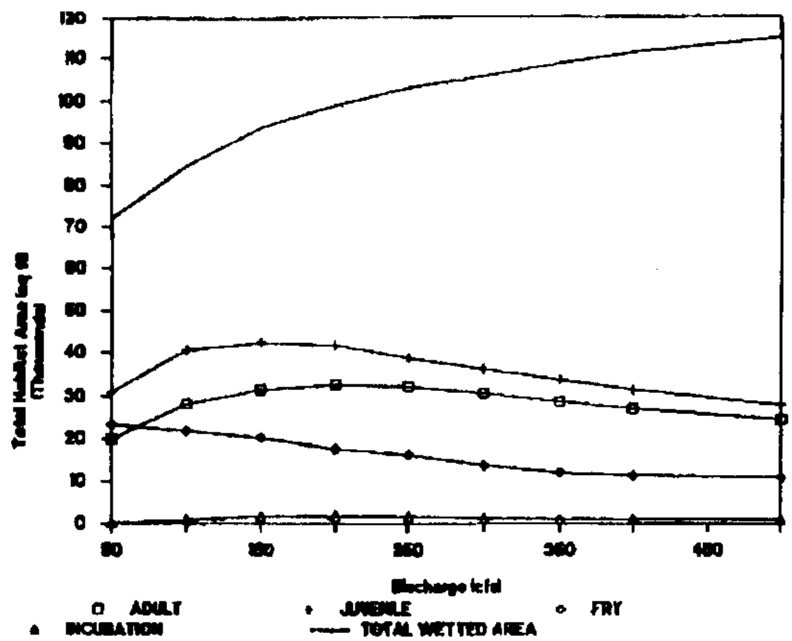

Figure 4-17 Weighted usable area (WUA) versus flows for all life stages of brown trout in the bypassed reach at Gardners Falls Project (Source: KA 1992).

The staff expects minimal use of the bypassed reach by brown or rainbow trout and believes that the spatial partitioning of placing more emphasis on managing the stream reach below the powerhouse is more important for brown and rainbow trout than is their potential use of the bypassed reach. The 50 cfs minimum flow to the bypassed reach would maintain water levels in existing pools in the bypassed reach and would provide some habitat for brown trout, which are likely to be the primary users because they are more tolerant of warmer water temperatures than are rainbow trout. Brown trout are known to dwell in both riverine and lacustrine habitats and to prefer deep, quiet pools, adjacent to slower moving sections of streams (Scarola 1973, Raleigh, *et al.* 1986). The large, deep pools in the bypassed reach would provide cover for brown trout under any flow scenario.

Juvenile brown trout have not been reported in the bypassed reach. Any juveniles present in the bypassed reach would likely enter the bypassed reach as downstream migrants from successful reproduction occurring upstream as there is little to no spawning habitat in the bypassed reach. Any juvenile brown trout reaching the bypassed reach would have fair cover and habitat (73 percent of maximum WUA) with a minimum flow release of 50 cfs. With a flow release of 150 cfs, juvenile brown trout would have access to 100 percent of the maximum WUA.

As we mentioned above, there is little favorable substrate in the bypassed reach to support brown trout fry production. Over the years, the substrate has been scoured in the bypassed reach by high velocities and turbulence caused by historically high channel flows. Therefore, few brown trout fry are expected to occupy the bypassed reach. Some brown trout fry could wash into the bypassed reach from upstream areas although this number is expected to be small because of the distances travelled and predation mortality enroute. For these reasons, we don't believe brown trout fry management in the bypassed reach is worthwhile and efforts to establish brown trout should be targeted for the area below the powerhouse.

Summer temperatures may limit the use of the area by trout species during that time (KA 1990b). As discussed in the water quality section (Section 3.3.2.2), water temperatures reached 23° C in the bypassed reach during sampling in August 1989. The staff can speculate that there might be some improvement in water temperatures caused by a release of minimum flows throughout the Deerfield River under any new license conditions. However, it seems unlikely that there would be more than a degree or two drop in overall temperatures, if that, during the summer months, which is the crucial time for stocked trout to hold over until the water cools in the fall or for resident trout species to survive increasing temperatures. Optimum temperatures for brown trout range from 65° to 75° F (18.3° to 23.9°C) (Brynildson *et al.* 1963) whereas rainbow trout prefer waters with temperatures less than 70 ° F (21°C) (Scott and Crossman 1973). Some researchers show rainbow trout surviving in water temperatures ranging from 0° to 25° C (32° and 77° F) with the optimal range of from 12° to 18° C (53.6 to 64.4°F) (Raleigh *et al.* 1986). However, trout exposed to higher water temperatures, should have access to areas where they can retreat to cooler, well-oxygenated water when they become temperature-stressed. The staff believes the MA DFW is being optimistic about establishing a self-sustaining population of brown trout in the Gardners Falls Project bypassed reach. The staff believes that the best potential for establishing a self-sustaining population of brown trout in the area would be in the area below the powerhouse and in the Deerfield No. 2 development reservoir, where water temperatures were 3 degrees cooler (20°C) than they were in the bypassed reach on the same sampling date and where there is more habitat and areas to escape warmer waters.

Atlantic salmon parr

The IFIM study determined that optimum habitat would occur in the bypassed reach and below the powerhouse at flows of around 150 to 200 cfs for Atlantic salmon juveniles. WMEC's proposal to release 50 cfs at the dam and 100 cfs at the powerhouse from April through June would provide 79 percent of maximum habitat in the bypassed reach and roughly 100 percent of maximum habitat for the period of April through June below the powerhouse (because the minimum flows reaching the area would be 150 cfs). The resource agencies proposal of 150 cfs in the bypassed reach would provide for 100 percent of the maximum habitat for Atlantic salmon juveniles in the bypassed reach and below the powerhouse.

There is no single flow release into the bypassed reach or below the powerhouse that would provide optimum habitat for all fish species and life stages. In addition, there are three different fishery management goals that the MA DFW is pursuing for the project area (including the bypassed reach, the Gardners Falls reservoir, and the Deerfield River from the dam downstream to the Deerfield No. 2 development): (1) provide rearing and nursery habitat for Atlantic salmon parr, (2) support a put-and take fishery in the reservoir and below the powerhouse, and (3) manage the river for a self-sustaining population of brown trout. These objectives can also present conflicts in deciding which minimum flows should be released. For example, flows released in the bypassed reach that might optimize habitat for rainbow trout or brown trout are not compatible with flows needed for Atlantic salmon juveniles (i.e., brown and rainbow trout adults need flows of 200 to 300 cfs while Atlantic salmon juveniles need flows of around 150 cfs).

The staff has assumed the priority of the resource agencies fisheries objectives are in the order they are listed above: first priority: salmon rearing, second priority: continue a put-and-take fishery, and third priority: establishment of a self-sustaining population of brown trout in the Deerfield River in the project area. With these priorities in mind, the solution for determining the best minimum flow releases is to spatially partition the project into two areas for management purposes. With spatial partitioning it becomes evident that the 1,400 foot bypassed reach is more suitable for salmon management and the stream reach below the powerhouse is more suitable for trout management. Spatial partitioning of optimized habitat may also serve to reduce competition among brown trout, rainbow trout, and Atlantic salmon parr. It has been documented for similar tributaries of the Connecticut River drainage (Hearn and Kynard 1986). There are specific times of the year when all three species and life stages would occupy the same areas (*i.e.*, April, May, and June).

There is no proposal to stock Atlantic salmon fry or juveniles in the bypassed reach. Atlantic salmon juveniles would reach the bypassed reach from stockings made upstream. The numbers of juveniles reaching the site would depend on many variables including the numbers of fish stocked upstream, the facilities in place for downstream passage of these fish, and predation and other loss factors. The staff believes that most juvenile Atlantic salmon reaching the bypassed reach would likely pass through the area in their downstream movements rather than remain in the area for any length of time because of the relatively short length of the bypassed reach.

The substrate composition of the bypassed reach is a mosaic of well-scoured ledges, boulders, rocks of about 12 inches in diameter, and cobble that is typical of free-stone, high gradient New England streams. There are no deposits of fines or gravels, except as small patches in the back eddies of some boulders (KA 1990b). Juvenile Atlantic salmon prefer this kind of habitat and would likely do well here for the short period they may be present during their seasonal passage through the area. It is doubtful that juvenile Atlantic salmon would remain in the area through the winter as winter juvenile habitat appears to be limited based on the general criteria described by Cunjak (1988).

A flow of 50 cfs into the Gardners Falls bypassed reach would provide about 79 percent of this type of habitat preferred by juvenile Atlantic salmon. The 150 cfs proposed by the resource agencies would provide about 21 percent more habitat for juvenile Atlantic salmon than would the flow of 50 cfs, but the staff believes a flow of 50 cfs would adequately protect juveniles reaching the area and based on the facts discussed above. In addition, we note that there would continue to be a leakage flow of from 30 to 50 cfs through the flashboards into the bypassed reach. In effect, the minimum flow could be between 80 and 100 cfs during certain times of the year and could raise the maximum WUA well above 79 percent for juvenile Atlantic salmon. However, since this leakage flow is uncertain and unreliable, we have not included this flow in calculating what flows are needed for juvenile Atlantic salmon and we continue to believe that the 50 cfs minimum flow release proposed by WMEC would provide adequate juvenile Atlantic salmon habitat in the bypassed reach. The most protective fishery resource flow would be provided by the 150 cfs (or inflow) minimum flow requirement required by the WQC and we recommend that flow be required by any license issued for the project.

Effects of Project Operation on the Area Downstream of Powerhouse

The IFIM study conducted below the powerhouse was composed of two sections: a rapids area extending from the outlet of the tailwater pool downstream to the toe of the rapids (total length of study area was about a 300-foot-long section); and an area constantly covered by the backwater of the Deerfield No. 2 development and considered to be deep pool habitat. The rapids portion of the study area experiences daily inundation by the Deerfield No. 2 development reservoir from June through October when flashboards are employed and a daily peaking regime changes the study site from lotic to lacustrine.

Trout

The amount of fishery habitat created by various flows in the study reach below the powerhouse, as determined by the IFIM study, were similar to the results determined for the bypassed reach. For adult rainbow trout and brown trout, maximum WUA is achieved at flows of around 600 and 350 cfs. However, the primary gains in WUA occur at 250 cfs for both rainbow trout and brown trout, which is similar to what was determined for the bypassed reach for both species (i.e., 300 cfs for rainbow trout and 200 cfs for brown trout). WUA for Atlantic salmon juveniles (parr) peaked at a flow of 300 cfs but the peak was essentially reached at a flow of around 150 to 200 cfs because there is less than a 2 percent gain between 200 and 300 cfs (the bypassed reach maximum WUA was achieved at 150 cfs for Atlantic salmon). WUA for brown trout juveniles and fry peaked at flows of around 250 and 100 cfs respectively. There was a definite increase in WUA for juvenile brown trout that occurred at 100 cfs and basically little gains in habitat between 150 and 250 cfs (the maximum WUA for the bypassed reach for juvenile brown trout was 150 cfs). For brown trout fry there was essentially no change in the amount of habitat with flows ranging from 50 to 200 cfs which is similar to habitat that would be created under the 50 cfs where maximum habitat was created at flows less than 50 cfs for the bypassed reach.

Based on some protocols established by the team preparing the IFIM study, the suitability index curves used in the IFIM study had some site-specific "cover-conditional" velocity criteria for rainbow trout and brown trout that included study cells that had "abundant refuge" and "few refuge" that referred to the presence or absence of cover. About 41 percent of the study area vertical measurements were comprised of "few" refuge habitat and 59 percent were comprised of "abundant" refuge habitat. Prorating the difference between the flows that would provide the highest WUA for "abundant" refuges with those with the highest WUA for "few" refuges would determine the optimal flow. Based on this methodology, optimal flows of from 260 to 310 cfs were determined for adult brown trout and a flow of 370 cfs was determined for adult rainbow trout for the study reach below the powerhouse.

The staff doesn't believe that a year round minimum flow of 150 cfs is needed at the powerhouse to support the put-and-take trout fishery or to establish a self-sustaining brown trout population. WMEC's proposal to release supplemental flows of 100 cfs during the season when trout are stocked in the area below the powerhouse would be beneficial to trout. A flow of 150 cfs would provide 82 and 68 percent of the maximum WUA for brown trout and rainbow trout, respectively in the area below the powerhouse. Probably the biggest benefit to the trout resources from the 100 cfs supplemental or the 150 cfs release would be the maintenance of better water quality that should help to reduce water temperatures in the area.

Salmon

The supplemental flow release of 100 cfs at the powerhouse would provide additional habitat for juvenile Atlantic salmon and improve downstream passage during the April through June movement for the area below the powerhouse. However, juvenile Atlantic salmon prefer a riverine environment and the area below the powerhouse has backup waters from the Deerfield No. 2 development, creating a pond environment that would subject the fish to increased predation, seasonally, from the stocking of trout at Wilcox Hollow. However, the combined flows of 50 cfs from the bypassed reach and 100 cfs from the powerhouse should provide adequate habitat to protect juvenile Atlantic salmon.

Summary

Our analysis of the flow recommendation for the bypassed reach and area below the powerhouse takes into consideration the results of the IFIM study, the biology of the species being evaluated, the agency fisheries management priorities for the project area, and characteristics and usage of the Deerfield River in the project vicinity. Our final recommendations concerning flows for the bypassed reach are discussed in the Comprehensive Development and Recommended Alternative section.

Fish Passage

Atlantic salmon have been stocked in the Deerfield River Basin since 1983. More extensive stocking of Atlantic salmon will be initiated basin-wide as soon as there are available young salmon from brood stocks (letter from Joseph Bergin, Aquatic Biologist, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts to R.A. Reckert, Vice President, Northeast Utilities, Hartford, Connecticut, dated May 12, 1989). MA DFW personnel state that increased stocking of Atlantic salmon will occur soon. The closest stocking of young Atlantic salmon near the Gardners Falls Project occurred in 1995 in the mainstem of the Deerfield River upstream from the Deerfield No. 4 development. The Gardners Falls Project has the potential to adversely affect the free downstream movement of any Atlantic salmon smolts reaching the project because the dam would slow their movements and there is potential for entrainment losses. There is no data indicating how many Atlantic salmon smolts currently pass through the Gardners Falls Project area.

Downstream passage of anadromous and resident fish past hydroelectric projects includes entrainment of fish through turbines. Mortality of juvenile salmonids passing through Francis-type turbines (which are present at the Gardners Falls Project) is about 10 percent, although site-specific conditions and sampling methods influence mortality estimates at each project (Stone & Webster Environmental & Technology Services 1992).

DOI and MA DFW have recommended that downstream Atlantic salmon smolt passage facilities be developed at the Gardners Falls Project and that accompanying study plans also be developed to evaluate their effectiveness. DOI also recommended that the design and construction schedule for the passage facility be submitted within four months from the issuance date of the license and that the facility be operational within two years after issuing the license. DOI has also recommended that once the passage facility is operational, that it should be operated from April 1 through June 15, and from September 15 through November 15 to accommodate the downstream movement of smolts. DOI has reserved their authority, under Section 18 of the FPA, to prescribe upstream fish passage facilities at the Gardners Falls Project in the future, if and when they are needed.

WMEC has proposed to install downstream fish passage facilities for Atlantic salmon juveniles that include floating louvers and a bypass system. WMEC has proposed to install an automatic gate structure in the crest of the dam to provide a minimum flow to the bypassed reach and a flume to direct flows from the gate to a pool at the base of the dam. This minimum flow gate would provide for the seasonal downstream passage of Atlantic salmon smolts and would also be the point for minimum flow releases into the bypassed reach. The smolts would be guided to the gates by a floating louvre array installed upstream of the canal intake.

A louvre and bypass system has worked effectively in bypassing salmon smolts in the canal system for the Holyoke Project (FERC No. 2004) located on the Connecticut River, in Massachusetts. However, the successful use of a louvre and bypassed system outside the entrance to a power canal has not been proven. A similar use of a louver system outside an intake to a power canal is also proposed for two other hydropower projects in the New England area in 1995 (*i.e.*, Eastman Falls (FERC No. 2457) and Garvins Falls (FERC No. 1893) Projects). WMEC has discussed their conceptual downstream fish passage plan with USFWS and MA DFW during the consultation phase of license preparation. The USFWS expressed concern that louvers placed outside the entrance to the power canal may not be an effective passage solution but have agreed to their use with the bypass opening pending the installation of permanent downstream passage facilities.

WMEC's installation of their proposed downstream fish passage facility should provide for the safe downstream passage of Atlantic salmon smolts and we concur with its installation. However, prior to the installation of the louvre and the construction of the bypass opening in the dam crest, a plan is needed to address how smolts would be passed downstream until both pieces (louvre and bypass gate) of the bypass facility are completed. The completion of fishway facilities doesn't always synchronize with the issuance of a license and any delays in constructing permanent fishway facilities could continue to potentially adversely affect Atlantic salmon smolts passing through the area. It is more realistic to construct interim downstream passage facilities to enable smolts to effectively out migrate while plans for permanent measures are being finalized. Interim passage facilities should include components that can be incorporated into the final designs, such as weirs and sluiceways, that enable safe passage of smolts past the project. Interim passage facilities should be designed in consultation with the resource agencies. Temporary interim measures might also include such things as programmed spills and selected flashboard removal during migration times.

The DOI has recommended that permanent downstream fish passage facilities be completed for the Gardners Falls Project within two years after issuance of the new license. WMEC has requested FERC to allow them three construction seasons to complete the downstream passage facilities. WMEC says that they are unwilling to proceed with designing the necessary fishway facilities until a minimum flow requirement is established in any license issued for the project. WMEC is concerned that the design and construction of the facilities might take longer than two construction seasons and they wanted to set a firm completion date of three years because they thought they could meet that date for compliance purposes. The bypass part of the fishway employs a multi-purpose gate that releases minimum flows needed for the bypass and for downstream fish passage (these flows may be identical, i.e., 50 cfs). Since the resource agencies and the WMEC all agree that the louvre and bypass facility is a reasonable approach to solving downstream smolt passage at the project, it appears unreasonable to staff that WMEC would need three construction seasons to complete the downstream fish passage facilities when design of the facilities should be underway at present. The staff doesn't believe there is a need for additional construction time based on the outcome of any future minimum flow that is required in the license. The multi-purpose gate would accommodate various flow releases and would not justify the need to extend the construction schedule to three construction seasons. If difficulties did arise during construction, WMEC could contact the Division of Project Compliance and Administration with a request for an extension of time to complete construction.

A monitoring plan would likely include studies that would be required to determine if the downstream passage facilities are operating effectively. These studies should be designed to: (1) determine whether the permanent downstream fish passage facility efficiently diverts Atlantic salmon smolts away from the power plant intake, through the sluice, and to safety downstream of the project; and (2) address whether continued operation of the facility during the fall is warranted. The second component of the effectiveness study should not be implemented until there is evidence that smolt outmigration is occurring. Structural or operational changes to the fishways to improve effectiveness of the fishway, if any, should be discussed in the study reports. Plans for these studies should be developed in consultation with the DOI and MA DFW and approved by the Commission.

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

We believe that the downstream fish passage facilities, as proposed by WMEC, combined with the resource agencies requirements, would provide juvenile Atlantic salmon with safe downstream passage at the project.

Fish Entrainment

MA DFW was concerned that the trout stocked annually in the reservoir in support of a put-and-take fishery were susceptible to potential project entrainment and injury. The stocked trout (brown trout and rainbow trout) are adult fish (catchable size ranging from 8 to 15 inches long). Involuntary entrainment of fish typically occurs at hydropower projects when fish approach project intake areas where water velocities exceed the fish's swimming speed. MA DFW recommended that WMEC conduct a study to examine the water column velocities occurring at the entrance to the project power canal under typical operating conditions.

WMEC conducted the velocity study in October 1990 to help determine whether fish entrainment may occur. Velocity measurements were collected at three locations: (1) immediately upstream from the intake canal headgate structure; (2) immediately upstream from the intake of Unit No. 4 at the powerhouse; and (3) immediately upstream of Unit No. 3 at the powerhouse. All the penstocks are screened with trashracks that have vertical steel bars with fixed clear bar spacings ranging from 1¼ inches to 2¼ inches depending on the unit.

The results of the study indicated that the measured velocities at the three sites, including those calculated for the power canal, generally fell well within the reported range for cruising speed for rainbow and brown trout (Beamish 1978). Swimming speeds of fish as defined by Bell (1984) define "cruising" as a speed which can be maintained indefinitely by fish without metabolic fatigue. In addition, the study determined that at no time would the velocities be expected to exceed the burst speed of these trout (Burst speed is defined by Bell

(1984) as the maximum attainable speed which can be maintained for a relatively short time for feeding or escape purposes, generally less than 10 seconds). Therefore, the study concluded that any trout encountering the head works of the power canal intake would not be involuntarily entrained but could voluntarily enter and exit the canal freely. The potential for entrainment by juvenile brown trout that might enter the reservoir in the future from upstream sources was also examined. The conclusion was that it was unlikely that these juvenile brown trout would become entrained because their burst swimming speeds would exceed the stream velocities at the project intake. The staff also notes that anglers fish the power canal which could be another indicator that occasionally trout freely swim into and out of the power canal and that entrainment is not a serious problem with trout, however, this is supposition on the staff's part because these trout movements in and out of the canal have not been monitored. We also believe that the installation of the louvre and bypass system for Atlantic salmon would also function to direct some trout downstream and away from being entrained.

4.1.2.4 Vegetation and Wildlife Resources

Continued operation and the proposed flow changes would have no adverse effects to vegetative or wildlife resources at the Gardners Falls Project, therefore, WMEC, the agencies, nor staff propose any specific measures for vegetative or wildlife resources.

4.1.2.5 Threatened and Endangered Species

By letter dated October 5, 1994, USFWS states that no Federally listed or proposed threatened and endangered species under USFWS's jurisdiction are known to occur in the Gardners Falls Project area, with the exception of occasional transient individuals. No Biological Assessment (BA) or further consultation is required with USFWS under Section 7 of the Endangered Species Act (ESA) of 1973, as amended, at this time. Should project plans change, or additional information on listed or proposed species becomes available, this determination may be reconsidered (letter from Andrew Raddant, Acting Regional Environmental Officer, DOI, Office of the Secretary, Boston, MA). Bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus anatus*), federally listed endangered species, use the Gardners Falls Project area as transients.

We conclude that continued operation of the Gardners Falls Project would not likely adversely affect any federally-listed or proposed threatened and endangered species.

4.1.2.6 Recreation and Land Use Resources

To enhance and protect recreational opportunities at the Gardners Falls Project, WMEC proposes to improve the nature trail along the project canal, the picnic facility near the impoundment, the Wilcox Hollow access area, and improve the directional signs near the recreational facilities. WMEC further plans to develop a carry-in boat launch area on the impoundment and develop educational materials pertaining to the project's recreational facilities (for discussion of cost associated with implementing the enhancements see Section 5.3).

WMEC's proposed recreation enhancements are consistent with the WQC issued by MA DEP, requiring WMEC to enhance access for recreational uses according to the recreation plan submitted as part of the Gardners Falls Project license application. The WQC would also require WMEC to ensure that recreational access complies with applicable state and federal regulations.

Massachusetts provides five recommendations regarding recreational enhancements at the Gardners Falls Project which are generally consistent with WMEC's proposal with one exception. Specifically, they recommend that WMEC: (1) establish an enhancement fund, (2) cooperate in the development of the Deerfield River Trail, (3) improve access on the western shore of the Deerfield River, (4) improve access at Wilcox Hollow, and (5) provide the public with educational resources. AMC also provides recreational recommendations that generally correspond to those recommended by Massachusetts. Massachusetts' and AMC's recommendations are discussed below except for the enhancement fund recommendation (recreation recommendations that would modify WMEC's proposal are addressed in Section 4.2.2.4)

To further develop and improve the Deerfield River Trail, Massachusetts recommends that WMEC provide interpretive signs at cultural sites, historical sites, important natural resource locations, and at the hydroelectric facilities within the Gardners Falls Project. This existing trail begins at Wilcox Hollow and would eventually extend downstream to the Stillwater Bridge (about 8 miles downstream). Massachusetts recommends that WMEC consider MA DEM standards when developing the interpretive signs.

WMEC's proposed signage program includes providing directional signs that would identify recreational resources and provide general information about the resources available at the project. Their proposal to provide educational materials at the recreation facilities includes brochures and maps that would also interpret the historical and natural resources available at the Gardners Falls Project. Developing these signs by consulting MA DEM's standards for interpretive signs would ensure that these measures are consistent with the agency's recommendation. Finally, proposed improvements at Wilcox Hollow would further enhance the Deerfield River Trail by providing parking and serving as one of the major trail heads.

To enhance recreational access to the river's western shore, Massachusetts and AMC recommend: 1) directional signs that improve the public's ability to find recreational resources at the project; 2) improved parking near the dam; 3) trail improvements from the Gardners Falls Picnic Area to the impoundment; 4) trail improvements at the Gardners Falls Nature Trail; and 5) trail improvements from the powerhouse access area to the tailrace. WMEC's recreational enhancement proposal accommodates these recommendations.

Massachusetts' educational resource recommendation includes: developing a school curriculum for the Gardners Falls Nature Trail, providing teacher training workshops in area schools, and providing services to inform the public about the resources at the project. We find that WMEC's proposed improvements to the Gardners Falls Nature Trail, proposed signage program, and their proposal to develop interpretive brochures and maps would improve the educational opportunities at the project. WMEC also provides scheduled tours of the powerhouse for educational purposes. While these measures are generally consistent with the Massachusetts' recommendation, WMEC does not propose to provide teacher training workshops. We conclude that Massachusetts' recommendation to provide teacher training workshops is not accompanied by supporting documentation showing how public benefits are related to project.

Massachusetts and AMC are concerned about overdeveloping the Wilcox Hollow access area to ensure that this site maintains its remote character. To improve Wilcox Hollow, Massachusetts recommends that WMEC: provide toilet facilities and trash containers; develop access for individuals with disabilities, while ensuring that this access is consistent with the less developed character of the area; improve the safety of entering/exiting the Wilcox Hollow area by paving the entrance section of the gravel road; and improve parking at the site without compromising the undeveloped character of Wilcox Hollow. AMC recommends improving Wilcox Hollow by providing access for individuals with disabilities, improving the entrance to the access road, formalizing parking, providing car top boat access.

TU also expressed concern about the overdevelopment of the Wilcox Hollow access area, and indicates that excessive development would destroy the unique resource that is presently available. TU is specifically concerned that WMEC's proposed barrier-free boat launch would promote power boating access at this site which would negatively affect and alter the nature of the recreational experience currently available.

WMEC's proposed enhancements for Wilcox Hollow are consistent with Massachusetts' recommendations with the exception of providing toilet facilities. While WMEC provides toilet facilities along the impoundment at the Gardners Falls Picnic Area, there are no toilet facilities near the tailrace area at Wilcox Hollow. Wilcox Hollow is the primary access to the Gardners Falls tailrace and MA DFW currently provides a put-and-take fishery along this portion of the Deerfield River. Recreational use at this site would likely increase due to the proposed road access improvements, expanded parking spaces, and the barrier-free boat launch improvements. NEP's proposed recreation plan includes improvements to the Deerfield River Trail which would also influence the likelihood of increased use at Wilcox Hollow (for further discussion see the Deerfield Recreation and Land Use Resources, Section 4.1.1.6).

We conclude that providing toilet facilities at Wilcox Hollow, as recommended by Massachusetts, is needed to accommodate the anticipated recreation demands. While we agree that excessive development at this site would detract from the natural character of this area, providing toilet facilities is consistent with the proposed enhancements and would result in minimal effects that could compromise the setting at this site. WMEC's intent to improve Wilcox Hollow in consultation with the MA DEM would further ensure that these facilities do not adversely affect the site's undeveloped character or promote unacceptable uses (*i.e.*, motor boating).

Barrier-free access

To enhance access opportunities for individuals with disabilities, WMEC evaluated their existing recreational facilities and found that Wilcox Hollow was the most appropriate site to provide barrier-free access facilities. WMEC plans to design the parking area and carry-in boat facility at this location to accommodate the national standards for disabled access established by the Architectural and Transportation Barriers Compliance Board in 1991. WMEC's planned barrier-free access improvements at Wilcox Hollow would limit development that could compromise the rustic character of the area. They also plan to consult with an Access Coordinator from the MA DEM regarding the barrier-free design facilities at Wilcox Hollow.

Minimum Flow Effects on Angling

WMEC's proposal to release a continuous minimum flow of 50 cfs within the bypassed reach and a supplemental flow of 100 cfs below the powerhouse (April 1 through June 30) would further improve angling opportunities along this portion of the Deerfield River. Based on WMEC's IFIM study the angling attraction of the 1,400-foot-long bypassed reach is suitable at flows of 50 cfs; above 100 cfs, flows become too deep and turbulent for wade angling.

Wade angling and boat fishing in the tailrace are currently influenced by instream flows from the powerhouse and bypassed reach, as well as, the backwater effect of the Deerfield No. 2 impoundment. At WMEC's proposed 100 cfs supplemental flow, anglers could access the area below the powerhouse by near-shore wading or shore angling. The proposed flow releases would, however, inhibit wade fishing because of water depth, velocity, and turbulence (for further discussion on suitable flows for angling, see Recreation Resources, Section 3.3.2.6). Boat fishing in the tailwaters is suitable at flows about 100 cfs, but turbulence and water velocity begin to limit boat angling above 100 cfs. When the tailrace is inundated by the backwater effect of Deerfield No. 2, it becomes more accessible to boat anglers.

We conclude that WMEC's minimum flow and supplemental flow proposals would enhance angling along the bypassed reach and tailrace. These proposed flows would further enhance MA DFW's annual put-and-take trout stocking program downstream of the powerhouse.

Recreation Resources Summary

We conclude that WMEC's proposed recreation measures would significantly enhance recreational opportunities at the Gardners Falls Project over the existing conditions and meet foreseeable future recreation demands. These proposed measures are also consistent with the Gardners Falls WQC, and are generally consistent with the recommendations provided by Massachusetts, AMC, and TU.

Boating activity on the Deerfield River is increasing, and the proposed facilities at Wilcox Hollow and along the impoundment would further provide for the additional boating demands. Improving boating access at the Wilcox Hollow area, in conjunction with NEP's proposal to provide a canoe portage at the Deerfield No. 2 dam, would also improve access to the remote river reach below Deerfield No. 2. While directional signs at WMEC's recreational facilities are currently inadequate, their proposed signage program would further improve the public's accessibility to recreational opportunities at the project. Finally, we find that WMEC's proposed improvements at Wilcox Hollow would enhance recreational opportunities for individuals with disabilities and also enhance access to the Deerfield River trail.

4.1.2.7 Aesthetic Resources

Project facilities are unobtrusive in the landscape and continued operation of the Gardners Falls Project would not adversely affect aesthetic resources in the nearby area. Construction activities associated with the proposed recreational enhancements and fish passage facilities would, however, disrupt the viewshed in the area. These short-term effects are minimized since WMEC proposed recreation improvements and minimum flow releases would eventually enhance the scenic value in the project area. Specifically, WMEC's enhancements at the Wilcox Hollow area and at their nature trail would improve access to the existing aesthetic resources, while the proposed minimum flows would enhance the viewshed along the bypassed reach.

4.1.2.8 Cultural Resources

Inasmuch as the Gardners Falls dam, power canal, and powerhouse are eligible for inclusion in the National Register, issuing a license to continue operating and maintaining the Project's works under the protection afforded by Section 106 of the NHPA, might generally be considered to have a beneficial effect on the historic integrity of those project features.

Project operation, project-related construction, including fish passage facilities and improvement of recreational facilities, and recreational use at the Gardners Falls Project have the potential to cause adverse effects on prehistoric and historic archeological resources which may be present in the project's area of potential effect (see Section 4.1.1.8).

In order to protect archeological and historic resources, we are developing a PA, pursuant to Section 106 of the NHPA in consultation with the Council, the Massachusetts SHPO, and WMEC. We would execute the PA with the Council and the Massachusetts SHPO.

The PA would require WMEC to design a plan to minimize adverse effects to the historic integrity of the project dam, power canal, and powerhouse. It would also require WMEC to develop a CRMP which would include a mechanism for identifying and mitigating adverse effects to National Register-eligible prehistoric and historic archeological resources that may result from current and proposed project operation, recreational construction, and recreational use, and, ultimately, for any future proposals, as well. We recommend, therefore, that any license issued for the Gardners Falls Project incorporate the PA and its stipulations.

Summary of Effects

There would be unavoidable adverse effects on cultural resources at the Gardners Falls Project. However, mitigation of impacts to those resources would be provided through implementation of measures such as those provided by WMEC (see Section 2.2.2) and which would be included in the stipulations of the Gardners Falls PA.

4.1.3 Amendment as Proposed - Bear Swamp Project

Only the resources that would be affected by the amendment of the Bear Swamp license are included in detail below in this EIS. We reviewed the project in relation to the environmental resources in the project impact area, based on the proposed amendment, and we have concluded that amending the Bear Swamp license as proposed by NEP would not cause direct or indirect adverse environmental effects on: Geology and soils, vegetation and wildlife resources or socioeconomic resources. Therefore, we have excluded these resources from our detailed analysis for the following reasons:

(a) No project-related construction adversely affecting geologic, soils, or terrestrial resources is proposed, no mitigation measures for terrestrial resources are proposed by the resource agencies or the applicant, and no adverse effects are expected to occur to terrestrial resources as a result of amending the Bear Swamp license; and

(b) Amending the Bear Swamp license would not affect the socioeconomics of the project area because no major construction activities, with their associated effects on employment, business, infrastructure, and/or tax revenues, are proposed.

4.1.3.1 Water quality and quantity

Presently, NEP releases a minimum flow of 125 cfs or inflow from Fife Brook into the Deerfield River from July 1 to August 31, and 75 cfs for the rest of the year. There is no bypassed reach. Under the Settlement, NEP would release a continuous year round minimum flow of 125 cfs at the dam.

The release of 125 cfs under the Settlement would provide a minor enhancement to water quality, especially during low flow periods when solar radiation and incidental warming can increase water temperature and decrease the DO saturation level. Downstream reaches would continue to be subject to fluctuations in the quantity of water released over the course of the year, due to the project's peaking operation, but this would have minimal effect on resultant downstream water quality.

4.1.3.2 Fishery Resources

The Settlement's requirement that Fife Brook release a year round minimum flow of 125 cfs should provide for a slight improvement for aquatic biota, particularly during the low flow period when the minimum flow would be increased by about 50 cfs over flows that were previously released during the same time period. There would be slightly more habitat available to aquatic biota from this increased minimum flow.

The proposed flow release of 125 cfs would continue to protect the primarily put-and-take fishery that occurs in the river reach below Fife Brook dam. This minimum flow release would also be compatible with the required minimum flow release for Deerfield No. 4 development.

The existing use of the Fife Brook reach shows compatibility between whitewater recreational boating and a put-and-take fishery. Under the Settlement, the 3-hour whitewater flow releases of at least 700 cfs occur on 106 days annually from April through October. Currently there are some voluntary releases of water for whitewater boating in this stream reach. These whitewater flow releases would not be very noticeable to fishery resources for most of the year because over 50 percent of the year flows are 800 cfs or greater. However, 3-hour releases of 700 cfs during periods of low flow (July through September) would likely be detrimental to self-sustaining fish populations, but would have marginal to little impact on the put-and-take fishery. The effects of these whitewater flow releases would be moderated or diminished as the flows travelled 17 miles down to the Deerfield No. 4 dam. However, in the areas immediately below the dam, a 700 cfs whitewater release into a stream reach with an existing flow of 125 cfs would be a dramatic change and would tend to flush fish, and fish habitat downstream and make the area unsuitable for sustaining self-supporting fish populations.

Planted fish would continue to move in and out of the greatest impacted stream reach below the dam and would not be affected by these whitewater releases because they are only present in the stream for a relatively short period of time before they are removed by anglers. On balance the benefits to whitewater boating resulting form the proposed release outweigh the minor adverse impacts to fishery resources. We agree with the Settlement.

4.1.3.3 Recreation and Land Use Resources

Recreation and Land Use Resources pertinent to the Bear Swamp Project area are discussed in Section 4.1.1.6.

4.1.3.4 Aesthetic Resources

Aesthetics pertinent to the Bear Swamp Project area are discussed in Section 4.1.1.7.

4.1.3.5 Cultural Resources

Historic architectural properties

Inasmuch as the project features aren't eligible for the National Register, and there are no other historic architectural resources in the project's area of potential effect, amending the Bear Swamp license would have no effect on historic architectural resources.

Prehistoric and historic archeological resources

Project operation, project-related construction, including fish passage facilities and improvement of recreational facilities, and recreational use at Bear Swamp have a potential to cause adverse effects on prehistoric and historic archeological resources similar to those discussed for the Deerfield River Project.

Because no archeological surveys have yet been conducted at the Bear Swamp sites which would be affected by such activities and uses, NEP needs to develop a CRMP for Bear Swamp which would provide for studies necessary for identifying and mitigating adverse effects to National Register-eligible prehistoric and historic archeological resources that may occur from project operation, recreational construction, and recreational use

Because this would best be accomplished through implementation of a PA similar to the Deerfield Project PA, we are preparing such a PA for Bear Swamp to be executed by the Commission, the Massachusetts SHPO, and the Advisory Council. We therefore recommend that the Bear Swamp license be amended to include the Bear Swamp PA and its stipulations.

Summary of Effects

There could be unavoidable adverse effects on cultural resources at Bear Swamp. However, mitigation of impacts to those resources would be provided through implementation of the Bear Swamp PA and its stipulations

4.2 MODIFICATIONS TO THE PROPOSED PROJECTS OPERATION OR FACILITIES TO FURTHER PROTECT AND ENHANCE ENVIRONMENTAL RESOURCES

The majority of VANR's water quality conditions either supersede the terms of the Settlement to a minor degree or consist of monitoring. Some of VNRC's recommendations fall also under the above categories. Because of the above the reader is referred to Table 5-1 and 5-2 for a summary of the effects of the above recommendations on important resources. Staff discusses in this section only recommendations that are unique and have not been covered either in the Settlement or Cultural Resources Management Plan.

4.2.1 Deerfield Project

4.2.1.1 Fishery Resources

4.2.1.1.1 Somerset development

Project Peaking Operations

VNRC recommends annual peaking operations be eliminated for Somerset, Searsburg, Harriman, and Sherman reservoirs VNRC says the annual peaking operation of the Deerfield Project causes significant adverse impacts to the aquatic biota and habitat in the Deerfield River. NEP is not proposing to eliminate peaking operations for its Deerfield Project.

Cessation of all peaking operations for the Deerfield Project would eliminate the adverse effects associated with peaking operations (*e.g.*, rapid flow fluctuations, and dewatering bypassed stream reaches) and would be beneficial to aquatic biota. There could possibly also be some negative impacts on the fishery resources by operating the Deerfield Project run-of-the-river. For example, under current operating procedures, the flashiness of the Deerfield runoff season is moderated by storage in the reservoirs and water is then released unevenly during the summer months when otherwise there would be little flow in the river. The peaking operation has affected river reaches by reducing streamflow, but it has also provided water to some stream reaches that would otherwise have very little flow during the summer months under a run-of-the-river operation.

Maximum Gate Flows

VNRC recommends a maximum flow of 200 cfs from Somerset to protect the aquatic resources from controlled releases downstream generating facilities. Monthly duration curves provided by the licensee show that controlled flow releases exceeding 200 cfs presently occur about 12 to 13 percent of the time annually, with most of those releases occurring in October and November. The IFIM habitat mapping conducted by NEP (1991) also shows that the store-and-release operating regime of Somerset result in little change in habitat location or quality for brook trout at flow fluctuations between 200 cfs and higher. The frequency of the releases and the time of the year of these releases would have minimal impacts on aquatic resources and we see no need to impose a maximum flow release based on the information provided. We believe it is not the maximum flows that are causing limitations to aquatic resources below Somerset, rather it is the lack of minimum flows during the summer months that were most limiting to the aquatic resources.

VANR required in the WQC a maximum limit for the gate releases at Somerset reservoir of 312 cfs, or instantaneous inflow if higher. As we said above, the Settlement didn't set any limits on this parameter. VANR is concerned about the impacts on downstream aquatic resources caused by controlled releases of over 312 cfs from Somerset reservoir for downstream hydropower facilities. The flow duration curves presented in the license application (NEP 1991) show that, during a typical water year, the flow releases don't exceed 300 cfs. Therefore, we would not expect these releases to occur frequently, and when they do occur they would usually be associated with high natural flow conditions that would have occurred sometime within the year anyway. Based on the above, we believe that the maximum limit is not warranted, however there appears to be little impact in implementing this recommendation, and it is a mandatory requirement of the WQC. The effects on aquatic resources of the maximum gate flow restrictions required by VANR would also be diminished by the ramping rates and minimum flows required at the Somerset development.

Ramping Rates

VNRC recommends ramping be provided at Somerset. Furthermore, VANR's WQC, requires specific rates and time periods for ramping. VANR's ramping rates of 100 and 50 cfs over a 24 hour period and the time of year ramping is needed (from August 1 to September 30 and from March 1 to April 30) are also discussed below.

The WQC requires that NEP provide an up ramping rate at 100 cfs or less over 24 hours and down ramping rate of 50 cfs or less over 24 hours for Somerset. VNRC also recommends ramping be provided for Somerset but didn't recommend any specific ramping rates. The WQC provides that NEP can elect to complete a study to define alternate ramping rates (instead of 100 and 50 cfs) based on biological information or channel hydraulics. The WQC requires that any study plan shall be developed in consultation with the VANR and a proposal for alternate ramping rates would require an amendment of the WQC.

The minimum flows below Somerset would enhance the existing aquatic biota. However, there would be times when water released to the Somerset Reach would be greater than the existing minimum flows and therefore a ramping rate would be needed. The 100 cfs up ramping over a 24-hour period and the 50 cfs down ramping rate over a 24-hour period recommended by VANR appears to be a reasonable rate to analyze the biological effects on aquatic biota and should be implemented with the issuance of any new license for the Deerfield Project. This ramping rate would be considered an interim ramping rate until a final ramping rate, if any, is determined. Any new or different ramping rate would be based on biological data and/or channel hydraulics

Suspension of Up ramping Rates

The WQC requires that NEP can suspend the 100 cfs up ramping rate, if necessary, to lower the reservoir to protect loon nesting in the Somerset Reservoir by May 1. The WQC requires that the management plans for Somerset Reservoir gate operations should take this action into consideration and design a plan that minimizes or eliminates the need to exceed the up ramping requirements while at the same time achieving a high probability of attaining the target elevation for the reservoir. Any short suspension of the up ramping rate should have minimal impacts on near shore spawning habitat used by warm water species due to the small changes in reservoir elevation.

Maximum and Minimum Reservoir Elevations

The WQC requires that NEP limit draw down at the Somerset Reservoir to no lower than 2,107 feet msl (which would likely occur in early March) at anytime during the year. Furthermore, VANR requires that the lowest summer/fall (through November 1) drawdown in Somerset Reservoir not be lower than 2,120 feet msl. As shown in Figure 3-1, under present operations, Somerset Reservoir is typically drawn down around 5 feet over the summer/fall period from typical spring water levels, and an additional 10 feet during the winter period (mid December through mid March). VANR is requiring these reservoir drawdown elevation limits to protect: (1) open-water recreational use, (2) fishery resources from excessive predation during the winter, and (3) reservoir biomass from excessive releases out of the reservoir. The Settlement does not require a drawdown limit for Somerset Reservoir.

VANR's requirement that the drawdown of Somerset reservoir be no lower than 2,107 feet msl annually, appears to offer more protection to fish than not having a limit on drawdown level. Traditionally the reservoir is drawn down to around 2,116 feet msl, although in 1984 the reservoir was drawn down to 2,105.6 feet msl for emergency reasons. A specific limitation at 2,107 feet msl would provide more wetted shoreline area and more volume than under an operating regime that would allow lower drawdowns. However, staff doesn't have specific fisheries information about to what extent wintertime entrainment occurs, nor data from fish population studies to determine whether increased predation occurs during the winter drawdowns, nor whether the amount of increased wetted shoreline habitat under the drawdown limit of 2,107 feet would provide additional valuable fisheries habitat. In addition, we expect normal changes in the drawdown levels to occur within the reservoir with the new releases of minimum flows from Somerset Reservoir under the Settlement and perhaps, under a new license, the reservoir would not frequently reach the 2,107-foot level under a new operating regime. Setting a drawdown limit of no lower than 2,107 feet msl for Somerset reservoir appears to be reasonable to staff based on the limited fisheries information, but we believe variances should be allowed for emergency situations, and a plan should be developed by NEP, in consultation with VANR, to modify the maximum draw down level under emergency situations.

4.2.1.1.2 Searsburg development

Maximum and Minimum Reservoir Elevations

VANR requires in the WQC that NEP not change water level fluctuations in the Searsburg reservoir above what currently occurs for the project. NEP does not propose any changes to reservoir water levels. The water level fluctuations would continue to seasonally change from three feet below the crest of the dam to the top of the flashboards. The impacts on the fishery resources would likely remain the same. Fish population would remain essentially unchanged under a new license with the same restrictions placed on it by the WQC.

Minimum Flows Associated With Flashboard Removal

The WQC requires that NEP make adjustments to the minimum flows required in the WQC for the Deerfield River below Searsburg dam following (1) the reinstallation of flashboards or (2) after an approved special maintenance operation that caused a drawdown of the reservoir. Under these two conditions, VANR requires that if the reservoir is so low that it cannot be filled while meeting the minimum bypassed reach flow requirements, up to 10 percent of the instantaneous inflow may be placed in storage and the downstream minimum flow requirements (of 35 and 55 cfs) may be adjusted accordingly.

We believe the instantaneous 10 percent minimum flow requirement by VANR would have minimal impacts on water quality and fishery resources of the Deerfield River. The frequency of this event is about once a year unless there is a flood or other unforeseen emergency or maintenance activity. Flashboards are usually removed for the period November 1 through May 30, a period when there are normally high flows in the river. Under those situations when water levels are naturally low, the 10 percent rule would still provide more water to the 3.5-mile-long bypassed reach than was the case prior to the Settlement, when only leakage was released to the bypassed reach.

Fishways

VNRC recommends upstream and downstream fishways at Searsburg. VNRC bases their recommendation on the comments made by VFWD personnel in internal agency correspondence dated June 27, 1994. The staff has reviewed VFWD's comments on this issue and finds some points in opposition to the recommendation made by VNRC concerning the need for fishways at Searsburg. First, VDFW stated that upstream fish passage is not being pursued at Deerfield Project dams in Vermont at this time. Secondly, VFWD mentions that downstream fish passage is necessary at the Searsburg dam, and is "desirable" to provide for safe and expeditious passage. VDFW also stated that the implementation of landlocked salmon fry stocking in the Deerfield River and east branch upstream from the Searsburg Reservoir would necessitate passage for juvenile salmon. In our view, VFWD appears to hinge the need for downstream fish passage at Searsburg on a future salmon smolt outmigration program which has not been initiated. Under that scenario, VFWD would have to stock landlocked Atlantic salmon fry in the Deerfield River above Searsburg, and this has not been done. Staff believes there needs to be a salmon management program, with monitoring underway for several years before a decision could be made on whether upstream or downstream fishways are needed at Searsburg.

VANR requires in the WQC, that NEP submit a plan for upstream and downstream fish passage at Searsburg within four months of receiving a request from VFWD. The USFWS has requested a reservation of its Section 18 authority to prescribe fishways for the Deerfield Project in the future, which would include such structures at the Searsburg development, if they are found to be needed sometime in the future. In addition, the WQC requires that the plans for both upstream and downstream fish passage facilities be submitted by NEP to the VFWD within four months of a request for such facilities by VFWD. Our experience shows that licensees need a minimum of six months to meet the terms and conditions of license articles requesting plans or other schedules.

Intake Protection

VANR requires in the WQC, that NEP prepare a plan to prevent fish impingement and entrainment at the Searsburg dam intake if a request is not made by VDFW for installation of downstream fishways within 7 years and 4 months from the date of issuance of the WQC (by May 30, 2002). VANR also requires that the intake protection plan be developed in consultation with the USFWS and VDFW and include (1) an implementation and construction schedule, (2) an erosion control and water management plan to assure compliance with state water quality standards during construction of any measures described in the plan, and (3) measures to implement the plan within one year from the date of approval by VDFW.

There have been no reports of resident fish mortality associated with entrainment or impingement at Searsburg. There currently is some protection afforded resident trout and other fish at Searsburg from the existing trashrack with 1 and 1/4 inch clear bar spacing located in front of the intake. Studies have shown that other trashracks having a clear bar spacing of one inch have excluded brown and rainbow trout that are about 9 inches long (Consumers Power Company 1991) and would probably provide similar protection to brook trout. Furthermore, studies have determined that smaller fish, including fry, suffer less mortalities than adult fish when passing through certain types of turbines (Cada 1990). Because no site-specific evaluation of fish intake concerns has been conducted, we agree with VANR that the issue of safe intake passage at Searsburg may need closer scrutiny by NEP in the future if VDFW management activities for migratory salmonids occur and are successful upstream from Searsburg and it is shown that a downstream fishway is needed. However, based on the fact that there will be a release of minimum flows into the Somerset Reach that is likely to improve conditions for resident brook trout and their numbers would likely increase, we agree with VANR's WQC requirement and will require NEP to prepare a plan now that addresses the effectiveness of the Searsburg intake to reduce fish impingement and entrainment.

4.2.1.1.3 Harriman development

Maximum and Minimum Reservoir Elevations

VANR requires in the WQC that NEP draw down Harriman reservoir no lower than 1,475 feet msl during the summer/fall open water recreational season (through November 1, see Table 3-3) and that the reservoir not be drawn down lower than 1,440 feet msl at any time during the year. VANR has required the reservoir be drawn down no lower than 1,440 feet msl based on their objective of protecting the fishery resources from increased predation and to prevent the excessive release of reservoir biomass. VANR has estimated that a reservoir elevation of 1,440 feet msl would cause a reduction in reservoir volume of about 68 percent in comparison with the typical high spring elevation.

Under present operation, Harriman reservoir is typically drawn down from 1,494 feet to 1,480 feet msl during the summer/fall recreational season. These drawdown impacts are discussed below in the Section 4.2.1.3 Recreation and Land Use Resources, and in the Section 3.2.6 Aesthetics Resources. As discussed in Section 4.1.1.3 Fishery Resources, existing reservoir fluctuations can adversely affect fishery resources. Setting minimum and maximum drawdown levels for the Harriman Reservoir, as required by the WQC, should reduce impacts on the fishery resources.

As was discussed above for the maximum wintertime drawdown of the Somerset Reservoir, the staff believes that a drawdown to 1,440 feet msl during the winter (the maximum drawdown usually occurs around early March) would not cause markedly increased predation nor cause huge losses in reservoir biomass because of the location of the water outlets in deep water and season (winter). NEP has requested that VANR consider a maximum drawdown limit of 1,417.5 feet msl for Harriman Reservoir for the year based on meteorological data. Typically the reservoir is not drawn down to a depth of 1,417.5 feet msl but NEP believes it needs this variance in drawdown levels in the reservoir to be able to store spring runoff to prevent upstream and downstream flooding. The WQC requirement would offer a greater volume of water during this time of the year than would be provided by the Settlement or by the historical maximum drawdown to 1,416.3 feet msl (however, the average maximum winter drawdown is to elevation 1,450 feet msl) and therefore would provide greater protection to aquatic resources.

Maximum Drawdown Rate

The WQC requires that NEP use a maximum drawdown rate of 1 foot per day in Harriman Reservoir from June 16 to July 15. There currently is no drawdown rate for the reservoir, nor was one required by the Settlement. VANR sees a correlation between drawdown rate and productivity of fishery resources in Harriman Reservoir. VANR stated in the 401 WQC that the present catch rates for smelt, smallmouth bass, and yellow perch compare favorably with the catch rates for these species at two other large lakes in Vermont. VANR expects sport catch rates for these species to improve with the stabilization of the spring reservoir levels.

VANR's drawdown rate from June 16 to July 15 is primarily to protect smallmouth bass fry from becoming stranded and to provide them with the opportunity to move with the slowly changing water levels. We agree, and will require these conditions be imposed in any license issued for the project.

April 1 --June 15 Water Level Management

VANR requires in the WQC that Harriman reservoir water levels be stable or rising during the period from April 1 to June 15 to protect fishery resources. We have discussed these impacts in Section 4.1 Fishery Resources. The Settlement requires that these same reservoir water level conditions be in effect by May 1. We believe VANR's April 1 water levels requirement for Harriman would offer more protection to spawning smelt than the Settlement's recommendation of May 1.

4.2.1.2 Vegetation and Wildlife Resources

Rare plants

The VNRC recommends the elimination of annual peaking including appropriate limitation of reservoir drawdowns to restore lacustrine ecosystems in project reservoirs and that daily peaking operations should be significantly limited. In addition, the VNRC recommends provisions of instream flow conditions necessary to restore and maintain aquatic and riparian habitat in the river section impacted by project developments.

VNRC's flow recommendation conflict with those found in the Settlement. During the critical growing season for vegetation at Somerset reservoir, VNRC recommends minimum flows of 19 cfs, the Settlement proposes 12 cfs. Neither of these flows is expected to affect wetland or riparian vegetation located along Somerset reservoir. The effects of minimum flows increases on tubercled orchid (a Vermont and Massachusetts listed threatened species) are discussed in Section 4.1.1.4. VNRC's proposal to release 90 cfs year-round below Harriman dam is expected to provide greater adverse effects on tubercled orchids than the Settlement minimum flow of 57 cfs (July 1 through September 30) and 70 cfs (October 1 through June 30). A flow release of 90 cfs would likely result in approximately 90 percent tubercled orchid mortality (Figure 4-16). For this reason, we disagree with VNRC's recommended minimum flow release at the Harriman reservoir.

The WQC requires that the impacts to the tubercled orchid habitat in the Harriman and Searsburg bypassed reaches be partially mitigated. The WQC requires that a mitigation plan be developed that emphasizes the creation of new habitat along the original riverbank since transplanting orchids in the wild is very difficult. Transplantation, also required, would be considered experimental with follow-up monitoring to determine success, and limited only to those individual plants that would be inundated or harmed by increase flow releases. Seeding in all transplant areas is required and attempting to move plants into those areas. Habitat manipulation would entail cutting down alders to create open areas suitable for colonization by the tubercled orchid.

As noted above, the proposed flow releases would adversely affect tubercled orchid habitat. If the perennial tubercled orchids are up-rooted during one growing season, it is likely that they will not return in following years. Therefore, some form of mitigation for habitat loss is appropriate. The proposed conservation easements would also provide some enhancement to this plant species by minimizing disturbance of habitat by minimizing development along the shoreline of the Harriman bypassed reach.

Wetlands

The WQC requires reservoir surface elevation limits for the protection of common loons (see below). The stabilization of the Somerset reservoir would also have beneficial effects to wetland vegetation at Somerset reservoir since the May 1 to July 31 coincides with the critical growing season for wetland vegetation. The WQC requirement appears to satisfy some of VNCR's concerns about enhancing lacustrine habitats.

According to VANR (1995), wetland plant communities around the shorelines of the Somerset and Harriman reservoirs are limited in areal extent. This is attributed to non-nutritive, sandy, and gravelly substrates; soft, clear waters; steeply sloping shorelines; wind and wave effects; and water level fluctuations. According to the preliminary field survey conducted (See NEP 1991), only two areas of muck soils support quality wetlands at Somerset Reservoir and only alluvial deposits at tributary mouths, including the mainstem of the Deerfield River, support wetlands of substantial extent at Harriman Reservoir. Contrary to NEP, VANR believes the extensive drawdowns at Somerset and Harriman Reservoirs are a major factor in preventing the establishment of beneficial wetland plant communities that would otherwise become established along the Deerfield Project shoreline and in the shallow areas of the reservoirs. Perennial wetland species that VANR argues could become established if the reservoirs were stabilized include: cattail, soft-stem bulrush, arrowhead, rattlesnake mannagrass, horsetail, and spike rush. Over time, the organic soils would accumulate in the wetland zones and cover the presently coarse substrates.

We agree with VANR that the existing wetlands located at the Deerfield Project are not of high quality. However, several factors including many outside of NEP's control, *i.e.*, topography (see Section 4.1.1.4) play a significant role in limiting the quality of existing wetlands. The summer drawdowns of the Somerset and Harriman reservoirs likely affect wetlands adversely. However, the extent of possible wetland establishment through alternative water level management regimes at Somerset reservoir is speculative at this time. While the Settlement provides for no specific enhancements of wetlands it would stabilize the Somerset and Harriman reservoirs at a time coinciding with the critical period for wetland plant growth and establishment which would provide some level of enhancement.

Wildlife

The Vermont WQC says that the Settlement's proposed water level management range for the loon nesting period (maintenance of water level within a 2-foot range from May 15 through July 15) is inadequate to protect nesting. Consequently, the WQC requires that all reasonable measures be instituted to reach a target elevation of 2,128.58 feet msl by May 1 and to maintain the water level within ± 3 inches (not ±1 foot) through July 31, unless the VDFW determines earlier than July 31 that no loon nesting is occurring. VANR also requires a reservoir stage recorder and real-time data transmitter to enhance the capability of monitoring reservoir elevations and reacting the changes in stage. Gate automation may be warranted if waterfowl nesting failure occurs frequently because of flooding or stranding.

NEP (1994c) believes that the standard of performance stipulated in the WQC at ± 3 inches during the loon nesting season will have no appreciable benefit to the success of common loon nesting beyond the reservoir management that is proposed by NEP. NEP believes that natural variation in water level at the nest site will be greater than ± 3 inches and will not directly relate or correspond to a standard maintained at the gate house for gate operation. Because of the length of the Somerset reservoir, the reservoir is exposed to wind, resulting in wave action along the shoreline. NEP believes it to be difficult, if not impossible, to achieve such precise pond level stabilization as ± 3 inches. The size of Somerset reservoir and the nesting area at the opposite end of the lake provide additional aspects of variability. NEP believes that the ± 3 inch range must be treated as a goal and not a mandatory condition.

Based on the best available information, we agree with the WQC's requirement to protect common loons. While reservoirs differ, previous common loon studies on other New England reservoirs have demonstrated that ± 3 inch water level fluctuations provide greater common loon protection than the ± 1 foot.

4.2.1.3 Recreation and Land Use Resources

Searsburg Canoe Portage

The Deerfield Project WQC stipulates that NEP should modify its proposed recreation plan to include a canoe portage at Searsburg and a put-in area on river right below the Searsburg dam. Providing a canoe portage at Searsburg would further enhance canoeing opportunities in the area by improving the ability to canoe from the Deerfield River's headwaters to the Harriman Reservoir. While the Deerfield River's mainstem offers limited boating opportunities above Searsburg, the 6-mile-long section of the East Branch offers canoeing opportunities when flows above 150 cfs are provided from the Somerset Reservoir. The recommended portage at Searsburg would improve the opportunities for canoeists to float an additional 3.7-mile-long stretch of the Deerfield River from Searsburg to Harriman.

While NEP's proposed recreation plan includes access facilities to the Searsburg impoundment, there are no provisions to improve access below the dam. Currently, access to the bypassed reach is obstructed by the above-ground sections of the Searsburg penstock. Because the bypassed reach is 100 to 200 feet wide below the dam, this section of the Deerfield River would offer limited canoeing opportunities at the proposed minimum flows due to insufficient water depths. Boatable flows would occur when flows at Searsburg spill into the bypassed reach.

We conclude that providing a canoe portage at the Searsburg dam and a put-in area below the dam would enhance canoeing along the upper reaches of the Deerfield River. While the bypassed reach would continue to offer limited canoeing opportunities under most flow conditions, these facilities would require minimal land-disturbing activities and minimal capital costs. We also find that these facilities would further enhance recreational opportunities at Searsburg by improving angling access to the Searsburg bypassed reach.

Drawdown Effects on Recreation

The Deerfield Project WQC requires drawdown limits at both Somerset and Harriman in order to protect summer and fall recreational use. At Somerset, the WQC would require a maximum drawdown level of 2,120 feet msl (13.58 feet below crest) during the summer/fall season to protect open-water recreational use. At Harriman, the WQC would require a maximum drawdown level of 1,475 feet msl (17.66 feet below crest). Between 1940 and 1993, the average water-level drops at Somerset and Harriman between May and December average 5 feet and 12 feet, respectively (for further discussion, see Aesthetic Resources, Section 3.2.6).

Based on 53 years of recorded drawdowns at Somerset and Harriman, NEP's proposed project operations would typically meet VANR's maximum drawdown level requirements for the summer/fall season, as stipulated in the WQC. We conclude, therefore, that the WQC drawdown requirements for the summer/fall season would result in minimal recreation benefits over NEP's proposal. We also find that the drawdown level requirements for the summer/fall season would not alter NEP's project operations under normal conditions.

VNRC recommends eliminating NEP's seasonal peaking operation and limit the daily peaking operation through appropriate maximum and minimum flow restrictions (VNRC's recommended minimum flows and maximum flow restrictions are listed in Section 4.2.1.1). Under VNRC's suggested operation scenario, drawdowns level limitations at Somerset and Harriman would benefit recreational opportunities. NEP's current drawdowns at these reservoirs affect recreation opportunities by limiting boating and swimming use when water levels restrict use of boat ramps, docks, and beaches. Current drawdowns also affect ice fishing use during the winter months due to ice shifting, cracking, and occasionally exposing open water along the shoreline. VNRC suggested operation scenario would curtail these effects.

We conclude that VNRC's suggested operation scenario would improve open-water access by extending the amount of accessible days at the recreation facilities along the Somerset and Harriman reservoirs. We find, however, that NEP's current and proposed facilities accommodate water-level drawdowns during the heavy use season. For example, NEP's boat launches, docks, and beaches remain accessible during the summer months under NEP's existing operations at Somerset and Harriman.

Whitewater Boating

While VNRC's suggested operation scenario at Somerset and Harriman would result in recreational benefits as discussed above, their scenario would adversely affect NEP's proposed whitewater boating flows. To determine the effects of VNRC's operation scenario, NEP used the HEC5 operations model. Because VNRC did not initially specify drawdown levels, NEP modeled a drawdown limit of 3 feet at the Somerset, Searsburg, Harriman, and Sherman Projects. [10] NEP included in their modeling analysis VNRC's suggested minimum flows and maximum flow restrictions. Finally, NEP's analysis of VNRC's suggested operation scenario included the drawdown restrictions specified in the Settlement to facilitate common loon nesting and smelt spawning.

Harriman and Sherman are the two developments that are operated to provide sufficient water for whitewater boating at the Monroe Bridge and the Fife Brook Sections. NEP determined from their modeling analysis that VNRC operation scenario would limit NEP's ability to provide the whitewater flow releases as stipulated in the Settlement. VNRC's scenario would particularly limit NEP's ability to provide the proposed duration of whitewater flows. In addition to impacts on NEP's proposed whitewater flow schedule, VNRC's operation scenario would adversely impact the Deerfield Project's energy generation and revenues (See Section 2.7 for further discussion on energy losses due to VNRC's operation scenario).

Whitewater boating opportunities at the Monroe Bridge and Fife Brook Sections are significant recreational resources in the Deerfield River Basin. NEP's proposed whitewater flow schedule and recreational facilities along these two river sections would further enhance these resources. Implementing these enhancements would consequently provide outstanding whitewater boating opportunities with regional significance (for further discussion on the whitewater boating, see Sections 3.2.5 and 4.1.1.6). Flow duration data from NEP's HEC5 analysis shows that VNRC's scenario would prevent NEP from providing the quantity and duration of flows sufficient for whitewater boating at the Monroe Bridge and Fife Brook Sections. We

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[10] By letter dated December 7, 1994, VNRC suggested analyzing several operation restriction scenarios that included a run-of-the-river mode of operation and modified peaking operations with drawdowns restrictions (letter from Christopher M. Kilian, Esq., Staff Attorney and Water Program Director, Vermont Natural Resources Council, Montpelier, Vermont).

conclude that VNRC's suggested operation scenario would restrict NEP's proposed whitewater flow schedule and adversely affect the whitewater boating potential on the Deerfield River.

Tailrace Safety

TU states that NEP's current operations of the Deerfield Project provide insufficient time for anglers, swimmers, and other river users to safely exit the Deerfield River when a release for hydrogeneration occurs. TU suggests that alarm systems and more gradual ramping rates would improve recreational user safety downstream of NEP's project dams on the Deerfield River.

NEP currently operates a video surveillance of the river bed immediately below the Deerfield No. 3 dam and remotely activates an alarm horn and flashing light prior to spilling flows at the dam. NEP also provides downstream warning signs at the Deerfield Nos. 2, 3, 4, and 5. The Commission's "Environmental and Public Use Inspection Report" (FERC 1992) indicates that NEP's safety devices are adequate, except for several developments that needed warning buoys. NEP proposes no public safety devices for downstream recreational users in addition to the existing measures.

NEP proposes no ramping rate limits for the Deerfield Project. We note, however, that the Vermont WQC includes up and down ramping limit requirements for Somerset for the protection of stream biota. [11] VANR does, however, indicate in the WQC that NEP may elect to complete a study in consultation with VANR to define alternative ramping rates based on biological information or channel hydraulics.

To address the safety of river users, NEP conducted an instream recreation safety study that examined the potential for improving safety below Deerfield No. 4 and Deerfield No. 2. These sites were selected because they both receive considerable angling activity. NEP's study examined the escape window [12] under five separate start-up scenarios and found that the typical escape window was at least five minutes under scenarios that included a minimum flow of 125 cfs at Deerfield No. 4 and a minimum flow of 157 cfs at Deerfield No. 2.

NEP concludes from their instream recreation safety study that a variety of operational characteristics (*e.g.*, minimum flow levels, tailwater conditions, local channel geometry) are critical when determining the need for ramping to accommodate and protect recreational users. As a result, NEP considers it prudent to address recreational safety needs once the operational regime for the Deerfield Project is determined under a new license. NEP plans to reevaluate the need for recreational ramping, or other options to address recreational safety needs, upon license issuance.

In Section 4.1.2.6, we conclude that NEP's proposed minimum flows, whitewater flow schedule, and public access enhancements for the Deerfield Project would increase angling and boating opportunities below the project developments. As a result of increasing the public's exposure to potential hazards below powerhouse tailrace areas, NEP may also need to increase the amount of protection necessary for public safety in these areas. River reaches which we find would increase in recreational use, and are of particular concern regarding public safety, are the tailrace areas below Deerfield Nos. 2 and 4, the bypassed reach at Deerfield No. 5, and the Bear Swamp Project's Fife Brook tailrace.

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[11] Ramping refers to limits on how quickly the release can be altered; up ramping limits how fast flow can be increased and down ramping limits how fast flow can be decreased.

[12] The escape window was defined as the time between detection of change in flow-related noise level and the time when the river is unwadeable. The escape window period is available for a person to move to safety after becoming aware of changing flow conditions.

We agree with NEP's proposal to reevaluate recreational ramping, or other safety options, once the operational regime and recreational enhancements are determined in a new license, and will recommend that TU and VANR be consulted in this regard.

Coastal Zone Management

The Massachusetts Executive Office of Environmental Affairs' Coastal Management Program is responsible for reviewing federally licensed projects for consistency with the state's Coastal Management Plan.[13] Under the Coastal Zone Management Act of 1972, before the Commission can issue a license, the Massachusetts Coastal Management Program must: (1) find the project consistent with the Coastal Management Program, or (2) waive the requirements by failing to act in a timely manner. The Deerfield River Basin, however, is located outside of Massachusetts' coastal zone boundary and the Massachusetts Executive Office of Environmental Affairs' has not defined a geographic area for federally licensed activities which are located outside of the coastal zone (Massachusetts Executive Office of Environmental Affairs 1979). Following the notice of the licenses the Massachusetts Coastal Management Program provided no comments regarding the projects' potential effects on coastal resources in the state of Massachusetts. We conclude, therefore, that the Massachusetts Executive Office of Environmental Affairs has waived its right to review the projects' consistency with the Massachusetts Coastal Management Program, under section 930.54 of the Coastal Zone Management Act of 1972, as amended. In Sections 3.2.3 and 4.1.2.3, we address how NEP's and WMEC's hydroelectric projects affect coastal resources, *i.e.*, Atlantic salmon.

4.2.1.4 Aesthetic Resources

Because VNRC's suggested operational scenario would eliminate NEP's seasonal peaking operation at Somerset and Harriman, this scenario would improve the aesthetic effects of drawdowns (these effects are discussed in Section 4.1.2.7). Current dewatered zone at these reservoirs exposes shoreline substrate that disrupts the scenic quality of these resources. VNRC's recommendation conflicts with the Vermont WQC requirements, the Settlement proposals and the benefits to aesthetic resources don't outweigh adverse effects to rare plants and whitewater boating (Sections 4.2.1.2 and 4.2.1.3).

4.2.1.5 Cultural Resources

The Vermont WQC requires filing a plan for downstream and upstream fish passage at Searsburg dam to be implemented at the request of the VDFW. No archeological resources would be affected because ground-disturbances to the area which have occurred when the dams were built. However, addition of new fish passage facilities to any of the historic project dams could have an adverse effect on the historic integrity of the dams. The Deerfield Project PA would include appropriate means for taking these effects into account and for providing appropriate mitigation.

4.2.1.6 Socioeconomic Resources

We conclude in Section 4.2.1.3 that VNRC's suggested operational scenario for the Deerfield Project in Vermont would significantly restrict whitewater boating flows at the Monroe Bridge and Fife Brook Sections. We also anticipate that the Settlement's proposed whitewater boating enhancements (*e.g.*, increased flows, improved boat launches, increased parking, *etc.*) could significantly increase revenues to the river basin's tourism industry. VNRC's operation scenario would, therefore, restrict the anticipated growth of whitewater boating on the Deerfield River and inhibit the resulting revenues to the tourism industry.

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[13] The state of Vermont does not have an approved Coastal Zone Program.

4.2.2 Gardners Falls

4.2.2.1 Geology and Soils

Erosion and sediment control measures should be an integral part of recreation-related construction at the project. Because ongoing use of existing and new recreational facilities could result in development of new erosion, sediment, and, river bank problems, appropriate resource agencies should have a means of notifying WMEC of problems as they arise.

A specific, regularly-scheduled monitoring and maintenance program implemented in consultation with the appropriate agencies would ensure that erosion, sediment, and river bank problems are minimized.

4.2.2.2 Fishery Resources

Project Operation and Minimum Flows

MA DFW recommends that WMEC release an instantaneous minimum flow of 150 cfs from the project dam into the bypassed reach year round to protect fishery resources. The WQC requires and DOI recommends a minimum flow of 150 cfs, but allow for some variance based on their uncertainty of what flows would be released from the upstream Deerfield No. 3 development. The MA DFW flow recommendation is more restrictive than that required by the WQC and recommended by DOI because it doesn't include the "or inflow" allowance. However, MA DFW states that WMEC's ability to provide 150 cfs will be determined by inflow from Deerfield No. 3 releases and limited storage. The MA DFW and USFWS have specific goals to manage the Deerfield River in the vicinity of the Gardners Falls Project as: (1) year-round nursery or rearing habitat area for juvenile Atlantic salmon, (2) a spring (April through June) fishery for stocked catchable adult brown and rainbow trout, and (3) to manage the river to establish a self-sustaining population of brown trout for a recreational fishery. A minimum flow of 150 cfs would provide about 80 and 96 percent of the maximum WUA respectively for adult rainbow and brown trout, and 100 percent of habitat for juvenile Atlantic salmon and brown trout and 87 percent of habitat for brown trout fry.

MA DFW and DOI recognize that WMEC has minimal storage capacity at the Gardners Falls reservoir and that the water received at the Gardners Falls Project is controlled by other hydropower projects located upstream. Both entities also recognize and are parties to the Settlement for Deerfield Nos. 3 and 2 developments, respectively, located above and below the Gardners Falls Project. Under the Settlement, the upstream Deerfield No. 3 would be required to release a minimum flow of 100 cfs and the Deerfield No. 2 would be required to release a minimum flow of 200 cfs, including a release from its storage reservoir if needed to meet the minimum flow requirement of the Settlement.

The DOI says that NEP would routinely be releasing greater than 100 cfs total flow from the upstream Deerfield No. 3 development to meet the 200 cfs minimum flow required under the Settlement for Deerfield No. 2 development. Therefore, DOI believes that WMEC would be able to release a minimum flow of 150 cfs into the bypassed reach by using some storage capacity in Gardners Falls reservoir and passing all water that is released above and beyond the 100 cfs minimum flow required from the upstream Deerfield No. 3 development.

Flows exceeding project capacity occur about 20 percent of the time and during those times water is spilled over the dam. WMEC should be able to meet the flow of 150 cfs in the bypassed reach during high flow conditions. We recognize that the limiting factors for water quality effects on the biologic community occur during the low-flow periods of the summer and early fall, when smaller amounts of water in the areas below the powerhouse and in the bypassed reach limit biological productivity and success of some fish species, such as trout.

We have analyzed what impacts WMEC's (50 and 100 cfs) and the resource agencies (150 cfs) flows would have on the fishery resources using the IFIM and our discussion can be found in Section 4.1.2.3, Fishery Resources. We determined that WMEC's proposed 50 cfs minimum flow into the bypassed reach would adequately protect water quality and fishery resources and the existing classification of this stream section as Class B warmwater fishery resources. The resource agencies' recommendation of 150 cfs for the bypassed reach would provide about 23 and 35 percent more habitat respectively for adult rainbow and brown trout than WMEC's flow release of 50 cfs. From a purely fisheries perspective, the 150 cfs minimum flow in the bypassed reach would be best for all fishery resources. Our analysis of the expected hydrograph for the bypassed reach concludes that while the 150 cfs is feasible, only 100 cfs would be the inflow to Garners Falls (during non-generating periods and assuming no other spill), and therefore the WUA habitat enhancement would most likely peak at 100 cfs. From a flow habitat perspective, Figure 4-17 shows little increase in juvenile salmon and brown trout habitat when flow is increased from 100 to 150 cfs, whereas there is a sizeable increase in habitat for both species upon flow increase from 50 to 100 cfs.

We conclude that DOI's recommendation that the project's daily storage capacity be utilized to the extent possible to maintain a 150 cfs minimum flow would have an insignificant effect on flows and benefit to resources. As noted above, the total available storage at Gardners Falls is very small and would not supplement minimum flows very long. Available storage for a 1.8-foot drawdown is about 37.2 acre-feet. This storage could sustain a 150 cfs flow release for 3 hours, a 50 cfs flow release for 9 hours, or a 25 cfs flow release for 18 hours. With a 100 cfs inflow, augmenting flows with storage would delay lower flows for 9 hours. In any case, using storage would delay lower flows for far less than 1 day, which we believe would have no discernable beneficial effect on flows or resources in the bypassed reach.

Flows less than 150 cfs occur infrequently, about 2 percent of the time, mostly during the months of August and September, and they usually last longer than 1 day. Thus, preventing flows less than 150 cfs, by augmenting flows for 1 day or less, would be a rare occurrence. At best, we could expect augmenting flows from storage would delay lower flows for 1 day or less. We do not perceive that delaying lower flows for this short time period provides any realized benefit to aquatic resources.

It may be argued that augmenting the flow from storage would reduce the frequency or magnitude of flow fluctuations in the bypassed reach. In theory this may be true, however, a more complex release plan would be needed, and with such small storage, operational constraints are likely to preclude these benefits. In any case, the benefits from these brief augmentation flows would be very difficult to discern.

We recognize that flows less than 150 cfs are expected to occur infrequently, and little or no power generation occurs at these low flows. Thus, additional energy losses from augmentation are expected to be minimal. Some energy loss, however, would occur. For example, from 3 to 18 hours of generation time would be lost during the period of time it takes to refill the reservoir after a drawdown. The exact amount of lost energy for this time period would depend on the volume of inflow. In our opinion, in this case, the benefits of flow augmentation to aquatic resources are negligible and would not likely be realized. A small energy loss would likely result, but most importantly a more complex release plan, much more difficult to monitor, would be needed.

Staff concludes that the DOI and MA DFW recommendation and the WQC requirement would enhance habitat in the bypassed reach of the Gardners Falls Project, but the intended minimum flow enhancement of 150 cfs would only occasionally be realized. Resulting habitat gains would most often be limited to that which occurs at 100 cfs. Therefore WMEC should be required to release 150 cfs, augmented by the project's daily storage capacity to the extent possible to maintain a 150 cfs minimum flow, or inflow if less, to the bypassed reach. This recommendation complies with the requirements of the WQC.

NGOs

TU didn't make a specific flow recommendation for the Gardners Falls Project but recommended the Commission review upstream flow releases from Deerfield Nos. 4, 3, and 2 developments, and based on that review, to keep in mind the "realistic possibility" of releasing a flow of 200 cfs from Gardners Falls. We have examined minimum flows released at these developments under the Settlement (see Section 4-6) and impacts of various flows on water quality and fisheries resources, as discussed above and in Section 4.1.2.3, Fishery Resources for Gardners Falls. AMC recommends a base flow of 198 cfs at the Gardners Falls Project to provide for the fishery potential that exists in that river segment. As discussed above and in Section 4.1.2.3., Fishery Resources, our analysis of the IFIM, and other factors, led us to conclude that a minimum flow release of 50 cfs for the bypassed reach and a 100 cfs supplemental flow release for three months at the powerhouse would protect and enhance the fishery resources of the Deerfield River. There is no question, that from a purely fisheries perspective, a minimum flow release of 198 cfs or 200 cfs would provide excellent habitat for most life stages of trout in the bypassed reach. Final flow recommendations are discussed in Section 5.4, Comprehensive Development and Recommended Alternatives.

Monitoring and Gaging

DOI and MA DFW recommend that WMEC submit a Plan for maintaining minimum flow releases from the project into the bypassed reach. The DOI recommends this plan be filed for approval by the Commission within three months after the license is issued. The DOI also recommends that the plans include descriptions of all mechanisms and structures to be used for monitoring minimum flows, the methods for recording and maintaining data on project operations, and a plan for maintaining these data for inspection, and for providing it to the Commission and resource agencies. Additionally, DOI recommends these plans be developed in consultation with them and the MA DFW and that comments made on the plan by the resource agencies be included in any WMEC filing with the Commission and that the resource agencies be given a minimum of 30 days to respond to the draft plan before it is filed with the Commission for approval.

The resource agency recommendations for this monitoring and gaging plan appear reasonable and we recommend that they be included in any license issued.

Fish Passage

The DOI, using its Section 18 Authority, has prescribed that: (1) a downstream fishway be constructed at the Gardners Falls Project within two years after issuance of a license and operated from April 1 through June 15 and September 15 through November 15, and (2) have reserved their authority to prescribe future upstream passage facilities, and (3) requested authority to require modifications to the fishway at the project, as needed, to facilitate future fish passage. The MA DFW has also recommended WMEC construct downstream fish passage facilities at the Gardners Falls Project and that future upstream passage, either by installing a fishway or operating a trap and truck program, may be requested of WMEC in the future. Both resource agencies agree that a louvre and bypass system would be an acceptable downstream fish passage measure at the project and WMEC is proposing to install these facilities. The staff agrees as discussed in Section 4.1.2.3, Fishery Resources.

Both resource agencies and we agree that once the downstream fishway becomes operational that it should be operated from April 1 through June 15 and from September 15 through November 15 unless additional information becomes available to modify or fine tune its use based on new downstream passage information.

The MA DFW also recommends that the downstream fish passage facilities be completed within two years after issuance of a new license. The WMEC recommends completing the passage facilities within three years after a license is issued. The DOI recommends WMEC install interim downstream passage facilities prior to the construction of the permanent downstream passage facilities (not included in its Section 18 prescription). We discuss the two year time frame and the use of interim downstream passage facilities in Section 4.1.3.2, Fishery Resources. WMEC has already installed one temporary downstream interim passage measure, and has removed flashboards in the area where the future bypass gate would be installed. We agree with DOI that the louvre part of the downstream passage system could be employed in the interim prior to constructing the permanent bypass gate in the dam crest.

As discussed in Section 4.1.2.3, and here, we agree with DOI that the design of the downstream fishway facilities should be developed in consultation with DOI. We also agree with DOI that flows needed for operation of the downstream passage facility and for attraction to the facility would be developed in consultation with it when designing the fishway. DOI also recommends that WMEC develop and submit to them functional design drawings of the passage facilities and of a construction schedule within four months from the issuance date of the license. We agree.

DOI also recommends that WMEC should prepare and file for Commission approval, plans and schedules for the operation, maintenance, and monitoring of the downstream fishway within six months from the issuance of the license. To ensure the fishway is operated as intended, DOI recommends the fishway monitoring plan include: (1) a description of facility oversight and personnel commitments needed to operate the facility, (2) identify back-up equipment and supplies maintained by WMEC to ensure fast repairs of the fishway in the event of equipment failure, and (3) means of monitoring the effectiveness of the bypass facility for determining injury or mortality of fish using the fishway. DOI also recommends that all plans associated with the downstream fishway, including operation, maintenance, and monitoring, should be developed in consultation with it and the MA DFW and that the resource agencies be provided a minimum of 30 days to comment on the plans prior to filing them with the Commission. Furthermore, DOI states that the filings of the plans with the Commission should incorporate recommendations made by the resource agencies or provide responses to their comments in those filings. In addition, the DOI recommends that WMEC provide the results of any studies associated with the downstream fishway to the resource agencies allowing them a minimum of 30 days to provide comments before filing the results with the Commission.

We agree with DOI that WMEC should prepare and file for Commission approval, plans for operating, maintaining, and monitoring the downstream fishway, and will recommend inclusion of such provisions in any new license issued. These types of plans would provide necessary information needed by the resource agencies and the Commission to determine if the required downstream fishway was functioning properly. Filing and approval of plans by the Commission should be required before any construction or changes in project operation take place.

The MA DEP WQC requires that WMEC construct a bypass system approved by the USFWS and MA DFW for the downstream passage of Atlantic salmon smolts and adds several other limitations:

(1) that the facility be operational within two construction seasons after issuance of the new FERC license;

(2) that flows necessary to operate the facility should be provided during the periods of downstream migration (April 1 to June 15 and September 15 to November 15); these flows can be modified by the MA DEP if additional information regarding the period of migration warrants change; and

(3) that plans to evaluate the effectiveness of the facility should be submitted by WMEC to MA DFW within one year of the issuance of the FERC license.

The items described in the WQC concerning the downstream fishway are compatible with what we have recommended. In addition, the bypass facility, which is an integral part of the fishway, would also be used to provide minimum flows to the bypassed reach.

TU recommends that WMEC should provide some form of downstream fish passage at the Gardners Falls Project and that the facility should be monitored to determine its effectiveness in safely passing fish downstream. TU also recommends the monitoring study plan be reviewed and approved by state and federal resource agencies and the Commission so that the facility could be modified accordingly if it fails to achieve a fish passage rate of greater than 90 percent. We partially agree with these TU recommendations. WMEC has agreed to build the downstream fishway and we would require monitoring of the fishway to determine its effectiveness in passing fish. However, it is premature at this point to establish a specific passage efficiency standard. We conclude that is best left to the design phase.

4.2.2.3 Vegetation and Wildlife Resources

Vegetation

The MA NHP reported that the Deerfield River in the Gardners Falls area contains potential habitat for six state-listed rare plant species: (1) mountain alder (state special concern), (2) roundleaf shadbush (state special concern), (3) muskflower (threatened), (4) barren strawberry (state special concern), (5) pale green orchid (tubercled orchid) (threatened), and (6) leafy white orchid (threatened). During field investigations in 1989, several individuals of mountain alder were found on the west side of the Gardners Falls bypassed reach in the unconsolidated shore vegetation cover type. None of the other state-listed plant species were found. It is not known how long the population of mountain alder has occurred along the Deerfield River shoreline of the bypassed reach. However, WMEC says that the mountain alder plants do not appear to be affected by any fluctuations that occur in the bypassed reach.

Normal, daily fluctuations for WMEC's existing and proposed operation are not expected to adversely affect mountain alder. WMEC, the agencies, nor staff recommend specific measures for the mountain alder. We conclude that WMEC's existing and proposed operation of the Gardners Falls Project would maintain the existing population of the rare mountain alder.

WMEC studies found that aquatic plants such as elodea and potamogeton occur in small scattered patches along most of the east bank and the upper quarter of the west bank of the impoundment. In any areas an abrupt drop-off into deep water limits the area available for rooted aquatic plants. Bedrock and boulder substrate also would limit such plant species. Since only a very narrow band of substrate is influenced by water level fluctuations, such fluctuations result in little, if any impact to aquatic vegetation at the Gardners Falls Project. In addition, the small emergent and shrub wetland areas along the east side of the upper end of the impoundment are perched areas several feet above the impoundment water level. As a result, these areas are not influenced by fluctuating pond levels.

By letter dated December 14, 1994, as part of the WQC, the MA DEP states that any construction activities shall be conducted in compliance with the Massachusetts Wetlands Protection Act. WMEC is not proposing any specific construction related activities with the exception of the proposed recreational facilities. We conclude that vegetative resources would not be affected by the continued operation of the Gardners Falls Project.

4.2.2.4 Recreation and Land Use Resources

Tailrace safety

Because of the variation in flows below the powerhouse, TU requests that the Commission address recreational user safety downstream of the Gardners Falls Project. TU suggests that WMEC provide reasonable and safe ramping rates, in addition to their existing alarm system. Safe ramping rates are considered flows sufficient to alert anglers and swimmers that a release was imminent and allow them a reasonable period of time to leave the river while the flow was not unwadeable.

WMEC's current warning system includes an audible alarm system that sounds prior to the start-up of each turbine unit and signs posted below the project explaining the purpose of the sirens. Since the project turbines are activated sequentially, flows gradually increase below the project and stabilize before another unit begins to operate. Further, WMEC provides a public safety brochure explaining how the project operates and explaining the warning system. [14] WMEC plans to distribute these safety brochures to schools, town officials (for distribution with fishing and hunting licenses), and watershed associations to promote an awareness of the potential dangers associated with water-based activities near hydroelectric projects.

We conclude that WMEC's existing safety measures adequately alert recreational users prior to project operational flow increases.

Minimum Flow Effects on Angling

While the agencies recommended 150 cfs minimum flow would further enhance fishery habitat in the bypassed reach, it would limit wade angling in this reach. Based on WMEC's IFIM study angling opportunities are limited for wading in the bypassed reach at flows above 100 cfs due to water depths, turbulence, and high velocities produced by flows through the boulder substrate. We conclude, however, that the agencies recommended minimum flow would benefit trout angling opportunities by further improving the habitat for trout over WMEC's proposed minimum flow (for further discussion on the benefits of the agencies recommended minimum flows see Fisheries Section 4.2.2.2). Under the agencies recommended 150 cfs minimum flow, fishing opportunities would remain available for shoreline angling along the bypassed reach and in the tailrace.

Enhancement Fund

Massachusetts, DOI, and AMC all recommend that WMEC establish an Environmental Enhancement Fund in the amount of $50,000. WMEC opposes the establishment of this recommended fund. The purpose of the recommended enhancement fund is similar to the $100,000 fund included as part of NEP's Settlement. The agencies and AMC provide no basis for the amount of this fund.

WMEC's proposed recreational enhancements would significantly improve the recreation opportunities currently available at the Gardners Falls Project area. We conclude that their proposal would meet the current recreation demands at the project and provide adequate recreational access at the project. Specifically, WMEC's proposed enhancements would provide adequate angling and boating access to both the impoundment and tailwaters. While we cannot anticipate unforeseen recreation needs through a license term, the Commission's Form 80 monitoring process provides periodical review to determine whether additional facilities are necessary during the license term. Therefore, we are not recommending that the Commission require an enhancement fund. Per section 10(a) of the FPA, the other enhancements we are recommending provide a reasonable balance of the competing interests.

Conservation Easements

AMC recommends that WMEC establish Conservation Easements along the project impoundment, bypassed reach, and power canal to ensure that no further subdivision or development occurs on these lands, except for development that improves recreational access at the project.

WMEC considers conservation easements on lands at the Gardners Falls Project as unnecessary due to the steeply sloped topography along the river which limits the developmental potential of project lands. We agree with WMEC. WMEC proposes no land-disturbing or land-clearing activities that would adversely affect

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14 WMEC's public safety brochure is titled "Be Alert to River Conditions near Hydroelectric Power Station Areas"

the aesthetic or recreational resources at the Gardners Falls Project. Steep topography along the impoundment and bypassed reach naturally provides a buffer to development by limiting the potential to develop these lands.

The Commission's Standard Land Use Article would allow WMEC to develop lands within the project boundary, under certain circumstances, without prior Commission approval (for example, a non-commercial pier that accommodates less than 10 watercraft or a retaining wall for soil erosion control). Additional development or subdivision, however, on the 48.9 acres included within the Gardners Falls Project area would require Commission approval. We conclude that the current Gardners Falls Project boundary adequately protects aesthetic resources and public access opportunities in the project area.

4.2.2.5 Cultural Resources

Massachusetts recommends that WMEC be required to place interpretive signs at all cultural and historic sites throughout the Gardners Falls Project area. Although this could inadvertently invite undesirable vandalism or other damage to archeological or historic architectural resources which may be present at the project, we don't necessarily preclude this proposal. Appropriate handling of these resources will be taken into account through the Gardners Falls PA, and may ultimately include placement of interpretive signs.

4.3 CUMULATIVE EFFECTS

4.3.1 Water quality and quantity

There should be an overall improvement in the water quality of the Deerfield River as result of relicensing the Deerfield River and Gardners Falls Projects under the Settlement and staff-recommended measures. Under the new licenses there would be water in bypassed stream reaches when and where there had seasonally not been water. Under the current operating regime adverse cumulative impacts by the hydropower projects caused stream temperatures to increase and DO to decrease in bypassed stream reaches. Fish communities have adjusted to these situations, warmwater fish replacing coldwater fish. Put-and-take coldwater fisheries were established for those periods when the water remained cold. Under the new licenses, there is a potential for new stream reaches to be reclassified as Class B coldwater fish from the Class B warmwater fish category. There is also the potential for new stream reaches to have longer periods of cold water temperatures because of minimum flow releases.

Although not related to the hydropower licensing activities, the cessation of operation of the Yankee facility should, in conjunction with the new minimum flow releases from the Deerfield Project, lead to cooler water temperatures in stream areas below the Sherman reservoir.

The release of minimum flows throughout the Deerfield River (including the Deerfield, Gardners Falls, and Fife Brook Pumped Storage Projects) should also act to reduce any adverse cumulative impacts to water quality caused by the release of wastewater effluents to the river and by nonpoint agricultural runoff entering the river in the lower reaches of the river basin.

Overall water quality is likely to remain unchanged in the Somerset and Harriman reservoirs. However, the immediate stream reaches below both of these reservoirs could potentially develop into an excellent coldwater trout fishery because of the cold, well oxygenated water releases and the establishment of year round minimum flows which previously were lacking or insufficient to sustain large fish populations.

4.3.2 Anadromous Fishery Resources

Downstream passage of Atlantic salmon smolts has been hampered or delayed by several dams erected on the mainstem of the river. Installing downstream fish passage facilities at four dams on the mainstem of the lower Deerfield River would greatly facilitate the safe and swift downstream movement of Atlantic salmon smolts stocked in the upper portions of the Deerfield River Basin. The construction of these downstream passage facilities should provide cumulative beneficial results to state and federal resource agencies that are trying to re-establish Atlantic salmon in the Deerfield River Basin. In addition, the phased approach of providing upstream passage facilities for returning adult Atlantic salmon at the lowermost dam on the Deerfield River (Deerfield No. 2) would further provide cumulative benefits and is pivotal to the future use and access of the upper reaches of the Deerfield River by adult Atlantic salmon once they become well established in the Deerfield River.

There is the potential for a recreational sport fishery for Atlantic salmon to develop in the lower reaches of the Deerfield River between the Deerfield No. 2 development and the Connecticut River once ample numbers of adult fish are established and are returning to this stream for spawning (see Section 4.3.5, Recreation and Land Use).

Reservation of authority to prescribe fishways

DOI requests that the Secretary of Interior's authority to prescribe the construction, operation, and maintenance of upstream and downstream fishways under Section 18 of the FPA be reserved for the Deerfield and Gardners Falls Projects. Section 18 of the FPA provides the Secretary of Interior the authority to prescribe fishways.[15] We recognize however, that future fish passage needs and management objectives cannot always be predicted at the time of license issuance. Under these circumstances, and upon receiving a specific request from DOI, it is appropriate for the Commission to reserve DOI's authority to prescribe fishways.[16]

Currently there are no self-sustaining populations of Atlantic salmon in the Deerfield River Basin. Atlantic salmon can enter the Deerfield River from the Connecticut River but have not been reported to do so. Atlantic salmon fry, parr, and smolts have been stocked in the Deerfield River Basin for many years but no populations have become established. These fish are subject to injury and death as they seasonally migrate downstream past several dams and hydropower projects. As agreed to in the Settlement and in the Section 18 prescriptions, we recommend downstream fish passage facilities be built at Deerfield Developments No. 4, No. 3, and No. 2, and at the Gardners Falls Project. Upstream passage facilities would be built at the Deerfield No. 2 Development, the first upstream impediment to salmon migrating up the Deerfield River. These fishways should greatly improve the chances of establishing Atlantic salmon populations in the Deerfield River Basin.

The specific Section 18 prescriptions for the construction, operation, and maintenance of the upstream and downstream fishways are discussed in Sections 4.1.1.3 and 4.2.2.2, Fishery Resources. We recommend the measures required in the Section 18 prescriptions with one exception. DOI requires NEP and WMEC to provide final design drawings of the fishways for the Deerfield No. 4, No. 3, and No. 2 developments and for the Gardners Falls Project, for DOI approval, prior to the start of construction. We do not agree. The Commission, following the Lynchburg Hydro Associates decision,[17] determined that it retains final approval authority over all project structures, including fishways, and we therefore believe the DOI approval of the fishways is not a prescription under FPA Section 18.

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

[16] *Lynchburg Hydro Associates*, 39 FERC ¶ 61,079 (1987).

[17] *Ibid.*, 39 FERC ¶ 61,079 (1987))

4.3.3 Fishery Habitat

The relicensing of the Deerfield and Gardners Falls Projects under the proposed Settlement and staff recommended measures would provide significant cumulative enhancements to fishery habitat in the Deerfield River Basin. The current Deerfield and Gardners Falls Project operate largely without minimum flows required in bypassed stream reaches. Under new licenses, over 12 miles of bypassed stream reaches which previously only received leakage flows from dams or minor flow releases, especially during the dry, late summer and early fall months, would receive minimum flows that would greatly improve existing fish habitat in these stream reaches and provide year round fisheries habitat where previously there was none. Adverse cumulative impacts on fisheries habitat caused by all hydropower projects on the Deerfield River would also be moderated by establishing minimum flows and better management of water level fluctuations in the reservoirs, particularly in the two largest reservoirs in the Basin, the Somerset and Harriman Reservoirs. The closer manipulation of water levels in these two larger reservoirs should improve spawning and near shore nursery activities for smelt and for warmwater fish. The new minimum flows are also likely to create more habitat for smelt in stream reaches above Harriman Reservoir.

In addition to having over 12 miles of bypassed stream reaches in the Deerfield River, the hydropower projects affected over 16 miles of fisheries habitat in the river by fluctuating flows caused by peaking operations. Whereas, peaking operations would continue under the new licenses, the implementation of minimum flows and some ramping rates at several developments, should act to minimize the effects of these flow fluctuations and stabilize or increase fisheries habitat in the river.

4.3.4 Wetland Resources

The Settlement's proposed operational changes and recreational enhancements are not expected to result in adverse cumulative effects to wetlands in the Deerfield or Gardners Falls Project areas. Wetlands would continue to be affected by seasonal fluctuations of the Somerset and Harriman reservoirs to some degree, but this effect is minor and no net loss of wetlands is expected. Beneficial cumulative effects would occur to the rare tubercled orchid through the implementation of the Mitigation Plan. In addition, the Settlement's proposal would result in cumulative benefits to wetland dependent wildlife, such as the common loon and other species of waterfowl, and beaver through the implementation of various wildlife enhancement measures (see Sections 4.1.1.4 and 4.2.1.2). Implementing these enhancement measures would not only benefit the resources in the immediate Deerfield Project area by providing additional habitat, but would cumulatively benefit wetlands and associated wildlife resources throughout the entire Deerfield River Basin.

4.3.5 Recreation and Land Use Resources

Recreational enhancements and minimum flows, as proposed by both NEP and WMEC, would collectively result in cumulative effects and enhance recreation opportunities in the Deerfield River Basin. NEP's proposed recreation enhancement program is comprehensive and includes recreational facilities that would improve picnicking, boating, hiking, and angling opportunities throughout the basin. Within the Gardners Falls Project area, WMEC's proposed recreation measures would further enhance recreational access to the Deerfield River. Further, NEP's and WMEC's proposed recreational enhancements include providing barrier-free facilities that would cumulatively benefit recreational opportunities for individuals with disabilities.

While NEP's and WMEC's proposed enhancements would significantly improve various recreational opportunities along the Deerfield River, we find that the proposed measures would cumulatively benefit both whitewater boating and angling. Whitewater boating and angling are the principal recreation activities in the basin, and both of these activities would cumulatively benefit from implementing the proposed measures.

Whitewater boating opportunities on the Deerfield River would significantly improve as a result of NEP's proposed whitewater flow schedule, flow notification telephone service, and access facility enhancements.

Predictable whitewater flows and adequate boating access at the Monroe Bridge and Fife Brook Sections would combine to offer a valuable whitewater boating resource. Implementing NEP's proposed measures to enhance whitewater boating would consequently offer quality whitewater boating opportunities for whitewater boating enthusiast in the nearby New York and Boston metropolitan areas.

Implementing minimum flows below the 10 dams along the Deerfield River as proposed by both NEP and WMEC would improve angling opportunities in the basin. Insufficient flows below hydroelectric developments have historically restricted fishery potential and angling opportunities. Minimum flow proposals would significantly enhance fisheries along significant stretches of the Deerfield River that currently offer limited angling opportunities. When combined, these fishery habitat enhancements would significantly improve the Deerfield River's trout fishery, cumulatively benefiting angling opportunities within the basin. Further, NEP's and WMEC's proposed recreational enhancements would cumulatively benefit angling opportunities along the Deerfield River by improving river access. Angling access improvements include new and improved parking access, trails, fishing platforms, and boat ramps.

NEP's and WMEC's proposed measures to help restore an Atlantic salmon fishery on the lower Deerfield River by installing downstream and upstream fish passage facilities could also cumulatively benefit angling opportunities. Atlantic salmon are an important recreation fish in the New England region and successful efforts to restore Atlantic salmon on the lower Deerfield River could lead to a substantial increase in angling pressure.

In addition to minimum flow effects, project operations along the Deerfield River cumulatively affects recreational use due to the sudden increase of tailrace flows when powerhouse units go on line. Both NEP and WMEC currently provide audible alarm systems at two of the developments on the Deerfield River which alert individuals that a release is imminent. WMEC's Gardners Falls Project also operates so that flows gradually increase since the project turbines are activated sequentially. NEP conducted an instream safety study at selected developments of the Deerfield Project and they plan to reevaluate recreational safety needs once the project operational regime is determine upon license issuance. Based on their reevaluation study, NEP would determine the need for ramping rates for recreational safety or additional safety options.

Finally, NEP proposes conservation easements that would cumulatively benefit recreation and land use resources by protecting significant portions of the basin from inappropriate development. NEP's conservation easements include over 18,000 acres along the Deerfield River, and NEP would manage these lands in accordance with their Forest Management Guidelines. NEP's management guidelines would ensure the continued multiple use value of the basin's resources and would provide long-term public benefits by protecting recreational access to project waters and surrounding land. The proposed easements would also provide a buffer from inappropriate development along a significant percentage of the Deerfield River shoreline. Therefore, implementing the proposed easements and Forest Management Guidelines would cumulatively benefit recreational and land use resources.

4.3.6 Aesthetic Resources

NEP's and WMEC's proposed minimum flows would cumulatively affect aesthetic resources in the basin by enhancing scenic views of the Deerfield River below the project developments. Currently, the viewshed along river sections where flows are limited to leakage and local drainage include the bypassed reaches at Searsburg, Harriman, Deerfield No. 4, Deerfield No. 3, and at the Gardners Falls Project. Minimum flows at these reaches, as proposed or recommended by the agencies, would cumulatively enhance scenic views at these river reaches. NEP's proposal to increase minimum flows at Somerset, Deerfield No. 5, Deerfield No. 2, and Bear Swamp's Fife Brook dam would further benefit aesthetic views of the Deerfield River.

Impoundment level management along the Deerfield River also cumulatively affects aesthetic resources by disrupting scenic views. Scenic views, particularly at the Harriman and Somerset Reservoirs, are disrupted due to drawdowns which expose substrate along the shoreline. While NEP's proposed drawdown management plan would continue to affect aesthetic views at impoundments along the Deerfield River, NEP would minimize these effects by limiting drawdowns during the spring and early summer.

Finally, NEP's proposed conservation easements would cumulative affect aesthetic resources in the basin by providing an extensive buffer zone along a significant portion of the Deerfield River corridor. River corridor land subject to the conservation easement include 15,736 acres in Vermont and 2,619 acres in Massachusetts. Implementing these conservation easements would prevent inappropriate development along the Deerfield River and protect the basin's aesthetic resources.

4.3.7 Hydroelectric Generation

Table 2-5 shows the net power benefits for all 10 projects in the river basin. Table 5-1 summarizes the cumulative effects for hydroelectric generation within the Deerfield River Basin for each of the alternatives analyzed.

Regarding non-developmental cumulative effects on hydroelectric generation, by letter dated October 5, 1994, Massachusetts recommends that WMEC should develop school curriculum to go with the interpretive trail along the west side of the power canal. This curriculum should address the natural resources of the area, and specifically the river system, and also include educational content concerning hydroelectric power production.

4.4 NO-ACTION ALTERNATIVE

The no-action alternative would maintain the *status quo* and result in no change to the existing environments at the Deerfield and Gardners Falls Projects (described above in Section 3.3.1). The projects would continue to operate under the same terms and conditions of the previous two licenses and there would be continued energy production. Furthermore, NEP and WMEC would not be required to provide any further enhancement measures. Also, there would be no amendment to the existing Bear Swamp Pumped Storage Project.

4.5 RELATIONSHIP TO LAWS AND POLICIES

The National Environmental Policy Act (NEPA) [18] mandates the preparation of an EIS for all federal actions significantly affecting the quality of the human environment. We have determined that issuance of new licenses for the Deerfield River projects are actions that fall within this NEPA mandate.

Section 10(a) of the FPA [19] requires that each licensed project be best adapted to a comprehensive plan for improving or developing a waterway for, among others, beneficial public uses including recreational purposes. The Commission, therefore, requires that each license applicant consult with the concerned federal, state, and local recreation agencies to determine the an appropriate level of development to help meet the recreational needs of the area.

Before issuing a new licenses to NEP and WMEC for their projects, the Commission, the SHPO, and the Advisory Council on Historic Preservation would execute a Programmatic Agreement for protecting historic properties that will satisfy all of the Commission's obligations under §106 of the National Historic Preservation Act.

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[18] 42 U.S.C. §§4332 *et seq.*

[19] 16 U.S.C. §803(a)

Per the Fish and Wildlife Coordination Act, [20] the Commission must consult with the USFWS and Fish and Game on preventing loss or damage to fish and wildlife resources and on developing and improving water resources.

Consistent with the requirements of Section 7 of the Endangered Species Act [21] the Commission requires applicants for license to submit a list of federally listed or proposed threatened or endangered species and critical habitats occurring in the vicinity of projects. DOI says that except for occasional transient individuals, no federally listed or proposed endangered or threatened species are known to exist in the projects' impact area. Therefore, no biological assessment or further consultation under the Endangered Species Act is required at this time. The NMFS states that the federally listed, endangered shortnose sturgeon may inhabit the project area. See Section 4.1.1.5 for our discussion of the shortnose sturgeon.

Commission regulations require applicants to obtain, per §401 of the Clean Water Act [22], either: (a) state certification that any discharge from the project would comply with applicable provisions of the Clean Water Act or (b) a waiver of certification by the appropriate state agency. The Commission requires that applicants apply for such certification or waiver before they file their application with the Commission. Water quality certificates for the projects have been issued by Vermont and Massachusetts. See Sections 2.4.1 and 2.4.2 for a listing of measures required by the WQC's.

Vermont and Massachusetts have regulations to maintain water quality standards in the Deerfield River. In addition, the Clean Water Act has anti-degradation policies, which are to prevent degradation of waters that meet or exceed the standards. The mechanism by which the state enforces and the anti-degradation policy for hydropower projects is water quality certification in which the state specifies requirements for project operation that it feels are sufficient to maintain water quality adequately.

Section 18 of the FPA, 16 U.S.C § 811, states that the Commission shall require construction, maintenance and operation by a licensee of such fishways as the Secretaries of Commerce and DOI may prescribe. By letters dated October 5, 1994, DOI prescribed upstream and downstream fishways at the Projects and requested reservation of authority to prescribe the construction, operation, and maintenance of fishways pursuant to Section 18 of the FPA. See Section 4, Fishery Resources, for further discussion on fishways.

Under Section 307 (c)(3)(A) of the Coastal Zone Management Act of 1972, 16 U.S.C § 1456 (3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone, unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program (which has been approved by the Secretary of Commerce), or the agency's concurrence is conclusively presumed by it's failure to act within 180 days of its receipt of the applicant's certification. The Massachusetts Coastal Management Program must either find the project consistent with the Costal Management Program or waive the requirements. However, the Deerfield River Basin is not located within the Massachusetts Coastal Zone and Vermont does not have an approved Costal Zone Program. For further discussion on the Coastal Zone Management Act see Section 4.2.1.6.

4.6 UNAVOIDABLE ADVERSE IMPACTS

Even with staff's recommended mitigation and enhancement measures (see Section 5.4), the minor impacts listed below would likely continue to occur:

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[20] 16 U.S.C. §§661 *et seq.*

[21] 16 U.S.C. §1531, as amended

[22] 33 U.S.C. §1341

Geology and Soils: Some minor continuing reservoir shoreline erosion, sediment, and bank problems would be unavoidable due to combined effects of wave action, reservoir pool fluctuations, and ice scouring.

Some minor, unavoidable erosion and sediment problems would occur over time due to recreational use.

Some minor short-term erosion and sediment problems would result from construction of recreational and fish passage facilities.

Fishery Resources: Whitewater boating releases at Deerfield No. 5 and Bear Swamp would adversely affect establishment of self sustaining trout populations.

Terrestrial Resources: Minor, short-term displacement of some plant and animal populations would occur if recreational changes are made to the various project sites as proposed, as well as the agency proposed transplantation experiments for the tubercled orchid.

Recreation and Land Use Resources: Whitewater boating would displace anglers below Fife Brook due to NEP's proposed whitewater releases. Whitewater boating effects on angling is minimized, however, by NEP's proposed minimum flows in reaches that would significantly improve angling opportunities.

Aesthetic Resources: Project-related construction related to NEP's recreation enhancements and fish passage measures would disrupt the viewshed at selected sites. These short-term aesthetic effects are considered localized and minor.

Cultural Resources: Some long-term adverse effects to the integrity of historic project features would be unavoidable over time due to project operation and maintenance.

Some unavoidable, long-term adverse effects to archeological resources along the reservoir shorelines could result from combined effects of wave action, reservoir pool fluctuations, and ice scouring.

Some unavoidable adverse effects to the integrity of historic features could result from construction of fish passage facilities.

Air Quality: Short-term, minor, unavoidable impacts would result from increased dust, noise during the construction of the fish passage facilities.

4.7 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Continued operation of the existing projects would continue the commitment of lands and waters previously developed for energy production.

4.8 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The Deerfield and Gardners Falls Projects are expected to provide an average of about 253,956 GWh and 15,137 of energy, respectively, each year to NEP's and WMEC's service area. This long-term productivity would extend at least as long as the duration of the licenses (30 to 50 years). The recommended alternative is designed to avoid long-term decreases in biological productivity of the system.

If the projects were to operate solely to maximize hydroelectric generation, there would be a loss of long-term productivity of the Deerfield River fisheries and anadromous fisheries restoration efforts due to decreases in habitat availability, the loss of upstream and downstream fish passage, and a loss in weekend boatable days for whitewater recreationists. With the alternatives recommended and appropriate enhancement or mitigation measures at each site, the Deerfield River Basin should still be able to achieve the anadromous fisheries restoration goals established by the agencies and other enhancements to aquatic life, as well as accommodating whitewater boating interests.

5. STAFF'S CONCLUSIONS

Staff evaluated the cumulative and site specific environmental effects of the following actions in this document:

(1) Relicensing NEP's proposed 76.9-MW Deerfield River Project, which consists of an Offer of Settlement between NEP and 12 agencies and NGOs, and a Cultural Resources Management Plan, and relicensing WMEC's 3.6-MW Gardners Falls Project, which is not part of the Settlement. As a part of the Settlement, Staff also analyzed the effects of amending the license of NEP's 610-MW Bear Swamp Pumped Storage Project. (See Section 4.1)

(2) WQC conditions made by the Vermont Agency of Natural Resources (VANR) and the recommendations of the Vermont Natural Resources Council, an NGO, and some additional staff recommendations on the Deerfield River and Gardners Falls Projects (See Sections 4.2).

(3) the No-Action Alternative, which would allow the projects to continue to operate under the terms and conditions of the existing licenses. (See Section 4.4).

5.1 CUMULATIVE EFFECTS SUMMARY

Table 5-1 summarizes and compares the anticipated cumulative effects to key resources from the proposed projects, WQCs, VNRC's recommendations, Staff's alternative, and No Action. The cumulative effects analysis was defined through the scoping process and includes the following resource areas: water quality and quantity, anadromous fisheries, fishery habitat, wetlands, recreation and land use, aesthetics, and hydroelectric generation. Because the Deerfield project is located in both Vermont and Massachusetts and the Gardners Falls project in Massachusetts, we examined the above resources of the East Branch of the Deerfield River and the mainstem Deerfield River downstream to the southern confluence with the Connecticut River.

Overall, all of the action alternatives examined would enhance environmental resources to varying degrees, especially anadromous fishery restoration efforts, whitewater boating, and recreational opportunities in the river basin. However, reductions in the level of hydroelectric generation and increased costs of operating the projects would have to borne by the projects to realize the environmental benefits.

Table 5-1 Cumulative Effects Summary for key resources within the Deerfield River Basin (Source: Staff).

CEA Resource	Proposed Projects	WQC's	VNRC's Recommendations	Staff Selected Alternative	No Action Alternative
Water Quality & Quantity	Cumulative improvements in overall water quality in the Deerfield River and significant improvements in some bypassed reaches that previously received flows intermittently and experienced reductions in DO and increases in temperature. Increased flows and establishment of minimum flows will also act to cumulatively improve water quality throughout the Deerfield River and would dilute effluents released into one bypassed reach.	Same cumulative benefits as Settlement, plus the stabilization of Somerset and Harriman Reservoir levels should act to further minimize erosion and turbidity. Several bypassed reaches should improve to meet "use" designations because of increased flows. Gate management plan at Somerset, temperature and DO monitoring at Harriman reservoir outlet, and overall monitoring of both these reservoirs with a refinement of watershed model and flow management should improve the overall water quality of the Deerfield River.	Similar cumulative benefits to water quality as Settlement and the 401 WQC. However, with a reduction of annual peaking at upper three reservoirs with VNRC's proposal, water quality would likely improve throughout a greater portion of the Deerfield River than under the Settlement or the 401 WQC.	Overall cumulative benefits to water quality and quantity in the Deerfield River, particularly in the 12 miles of stream reaches that were previously bypassed and in the 16 miles of the Deerfield River that experienced fluctuating flows. Potential for a slight overall decrease in water temperatures in the Deerfield River below the warmwater coldwater dividing point at the No. 4 Development.	Continued reductions in water quality and quantity throughout the Deerfield River and particularly in bypassed stream reaches. Waste assimilation would continue to be a problem in some areas and several stream segments would continue to fail to meet state designated "use." Water level fluctuations in the Somerset and Harriman reservoirs would continue to be dramatic. Over 16 miles of the Deerfield River would be affected by water level fluctuations that can have adverse cumulative impacts on water quality and aquatic biota.

CEA Resource	Proposed Projects	WQC's	VNRC's Recommendations	Staff Selected Alternative	No Action Alternative
Anadromous Fishery Resources and Fishery Habitat	Major cumulative benefits for downstream anadromous fish passage in the lower Deerfield River from the No. 4 Development to the Connecticut River. Upstream passage for Atlantic salmon at Development No. 2 should greatly enhance salmon restoration in the Deerfield River. Minimum flows will provide increased nursery habitat for Atlantic salmon smolts and better habitat for resident species by providing more stability and new habitats in bypassed stream reaches. Better water level management in Somerset and Harriman reservoirs will also provide cumulative beneficial habitats for resident fish, particularly smelt, and warmwater fish.	Same cumulative benefits for resident fish habitat and anadromous fish passage. Setting ramping rates and monitoring flows and reservoir operations improves ability of NEP to meet Settlement objectives of improving conditions for fish and wildlife of the Deerfield River. Proactive approach for potential future need for migratory salmonid fish passage and impingement/entrainment protection in the Upper Deerfield river (i.e., Searsburg) as related to establishing a salmonid fishery in Harriman reservoir. No immediate need for these measures, but VANR required plans would provide future direction for use of large segment of upper Deerfield River by migratory salmonids, particularly landlocked Atlantic salmon.	Similar cumulative benefits for resident fish habitat and anadromous fish passage as gained with NEP and VANR recommendations. VNRC also favors upstream and downstream passage at Searsburg based on the establishment of a landlocked Atlantic salmon population and intake protection at Searsburg. These measures would improve passage for migratory fish in the Upper Deerfield River and protect fish once they are established, but these measures appear premature to staff as the stocking program has not been initiated and is uncertain when and if it will be initiated and the success of establishing landlocked Atlantic salmon in Harriman reservoir has been unsuccessful thus far.	Cumulative benefits for resident and anadromous fish habitat throughout the Deerfield River and marked improvements in fish passage in the lower half of the River. Anadromous fish passage in the upper portion of the Deerfield River is deferred until there are established populations or very active stockings of Atlantic salmon fry or smolts in these upper stream reaches.	Adverse cumulative impacts would persist for fish habitat. Over 12 miles of bypassed reaches would frequently be without water or have minimal amounts and thereby reduce fish habitat. Downstream anadromous fish passage would be riskier and subject to entrainment and impingement. Upstream anadromous fish passage would be limited to the stream reach between the mouth and the No. 2 Development.

CEA Resource	Proposed Projects	WQC's	VNRC's Recommendations	Staff Selected Alternative	No Action Alternative
Wetlands	Minor, cumulative beneficial effects would occur to wetlands at Somerset & Harriman from minimizing fluctuations or stabilizing the reservoirs during certain times of year	Moderate, cumulative beneficial effects would occur to wetlands resulting from more strict changes in reservoir fluctuation levels, and a proposed plan to protect the tubercled orchid.	The effects of run-of-the-river operation throughout the Deerfield River System could result in a net change in the quantity of wetlands; however, this effect remains unknown.	Moderate, cumulative beneficial effects would occur to wetlands at Somerset & Harriman, to include benefits to the rare tubercled orchid from changing the operation of these reservoirs and implementing a required enhancement plan for the tubercled orchid.	No change to existing wetlands.
Recreation & Land Use					
Whitewater Boating	Whitewater flows at No. 5 and at Fife Brook, in addition to increased flows below Somerset and No. 2, would cumulatively enhance whitewater boating opportunities significantly. NEP's access improvements would further enhance whitewater boating in the river basin.	Providing a canoe portage at Searsburg, as stipulated in the WQC, would provide some additional whitewater boating enhancement in the upper Deerfield River.	Modifying NEP's peaking operation would significantly restrict NEP's ability to provide the proposed whitewater flow releases and adversely affect the summer whitewater boating potential on the Deerfield River.	In addition to NEP's proposed whitewater boating enhancements, our recommended canoe portage at Searsburg would further enhance whitewater boating opportunities in the upper Deerfield River.	Whitewater boating at both No. 5 bypassed reach and below Fife Brook would remain limited to flows voluntarily released by NEP. Further, NEP would not implement the needed access improvements to these whitewater boating sections.
Sport Fishing	Minimum flow increases and the proposed fishways would cumulatively enhance angling opportunities by significantly improving the river's sport fishery. Implementing NEP's and WMEC's recreation plans would further enhance angling opportunities by improving access and providing barrier-free angling facilities.	No additional cumulative benefits over NEP's proposal.	Modifying NEP's peaking operation could provide some minor angling benefits at the Somerset and Harriman reservoirs by limiting drawdowns that affect ice fishing and boat angling.	No additional cumulative benefit over NEP's or WMEC's proposal.	Restricted flows in the bypassed reaches and tailraces at both projects would continue to limit angling opportunities. The absence of appropriate fishways at the projects would continue to limit future potential of an Atlantic salmon sport fishery.

CEA Resource	Proposed Projects	WQC's	VNRC's Recommendations	Staff Selected Alternative	No Action Alternative
Buffer Zones	NEP's conservation easements would cumulatively benefit recreational resources significantly by protecting a significant percentage of the river's shore lands from development and ensuring long-term public access to these resources.	No additional cumulative benefit over NEP's proposal.	No additional cumulative benefit over NEP's proposal.	No additional cumulative benefit over NEP's proposal.	Over 18,000 acres of land along the Deerfield River corridor would remain unprotected from potential development or mismanagement.
Aesthetics					
Scenic Views	Minimum flows below the developments and NEP's conservation easements would cumulatively enhance and protect scenic views of the Deerfield River significantly.	No additional cumulative benefit over NEP's proposal.	Limiting drawdowns at the Somerset and Harriman reservoirs would significantly reduce the dewatered zone and improve the scenic quality along those particular reservoirs.	No additional cumulative benefit over NEP's proposal.	Limited flows in the bypassed reaches of both projects would continue to cumulatively diminish views along numerous segments of the river.
Hydroelectric Generation	Minor cumulative effects on hydroelectric generation would result from increased minimum flows at various developments, resulting in a decrease of about 38,089 MWh of energy for the river basin.	Minor cumulative effects on hydroelectric generation would result from increased minimum flows at various developments, resulting in a decrease of about 41,895 MWh of energy for the river basin.	Moderate to significant cumulative effects on hydroelectric generation would result from increased minimum flows at various developments, resulting in a decrease of about 90,126 MWh of energy for the river basin.	Moderate cumulative effects on hydroelectric generation would result from increased minimum flows at various developments, resulting in a decrease of about 73,700 MWh of energy for the river basin.	No change to the existing total generation of 724,735 MWh of energy for the river basin.

5.2 COMPARISON OF ENVIRONMENTAL EFFECTS OF PROPOSED ACTIONS AND ALTERNATIVES

Table 5-2 is a summary comparison of the impacts and enhancement measures associated with the Deerfield and Gardners Falls Projects under the various alternatives. The projects as they currently exist, the No-Action alternative, provide the greatest amount of power generation, but provide no environmental enhancements.

Table 5-2. Comparative environmental effects of the **Deerfield Project only**, as proposed by NEP, including the Settlement, the Vermont and Massachusetts WQC's, the project as proposed with Staff's modifications, and the no action alternatives (Source: Staff).

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
		GEOLOGY & SOILS		
a) shoreline erosion	Continuing minor erosion, sediment, and bank problems from the combined effects of wave action, reservoir pool fluctuations, and ice scouring. Less than No Action due to proposed remedial shoreline repairs at Molly Stark and Jacksonville Picnic Areas.	No appreciable difference from No Action.	Same as NEP's Settlement.	Continuing minor erosion, sediment, and bank problems from combined effects of wave action, reservoir pool fluctuations, and ice scouring
b) erosion & sediment from fish passage	Minor, short-term erosion and sediment effects from excavation in river bed and right bank below dam at Deerfield No 4, and excavation in river bed below dam at Deerfield No.3.	Additional minor, short-term erosion and sediment effects from constructing fish passage at Searsburg would be kept to minimal levels due to erosion control plan required by the VT WQC (*Note*: this VT WQC requirement does not preclude NEP's proposed fish passage construction in Massachusetts).	Less than NEP's; requiring erosion and sediment controls at any fish passage installation (as suggested by DOI at agency scoping meeting) would keep effects to minimal levels.	None
c) erosion and sediment due to recreational development.	Some erosion and sediment runoff from land-clearing and ground-disturbances during each proposed construction and enhancement; could be moderate, depending on site.	Some erosion and sediment runoff from land-clearing and ground-disturbances during each proposed construction and enhancement, but would be only minor due to inclusion of erosion and sediment measures in design plans.	Same as VT 401 WQC.	None
d) erosion and sediment problems due to recreational use	Long-term erosion and sediment runoff at all sites, with additional bank problems at sites located on reservoir and river shorelines; could become moderate to severe depending on site.	Same as No Action: long-term erosion and sediment runoff at all sites, with additional bank problems at sites located on reservoir and river shorelines; could become moderate to severe depending on site.	Long-term erosion, sediment, and bank problems would be kept to minor levels because monitoring and maintenance program would prevent problems from getting out of hand.	Long-term erosion and sediment runoff at all sites, with additional bank problems at sites located on reservoir and river shorelines; could become moderate to severe depending on site.

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
		WATER QUALITY & QUANTITY		
Water quality and quantity	Improves water quality and quantity in the Deerfield River, particularly in bypassed stream reaches. DO levels should increase and water temperatures should decrease slightly during the low-flow periods. Increase in quantity of water in several bypassed stream reaches may lead to meeting state designated "use" of reach. Fluctuations in water levels in stream reaches would be modified by minimum flow releases.	Similar to Settlement except monitoring of DO and water temperature at Harriman ensures water quality standards are met. Restricting reservoir fluctuations and setting maximum and minimum levels of drawdown in Somerset and Harriman reservoirs could help to reduce any shoreline erosion and concomitant turbidity and thereby offer slight increase in water quality over the Settlement. Implementation of several management features at Somerset and Harriman reservoirs should also lead to a refinement of the watershed model and flow management within the Deerfield River--all features that could improve overall water quality within the river and reservoirs. Setting ramping rates and maximum gate releases at Somerset and Harriman reservoirs should minimize impacts of water level fluctuations on aquatic biota. Increase in flows and continuity of flows in several bypassed reaches should help to dilute effluents and meet state designated "use" criteria which previously failed because of flow fluctuations.	Similar improvements to water quality and quantity as Settlement and WQC's because we are incorporating combined recommendations.	Continued adverse effects on water quality and quantity. Several bypassed stream reaches would not meet state designated "use" criteria and flows throughout the Deerfield River would not be subject to lowered temperatures during the low-flow period. Fluctuating water levels in the Somerset and Harriman reservoirs would continue to increase the likelihood of some sedimentation and turbidity.

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
		FISHERY RESOURCES		
Resident Fish	Improves and enhances habitat for resident fish. Stabilization of Somerset and Harriman reservoir levels during the fish spawning and rearing seasons would be beneficial to warmwater fish. Release of minimum flows in bypassed reaches improves habitat for fish. Release of minimum flows should also improve conditions for aquatic macroinvertebrates in the Deerfield River and thereby increase food sources for fish. Increased flow releases should facilitate the establishment of self-sustaining fish populations. Whitewater recreational flow releases at Fife Brook and the No. 5 Development adversely affect resident fish but would not alter management of these stream reaches for a put-and-take fishery.	Similar benefits to resident fish as Settlement. Some additional benefits likely from VANR WQC that requires ramping rates and monitoring of DO and water temperatures at Somerset and Harriman, and implementing other management measures such as (1) gate management plans, (2) monitoring reservoir levels and flows (includes providing turbine rating curves to VANR), (3) flashboard installation requirements at Searsburg, and (4) refinement of the watershed model. The VANR WQC recommends future intake protection for fish at Searsburg which could be postponed or waived if information furnished to VDFW by NEP provides risk assessment of entrainment/impingement potential of Development.	Similar benefits to resident fish as Settlement and WQC's. Staff believes intake structures at Searsburg protect resident fish and therefore have not recommended additional justification for added protection or modification of existing facilities.	Fish habitat would continue to be degraded in over 12 miles of the Deerfield River where flows are reduced or eliminated during certain times of the year in bypassed reaches. Water level manipulations in Somerset and Harriman reservoirs would continue to potentially adversely affect resident fish. Establishment of self-sustaining resident fish populations in several stream reaches would be unlikely. There would be no expansion of recreational fishing into areas where flows would have been provided under the Settlement.

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
Anadromous fish	Greatly enhances the downstream passage of anadromous fish in the lower Deerfield River and provides upstream passage at the No. 2 Development. Minimum flows would provide increased nursery habitat for Atlantic salmon smolts. Smelt in Harriman reservoir would benefit from stabilized water levels that would accommodate their near shore spawning and additional spawning habitat would be provided by minimum flows at Searsburg--these enhancements could increase smelt populations and improve forage for landlocked Atlantic salmon stocked in the Harriman reservoir.	Similar benefits to anadromous fish as Settlement and MA WQC. VANR's WQC would provide additional benefits to anadromous fish once they are introduced above Searsburg or become established in Harriman reservoir. VANR's WQC would also require intake protection at Searsburg with the use of the upstream reach as a nursery area for landlocked Atlantic salmon.	Similar benefits to anadromous fish as Settlement and MA WQC. Staff has not agreed with VANR's WQC requirements for anadromous fish at Searsburg. VANR's recommendations are based on future actions which may or may not occur with regard to establishing landlocked Atlantic salmon in Harriman reservoir, and with stocking efforts above Searsburg.	The downstream movement of Atlantic salmon smolts stocked in the Upper Deerfield River would be subject to losses from entrainment and impingement at the Deerfield Project. Downstream movement of these stocked salmon would also be slowed by the dam and reservoir and would not benefit from specific directional flows provided over dams at fishways, rather they would pass haphazardly over spillways or through the turbines. Atlantic salmon would be prevented from moving upstream past the No. 2 Development to use available spawning and rearing habitat in the Upper Deerfield River. There would be no minimal flows released to several bypassed reaches and therefore no nursery habitat available for use by stocked Atlantic salmon smolts and fry.
		VEGETATION & WILDLIFE RESOURCES		
wetlands	Stabilization of the reservoirs during summer may provide some minor enhancements to wetlands over existing conditions.	Slightly more beneficial than NEP's Settlement due to more strict reservoir level fluctuations and flow releases.	Minor cumulative benefits on wetlands would occur as a result of minimizing reservoir level fluctuations; enhancements similar to Section 401.	Wetlands would continue to be adversely affected by projects's peaking operations.
tubercled orchid	Adverse effects to rare plant due to proposed flow releases in Harriman bypassed reach.	Benefits due to mitigation plan to include transplanting & monitoring plants.	Same as VT 401 WQC.	No effect due to lack of flows in bypassed reach.
birds & fur-bearing mammals	Enhancements to nesting waterfowl as a result of installing nesting structures and providing protection to beavers.	Additional reduction in the Somerset reservoir surface elevation fluctuations during May through July, would enhance loon nesting success.	Same as VT 401 WQC.	No effect.

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
		THREATENED & ENDANGERED SPECIES		
shortnose sturgeon	No effect	No effect	No effect	No effect
		RECREATION & LAND USE RESOURCES		
Barrier-free Access	NEP's comprehensive recreation plan includes providing numerous facilities accessible to persons with disabilities: designated parking, accessible pathways, picnic tables, toilets, an accessible boat dock, an accessible beach area, and an accessible fishing platform.	No additional benefits.	No additional benefits.	Barrier-free recreational access opportunities would continue to remain limited; none of NEP's recreation facilities currently conform fully to the National standards of accessibility.
Whitewater Boating	To enhance whitewater boating, NEP would provide 32 flow releases averaging 1,000 cfs at Deerfield No. 5 and 106 flow releases averaging 700 cfs at Fife Brook dam. NEP would also provide whitewater related facilities at both reaches (*i.e.*, launch platforms, access stairs, parking areas, take-outs, changing rooms, and picnic tables).	Providing a canoe portage at the Searsburg dam, as stipulated in the WQC, would further enhance whitewater boating along the Deerfield River. The canoe portage would improve opportunities for canoeists to float from Somerset to Harriman reservoir (9.7-mile-long stretch).	In addition to NEP's proposed enhancements, our staff recommended canoe portage at Searsburg would further enhance whitewater boating opportunities on the Deerfield River.	No license condition would require NEP to provide whitewater boating flows at Deerfield No. 5 or at Fife Brook dam. Reliable whitewater boating opportunities during the summer would remain limited along the Deerfield River.
Sport Fishing	NEP's proposed minimum flows would significantly improve angling opportunities along three bypassed reach segments (Searsburg, Harriman, and Deerfield No. 4). With a total combined length of nearly 9 miles, the current flows in these three reaches are limited to leakage/local drainage. Increased minimum flows below the remaining developments would further enhance angling opportunities due to the increased fishery habitat. Numerous recreation facility improvements would also improve angling access along the Deerfield River.	No additional benefit over NEP's proposal.	No additional benefit over NEP's proposal.	Trout angling would continue to be restricted below the project developments due to the absence of suitable fishery/angling conditions.

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
Access Protection	NEP's conservation easements amounting to 18,355 acres of river corridor land would ensure protection of important non-developmental values within the river basin, including public recreational access to project waters and land.	No additional benefits.	No additional benefits.	Land owned by NEP located along the Deerfield River would not be protected to ensure long-term recreational access or be protected from excessive and inappropriate development.
		AESTHETIC RESOURCES		
Scenic Views	NEP's proposed minimum flows would cumulatively enhance scenic views of the Deerfield River, particularly in those bypassed reach segments where flows are currently limited to leakage local drainage (Searsburg, Harriman, and deerfield No.4 development).	Limiting drawdowns at the Somerset and Harriman reservoirs, as contained in the WQC, would provide some additional aesthetic benefits over NEP's proposal by decreasing the extent of the drawdown zone; this zone currently disrupts the viewshed by exposing a band of substrate along the shoreline.	Limiting drawdowns at the Somerset and Harriman reservoirs, as contained in the WQC, would provide some additional aesthetic benefits over NEP's proposal. The drawdown restrictions would decrease the band of substrate within the shoreline drawdown zone, which currently disrupts the viewshed.	Insufficient flows below the project developments would continue to adversely effect the scenic quality of the Deerfield River.
Buffer Zone	NEP's term conservation easements would buffer significant portions of the river corridor from excessive and inappropriate development that would adversely affect scenic views.	No additional benefit over NEP's proposal.	No additional benefit over NEP's proposal.	Lands owned by NEP along the Deerfield River,not within the project, could potentially be managed inappropriately and adversely affect the scenic quality of the Deerfield River.
		SOCIOECONOMIC RESOURCES		
Tourism	NEP's proposed whitewater boating flow releases, minimum flow releases, and recreational facility enhancements would enhance whitewater boating and angling opportunities; the increased recreational use would significantly contribute to the river basin's tourism industry.	No additional benefit over NEP's proposal.	No additional benefit over NEP's proposal.	While NEP's recreation facilities currently contribute tot he river basin's tourism industry, NEP would not be required to enhance the recreational opportunities along the Deerfield River.

Resource	Proposed Project	WQC's	Proposed Project with Staff's Modifications	No-Action Alternative
		ARCHEOLOGICAL & HISTORIC RESOURCES		
archeological (prehistoric and historic)	Potential adverse effects would be reduced through implementation of NEP's proposed measures which would be incorporated at least in part in the Deerfield Project Programmatic Agreement.	Same as No Action.	Adverse effects would be kept to minimum through preparation, execution, and implementation of stipulations in the Deerfield Project Programmatic Agreement.	Potential for moderate to severe adverse effects on historic and archaeologic resources which may be present along shorelines, in logging areas, and at or near recreation sites.
historic project features	Potential adverse effects would be reduced through implementation of NEP's proposed measures which would be incorporated at least in part in the Deerfield Project Programmatic Agreement.	Same as No Action.	Adverse effects would be kept to minimum through preparation, execution, and implementation of stipulations in the Deerfield Project Programmatic Agreement.	Major adverse effects to historic integrity of National Register-eligible project features due to uncontrolled operation and maintenance practice would continue to worsen as project features continue to age and require increasing maintenance and replacement.

Table 5-3 Comparative environmental effects of the **Gardners Falls Project** as proposed by WMEC, the Massachusetts WQC, the project as proposed with Staff's modifications, and the no action alternative (Source: Staff).

Resource	Proposed Project	WQC	Proposed Project with Staff's Modifications	No-Action Alternative
WATER QUALITY & QUANTITY	Water quality and quantity would improve slightly in the bypassed reach and below the powerhouse. Slightly lower summer water temperatures are expected to occur in the bypassed reach. The amount of water in the bypassed reach would improve several fold over existing conditions, particularly during the natural low-flow period. The release of 100 cfs at the powerhouse when it is not operating would improve water quality in a 215-foot rapids area during those times when backup from the No. 2 Development reservoir does not reach the powerhouse.	Benefits of 150 cfs, or inflow, into the bypassed reach would have similar impacts on water quality as WMEC's 50 cfs proposal. Water quality in this short bypassed reach is going to approximately mimic the DO and water temperatures reported in the Gardners Falls reservoir. The width of the bypassed reach would preclude the 150 cfs from wetting much more area than the 50 cfs and therefore it is unlikely there would be much, if any difference in water temperatures and DO in the bypassed reach.	Staff agrees with and has not modified WMEC's recommendations to release a minimum flow of 50 cfs in the bypassed reach and 100 cfs below the powerhouse, but the 150 cfs required in the WQC is mandatory.	Water temperatures would continue to become slightly elevated in the bypassed reach during low-flow periods when water is leaking from the dam. Leakage flows would keep deeper pools filled in the bypassed reach and would provide little habitat for aquatic biota in the bypassed reach and below the No. 2 Development reservoir. Water temperatures would also tend to become slightly elevated in the lower end of the bypass and below the powerhouse during low-flow periods when the No. 2 reservoir level backs up to about 215 feet downstream from the powerhouse.

Resource	Proposed Project	WQC	Proposed Project with Staff's Modifications	No-Action Alternative
FISHERY RESOURCES	Improves fishery habitat in the bypassed reach by providing 73 and 79 percent respectively, of the maximum WUA for juvenile brown trout and Atlantic salmon. The minimum flow would provide some habitat for all life stages of trout, but is most suited for juvenile life stages. The 100 cfs flow below the powerhouse would benefit trout stocked in the No. 2 reservoir. Downstream fish passage facilities and minimum flows would help Atlantic salmon smolts move through the area.	Provides increased fishery habitat in the bypassed reach by providing 100 percent of the maximum WUA for juvenile brown trout and Atlantic salmon. There is little difference in fishery habitat provided below the powerhouse by the WQC flow because the powerhouse reach is very short and the 150 cfs bypassed flow would equal WMEC's combined flow of 50 cfs in the bypass and 100 cfs below the powerhouse. Generally, the same benefits as WMEC's proposal for downstream fish passage facilities and that provided by minimum flows.	Staff agrees with WMEC's recommendations to release a minimum flow of 50 cfs in the bypassed reach and 100 cfs below the powerhouse from April through June, but the 150 cfs required in the WQC is mandatory.	Fish habitat would continue to be reduced in the bypassed reach and in the short reach between the powerhouse and the No. 2 reservoir. Downstream passage of Atlantic salmon smolts stocked upstream would be hindered and more susceptible to entrainment and impingement injuries. Trout stocked in the No. 2 reservoir would not benefit from minimum flows.
VEGETATION & WILDLIFE RESOURCES	No effect	No effect	No effect	No effect
THREATENED & ENDANGERED SPECIES	No effect	No effect	No effect	No effect
RECREATION & LAND USE RESOURCES				
Access Facilities	WMEC's proposal would improve boating and angling access at both the impoundment and at the tailrace. Further, WMEC would provide new recreational opportunities for individuals with disabilities.	No effect	Staff's recommended restroom facility at the Wilcox Hollow access site would provide some additional enhancement over WMEC's proposal.	Existing recreational access would remain unimproved at the impoundment and at Wilcox Hollow.

Resource	Proposed Project	WQC	Proposed Project with Staff's Modifications	No-Action Alternative
Sport Fishing	WMEC's proposed minimum flows would enhance angling below the Gardners Falls Project by improving conditions for the put-anD-take trout fishery.	While the agencies' recommended minimum flow of 150 cfs would further benefit fishery habitat in the bypassed reach, it would also limit wade angling in this reach due to water depths, turbulence, and high velocities.	No additional benefit over WMEC's proposal.	The absence of minimum flow requirements below the project would continue to inhibit trout angling opportunities due to insufficient flows.
AESTHETIC RESOURCES				
Scenic Views	Increased flows in the bypassed reach, under WMEC's proposed minimum flow of 50 cfs, would enhance scenic views below the Gardners Falls Project.	The agencies's recommended flow of 150 cfs in the bypassed reach would provide some additional benefits over WMEC's proposal by further enhancing scenic views of the river channel below the project.	No additional benefit over WMEC's proposal.	In the absence of a minimum flow requirement, scenic views below the project are inhibited due to a lack of flow in the bypassed reach.
ARCHEOLOGICAL & HISTORIC RESOURCES				
Archeological	Potential adverse effects would be reduced through implementation of WMEC's proposed measures which would be incorporated at least in part in the Gardners Falls PA.	Same as No action.	Adverse effects would be kept to minimum through preparation, execution, and implementation of stipulations in the Gardners Falls PA.	Potential for moderate adverse effects on historic and archeological resources which may be present at or near recreation sites.
Historic Project Features	Same as No action.	Same as No action.	Adverse effects would be kept to minimum through preparation, execution, and implementation of stipulations in the Gardners Falls PA.	Adverse effects to historic integrity of National Register-eligible project features due to uncontrolled operation and maintenance practice would continue to worsen as project features continue to age and require increasing maintenance and replacement.

5.3 ECONOMIC EVALUATION OF THE PROPOSED ACTIONS AND ALTERNATIVES

As explained in *Mead Corporation* [1], the Commission assesses the economic consequences of proposed alternatives using a current-cost approach that does not purport to predict future economic trends over the term of the license; rather, it reviews economic considerations in light of what is known at the time of licensing.

As shown in Table 5-4, the cumulative hydroelectric generation in the Deerfield River Basin is 724,735 MWh, consisting of 623,151 MWh of on-peak energy and 101,584 MWh of off-peak energy. The Deerfield River and Gardners Falls projects contribute 289,052 MWh and 16,800 MWh of energy, respectively. The total annual cost of NEP's and WMEC's projects, combined, under existing conditions would be about $29,461,000 less than the current value of the power. Hence the net power benefit is $29.46 million annually.

Table 5-4. Median year annual energy generation (MWh) and net power benefits ($1,000) of all Deerfield River Basin Hydro Plants (Source: Modified from NEP's HEC-5 Model and Staff).

Proposed Operation	Total Energy	Change in Total Energy	Percent Change in Total Energy	Net Power Benefits	Change in Net Power Benefits	Percent Change in Net Power Benefits
No Action	724,735	0	0	29,461	0	0
Proposed Projects	686,646	-38,089	-5.26	27,013	-2,448	-8.3
WQCs	682,840	-41,895	-5.78	26,837	-2,624	-8.9
VNRC	634,609	-90,126	-12.45	25,219	-4,242	-14.4
Staff	679,006	-45,729	-6.31	26,710	-2,751	-9.3

Under the proposed Settlement Agreement, operational and non-operational enhancement measures at the Deerfield, Bear Swamp, and Gardners Falls Projects, would reduce the median annual energy generation in the basin by about 5 percent, while WQC conditions and VNRC's recommendations would bring the total reduction to 6 and 12 percent, respectively. It would cost about $27 million less to operate the projects than the current value of the projects'power. Staff's alternative consisting of the project proposals and the WQC conditions would reduce annual energy generation in the river by about 6.3 percent (Table 5-4). Net power benefits would reduce/decrease for all of the action scenarios, and up to 14 percent for VNRC's recommendation. Implementing the Staff's recommended alternative of relicensing the Deerfield River and Gardners Falls projects would cost $26.7 million annually less than the value of the project power, and reduce overall net power benefits by about 9.3 percent.

The Deerfield Project alone, operating under the Staff selected alternative, would produce about 247,843 MWh of energy annually, at an annual cost about $1,898,000 *lower* (or 7.66 mills/kWh lower) than the current value of the project power. Hence, the current net annual net power benefit is about $1.9 million. This represents a reduction of 57 percent in net power benefits from existing conditions. NEP's proposal for the Settlement and Cultural Resource Management Plan would have reduced net power benefits by 52 percent, while VNRC's recommendations would have caused an 85 percent reduction.

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[1] 72 FERC ¶ 61,027 (1995).

WMEC's proposed enhancement measures at the Gardners Falls Project, as affected by the Settlement, would cause energy generation to decrease only by about 1,663 MWh (about 9.90 percent), with on-peak energy decreasing by about 962 MWh. Off-peak energy would decrease by about 701 Mwh. However, net power benefits would decrease dramatically by 130 percent and become negative as a result of WQC conditions. VNRC's recommendations and our staff alternative would make the Gardners Falls Project more expensive then the value of the power. Net annual power benefits with VNRC's and the Staff's alternative, which includes the measures required by the WQC, would be -$117,900 and about -$66,000, respectively.

5.4 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Based on our independent review under Sections 4(e) and 10(a) of the FPA and our evaluation of NEP's proposed Deerfield River Project, which consists of the Settlement, Cultural Resources Management Plan, and all legally valid WQC conditions, and WMEC's proposed Gardners Falls, we conclude that relicensing the projects as recommended by Staff is the preferred alternative. We recommend that: (1) all of the provisions of the Settlement be approved and included in a new license for the Deerfield River Project, and (2) that an amendment to the operation of the existing Bear Swamp Pumped Storage Project be approved upon filing by NEP.

We recommend the respective alternatives for the Deerfield and the Gardners Falls Projects because: (1) our staff recommended measures would protect and enhance water quality, fishery resources, recreational boating and other recreational activities, and cultural resources; (2) the electricity generated from this renewable resource would be beneficial because it would reduce adverse effects from the use of fossil-fueled, steam-electric generating plants, thereby, conserving nonrenewable energy resources and reducing atmospheric pollution; and (3) we believe our recommended staff alternative would be best adapted to a comprehensive plan for the use of water power development along the Deerfield River Basin, while concurrently protecting and enhancing natural environmental resource values and uses.

We carefully considered VNRC's recommendations and agree that some would enhance environmental resources. However, as described in sections 4.2 and Table 5.1, some of VNRC's recommendations would conflict with other appropriate developmental and non-developmental values such as power production and whitewater boating. VNRC's recommendations would reduce the Deerfield River Project's net power benefits by 85 percent. In view of the above, we believe that the environmental benefits that could be realized with VNRC's recommendations would not justify the additional costs. Furthermore, Staff's preferred alternative consisting of the Settlement, Cultural Resources Management Plan, and would meet the WQC conditions, is well balanced and provides for the comprehensive development of the basin.

5.4.1 Consistency with Comprehensive Plans

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with Federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project(s). Under Section 10(a)(2) of the FPA, Federal and state agencies filed a total of 33 comprehensive plans that address various resources in Massachusetts and Vermont. Of these, we identified and reviewed 18 plans relevant to the hydroelectric projects on the Deerfield River. [2] No inconsistencies were found.

We also reviewed Federal and state plans that were relevant to the projects but weren't listed as Commission approved comprehensive plans. They are as follows: Green Mountain National Forest Land and Resource Management Plan, U.S. Forest Service (1986).

None of the parties have recommended the no action alternative for either the Deerfield or Gardners Falls Project. Adoption of the no action alternative would forego implementing any enhancement measures NEP or WMEC proposes to provide, in addition to those enhancement measures recommended by Federal and state agencies, NGO's, and staff.

Conclusion of Section 10(a)(1) and 10(a)(2)

From our evaluation of the environmental and the economic effects of the Deerfield River, Bear Swamp, and Gardners Falls Projects and the alternatives, as well as the comprehensive plans relevant to the projects, we conclude that relicensing the Deerfield River and Gardners Falls Projects, and implementation of the Deerfield River Settlement with staff's modifications, would best adapt the projects to a comprehensive plan for developing the Deerfield River Basin.

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[2] **Massachusetts:** (1) Deerfield River comprehensive management plan, Franklin County Planning Department, June 1990; (2) Massachusetts outdoors for our common good: open space and outdoor recreation in Massachusetts, Massachusetts Department of Environmental Management, Division of Planning and Development, December 1988; (3) Connecticut River Basin water quality management plan, Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, June 1983; and (4) Connecticut River Basin fish passage, flow, and habitat alteration considerations in relation to anadromous fish restoration, Technical Committee for Fisheries Management of the Connecticut River, October 1981.

Vermont: (1) The waterfalls, cascades, and gorges of Vermont, Jenkins, J. and P. Zika, Vermont Agency of Natural Resources, May 1986; (2) Vermont state comprehensive outdoor recreation plan, 1983-1988, Vermont Agency of Environmental Conservation, June 1983; (3) Vermont Rivers Study, Vermont Agency of Environmental Conservation, 1986; (4) Hydropower in Vermont: an assessment of environmental problems and opportunities, Vermont Agency of Natural Resources, Department of Environmental Conservation, May 1988; (5) Preliminary comprehensive rivers plan for the Deerfield River, Vermont: an inventory of uses, values, and goals, Vermont Agency of Natural Resources, Department of Environmental Conservation, Windham Regional Commission, July 1991; (6) Comprehensive river plan for the Deerfield River watershed, Vermont Department of Environmental Conservation, November 1992; (7) 1988 Vermont recreation plan, Vermont Agency of Natural Resources, Department of Forests, Parks and Recreation, 1988; (8) Wetlands component of the 1988 Vermont recreation plan, Vermont Agency of Natural Resources, Department of Forests, Parks and Recreation, Wetlands Steering Committee, July 1988; (9) Vermont's lake trout management plan for inland waters, Vermont Agency of Natural Resources, Department of Fish and Wildlife, May and July, 1990; and (10) A strategic plan for the restoration of Atlantic salmon to the Connecticut River Basin, Policy Committee for Fisheries Management of the Connecticut River, September 1982.

Federal: (1) North American waterfowl management plan, U.S. Fish and Wildlife Service, May 1986;(2) Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service, U.S. Fish and Wildlife Service, undated; (3) Final environmental impact statement - restoration of Atlantic salmon to New England rivers, Department of the Interior, May 1989; and (4) The Nationwide rivers inventory, National Park Service, January 1982.

5.5 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Section 10(j) of the FPA requires the Commission to include license conditions, based on recommendations provided by the Federal and state fish and wildlife agencies submitted pursuant to the Fish and Wildlife Coordination Act [3] for the protection of, mitigation of adverse impacts to, and enhancements of fish and wildlife resources affected by the project(s).

Pursuant to Section 10(j) of the FPA, we are making a preliminary determination that ***no*** Federal or state fish and wildlife agency recommendations for the Deerfield and Gardners Falls Projects conflict with the comprehensive planning and public interest standards of Sections 4(e) and 10(a) of the FPA.

5.6 STATUS OF RECOMMENDATIONS AND CONDITIONS ASSOCIATED WITH THE PROJECTS

Tables 5-5 and 5-6 list all the recommendations and conditions for the Deerfield and Gardners Falls Projects, respectively, and whether those recommendations and conditions have been adopted under the staff selected alternative for the projects.

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3 16 U.S.C § 661 et seq.

Table 5-5. All recommended enhancements considered for the relicensing of the Deerfield Project and Bear Swamp Project license amendment (Source: the Staff).

Enhancement Measure	Within the scope of 10(j)?	Annual Cost ($)	Adopted ?	Recommending Entity
PROJECT OPERATION				
Somerset				
1) Reservoir: ±1 ft (5/1-7/31)	Yes	148,000.	Yes [2]	1) STTLMT; DOI; MA
2) Reservoir: ± 3 in (5/1-7/31) w/ target el of 2128.58 ft msl	No	161,700.	Yes	2) VANR-401; Staff
3) Flows: a) 12 cfs (5/1-9/30) guaranteed from Searsburg storage; b) 30 cfs (10/1-12/15); c) 48 cfs (12/16-2/28); d) 30 cfs (3/1-4/30)	Yes	a) 2,681. b) 3,350. c) 5,165. d) 2,741.	No	3) STTLMT; DOI; MA (*NOTE*: compare with No.7, below.)
4) Release 19 cfs (5/1-8/30) versus 12 cfs	No	1,238.	No	4) VNRC
5) Implement Sufficient Ramping Conditions	No	0	Yes	5) VNRC; Staff
6) Eliminate all Annual Peaking & Replace with Run-of-the-river at those peaking Deerfield Developments	No	327,300.	No	6) VNRC
7) Flows: a) 12 / 9 cfs (5/1-7/31); b) 12 cfs (8/1-9/30) guaranteed; c) 30 cfs (10/1-12/15); d) 48 cfs (12/16-2/28); e) 30 cfs (3/1-4/30) guaranteed w/ Ramping Requirements for part b-e for 8/1 - 9/30 and 3/1 to 4/30 of: f) - up-ramping @ 100 cfs or less over 24 hrs & g) - down-ramping @ 50 cfs or less over 24 hrs	No	a) 1,601. b) 1,062. c) 3,350. d) 5,165. e) 2,741. f) 0 g) 0	Yes (a-g) Yes (f-g)	7) VANR-401; Staff
8) Max. annual drawdown of reservoir to el 2,107 ft msl & Max. Summer/Fall drawdown of reservoir thru Nov 1 to el 2,120 ft msl	No	160,400	Yes	8) VANR-401; Staff
9) Max. flow release not to exceed 200 cfs unless inflow is greater	No	66,448	No	9) VNRC
10) Somerset Gate Operation Management Plan & Max. gate release of 312 cfs or instantaneous inflows if higher	No	0	Yes	10) VANR-401; Staff
Searsburg				
11) Bypassed Flows: a) 35 cfs or inflow (6/1-9/30); b) 55 cfs or inflow (10/1-5/31)	Yes	a) 53,189. b) 127,235.	Yes (a&b)	11) STTLMT; VANR-401; DOI; MA; Staff

[2] Staff's recommended reservoir level (± 3 inches) is consistent with the Vermont WQC, which is more stringent than the Settlement's proposal to limit reservoir fluctuations to ± 1 foot elevation.

Enhancement Measure	Within the scope of 10(j)?	Annual Cost ($)	Adopted ?	Recommending Entity
12) Flows Below Dam: a) 45 cfs (5 16 - 9 30); b) 90 cfs (10 1 - 5 15); Below Powerhouse: c) 175 cfs (4 20 - 6 15)	No	a) 58,713. b) 194,573. c) 14,212.	No	12) VNRC
13) Flows Below Powerhouse: 175 cfs (4 20 - 5 15)	No	6,345.	Yes	13) VANR-401; Staff
14) Upstream & Downstream Fish Passage @ Searsburg	No	80,000	No	14) VNRC
15) Make adjustment to reservoir's storage and flow releases, up to 10%, during flashboard removal or maintenance	Yes	Indeterminate	Yes	15) VANR-401
Harriman				
16) Max. annual drawdown of reservoir to el 1,440 ft msl & Max. summer/fall drawdown of reservoir to el 1,475 ft msl	No	549,000	Yes	16) VANR-401; Staff
17) raising & stable reservoir water levels (5/1-6/15)	Yes	78,850	No [3]	17) STTLMT; DOI; MA
18) raising & stable reservoir water levels (4/1-6/15)	No	Included above in Item No. 15	Yes	18) VANR-401; Staff
19) _ 1 ft drop in el (6 15-7 15)	Yes	Included above in Item No. 15	Yes	19) STTLMT; DOI; MA; VANR-401; Staff
20) Bypassed Flows: a) 70 cfs (10 1-6 30); b) 57 cfs (7/1-9/30) (both flows guaranteed from storage)	Yes	a) 473,800 b) 61,350	Yes (a&b)	20 STTLMT; VANR-401; DOI; MA; Staff
21) Release 90 cfs yr-round w/ 57 cfs guaranteed	No	571,700	No	21) VNRC
Sherman				
None	-----	-----	-----	-----
Deerfield No. 5				
22) Bypassed Flows. 73 cfs or inflow year-round (not less than 57 cfs guaranteed)	Yes	192,579.	Yes	22) STTLMT; DOI; MA
23) Provide 32 whitewater releases of an average of 1,000 cfs (May-Oct)	No	38,792.	Yes	23) STTLMT; DOI; MA; Staff
Deerfield No. 4				
24) Flows: a) the lesser of 100 cfs or inflow (10/1-5/31); b) the lesser of 125 cfs or inflow (6/1-9/30)	Yes	a) 76,800 b) 48,100	Yes (a&b)	24) STTLMT; DOI Section 18 prescription; MA; Staff

[3] Staff's recommendation for reservoir water levels (see Table item No. 18) is consistent with the Vermont WQC, which includes the Settlement proposal.

Enhancement Measure	Within the scope of 10(j)?	Annual Cost ($)	Adopted ?	Recommending Entity
25) Permanent Downstream fish passage for Atlantic salmon smolts	Yes	58,100	Yes	25) STTLMT; DOI Section 18 prescription; MA; Staff
26) a) Construct Fishway within 2 yrs of license issuance; & b) Submit final design drawings of the fishway facilities to the USFWS for their approval prior to the start of construction.	No	a) Include above in Item No.24 b) Indeterminate	a) Yes b) No	26) DOI
Deerfield No. 3				
27) Release 100 cfs or inflow	Yes	102,600	Yes	27) STTLMT; DOI; MA; Staff
28) Permanent Downstream fish passage for Atlantic salmon smolts	Yes	103,300	Yes	28) STTLMT; DOI Section 18 prescription; MA; Staff
29) a) Construct Fishway within 2 yrs of license issuance; b) Submit final design drawings of the fishway facilities to the USFWS for their approval prior to the start of construction.	No	a) Included above in Item No. 27 b) Indeterminate	a) Yes b) No	29) DOI
Deerfield No. 2				
30) Release 200 cfs guaranteed	Yes	31,200	Yes	30) STTLMT; DOI; MA; Staff
31) Passage for Atlantic salmon: a) upstream (adults) = Trap & Truck b) downstream (smolts); & c) Monitoring	Yes	a) 189,000 b) 17,300 c) Indeterminate	Yes (a-c)	31) STTLMT; DOI Section 18 prescription; MA; Staff
32) a) Construct Fishways within 2 yrs of license issuance; & b) Submit final design drawings of the fishway facilities to the USFWS for their approval prior to the start of construction.	No	a) 17,300 b) 3,360	a) Yes b) No	32) DOI
33) Develop an Atlantic salmon Tagging Plan for adults @ No.2	Yes	80,000	Yes	33) STTLMT; DOI; MA; Staff
34) Maintain & Provide release flow data for 36 months showing flow under Settlement.	No	0	Yes	34) STTLMT; DOI; MA; Staff
35) Commission reconsider No. 2 peaking operation after 3 yrs	No	0	Yes	35) DOI; STTLMT; MA; Staff
Fife Brook Dam				
36) Release 125 cfs yr-round guaranteed	Yes	50,212.	Yes	36) STTLMT; DOI; MA; Staff
37) Provide 3-hr whitewater boating releases of at least 700 cfs for 106 days (April-Oct)	No	7,527.	Yes	37) STTLMT; DOI; MA; Staff
GEOLOGY & SOILS				
38) Erosion Control Measures for Recreation facilities	No	3,500.	Yes	38) VANR-401; Staff

Enhancement Measure	Within the scope of 10(j)?	Annual Cost ($)	Adopted ?	Recommending Entity
39) Erosion Control Measures for Searsburg Fish Passage Facilities	No	1,750.	Yes	39) VANR-401; Staff
WATER QUALITY & QUANTITY				
40) Monitor DO + T,(June-Oct) @ Harriman	No	500.	Yes	40) VANR-401; Staff
41) Meet DO + T Standards @ Harriman	No	500.	Yes	41) VANR-401; Staff
FISHERIES				
42) Flow Monitoring & Reservoir Operation Plan	No	500.	Yes	42) STTLMT; DOI; MA; Staff
43) Provide upstream & downstream Fish Passage @ Searsburg	No	See Item No.14.	No	43) VNRC
44) Refined Watershed Model	No	5,640.	Yes	44) VANR-401; Staff
45) Provide Turbine Rating Curve Record	No	0	Yes	45) VANR-401; Staff
46) Downstream Fish Passage Plan @ Searsburg (4/1 - 5/31)	No	6,260.	Yes	46) VANR-401
47) Contingent Fish impingement / Entrainment Plan @ Searsburg	No	3,130.	Yes	47) VANR-401
48) Upstream Fish Passage Plan @ Searsburg (3/15-5/15 & 10/1-11/15)	No	See above Item No.14.	Yes	48) VANR-401
49) Disposal of Debris Plan	No	700.	Yes	49) VANR-401; Staff
50) Permanent Downstream Fishway @ No 4; No 3; No 2; & Assoc Flows (4/1 - 6/15) & (9/15 - 11/15)	No	See above Deerfield Nos. 2,3,4 developments	Yes	50) DOI Section 18 prescription; Staff
51) Upstream Fish Passage Trap & Truck @ No 2 & Assoc Flows: a) constructed based on target numbers of Atlantic salmon reaching the river based on tagging study; & b)provide final design drawings prior to construction	No	a) See above Deerfield Nos. 2,3,4 developments b) 2,800.	Yes (a&b)	51) DOI Section 18 prescription; Staff
52) Reservation of Section 18 Authority & DOI right to modify Section 18 Fishway Prescriptions as needed to facilitate fish passage	No	0	Yes	52) DOI Section 18 prescription; Staff
53) Operation & Maintenance of upstream & downstream fishways & Fishway Monitoring Plan	Yes	See above Deerfield Nos. 2,3,4 developments	Yes	53) DOI; Staff
54) Flashboard Installation & Change in Minimum Flows @ Searsburg Dam	No	15,000	Yes	54) VANR-401; Staff
55) Maintenance & Repair Work Approval	No	Indeterminate	Yes	55) VANR-401

Enhancement Measure	Within the scope of 10(j)?	Annual Cost ($)	Adopted ?	Recommending Entity
TERRESTRIAL				
56) Provide Artificial Nesting Boxes for 4 species	Yes	3,600.	Yes	56) STTLMT; MA; Staff
57) Beaver Mgmt Plan at Somerset	Yes	900.	Yes	57) STTLMT; MA; Staff
58) Forest / Timber Management Plan	Yes	1,800.	Yes	58) STTLMT; DOI; MA; Staff
59) Tubercled Orchid Mitigation Plan	No	900.	Yes	59) VANR-401; Staff
RECREATION				
60) Provide Whitewater Boating Flow Releases	No	See above No. 5 development and Fife Brook	Yes	60) STTLMT; Staff
61) Deerfield Enhancement Trust Fund ($ 100K)	No	12,700.	Yes	61) STTLMT
62) Comprehensive Recreation Plan	No	1,400.	Yes	62) STTLMT; Staff
63) Public Access	No	Indeterminate	Yes	63) VANR-401; Staff
64) Recr. Plan to include portage @ Searsburg put-in	No	2,800.	Yes	64) VANR-401; Staff
65) Telephone Flow Notification System	No	Indeterminate	Yes	65) VANR-401; Staff
66) Instream Flow Recreation Safety Study	No	800.	Yes	66) NEP; Staff
LAND USE				
67) Term Conservation Easements (Fife Brook & No.2)	No	Indeterminate	Yes	67) STTLMT; MA; Staff
68) Term Conservation Easements (Bear Swamp)	No	Indeterminate	Yes	68) STTLMT; MA; Staff
69) Address possible Tax Losses from Conservation Easements in EIS	NA	Indeterminate	Yes	69) WRC; Staff
CULTURAL				
70) Programmatic Agreement	NA	Indeterminate	Yes	70) Staff

Table 5-6 All recommended enhancements considered for the relicensing of the Gardners Falls Project (Source: Staff)

Enhancement Measure	Within the Scope of Section 10(j) ?	Annual Cost ($)	Adopted ?	Recommending entity
WATER QUALITY & QUANTITY				
1) Release from dam 150 cfs continuous minimum or inflow from NEP's No. 3 Development if such inflow is lower than 150 cfs; Flow into the bypass reach should be maintained at 150 cfs during high flow conditions if operationally possible.	Yes	98,500	Yes	MA DFW; DOI; MA DEP-401; Staff
2) Release Minimum flow of 198 cfs or inflow.	No	130,000.	No	AMC
3) Release continuous minimum flow of 50 cfs from the dam; and release a supplemental flow of 100 cfs from the powerhouse during April, May, and June each year.	No	32,800.	No	WMEC; Staff
4) Monitoring Plan for min. flows & record to verify releases.	Yes	900.	Yes	MA DFW; DOI; Staff
FISHERY RESOURCES				
5) Downstream fish passage for Atlantic salmon smolts.	No	Included in Item No.6.	Yes	AMC
6) Design & install louver bypass system for downstream fish passage of smolts; operation (4/1 - 6/15 and 9/15 - 11/15).	Yes	24,200.	Yes	MA DFW; MA DEP-401; Staff
7) Fishway Monitoring Plan.	Yes	900.	Yes	MA DFW; Staff
8) Develop & Install Downstream fish passage facilities within 2 construction seasons after license issuance; operation (4/1 - 6/15 and 9/15 - 11/15).	Yes	Included in No.6.	Yes	DOI; MA DEP-401; Staff
9) Develop Plans & Schedules to maintain and monitor downstream fishway.	Yes	Included above in Item No.6 + 7.	Yes	DOI; TU; MA DEP-401; Staff
10) Reservation of Section 18 Authority, and the right to modify Section 18 Fishway Prescriptions.	No	0	Yes	DOI
11) Develop a Fish Passage Study Plan to achieve a fish passage rate of 90 %.	No	1,800.	No	TU
12) a) Submit functional design drawings of fishway within 4 months of license issuance. b) Submit final design drawings of the fishway facilities to the USFWS for their approval prior to the start of construction.	a) No b) No	a) 900. b) Indeterminate	a) Yes b) No	DOI; Staff
RECREATION & LAND USE RESOURCES				
13) Provide safety ramping rates associated with flows.	No	Indeterminate	No	TU

Enhancement Measure	Within the Scope of Section 10(j) ?	Annual Cost ($)	Adopted ?	Recommending entity
14) Recreation Enhancements to include a) Lead-in sign system from downtown Shelburne Falls / Buckland b) Improve fishing access north of picnic area ($2,500); c) Sign & improve pull-off at Dam; d) Upgrade path from powerhouse & provide signs ($3,500); e) Handicap access at Wilcox Hollow; f) Improve access from RT 2 to Wilcox Hollow; & g) Enhancement Fund ($50,000.00)	No	a) 100. b) 320. c) 100. d) 450. e+f) 9,525. g) 6,350.	a) Yes b) Yes c) Yes d) Yes e) Yes f) Yes g) No	AMC (a-g); MA DFW; DOI (g); Staff (b-f)
15) Establish Term Conservation Easements.	No	500.	No	AMC
16) Implementation of Deerfield River Trail	No	2,000.	Yes	MA DFW
17) Recreation & Access West Side to include: a) Lead-in sign system from downtown Shelburne Falls /Buckland; b) Improve Fishing Access north of picnic area ($2500); c) Parking improvements at pull-off near dam ($10,000); d) create a Self-guided interpretive trail near power canal & improve existing trail ($7,000); & e) Extend path in front of powerhouse to shoreline ($3,500). Provide trail designation & improvements.	No	a) Included above in No.14. b) Included above in No.14. c) 1,270. d) 890. e) Included above in No.14.	a) Yes b) Yes c) Yes d) Yes e) Yes	MA DFW; TU (a&b); Staff (b-e)
18) Recreation & Wilcox Hollow to include: a) maintain riverfront site, provide, do not overdevelop, and maintain trash cans & toilets; b) develop handicap access; c) improve entrance from Rt 2; and d) formalize parking & include signage	No	a) 2,000. b+c) Included above in No.14. d) 100.	a) Yes b) Yes c) Yes d) Yes	MA DFW; Staff (a-d)
19) Develop an educational natural resource curriculum & teacher training workshops in schools to be conducted.	No	4,500.	No	MA DFW
CULTURAL				
20) Programmatic Agreement.	No	Indeterminate	Yes	Staff
21) Provide Interpretive signs at all cultural & historic sites.	No	Indeterminate	No	MA DFW

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Bennington, County of
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Berkshire, County of
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Bernardston, Town of
Church Street
Bernardston, MA 01337

Town Clerk
Brattleboro, Town of
Administrative Offices
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Buckland, Town of
17 State Street
Shelburne Falls, MA 01370

Board Of Selectmen
Buckland, Town of
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APPENDIX A

NEW ENGLAND POWER COMPANY

DEERFIELD RIVER PROJECT RELICENSING

OFFER OF SETTLEMENT

United States of America
Before The Federal Energy Regulatory Commission

NEW ENGLAND POWER COMPANY	)))))	Deerfield River Project L.P. No. 2323-012

This Offer of Settlement (Settlement or Agreement) is entered into voluntarily by and between New England Power Company (NEP, Licensee and Applicant for a New License for Project No. 2323, described below), the United States Environmental Protection Agency (EPA), the National Park Service (NPS), the United States Fish and Wildlife Service (USFWS) the Massachusetts Division of Fisheries & Wildlife (MDFW), (collectively, the Resource Agencies), American Rivers, Inc. (ARI), American Whitewater Affiliation (AWA), The Appalachian Mountain Club (AMC), The Conservation Law Foundation (CLF), The Deerfield River Compact, The Deerfield River Watershed Association, New England FLOW (FLOW), and Trout Unlimited (TU), (collectively, the Intervenors), pursuant to Rule 602 of The Federal Energy Regulatory Commission (FERC) [18 CFR 385.602]. NEP, the Resource Agencies, and the Intervenors are collectively referred to herein as the Parties.

This Offer of Settlement provides the terms and conditions for the resolution of the fisheries, fish passage, wildlife, water quality, lands management and control, recreation and aesthetics issues raised by the Parties regarding the issuance of a new license for the Deerfield River Project, these being all the issues presently identified by the Parties.

I. Background

The Deerfield River is located in northwestern Massachusetts and southern Vermont. NEP is the licensee and applicant for a new license for the Deerfield River Hydroelectric Project, L.P. No. 2323, which consists of eight developments listed below:

Development	Description	Location
Somerset	storage reservoir	Vermont
Searsburg	5 MW	Vermont
Harriman	43 MW storage reservoir	Vermont
Sherman	7 MW	Massachusetts (backwater into Vermont)
No. 5	16 MW	Massachusetts
No. 4	6 MW	Massachusetts
No. 3	6 MW	Massachusetts
No. 2	6 MW	Massachusetts

The original license for the Project expired on December 31, 1993, and the Project has been subsequently issued an Annual License pursuant to 16 U.S.C. §808(a). NEP filed for a new license in December of 1991. Subsequent to that filing, FERC requested additional information from NEP in August of 1992. FERC's request was modified and clarified in January of 1993. NEP filed responses to the requests for additional information on October 1, 1993 and January 10, 1994. On March 9, 1994, FERC noticed its determination that the Application was ready for environmental analysis. The Parties subsequently requested an extension of time to respond to that notice until September 6, 1994, in order to allow for the negotiations that produced this Settlement to continue. On August 30, 1994 this period was further extended to October 6, 1994. The Parties have met numerous times since early 1993 to negotiate this Settlement.

II. General Provisions

A. The Parties have entered into this Settlement with the intent that all issues identified by the Parties to date associated with issuance of a new license for the Project involving fisheries, fish passage, wildlife, water quality, lands management and control, recreation and aesthetics are resolved to the satisfaction of the Parties.

B. NEP agrees to implement the various obligations and requirements set forth herein. The Resource Agencies and the Intervenors agree to support a new 40 year license for the Project incorporating and implementing the provisions contained herein. This support shall include reasonable efforts to expedite the National Environmental Policy Act (NEPA) process. For those issues addressed herein, the

Parties agree not to propose, support, or otherwise communicate to FERC or any other Resource Agency with jurisdiction directly related to the relicensing process any comments or license conditions other than ones consistent with the terms of this Agreement. However, this Agreement shall not be interpreted to restrict any Party's participation or comments in future relicensing of this Project. Further, this section shall not be read to predetermine the outcome of the NEPA analysis. If such NEPA analysis leads to addition of any license conditions inconsistent with those contained herein, the Parties recognize that such addition would trigger the rights of the Parties to withdraw from the Settlement pursuant to Paragraph VII.A.

C. The Parties agree that this Settlement fairly and appropriately balances the environmental, recreational, fishery, energy and other uses and interests served by the Deerfield River. The Parties further agree that this balance is specific to the Deerfield River Project. No Party shall be deemed, by virtue of participation in this Settlement, to have established precedent, or admitted or consented to any approach, methodology, or principle except as expressly provided for herein. In the event that this Settlement is approved by the FERC, such approval shall not be deemed precedential or controlling regarding any particular issue or contention in any other proceeding.

D. Nothing in this Settlement shall preclude the Resource Agencies from complying with their obligations under the National Environmental Policy Act, the Clean Water Act, the Endangered Species Act, the Federal Power Act, the Fish and

Wildlife Coordination Act or any other applicable state or federal laws. However, by entering into this Agreement the Resource Agencies represent that they believe their statutory obligations are, or can be, met consistent with this Agreement.

E. This Settlement shall become effective upon the later of: a) issuance of a new license, consistent with this Settlement, by FERC; or b) the expiration of any appeal period for §401 Water Quality Certifications issued by Vermont and Massachusetts. If Water Quality Certification is issued by either state that results in license terms inconsistent with the terms of the Settlement, any Party may withdraw pursuant to Section VII of this Agreement. The Settlement shall remain in effect for the term of the new license and for any annual license issued subsequent thereto subject to Authority reserved by FERC in the new license to require modifications.

F. The Parties have entered into the negotiations and discussions leading to this Settlement with the explicit understanding that all offers of settlement and the discussions relating thereto are privileged, shall not prejudice the position of any Party or participant taking part in such discussions and negotiations, and are not to be used in any manner in connection with these or any other proceedings.

G. The Settlement shall apply to, and be binding on, the Parties and their successors and assigns, but only with regard to the above-captioned proceeding and then only if the Settlement is made effective as provided herein. No change in corporate status of NEP shall in any way alter NEP's responsibilities under the Settlement. Each signatory to the Settlement certifies that he or she is authorized to execute the Settlement and legally bind the party he or she represents.

H. By entering into this Settlement, the Intervenors and Resource Agencies shall not be considered to have accepted any legal liability for the operation of the NEP Project.

I. Nothing in this Settlement shall be construed as binding the USFWS or NPS to expend in any one fiscal year any sum in excess of appropriations made by Congress or administratively allocated for the purpose of this Settlement for the fiscal year, or to involve the USFWS or NPS in any contract or other obligation for the future expenditure of money in excess of such appropriations or allocations.

J. With respect to EPA, nothing in this Agreement, including without limitation Sections II.B and D., shall be interpreted to preclude or otherwise limit EPA from complying with its obligations under the Clean Water Act, Clean Air Act, and National Environmental Policy Act, or other federal statutes. EPA support for the terms of this Agreement is based on its knowledge and understanding of the facts at the time of this Agreement's execution. Nothing herein shall preclude EPA from fully and objectively considering all public comments received in any regulatory process related to the Project, from conducting an independent review of the Project under applicable federal statutes, or from providing comments to FERC.

III. Fisheries and Wildlife

A. NEP agrees to provide minimum flows as follows to protect and enhance fishery and aquatic resources.

River Reach	Flow	Other Conditions
Below Somerset Dam	30 CFS from Oct. 1 to Dec. 15, 48 CFS from Dec. 16 to Feb. 28, 30 CFS from Mar. 1 to Apr. 30, 12 CFS from May 1 to Sept. 30	Minimum flow guaranteed from storage - From May 1 to July 31 flow may be reduced to 9 CFS if necessary to maintain reservoir elevations
Below Searsburg Dam	The lesser of 35 CFS or inflow from June 1 to Sept. 30, 55 CFS or inflow from Oct. 1 to May 31	
Below Harriman Dam	70 CFS from October 1 to June 30 57 CFS from July 1 to September 30	Minimum flow guaranteed from storage
Below No. 5 Dam	The lesser of 73 CFS or inflow	Inflow will not be less than the 57 CFS guaranteed at Harriman
Below Fife Brook Reach	125 CFS	Minimum flow guaranteed from storage
Below No. 4 Dam	The lesser of 100 CFS or inflow from October 1 to May 31; The lesser of 125 CFS or inflow from June 1 to September 30	
Below No. 3 Dam	The lesser of 100 CFS or inflow	
Below No. 2 Dam	200 CFS	Minimum flow guaranteed from storage

B. NEP agrees to operate Harriman and Somerset reservoirs as described herein to protect the resource values provided by the reservoirs.

1) The Somerset reservoir will be managed by NEP to maintain a stable reservoir elevation to facilitate loon nesting during the period of May 1 through July 31 in each year. During this period NEP will maintain the reservoir elevation stable within a range of +/- 1 foot.

2) NEP will manage the Harriman reservoir as follows to support rainbow smelt and small mouth bass spawning and early life stages. The reservoir water level will be stable or rising during the period from May 1 through June 15 each year. From June 16 through July 15 the reservoir elevation will drop no more than 1 foot per day.

C. It is expected that the future operation of Deerfield No. 2 will significantly reduce the frequency and effects of transitions from minimum flow to generation flows. (The "Expected Operation" is projected to average no more than 2 transitions per day and not more than 10 per week.) The Parties agree that subject to verification of this operation and its effects, no specific peaking limitations or restrictions are warranted at this time. NEP agrees to maintain release data for the No. 2 Station for a period of 36 months after issuance of a new License and will make this data available to the Parties on an annual basis. The Parties agree to cooperatively review and discuss this data, and consider whether any changes in Station operation are necessary. The Parties agree to support the inclusion of a license article allowing for the reconsideration of Station No. 2 operations if this data indicates that the Expected Operation is not occurring.

D. NEP agrees to submit, within one year of the issuance of a New License, a plan to FERC proposing means to monitor, report and verify the minimum flows and reservoir operations required by this Agreement. Said plan shall be prepared in consultation with the Resource Agencies. NEP agrees to implement the plan within two years of license issuance unless otherwise directed by FERC.

E. Emergency conditions beyond the control of NEP including but not limited to anticipation of or occurrence of high natural precipitation, or other natural conditions leading to extreme runoff events; flood storage requirements; ice conditions; equipment failure; or electrical emergencies in which the operational restrictions set out herein will or are reasonably likely to result in interruption of service to electrical customers; may occasionally require NEP to make variations from the operational restrictions setout herein when compliance would be impossible, or inconsistent with the prudent and safe operation of the Project. NEP will provide notice of such variation to USFWS and the Vermont Agency of Natural Resources (VANR) or the Massachusetts Department of Environmental Protection (MDEP), whichever is affected, within one business day of NEP's knowledge of such an event. Such variations shall not be deemed in violation of, or contrary to this Settlement Agreement.

F. NEP has provided plans for downstream fish passage facilities at Station Nos. 2, 3, and 4. NEP agrees to install these facilities in accordance with these plans (Plan nos. H-64758-P, H64757-P, H64755-P) as modified by the comments of the USFWS and said facilities shall be operational within 2 construction seasons of issuance of a New License. Prior to operation, NEP will provide a plan for evaluating the effectiveness of these facilities for review and comment by the USFWS and MDFW and approval by FERC.

NEP agrees to provide upstream passage at Station No. 2 for adult Atlantic salmon returning to the Deerfield River. Upstream passage will be implemented via a phased approach, determined by the number of adult Atlantic salmon returning to the Deerfield River. Adult Atlantic salmon will be radio-tagged and released at the Holyoke Dam Fishway and monitored at stations along the Deerfield River, in accordance with a plan to be developed by NEP and approved by the Connecticut River Atlantic Salmon Commission (CRASC) technical committee.

Radio tagging will begin in the first migration season after issuance of the new license and continue annually until either: 1) at least 12 adult Atlantic Salmon have been verified in the Deerfield River below Station No. 2 for two consecutive years and during those years an interim fish trapping system has successfully captured Atlantic salmon in the Deerfield River in a timely fashion with as little stress to the salmon as possible and with survival rates as good as those fish captured at the Holyoke fish lift; 2) at least 4 adult Atlantic Salmon have been verified in the Deerfield River below Station No.2 for two consecutive years and no interim trapping system was available or successful in recapturing fish during the monitoring period; or 3) CRASC determines that radio-tagging is no longer acceptable. Upon reaching the number of returning adult salmon under the conditions specified in 1 or 2 above, NEP will install a permanent upstream trap facility within two construction seasons in accordance with plans provided (Plan No. H-64756-P) as modified by comments of the USFWS, or implement an alternative system mutually agreed to by NEP, USFWS and MDFW.

Radio-tagging may also be discontinued if a ratio of salmon returning to the Deerfield River to all salmon released from Holyoke is mutually agreed to by NEP, MDFW and USFWS. If such a ratio is agreed to, it will be used to calculate the number of adult salmon returning to the Deerfield River for the purposes of determining if the numbers specified in 1 or 2 above have been achieved.

The Parties agree to support a license article providing for the retention of USFWS authority to prescribe upstream fish passage construction, as described in plans (Plan No. H-64756-P) as modified by comments of the USFWS, or some alternate upstream passage system agreed to by NEP, MDFW and USFWS, in the event that the radio-tagging is discontinued and no ratio of Holyoke released fish to Deerfield River fish has been agreed to.

G. NEP agrees to implement a program of wildlife enhancements as detailed in response to Additional Information Request 19, filed on October 1, 1993, to protect and enhance the wildlife resources of the Project.

IV. Recreation and Aesthetic Issues

A. NEP has proposed a comprehensive Recreational Plan which has been submitted to the FERC on October 1, 1993. NEP agrees to implement the plan, and install, operate and maintain the recreational facilities, existing and proposed, as described in this Plan and in accordance with the schedule provided therein. NEP agrees to provide free access with no charge or fees to the water and undeveloped Project land. NEP may charge reasonable user fees to recover the actual costs of providing and operating either its developed public recreation facilities or other facilities that may be provided in the future which do not provide primary or sole direct access to the water or undeveloped Project lands.

B. Boating Flows

1) NEP agrees to implement a schedule of whitewater releases as specified in Appendix A to provide for whitewater recreational opportunities at the Project.

2) NEP agrees to meet with representatives of FLOW or its successors and other interested members of the public before January 1 of each year to cooperatively develop release schedules for the coming summer. The proposed annual schedule will be issued for publication in January of each year. In order to account for unforeseen maintenance periods or other special scheduling requests, the final annual schedule will be issued by April 1 of each year following further consultation with FLOW and other interested members of the public. The Parties agree to minimize, to the extent possible, changes in the schedule set on January 1 of each year. The allocation of releases for each month set out in Appendix A may be adjusted by mutual consent of FLOW and NEP after allowing for comment by other interested members of the public provided the total number of annual releases remains

the same. NEP and FLOW agree to work cooperatively to disseminate the release schedule to the public.

3) NEP agrees to continue to provide a river flow information phone providing recorded river flow information. The river flow information phone shall be updated periodically as practicable, but at a minimum, daily, to provide information on current conditions and the next day's anticipated release schedule. The river flow information phone shall provide estimated flows below Somerset Dam, Deerfield No. 5 Dam, Fife Brook Dam, and Deerfield No. 2 Dam and inflow at Sherman Reservoir and No. 4 impoundment. Information on current and expected spillage amounts, will be provided for each day at all dams except Sherman and Deerfield No. 3, regardless of conditions, but NEP may at its discretion avoid providing inaccurate estimates or forecasts regarding natural spillage.

4) The Parties recognize that natural low, or high runoff conditions, mechanical failure, or other emergencies may prevent strict adherence to the annual schedule. In the event that natural low flow conditions restrict NEP from providing electric generation and whitewater releases according to the schedule, NEP will notify and meet with FLOW and the other

interested members of the public to cooperatively arrive at a reduced schedule that takes natural conditions into account. NEP will notify the public of the change in its release schedule through the River Information Phone as soon as possible. Scheduled releases will be canceled because of power generation needs only when performing the scheduled release will, or is reasonably likely to result in, interruption of service to electricity customers. In the event scheduled releases are canceled, they will be included as additional releases over the next two year's schedules.

5) NEP agrees to implement the new and enhanced recreational facilities of particular importance to whitewater recreation as detailed in the recreation plans filed on October 1, 1993, in response to AIR No. 24.

C. Enhancement Fund

NEP agrees that within sixty days of the issuance of a new license consistent with this Settlement, NEP will establish the Deerfield River Basin Environmental Enhancement Trust Fund in the amount of $100,000 (1994$) to finance watershed conservation, development of low impact recreational and educational projects and facilities, and planning, design, maintenance and monitoring of such facilities and projects. The Fund will not be used to carry out the various obligations set forth in the other provisions of this Agreement. The Fund will be disbursed on four year cycles. Over the first five cycles, the funds to be disbursed will be limited to 70% of the interest accrued over the previous four years, the remaining interest to be added to the principal. The last four cycles will be limited to all of the interest accrued in the preceding four years plus a portion of the principal, to be 20%, 25%, 33%, and 50% of the remaining principal for each of the four distribution cycles respectively. The last distribution cycle will be for all remaining funds in the account.

The Fund will be administered by a three member committee, which shall determine the investment strategy for the fund and the appropriate distribution of available funds for each year. The committee will be comprised of a representative of NEP, a designee of the Secretary of the State of Vermont Agency of Natural Resources and a designee of the Secretary of the Commonwealth of Massachusetts Executive Office of Environmental Affairs. Funding decisions will be made by unanimous vote of the three member committee. The committee will also be charged with approving additional contributions to the fund when and if they become available through gift, grant, or other means.

By the end of October of each year preceding a distribution cycle, the committee will submit to FERC for approval a ranked list of projects selected for funding by the committee and an accompanying accounting plan. One or more projects may be funded in any distribution cycle. Upon the completion or abandonment of any funded project, and in no case later than the next distribution cycle, the committee will submit to FERC an accounting specifying the actual use of the awarded funds over the course of the project.

Eligible Fund recipients include nonprofit organizations, educational institutions and units of government within Vermont and Massachusetts. In general, funds will be available on a 50% matching basis; however, the Committee is authorized to waive the matching requirement upon an applicant's showing of need. Projects will be selected through a competitive grant application basis.

To be eligible for funding, a proposed project would be required to provide clear public benefit and contribute to the goals of enhancing low impact recreational, environmental education or environmental protection opportunities directly related to the Deerfield River watershed. Projects must be located within the Deerfield River Basin or in towns with some portion falling within the basin. In the later case, projects must be directly tied to the basin, e.g., a trail spur originating outside the basin that connects with a trail network within the basin. Projects must be consistent with those plans accepted by the FERC as Comprehensive Plans for the Deerfield River. Funds may be used for outdoor educational programs, including curriculum development and travel for students, interpretative materials and signs.

V. Project Lands

A. NEP agrees to grant term conservation easements to qualified government or nongovernment land management organizations to provide for the continued preservation in a natural state of the lands within the Project owned by NEP in fee, and certain other lands owned by NEP in fee (Non-project Lands) downriver of Fife Brook Dam and the No. 2 development and along the river corridor. The grant of conservation easements on Non-project Lands shall be conditioned on FERC's approval that the Non-project Lands be added to the Project Lands and be treated as Land in Utility Use for accounting purposes. The intent of the conservation easements is to protect the scenic, forestry and natural resources of the lands from uses which would conflict with the preservation of these resources. No uses will be made of the land subject to the conservation restriction that are inconsistent with its intent, except as otherwise provided herein. The restrictions will allow for continued use of the property for forestry, educational, non-commercial recreation, open space and electric transmission and generation purposes. Subdivision of the property will not be allowed except when necessary to carry out one of the aforementioned purposes and only when consistent with the intent of the easements, including (1) maintaining forestry management units that maintain the potential and current productivity of the lands for commercial forestry and (2) preventing the fragmentation of wildlife habitat. The lands subject to this section are approximately as shown on a map attached as Appendix B. The holders of the conservation easements will be selected by NEP, CLF and AMC, and each party may in its sole discretion withhold its approval of said selection. The holders of the conservation easements shall not transfer the easements without the consent of NEP, CLF and AMC and each party may in its sole discretion withhold its approval of said transfer. Said conservation easements will run for the term of the new license and shall not be subordinated to any mortgage, lien, or similar encumbrance except said easements shall be subject to the terms of the General and Refunding Mortgage Indenture and Deed of Trust between New England Power Company and the New England Merchants National Bank dated January 1, 1977, as supplemented from time to time (the G&R Indenture). Said easements shall be subject to existing rights of third parties, if any. NEP agrees to continue the restrictions contained in the conservation easements during any annual licenses issued subsequent to the expiration of the new license and to renew the conservation easements for the term of the license in subsequent relicensing proceedings provided that, and to the extent that, the Project is relicensed under terms and conditions not inconsistent with the conservation easements and such that the Project continues to be an economically beneficial source of power relative to other available resources. The Parties agree that, in future relicensing proceedings, renewal of the conservation easements will be considered as proposed enhancement and not as past mitigation.

B. NEP agrees to grant a term conservation easement to a qualified government or nongovernment land management organization for the lands within the Bear Swamp Project, L.P. No. 2669 for the remaining term of the Bear Swamp License. Said conservation easement will be similar in form and intent to those described in Section V.A above but shall end absolutely at the expiration of the current license for the Bear Swamp Project, and shall be subject to the G&R Indenture and existing rights of third parties, if any. The Conservation Easements granted under this paragraph shall not be subject to the provisions of Section V.D, below. The lands subject to this section are approximately as shown on a map attached as Appendix B.

C. NEP agrees to reimburse the easement holders' reasonable costs for monitoring and enforcing the terms of the conservation easement.

D. NEP agrees to grant the holders of the conservation easements described in Section V.A, an option to purchase at the then fair market value (but in no case an amount less than the original acquisition cost) the lands subject to the easement which are not required for electrical generation and transmission purposes, then existing, approved or with regulatory approvals pending. Said option is to be exercisable if the conservation easements are not renewed at the termination of the new license. This option to buy shall be subject to the G&R Indenture and receipt of all regulatory approvals. The option shall become exercisable upon the termination of the conservation easements and for six months thereafter, which may be extended by mutual agreement for up to two years upon a demonstration of a good faith effort to bring the transaction to a timely completion.

E. NEP agrees to conduct its timber management programs in accordance with the guidelines attached as Appendix C and with the following goals: the protection of riparian zones along rivers and lakes; protection of visual quality within important public viewsheds and along trail corridors; limited use of clearcutting; minimizing interference with low impact recreational use and enjoyment; and the preservation of wildlife habitat.

VI. **Decommissioning**

A. NEP acknowledges its responsibility to plan for and seek to collect funds in anticipation of the proper future management of the Project upon retirement from power production. In fulfillment of its responsibility NEP agrees to:

1) within five years after issuance of a new license, complete a study in consultation with the Parties and FERC to identify and estimate the cost of various options for retirement of the Project in the event of (a) a surrender or implied surrender of the License, (b) a denial by the FERC of a subsequent new License, or (c) permanent nonpower operation or (d) partial or complete removal of the Project. The project retirement options will be developed in conjunction with an independent licensed professional engineer approved by FERC or its successor.

2) submit said study in a timely fashion to FERC and the Parties for comment and with approval of FERC select the most appropriate likely option for eventual retirement (the "Project Retirement Plan").

3) In its first rate filing after submitting the study to FERC, and in subsequent rate filings if the initial request is denied, seek to recover in its wholesale rates appropriate amounts during the remaining license term to accumulate by the end of the

license term, funds sufficient to support the Project Retirement Plan.

The implementation of the Project Retirement Plan would be subject to review and approval by FERC or its successor, or if no longer subject to federal jurisdiction, appropriate state authorities, and could include dam removal, if found to be the preferred course of action.

B. Funds collected by NEP for the Project Retirement Plan will be handled similarly to other Project depreciation reserves. NEP will file with FERC an annual certification of financial capability demonstrating that NEP has a tangible net worth at least three times the estimated cost of the Project Retirement Plan. If NEP is unable to provide this certification of financial capability NEP will within six months either (a) create a segregated trust fund, into which the full amount of funds previously and subsequently collected to support the Project Retirement Plan would be deposited; or (b) purchase insurance, post a bond, or provide other means previously approved by FERC ensuring that the full amount of funds collected to implement the Project Retirement Plan will be available upon the expiration of the license.

VII. Approval of Settlement; Dispute Resolution

A. The Parties have entered into and jointly submit this Settlement with the express condition that FERC approves and accepts all provisions herein and issues a new project license consistent with the terms of the Settlement. In the event that

FERC changes, conditions or modifies any provision contained herein in its order issuing a new license, whether through its own action or through incorporation of conditions of a §401 Water Quality Certification, the Offer of Settlement shall be considered modified to conform to the FERC order unless any Party to the Settlement within 30 days of FERC's action provides written notice by certified mail to the other Parties that it is withdrawing from the Settlement because of the modification, change or condition. Upon such notification, the Settlement shall be deemed void and withdrawn. In the event that the Offer of Settlement is withdrawn, it shall not constitute a part of the record of this proceeding in either the Massachusetts §401 Water Quality Certificate Proceeding, or the Vermont §401 Water Quality Certificate Proceeding.

In the event that FERC issues a final order that does not include conditions consistent with Sections IV.C (Enhancement Fund) and V. (Project Lands) of this Settlement and regardless of whether this Settlement is withdrawn by a party other than NEP, NEP agrees that it will comply with and implement the terms of Sections IV.C and V as long as the Project receives a new license with operational terms and conditions and financial impacts consistent with the Settlement as filed.

B. Dispute Resolution

In the event that any dispute arises over compliance with the terms and conditions of this Settlement, the Parties agree to engage in good faith negotiations for a period of at least 60 days, if necessary, in an effort to resolve the dispute. A minimum of two meetings shall be held to attempt to resolve the dispute during the 60-day period, if necessary. In the event that resolution cannot be reached within the 60-day negotiating period, the dispute may be referred to FERC pursuant to FERC's Rules of Practice and Procedure (18 CFR 385, et. seq.).

Notwithstanding any other provision of this Settlement, any Party may seek relief in any appropriate forum for noncompliance with this Settlement by any Party hereto.

C. Use of Reopener Clauses in the New License

This Agreement is not intended to limit or restrict any Party's authority to seek different or modified license conditions through a license reopener. Before any Party invokes any reopener clause, the Party shall request all Parties to commence negotiations for a period of at least 90 days to resolve the issue, and to agree to modify this Agreement accordingly, if necessary.

Entered into as of this day, October 5, 1994.

New England Power Company

John Rowe, Chairman

The National Park Service

Marie Rust, Regional Director,
North Atlantic Region

United States Fish & Wildlife Service

Ronald E. Lambertson,
Regional Director, Northeast Region

Massachusetts Division of Fisheries and Wildlife

Wayne F. MacCallum, Director

American Rivers, Inc.

Margaret Bowman, Esq.

The Appalachian Mountain Club

Andrew J. Falender, Executive Director

The Deerfield River Compact

William Lattrell, Chairman

New England FLOW

Richard L. Hudson, Director

American Whitewater Affiliation

Thomas J. Christopher, Director

Conservation Law Foundation

Douglas I. Foy, Executive Director

The Deerfield River Watershed Association

William Lattrell, President

Trout Unlimited

Charles F. Gauvin, President and Chief Executive Officer

The United States Environmental Protection Agency

John DeVillars, Regional Administrator, EPA - New England

American Rivers, Inc.

Margaret Bowman, Esq.

American Whitewater Affiliation

Thomas J. Christopher, Director

The Appalachian Mountain Club

Andrew J. Falender, Executive Director

Conservation Law Foundation

Douglas I. Foy, Executive Director

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William Lattrell, Chairman

The Deerfield River Watershed Association

William Lattrell, President

New England FLOW

Richard L. Hudson, Director

Trout Unlimited

Charles F. Gauvin, President and Chief Executive Officer

The United States Environmental Protection Agency

John DeVillars, Regional Administrator, EPA - New England

Accord:

Attorney General of the
Commonwealth of Massachusetts

____

The Massachusetts Executive Office of
Environmental Affairs

____

Appendix A
Whitewater Releases

1. 50 weekend and 56 weekday releases annually from Fife Brook Dam in Florida, Massachusetts during the recreational boating season, April 1 through October 31, according to the monthly allocation specified below.

April:	3 weeks of Wednesday through Sunday releases
May:	2 weeks of Wednesday through Sunday releases, plus 2 weeks of Saturday and Sunday releases.
June:	2 weeks of Wednesday through Sunday releases, plus 2 weeks of Saturday and Sunday releases.
July:	3 weeks of Wednesday through Sunday releases, plus 1 week of Saturday and Sunday releases.
August:	4 weeks of Thursday through Sunday releases.
September:	3 weeks of Thursday through Sunday releases.
October:	3 weeks of Wednesday through Sunday releases.
Holidays:	May be substituted for weekend days upon agreement before April 1 of each year.

2. 26 weekend or holiday, and 6 Friday releases annually from the Deerfield #5 Dam into the Deerfield #5 Bypass during the recreational boating season, April 1 through October 31 according to the following monthly schedule:

April:	No scheduled releases
May:	2 weekend days only
June:	5 weekend days and 2 Fridays
July:	6 weekend days and 2 Fridays
August:	7 weekend days and 2 Fridays
September:	4 weekend days only
October:	2 weekend days only

To the extent possible, each annual No. 5 Dam release schedule will minimize the number of "Friday-Saturday-Sunday" or "Saturday-Sunday-Monday(holiday)" occurrences.

3. Water releases on each scheduled day shall be for the following durations:

   a. On the Fife Brook section, releases shall be continuous for at least three hours starting any time between the hours of 9:30 a.m. and 12:00 p.m.

   b. On the Deerfield #5 Bypass, Friday releases shall be continuous for at least four hours starting at 11:00 a.m. Saturday releases shall be continuous for at least five hours starting at 10:00 a.m. Sunday releases shall be continuous for at least four hours starting at 10:00 a.m.

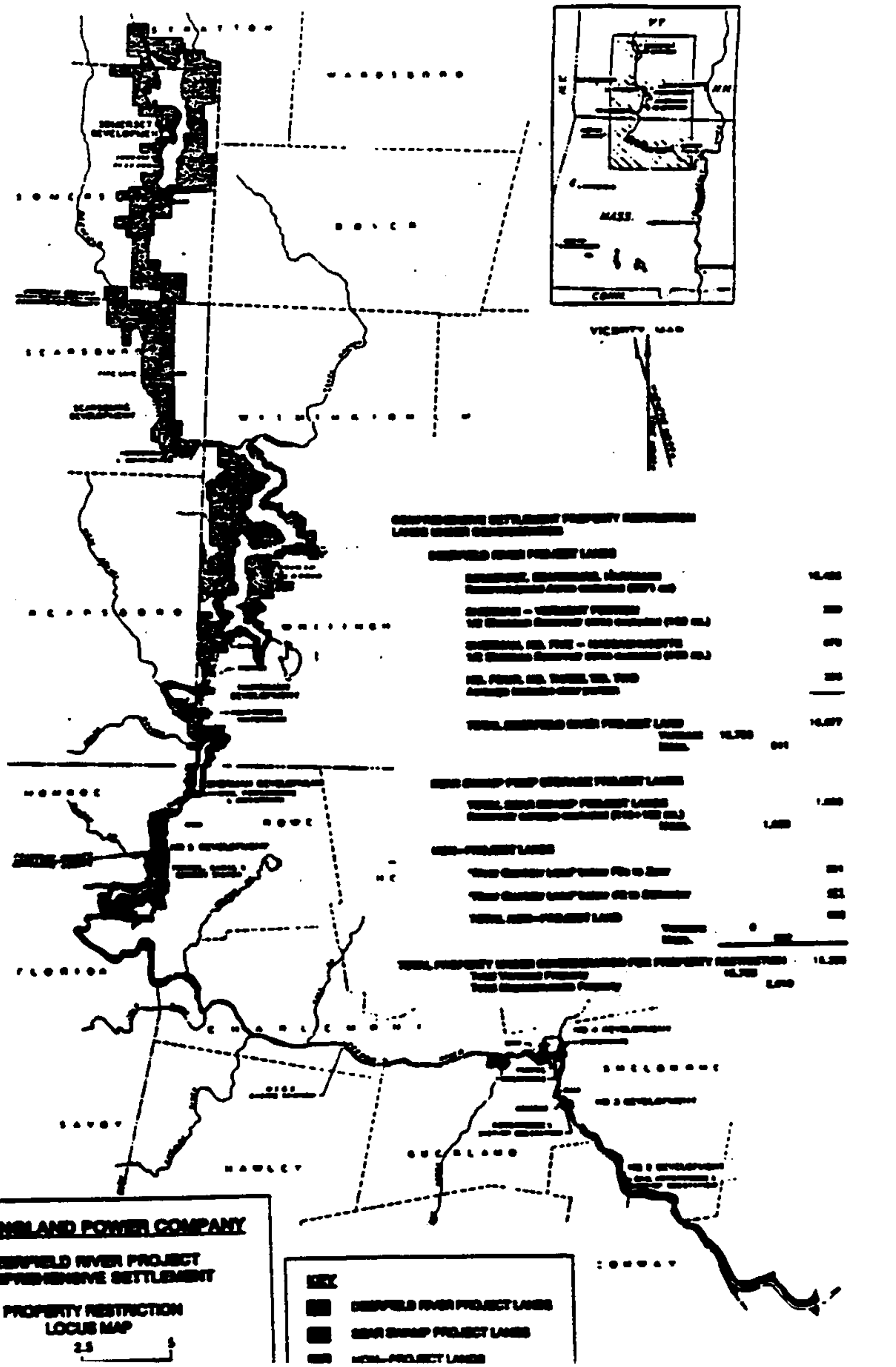
4. Flow levels for the above-mentioned release periods shall be:

   a. Fife Brook Dam: a minimum of 700 cubic feet per second

   b. Deerfield #5 Dam: releases of 900, 1000, and 1100 cubic feet per second distributed equally over the schedule so as to average 1000 cubic feet per second.

PROPERTY UNDER CONSIDERATION FOR CONSERVATION EASEMENT

Appendix B



Appendix C
Forest Management Guidelines

Statement of Intent

The provisions stated below establish specific guidelines for the protection of important biological and recreational resources on NEP's Deerfield Project forested lands. The intent is to allow NEP to retain flexibility in its forest management operations while ensuring that lands critical to maintaining aquatic and terrestrial wildlife habitat, recreational experiences, and long-term productivity are protected.

NEP agrees to conduct its timber management programs in accordance with the following goals:

Protect riparian zones along rivers and lakes.
Protect visual quality within important public viewsheds and along trails.
Protect fragile or highly erodible soils.
Prevent excessive nutrient depletion of low productivity soils.
Provide appropriate application of the clearcutting reproduction method.
Protect and manage wildlife habitat for all species that may be reasonably expected to occur on project lands.

Management Provisions

In addition to goals, objectives and the associated policies and practices outlined in the New England Electric System Companies' Forest Management Plan, dated 12/28/84, NEP shall manage lands associated with the Deerfield River Project L.P. 2323 and the additional non-project lands covered under this Settlement consistent with the following provisions:

Riparian Protection

- No commercial harvesting within 100' of shorelines associated with the East Branch and mainstem of the Deerfield River, including all reservoirs to a point below Deerfield Number 2 Station known as Stillwater Bridge. Logging operations shall comply with the Vermont Wetland Rules where applicable.

- Areas within a zone of 100'-200' from the shores of the Deerfield as outlined immediately above, and areas within 50' of permanent streams, ponds or non-forested wetlands, shall be restricted from removing more than 50% of the basal area over any 10-year period and designed to leave a well distributed age class of trees which are evenly dispersed.

- These zones shall be extended 50' in width if slopes exceed an average of 35% over the entire buffer.

Visual Aesthetics

- Stands that are within the viewshed of major public use ares (rivers, lakes, hiking trails, and highways) shall be managed, to the extent possible, so as to minimize visual degradation and maintain aesthetic quality.

Soil Erosion

- No harvesting shall be performed on any SCS-classified histosols (bog soils).

- For soils listed by SCS as having severe equipment limitations due to wetness (i.e., poorly drained soils) and soils rated severe for erosion hazard, harvesting shall be limited to winter periods when the soil is frozen or utilizing a suitable alternative harvesting method and plan which prevents erosion.

Site Productivity, Nutrient Depletion

- For stands in which the site indices (SI) for existing desirable and management species are below SI-40, no whole-tree harvesting will be allowed (i.e., stem-only harvesting).

- For stands in which the site indices for existing desirable and management species are between SI-40 and SI-60, whole-tree harvesting will be limited to partial cuts removing no more than 50% of the basal area over any 10-year period and designed to leave a well distributed age class of trees which are evenly dispersed.

Wildlife Management

- Wildlife management considerations shall be included in all stand management prescriptions and shall be consistent with measures outlined in the Wildlife Enhancement Report filed as Appendix E13 of NEP's application to relicense the Deerfield River Project and with suggestions provided by State or Federal wildlife management personnel or management guides. NEP shall comply with silvicultural standards for deer wintering yards established by the State of Vermont if the harvesting occurs in a deer yard as mapped by the Vermont Department of Fish & Wildlife.

Future, Alternative, Desirable Management

- NEP shall abide and follow the above-listed provisions. However, over the 40-year term of this Settlement, unforeseen circumstances, future management techniques, public policy and alternative, desirable resource considerations may justify and require actions otherwise prevented by the above-listed provisions. NEP shall continue to manage its forest land in an ethical steward-like manner, and shall not alter this philosophy. Alternatives and exceptions to the above provisions shall only be enacted if other, presently unforeseen, desirable resource management objectives dictate such and the goals outlined in Paragraph V-E of the Settlement are met. If NEP wishes to pursue such exceptions and/or alternatives, however, it first shall amend the forest management plan and/or guidelines with the approval of the easement Holder.

- All dead woody debris (both standing and down) shall be left on-site. The following exceptions are recognized: 1) The salvage of merchantable dead material resulting from fire, insect outbreak, large-scale windthrow, or other major disturbances; 2) The removal of dead material for firewood or other purposes on an individual non-commercial basis at the discretion of NEP.

Clearcutting

- Clearcuts will be limited to a maximum of 20 acres in size for stem-only harvests and 10 acres for whole-tree harvests.

- No more than 25% of any management Block shall be clearcut over any 20-year period.

- Clearcutting is prohibited on soils rated severe for erosion hazard when slopes are greater than 25% measured over a distance of 100 feet or more.

- All clearcuts will be separated by strips at least 300' in width in which no more than 50% of the basal area may be removed over any 10-year period. Additional harvesting within the buffers may take place when regeneration of desirable species is well-established in the adjacent clearcut but no sooner than 10 years after the initial harvest.

- Definitions and Standards: A "clearcut" is any timber harvesting operation greater than 2 acres in size which results in either of the following two conditions: 1) the average residual basal area of trees over 6" in diameter is less than 30 square feet per acre, or 2) the average residual basal area of trees over 1" in diameter is greater than 30 square feet per acre and the average residual area of trees over 6" in diameter is less than 10 square feet per acre.

  Regeneration will be considered well-established when 60% of 1/500-acre plots distributed across the harvest area contain at least one healthy, well-formed tree at least 5' tall.

Appendix B. LETTERS OF COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND STAFF RESPONSES

The Notice of Availability of the draft environmental impact statement (EIS) was published in the *Federal Register* on March 8, 1996. The draft EIS was mailed to federal, state, local, and non-governmental agencies and individuals on February 29, 1996. Section 8 contains a list of those agencies and individuals that were sent a copy of the EIS.

All timely letters of comment, that address specific analyses in the draft EIS, were reviewed by the FERC staff. Suggestions for correcting data or text and requests for further discussion of a subject have been considered. Those editorial changes and suggestions which were practicable, reasonable, and which improved the quality of the final EIS were incorporated.

Constructive criticism presenting a major environmental point of view or one in opposition to staff, when persuasively supported, is treated by making revisions in the appropriate part of the final EIS. When the major point of view is not persuasive, reasons are given why the staff did not change its point of view.

The sections or pages of the final EIS that have been modified as a result of comments received are identified in the staff responses to the right of the letters of comments. Other staff responses are self explanatory.

A "no response required" response is given to comments that are statements that raised no questions concerning treatment of subject matter in the draft EIS. A "your opinion has been noted" or "comment noted" response is given to comments considered to be statements of opinion.

Where possible, our responses start next to the start of the comment in the letter. Comments may extend for several pages. For each comment letter, our responses are numbered sequentially. Where necessary to avoid confusion, the comments are numbered as well.

The respondents, the date of their response, and the page on which they start are as follows:

1

american whitewater affiliation

96 APR 19 PM 1:30
REGULATORY COMMISSION

COPY

Tom Christopher
931 Union Street Rear
Leominster, MA 01453
(508)534-9447

April 15, 1996

Ms Lois C. Cashell, Secretary
888 First Street, N E
Federal Energy Regulatory Commission
Washington, D. C 20426

DEERFIELD RIVER PROJECT
DOCKET # LP2323-012

Dear Ms Cashell:

We have reviewed the Environmental Impact Statement for the Deerfield River Project (# LP 2323-012) and would like to extend our strong and unqualified support for the "Deerfield Settlement Agreement" component that is the preferred alternative for this project.

It has taken many years for the various interest groups that are concerned with the use of the Deerfield River resources to develop this plan for the future of this important river. It is our position that the " Deerfield Settlement Agreement" represents the best balanced use of these resources and will still allow for the economic viability of the hydroelectric generation facilities that are located on the river.

We ask you to reject all other alternatives except the "Deerfield Settlement Agreement."

If you have any questions about our position I can be reached at the above telephone number

Thank you for your time and consideration.

Sincerely,

Tom Christopher

Tom Christopher
New England Representative

Executive Office: P.O. Box 85, Phoenicia, NY 12464
(914) 688-5569

AWA-1. No response required.

Northeast
Utilities System

107 Selden Street, Berlin, CT 06037

Northeast Utilities Service Company
P.O. Box 270
Hartford, CT 06141-0270
[illegible]
Fax [illegible]

E. C. Chevalier
Vice President - Fossil/Hydro Engineering
and Operations

FILED
OFFICE OF THE SECRETARY
96 APR 24 PM 2:28
FEDERAL ENERGY
REGULATORY
COMMISSION

April 17, 1996
D09814

FERC No. 2334
Gardners Falls Project

Ms. Lois Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street
Washington, DC 20426

Reference: Draft Environmental Impact Statement for Deerfield River Projects, Vermont-Massachusetts (FERC Project Nos. 2334-001 and 2323-012), dated February 1996 (C06736).

Dear Ms. Cashell:

Gardners Falls Project
FERC Project No. 2334
Response to Draft Environmental Impact Statement

Western Massachusetts Electric Company (WMECO) has reviewed the Draft Environmental Impact Statement (DEIS) prepared for the hydroelectric projects on the Deerfield River in Vermont and Massachusetts and requests the following corrections and modifications to the document. The following comments pertain to WMECO's Gardners Falls Project, FERC No. 2334.

Comments on Minimum Flow Recommendations

WMECO contends that the final minimum flow recommendations for the Gardners Falls Project do not in fact reflect the environmental review performed by FERC staff, but rather are based on the feasibility of the project to pass higher flows. As such, the recommendations are not based on scientific fact and sound and reasonable judgment. WMECO requests that the DEIS be modified to reflect the staff's support of WMECO's proposal. Justification for this request is as follows.

NU-1. We examined flows of 50, 100, and 150 cfs and found that a minimum flow of 50 cfs would adequately protect the fishery resources of the bypassed reach. However, a minimum flow of 150 cfs would provide more habitat for adult trout and from a fisheries perspective, would be the best flow for all fish species. Our recommendation for a minimum flow of 150 cfs reflects the overall best potential increase in habitat for all species, improving water quality, and the mandatory conditioning authority of the state WQC. We believe the WQC stipulation for providing 150 cfs

Ms. Lois Cashell
D09814/Page 2
April 17, 1996

The environmental review performed for the project was rigorous and detailed, and indicates that WMECO's proposal was sound, valid and reasonable. The proposal provides significant environmental enhancements for a reasonable reduction in project generation. Staff concurred with WMECO's proposal, and made the following statements in the DEIS.

1. "...the 1,400 foot bypassed reach is more suitable for salmon management and the stream reach below the powerhouse is more suitable for trout management."

2. "The staff believes that most juvenile Atlantic salmon reaching the bypassed reach would likely pass through the area in their downstream movements rather than remain in the area for any length of time..."

3. "...we continue to believe that the 50 cfs minimum flow release proposed by WMEC would provide adequate juvenile Atlantic salmon habitat in the bypassed reach."

4. "We have determined that WMEC's proposed 50 cfs minimum flow into the bypassed reach would adequately protect water quality and fishery resources and the existing classifications of this stream section as Class B warm water fishery resources."

5. "Staff concludes that .... the intended minimum flow enhancement of 150 cfs would only occasionally be realized, with flows, and the resulting habitat gains would most often be limited to that which occurs at 100 cfs."

6. "The staff doesn't believe that a year round minimum flow of 150 cfs is needed at the powerhouse to support the put-and-take trout fishery or to establish a self-sustaining population."

7. "WMEC's proposal to release supplemental flows of 100 cfs during the season when trout are stocked in the area below the powerhouse would be beneficial to trout."

8. "The staff believes that the best potential for establishing a self-sustaining population of brown trout in the area would be in the area below the powerhouse and in the Deerfield No. 2 development reservoir."

These statements are totally consistent with WMECO's justification for its proposal. Based on these statements, it seems obvious that WMECO's recommendations should be the final recommendation of the DEIS. In fact, in Table 5-3, FERC states, "Staff agrees with and has not modified WMECO's recommendations to release a minimum flow of 50 cfs in the bypassed reach and 100 cfs below the powerhouse, but the 150 cfs required in the WQC is mandatory." Staff's justification for abandoning their beliefs in favor of

or inflow, whichever is less, allows reasonable alteration of minimum flows to the bypassed reach to meet stream flow conditions at the project and allow for variation in flows from upstream sources.

Ms. Lois Cashell
D09814/Page 3
April 17, 1996

higher flow requirements hinges on the feasibility for the project to pass a higher flow based on commitments contained in New England Power Company's Settlement Agreement for other projects on the river. WMECO maintains that the DEIS should be an objective document founded on scientific knowledge and sound and reasonable judgment. Staff demonstrated that the flow requirements of the Water Quality Certification are extreme and do not reflect sound and reasonable judgment. The legal standing of the Water Quality Certification should not be the basis for environmental recommendations. The conclusions of the DEIS should be based solely on staff's objective review of the project and its associated resources.

Comments on Economic Analyses

The economic analysis performed by FERC staff demonstrates the impact on the Gardners Falls Project caused by the Deerfield River Settlement Agreement. The imposition of higher minimum flow requirements will place the project at a greater economic disadvantage as the electric industry moves toward an open market system. Staff showed that the project currently provides a positive net benefit of approximately $104,000 per year. The implementation of the Settlement Agreement terms produces a net negative benefit of $32,000 per year. The resulting project, as recommended by staff, would produce a net negative benefit of $66,000 per year (based on revised FERC values provided at the hearing). The fact that the project would have a negative net benefit demonstrates that the benefits of hydroelectric power generation were not given equal consideration as required under the Electric Consumers Power Act of 1986 (ECPA). Staff maximized potential habitat gains with little or no consideration for power generation. Nowhere in the DEIS were the net economic benefits debated and evaluated as thoroughly as fisheries and other resources were considered.

In the Foreword, the relicensing mandate of the Commission under the Federal Power Act, as amended by ECPA, was stated. The mandate sets objectives for projects being relicensed to meet, including "...the improvement and utilization of water power development..." and "...the adequate protection, mitigation and enhancement of fish and wildlife..." Immediately after this mandate is the statement:

"The Commission may require such other conditions not inconsistent with the FPA as may be found to provide for the various public interests to be served by the project."

Certainly this disclaimer provides the Commission with the opportunity to disagree with State-imposed water quality certification requirements if they are judged to conflict with various public interests, including the availability of inexpensive, renewable power generation.

NU-2. We disagree. The Commission's approach to evaluating project economics based on current cost of project power is fairly straight forward. The Commission has held that it is the responsibility of the applicant to determine whether to proceed with a project that appears to cost more than the likely alternative source of power at the time of licensing (See Mead Paper Company 72 FERC ¶ 61,027 (1995) and Duke Power Co., 72 FERC ¶ 61,030 (1995)).

Ms. Lois Cashell
D09814/Page 4
April 17, 1996

<u>Corrections</u>

1. Table 1-1 should state the correct operational date for Gardners Falls of <u>1904</u>.

NU-3. Correction made.

2. The name "Gardners" was misspelled in several locations as noted below:

   a.) Page 2-18, Section 2.4, Par. 2, line 5.
   b.) Page 4-79, Section 4.2.2.3, Par, 1, line 1.
   c.) Page 5-1, Section 5.0, Par. 2, line 3
   d.) Page 5-19, Section 5.3, Par. 1, line 2.

NU-4. Corrections made.

3. Page 2-4, Section 2.1.2, last two paragraphs, should be replaced with the description of project operations provided on Page A-11 of the Application for New License dated December 1991.

NU-5. See revised text.

4. Page 3-11, Section 3.2.7, Par. 2, line 3 should read "...the Gardners Falls dam and power plant <u>were</u> completed in <u>1904</u>."

NU-6. Correction made.

5. Page 4-60, Fish Entrainment section, Par. 2, lines 2 and 3 should read "...(2) immediately upstream of the intake of <u>Unit</u> No. 4....(3) immediately upstream of the intake of <u>Unit</u> No. 3...."

NU-7. Correction made.

6. Page 5-1, Section 5.1, Par. 1, line 5 should be corrected to state that the Gardners Falls Project is only in Massachusetts.

NU-8. Correction made.

<u>Summary</u>

In conclusion, WMECO asks that Staff revise the final minimum flow recommendations for the project to be consistent with its rigorous and detailed evaluation and to support WMECO's proposal as stated in the Application for New License dated December 1991. The proposed project would provide significant environmental enhancements with a reasonable associated cost. WMECO believes that the intent of ECPA is adequately served by its proposal.

NU-9. See response to NU-1.

If you have any questions regarding these comments, please contact Mr. Kenneth J. Hodge, NUSCO Hydro Support Group, at (860) 665-3367.

Very truly yours,

WESTERN MASSACHUSETTS ELECTRIC COMPANY

R. G. Chevalier

cc: Service List for DEIS

DEERFIELD RIVER WATERSHED
ASSOCIATION, INC.
P.O. Box 13
Shelburne Falls, MA 01370

96 APR 22 PM 1:30

April 17, 1996

Lois Cashell, Secretary,
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Proj. Nos. 2323-012
and 2334-001 Deerfield
River and Gardners Falls
Hydroelectric Projects

To the Federal Energy Regulatory Commission:

We wish to add two comments tb the public record concerning the Environmental Impact Statement for the Deerfield River and Gardners Falls Hydroelectric Projects (Nos. 2323 and 2334). First, the Comprehensive Settlement Agreement for relicensing the dams on the Deerfield River were negotiated to improve conditions for native fish, salmon and wildlife, to provide recreational fishing, boating and whitewater rafting while at the same time allowing the utility to maintain a profitable business. The recently voiced objections by the Western Massachusetts Electric Company (WMECO) utility to the 150 cfs minimum flow for the Gardners Falls dam are not scientifically supported and do not serve the public's best interest. If the other dams on the Deerfield can remain profitable with the agreed upon minimum flow rate, then WMECO should be able to as well. These are public waters and the public's best interest is served by upholding the agreed upon minimum flow rates.

DRW-1. Comment noted.

Second, we are concerned about the objections raised by the Vermont Natural Resources Council that wildlife habitat in reservoirs in Vermont could be impacted by release of waters from those reservoirs. As an environmental group we are concerned about wildlife habitat throughout the Deerfield River basin, but the habitat impacts in the man-made reservoirs should be weighed against the downstream impacts caused by restricting water flows. There are many NPDES wastewater discharge points along the Deerfield in Massachusetts, and these wastes may not be adequately diluted if the water flow were restricted during the summer months. Furthermore, as our communities have developed along the river we are concerned about the reduction in flood control if the reservoir water levels are restricted.

DRW-2. Comment noted.

We hope you will be able to balance the benefits and impacts associated with the relicensing so that the environmental and public interests within the entire Deerfield Basin are best served.

Sincerely,

Dr. Mark D. Mattson, President
Deerfield River Watershed Association

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United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, Massachusetts 02210-3334

April 18, 1996

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REF ER 96/160
FERC Nos 2323-012, 2334-001
New England Power Company and
Western Massachusetts Electric Company
DEIS COMMENTS

Lois D Cashell, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N E
Washington, DC 20426

Dear Ms Cashell

This is in response to the Commission's Draft Environmental Impact Statement (DEIS) for the Deerfield River and Gardners Falls Projects, located on the Deerfield River in Vermont and Massachusetts

We have reviewed the DEIS and have the following comments

Deerfield River Project (FERC No 2323)

The Department strongly endorses the conclusions of the DEIS related to most issues associated with the Deerfield River Project We are very pleased at the DEIS's endorsement of virtually the entire Offer of Settlement between New England Power Company (NEP), the Fish and Wildlife Service, the National Park Service, and other resource agencies and non-government organizations The Department would have preferred that the FERC incorporate the Enhancement Fund into the preferred alternative, however, FERC's statement at page 4-47 recognizing the public benefits of the Enhancement Fund allows the Department to support the DEIS conclusions on the Deerfield River Project as written In fact, the Offer of Settlement included provisions to the effect that a component of the settlement, such as the Enhancement Fund, could survive in the event FERC failed to incorporate it into its recommendation for licensing The Department is also confident with NEP's continuing commitment to implement the measures contained in the Offer of Settlement

DI-1. No response required.

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Lois D. Cashell, Secretary

We understand that at the April 9, 1996 public meeting on the DEIS, Commission staff expressed some uncertainty regarding the proposed implementation of interim and permanent upstream fish trapping and passage facilities at the Number 2 Station. The trigger for implementing upstream passage/fish trap construction was agreed to by NEP, the FWS, and the Massachusetts Division of Fisheries and Wildlife (MDFW), and is described on page 10 of the Offer of Settlement. We are unclear as to the nature of the staff's uncertainty, but the following outline of the plan may help clarify the issue.

- o The agreement calls on NEP to implement a radio-tagging study of salmon released at the Holyoke Fishlift to see if enough salmon enter and ascend the Deerfield River to warrant fish passage construction.
- o On an interim basis, NEP may attempt to capture salmon that enter the Deerfield by netting or other means if the numbers of salmon verified in the Deerfield are low.
- o If NEP is successful with net capture or other interim measures, and 12 or more salmon are not verified below the Number 2 Station for two consecutive years, this interim capture technique would be continued until the two-year/12-salmon trigger is reached. When the two-year/12-salmon trigger is reached, permanent upstream passage/trapping facilities would be required.
- o If NEP chooses not to undertake an alternative capture method, or if an interim method to efficiently and safely capture salmon in the Deerfield cannot be found, the trigger for installing permanent facilities is four or more salmon in the Deerfield below Number 2 Station for two consecutive years.
- o Upon reaching either trigger for constructing permanent facilities, NEP must complete their installation within two construction seasons.

Gardners Falls Project (FERC No. 2334)

Unlike the Deerfield River Project, we have some significant concerns regarding the DEIS discussion and conclusions for the Gardners Falls Project. Our comments are as follows.

Section 10(j) Dispute

The DEIS, at page 5-21 and Table 5-6, states that the DEIS adopts all our Section 10(j) recommendations regarding the Gardners Falls Project. We do not agree that the license provision recommended in the DEIS fully incorporates the Department's recommendation for bypass flow releases. The Department, in its October 5, 1994 letter in response to the Commission's Notice

DI-2. We appreciate the clarification.

DI-3. WMEC has no control over the amount of water reaching its project. The Gardners Falls reservoir, has little storage capacity (around 37.2 acre-feet). WMEC would be required to release a minimum flow of 150 cfs into the bypassed reach or whatever inflow reaches the project site. As explained in the EIS, the upstream Deerfield No. 3 development, would release a minimum flow of 100 cfs or inflow. We know that typically

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Lois D Cashell, Secretary

of Application ready for Environmental Analysis, recommended that

> "1 The licensee shall release to the project bypass reach, an instantaneous minimum flow of 150 cubic feet per second (cfs) This flow shall be maintained by use of inflows to the project area and the project's daily storage capacity to the extent possible If inflows to the project area and the project's daily storage capacity together are not capable of maintaining the designated flow, the licensee shall release to the bypass reach, 150 cfs or the inflows to the project, whichever is less " (emphasis added)
>
> This minimum release may be modified due to operating emergencies beyond the control of the licensee and for short periods upon mutual agreement with the Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife

The conclusion of the DEIS provided for a 150 cfs bypass release on an "or inflow" basis and cites that inflows, which are guaranteed to be 100 cfs from the bypass flow requirement at the upstream Number 3 Station, would not always be 150 cfs This very fact was the reason that the Department recommended that the Commission require 150 cfs to be maintained by the "use of inflows to the project area and the project's daily storage capacity to the extent possible"

As described in the October 5, 1994 letter, the frequency and duration of periods when augmentation are needed would likely be limited, since NEP will be required to provide sufficient flow from the Number 3 Station to assure the guaranteed continuous release of 200 cfs from the Number 2 Station However, the DEIS did not recommend that the 150 cfs release requirement be so conditioned and the DEIS did not analyze this alternative

EIS Scoping Comments and Scoping Documents

The FWS's December 5, 1994 comments on Scoping Document I for the project discussed the concept of utilizing the available storage at Gardners Falls to augment flows in the bypass reach The FWS requested that in the EIS, the Commission present a complete analysis of the alternative of utilizing reservoir storage to augment bypass flows when inflow falls below 150 cfs In Scoping Document II, the Commission acknowledged the recommendation made by the FWS and indicated that the DEIS would analyze this issue This analysis was not done

Gardners Falls would not be able to release 150 cfs throughout the year, and like the state WQC, recommend that WMEC be required to release 150 cfs or **inflow** to the bypassed reach. When flows in the river are low the release of any storage or augmentation of flows from water stored in the Gardners Falls Reservoir would be quickly used up in contributing to any minimum flow of 150 cfs. We believe that our recommendation for a minimum flow of 150 cfs or inflow would preclude WMEC from storing water in the Gardners Falls reservoir during those times of the year when flows in the Deerfield River are historically at or below 150 cfs. See also response DI-4.

DI-4. As noted in our response to DI-3, our recommended minimum flow in the Gardner's Falls Project bypassed reach is consistent with that required in the WQC, i.e., 150 cfs continuous minimum flow, or inflow (from Deerfield No. 3) if lower, to be provided through the fish passage unit and by flow over the dam. We recognize that DOI also recommended that the project's daily storage capacity be utilized to the extent possible to maintain a 150-cfs minimum flow, however, we consider the potential effect on flows, and benefit to resources, to be insignificant. Nevertheless, we agree with the measure. See revised text in Section 4.2.2.2 for our rationale.

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Lois D. Cashell, Secretary

This analysis is necessary in order to fully assess the recommendations of the Department and the MDFW regarding bypass flows, and will be necessary to allow resolution of the potential 10(j) dispute this issue raises. The Final EIS should include a complete analysis of the potential for, and benefits of, utilizing the available storage of the Gardners Falls impoundment to augment bypass flows when inflow falls below 150 cfs. The frequency, duration and magnitude of flow reduction below 150 cfs, and the ability of the available storage to reduce the frequency, duration and/or magnitude of the reduction should be determined. The analysis would need to incorporate the likely inflow regime from the Number 3 Station, given its 100 cfs bypass flow requirement, and the need to release flows to guarantee 200 cfs below the Number 2 Station.

Based on this assessment, the proposed license condition should be modified to require the release of 150 cfs based on inflow and use of available storage, or further consultation with the Department on this issue should be conducted.

Inconsistency Between Staff Analysis in Section 4.1 and Modifications to the Proposed Projects in Section 4.2

In Section 4.2, at page 4-76, the DEIS states that there are benefits to fishery resources of the bypass flows recommended by the Department, and concludes that a flow of 150 cfs or inflow to the project would enhance habitat in the reach. In this Section and Table 5-6, staff adopts a 150 cfs flow requirement. However, in Section 4.1.2.3 and Table 5-3, the 50 cfs bypass flows proposed by WMECO are endorsed as being appropriate for fisheries and water quality.

As stated below, we have substantial concerns regarding the technical basis for statements and conclusions made in Section 4.1.2.3 and Table 5-3. However, within the DEIS there appears to be inconsistency between the DEIS's conclusions about appropriate bypass flows and staff's technical analysis included in earlier sections of the DEIS.

DI-5. See responses to comments NU-1 and revisions to Table 5-5 and Table 5-6.

Bypass Flow Technical Discussion

The Department disagrees with the technical analysis included in the DEIS that concludes, among other things, that 50 cfs is an adequate minimum bypass flow. Although the DEIS ultimately adopts a 150 cfs discharge, the Department cannot pass over this discussion and analysis without comment.

Trout Habitat in the Bypass Reach

On page 4-55, the DEIS states that staff expects minimal use of the bypassed reach by brown and rainbow trout. The basis for this conclusion is unclear, and we do not agree for the following reasons.

DI-6. We based our conclusion about brown and rainbow trout use of the bypassed reach on several factors: (1) summer water temperatures may limit trout survival in the bypass, (2) the length of the bypass in relation to the quantity of fish habitat created and the potential size of any self-sustaining population established in relation to the costs to release these minimum flows, and (3) the state fishery management objective of

- The IFIM results presented graphically on page 4-54 clearly show that there is as much habitat in the bypass reach for brown and rainbow trout as for Atlantic salmon juveniles However, this section concludes that the reach is more suited for salmon production

- The DEIS also states that no juvenile brown trout have been observed in the bypass reach We do not dispute this statement, but since the bypass reach has had virtually no flow for many years, and did not receive consistent flows prior to or during any fish sampling there, the presence of any fish would be unlikely The cited lack of juvenile trout does not reflect future conditions if adequate flows were provided in the bypass reach.

- The discussion states that due to scouring, little trout fry habitat is found in the bypass reach We agree that due to its steeper gradient and larger substrate, the reach is more suitable to juvenile and adult production, but again the IFIM results indicate that there is fry habitat in the reach

Water Temperatures and Trout Management

Water temperatures in the bypass reach are cited on pages 4-55 as precluding trout management in the bypass reach This conclusion is faulty due to its use of outdated and inappropriate data

- First, the data cited as indicating the bypass is too warm for trout is temperature data collected under the existing leakage flow conditions Under this condition (reported as 30 - 50 cfs leakage), substantial instream warming is likely Temperatures would be much different with a reasonable habitat flow such as 150 cfs

- The cited temperature data also do not reflect post-license conditions relative to overall Deerfield River flow management, that will substantially increase bypass flows in other river reaches, and dampen store-and-release peaking due to the guaranteed flow release provisions of the settlement agreement These changes would likely reduce incremental warming of river flows

- Lastly and most importantly, the cited data on Deerfield River temperatures reflects the river conditions when the Yankee Rowe Atomic Plant was operating This plant caused a significant elevation in river temperatures However, with the permanent shutdown of the Rowe plant, river temperatures are now lower and there are no longer concerns regarding the appropriateness of trout management relative to river temperatures

providing rearing and nursery habitat for Atlantic salmon parr.

DI-7. Massachusetts classifies the Deerfield River as a warmwater stream from its confluence with the North River to its mouth at the Connecticut River. In some reaches of the lower Deerfield River, trout are able to withstand increased water temperatures caused by summer warming and hold over from year to year by taking refuge in deep water. However, we cannot accurately predict what the future water temperatures will be at the Gardners Falls Project once the Deerfield Project is relicensed and the extent of the influence of other factors such as closing of YAEC. We would expect temperatures in the bypassed reach to reflect similarly the water temperatures in the Gardners Falls reservoir. The fact that the current put-and-take trout fishery in Gardners Falls reservoir is limited by summer water temperatures indicates that water temperatures in the bypassed reach would have similar limitations for success of trout.

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Lois D. Cashell, Secretary

Spatial Partitioning

The discussion in Section 4.1 of the DEIS supports spatial partitioning as the appropriate fisheries management approach for the two stream reaches affected by the project. Beyond the question of whether the Commission or the MDFW should be making fisheries management decisions, we cannot concur with the conclusions drawn in this Section.

The DEIS conclusion regarding the appropriateness of managing the bypass for trout was discussed above. However, we also question the DEIS conclusion regarding the application of spatial partitioning in this instance.

Spatial partitioning between different species and life stages is an alternative management approach that can, in some cases, help resolve flow issues. However, it is most applicable in cases where two distinct management goals are in direct conflict; where management for one species would preclude the other, and vice versa. This is certainly not the case at Gardners Falls. Flows appropriate for juvenile salmon also provide substantial habitat for trout, as the general relationship between flow and habitat are similar for both. Although optimal habitat cannot be attained for both adult trout and salmon at the same flow, there is tremendous overlap in habitat/flow curves (Figure 4-17 of the DEIS) that contradicts the statement on the top of page 4-56 that flows for trout are "not compatible" to flows needed for salmon. In fact, it can be argued that all flows between 150 and 250 cfs would provide a reasonable balance between habitat for juvenile salmon, adult rainbow trout, and all life stages of brown trout. There appears no justification, therefore, to argue for management for only salmon in the bypass reach.

In addition, the justification for spatial partitioning is to optimize habitat for one species/life stage in one reach, and optimize habitat for another species/life stage in another reach. If appropriately applied, this approach would prevent the selection of a single flow regime that offers marginal habitat for many species and life stages in all areas but no truly good habitat for any particular species or life stage in any area. The staff's conclusion in this section, however, is that 50 cfs is an appropriate bypass flow for juvenile salmon. This is clearly not even close to optimum for juvenile salmon, as 150 cfs provides 21% more habitat than does 50 cfs. The result of applying the staff's recommendation would be that habitat is first partitioned, and then the species of emphasis in one reach (salmon in the case of the bypass) would not be fully protected anyway.

DI-8. Our analysis of the IFIM data for the bypassed reach and the reach below the powerhouse was tempered by two other facts: (1) water temperatures can exceed preferred trout requirements despite the presence of flows calculated by IFIM studies, and (2) there is little source material (gravels) in the bypassed reach to provide spawning and egg incubation needed to establish self-sustaining populations of trout under various flow scenarios. It is unlikely that increased flows from the upstream Deerfield Project developments would increase spawning materials in the Gardners Falls bypassed reach.

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Lois D. Cashell, Secretary

The other half of the spatial partitioning argument in the DEIS is that trout management should be primarily focussed on the below-project reach. On page 4-55, it states that "we don't believe brown trout fry management in the bypassed reach is worthwhile and efforts to establish brown trout should be targeted for the area below the powerhouse", and on page 4-56, it states that "the stream reach below the powerhouse is more suitable for trout management", arguing that the bypass reach is not conducive to trout. The MDFW management goals for this section of the Deerfield River include management for natural spawning of brown trout. Management of the below-project reach for trout, as suggested in the DEIS, therefore, should be protective of all trout life stages and should be better than the bypass reach for all life stages to support the concept of spatial partitioning.

Review of the IFIM data presented in the Supplemental Habitat-Based Instream Flow Studies, dated April 1992, however, shows that this is not the case. Comparison between the total habitat area at various flow releases in the bypass reach (Table 4 of Volume I) and the below-project reach (Table 4 of Volume II) clearly shows that habitat is far greater in the bypass reach for all brown trout life stages, especially for fry and egg incubation. This fact further calls into question the staff's acceptance of the WMECO flow proposal based on spatial partitioning of habitat.

Given the above, the statements and conclusion in this section of the DEIS appear too poorly founded and are not supportable. The Commission should consider our comments, re-analyze the available information, and modify the EIS as appropriate.

Fish Passage Timing

We strongly endorse the DEIS conclusion regarding the implementation of downstream fish passage at the Gardners Falls Project. The staff rightly concurred with the FWS's call for completion of the facilities within two years of license issuance and rejected WMECO's argument that design and construction of the facilities would require substantially more time. There is a long history of fish passage implementation in post-license actions, where facilities are designed from scratch and constructed well within the time frame the Department called for and the DEIS endorses. In this case, the general design has already been completed, further diminishing any need for an extension.

DI-9. No response required.

Recreation and the Enhancement Fund

FERC's analysis of the various proposals contained at pages 4-61 to 4-63 is generally in accordance with the NPS position regarding recreational development at the project. The Department supports the Commonwealth of Massachusetts' proposal for educational training and the inclusion of a contribution by the applicant to the Enhancement Fund. We urge the FERC to reconsider incorporating these elements into the preferred alternative in the FEIS.

DI-10. See revised Sections 4.1.1.6 and 5.6.

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Lois D. Cashell, Secretary

Thank you for this opportunity to comment.

Sincerely,

Andrew Raddant
Regional Environmental Officer

New England Power Service
A NEES company

Mark E. Slade
Associate Counsel

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REGULATORY
COMMISSION

April 19, 1996

Ms. Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Re: Deerfield River Project, L.P. No. 2323-012, Comments of New England Power Company on the Draft Environmental Impact Statement

Dear Ms. Cashell.

Enclosed for filing with the Federal Energy Regulatory Commission (FERC) is an original and eight copies of New England Power Company's (NEP) comments on the *Draft Environmental Impact Statement for the Deerfield River Projects, Vermont - Massachusetts* (DEIS). NEP appreciates the opportunity to review and comment on this document, as well as the FERC staff's effort in preparing it.

These comments also respond to FERC's letter of clarification dated March 25, 1996, and the revisions to Tables 2-3, 2-4, and 2-5 supplied by FERC staff at the public comment meetings on April 9 and 10, 1996. In addition, this letter addresses specific questions regarding the interim fish trapping facility at Station No. 2 raised by FERC staff at the public comment meeting on April 9, 1996, as well as a specific question regarding the timing of maximum drawdown restrictions raised by FERC staff at the public comment meeting on April 10, 1996.

Although we have reviewed the entire document, our comments focus on the following areas: a) energy analysis for FERC staff alternative, b) economic analysis of the staff alternative, c) the need for an Amendment to License for the Bear Swamp Project (FERC No. 2669); d) the suggested inclusion of Fife Brook as part of the Historic and Archaeological Programmatic Agreement (PA) for the Deerfield River Project; e) clarification of the conditions requiring an interim fish trapping facility at Station No. 2; f) the periodicity of maximum drawdown restrictions at Somerset and Harriman Reservoirs; and g) the term of a new license.

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Energy Analysis

NEP's initial review of Section 5 of the DEIS raised a concern over the energy reported for the Staff's Alternative. Specifically, the energy reported for the Staff's Alternative in Tables 5-1 and 5-4 was significantly different than that reported for the proposed Project operation under the Offer of Settlement or the Vermont Water Quality Certificate (WQC). This was surprising given the close agreement between the three alternatives in terms of enhancement measures. Since our initial review of the DEIS, we have learned that there was an error in FERC staff's energy calculation for the Staff Alternative. The economics related to energy production were corrected by FERC staff and revised versions of Tables 2-3, 2-4, and 2-5 were provided at the public meetings of April 9 and 10, 1996. To the extent the revised economics for the Staff Alternative are now close to those FERC calculated for the operation of the Project under the Settlement and WQC Alternative, NEP assumes that the energy analysis will be as well. However, FERC staff should correct Tables 5-1 and 5-4 to reflect the revised energy analysis.

NEP-1. See revised Table 5-1 and Table 5-4.

Economic Analysis

As described above, FERC staff provided revised economic data in the form of revised Tables 2-3, 2-4, and 2-5 at the public meetings of April 9 and 10, 1996. Assuming the revised energy data requested above is the support for this revised economic data, these revisions to Tables 2-3, 2-4, and 2-5, and any associated text, should be included in the Final EIS (FEIS) so that the analysis is consistent.

NEP-2. We agree. See revised text in Section 2.6, Table 2-5, Table 2-4, and Table 2-3.

NEP is deliberately choosing not to debate FERC's analysis of the economic benefits of the Deerfield Project. We do not understand how these benefits were calculated and note that they are far more positive than NEP's detailed analysis provided in the Executive Summary to the January, 1994 AIR filing. However, in this time when every fundamental restructuring of the electric utility industry is in play, it is futile to enter into debate over the economic value of a long term resource like the Deerfield Project. A host of assumptions are involved in any such evaluation that will continue to be the subject of controversy. We note that in recent months the market value of power has been hotly debated in the context of industry restructuring. Positions on near term market value of power have ranged from under 2.5 to over 4 ¢/kWh. With a range of views this wide in the near term, the futility of attempting to reach agreement on long term economics becomes overwhelming. NEP does not accept that the power benefits FERC has calculated exist, but does not feel that it is worthwhile to debate the contentious issue of future power value in this context. NEP continues to believe that a more accurate picture of both the near term and long term costs and benefits of the Deerfield Project were presented in NEP's January 1994 filing.

NEP-3. No response required.

Application for Amendment - Bear Swamp Hydroelectric Project (FERC No. 2669)

The Offer of Settlement calls for certain operational changes at the Fife Brook development of the Bear Swamp Project (L.P No. 2669), all well within the scope of the existing license for Bear Swamp The Settlement provides for a series of whitewater releases from Fife Brook and the provision of a year round minimum flow of 125 cfs. However, the whitewater

NEP-4. Comment noted.

releases are equivalent to the normal generation releases inherent in the normal operation of Fife Brook under the existing Bear Swamp license. This amounts to little more than rescheduling generation releases to coincide with a schedule developed in cooperation with the whitewater community. Similarly, the minimum flow release of 125 cfs is currently provided during the months of July and August. The actions to be taken at Fife Brook are all well within the licensee's discretion under the Bear Swamp license. Therefore, NEP sees no need for licensing activity with respect to the Bear Swamp license.

Including Fife Brook in a Programmatic Agreement for the Deerfield Project

The DEIS at page 4-66 recommends that Fife Brook be included in the Deerfield Project Programmatic Agreement (PA) and that the license covering Fife Brook be amended to incorporate the PA and its stipulations. As noted above, the Fife Brook facilities are part of a separate FERC License for the Bear Swamp Pump Storage Project (FERC No. 2669) and are not a part of the relicensing for the Deerfield River Hydroelectric Project (FERC No. 2323). The limited operational changes and recreational enhancements planned at Fife Brook can be accommodated under the existing Bear Swamp license. NEP sees no justification for any part of the Bear Swamp Project to be included in the Programmatic Agreement. We note and appreciate that the Draft Programmatic Agreement that has been circulated is consistent with this position. NEP asks that this recommendation be deleted in the FEIS.

NEP-5. We disagree. Though no cultural resources have been identified, the Settlement provides for recreational development at the Bear Swamp project which could result in adverse impacts to unknown archeological resources. Consequently, we conclude that a PA is required

Upstream Fish Passage - Station No. 2

At the public meeting to discuss the DEIS, held on April 9, 1996, FERC staff asked for clarification of language contained in the Offer of Settlement, the Massachusetts WQC, and the U.S. Department of the Interior's Section 10 (j), Recommendations and Section 18 Prescriptions. Specifically, FERC staff wanted clarification on the timing and events triggering the construction of the Interim Trapping Facility for Atlantic salmon at NEP's Station No. 2.

NEP-6. No response required.

NEP has reviewed the language at pages 10 and 11 in the Offer of Settlement relative to upstream passage of Atlantic salmon returning to the Deerfield River. There are a number of interests and concerns dealt with in this language and providing a context will make the section easier to understand.

First, in an age of increasing competition and cost control, it was essential to NEP that there would be fish to use the upstream passage system if it was built. Therefore triggers were included to ensure some level of successful returns before NEP would become obligated to build the facility. At the same time, the fisheries interests view each returning salmon as precious, and therefore demanded that a lower trigger number be in place if the fish were not being successfully captured with interim measures.

A problem with the use of triggers is that a method must be developed to determine if fish are returning below the dam. While there was agreement that radio tagging was probably the easiest and most reliable way to determine how many of the fish released at Holyoke returned to the Deerfield, the agencies wanted the authority to curtail the practice if it was found to be harming the fish. Further, it is expensive and neither NEP or the fisheries interests wanted to continue the process indefinitely, if many years from now the trigger is still not met. Hence, the Settlement holds open the option for the parties to consider adopting a ratio of how many of the salmon released at Holyoke would be assumed to be entering the Deerfield.

In summary, NEP has committed to providing upstream passage once one of two trigger levels of salmon are returning to the Deerfield. These are:

1. At least 12 adult Atlantic salmon have been verified in the Deerfield River between Station No. 2 and the mouth for two consecutive years and during those years an interim fish trapping system has successfully captured Atlantic salmon in the Deerfield River in a timely fashion with as little stress to the salmon as possible and with survival rates as good as those of fish captured at the Holyoke fish lift.

or

2. At least four adult Atlantic salmon have been verified in the Deerfield River below Station No. 2 for two consecutive years and no interim trapping system was available or successful in recapturing fish during the monitoring period.

To determine whether these triggers are being met a radio tagging program will be implemented the first season after the issuance of a new license to continue annually until either the one of the two triggers set out above are met, or:

3. CRASC determines that radio-tagging is no longer acceptable.

or

4. A ratio of salmon returning to the Deerfield River to all salmon released from Holyoke is mutually agreed to by NEP, MDFW, and USFWS.

If either trigger 1 or 2 above are met, NEP has agreed to build a permanent upstream trapping facility within two construction seasons. If condition 3 is invoked, an alternate means of determining if salmon are returning to the Deerfield will need to be developed. If condition 4 is agreed to, it will be used to calculate the number of adult returning salmon for the purposes of determining if the numbers specified in 1 or 2 have been achieved, and eliminate the need for radio tagging.

This protocol for dealing with monitoring and upstream passage at Station No. 2 was established to give NEP, MDFW, USFWS, and CRASC flexibility in dealing with the complex issue of fish passage at Station No. 2. Insofar as both the Department of Interior's Section 10(j) letter and the Massachusetts WQC reference the Offer of Settlement when discussing upstream fish passage, we understand that these documents were intended to conform with the Offer of Settlement.

Periodicity of Maximum Drawdown - Somerset and Harriman Reservoirs

At the DEIS public meeting of April 10, 1996, FERC staff asked representatives of the Vermont Agency of Natural Resources (VANR) and NEP their understanding of the periodicity associated with the maximum annual drawdown restrictions in the Vermont WQC.

Drawdown restrictions at Somerset and Harriman Reservoirs are specified in Condition B of the Vermont WQC. NEP agrees with the terminology "maximum annual drawdown elevation" used in the WQC and sees no need to assign a periodicity to this. However, for both reservoirs, other seasonal reservoir elevation restriction create a defacto period when maximum drawdown could occur.

For Somerset Reservoir, elevation restrictions are documented at page 85 of the WQC. The WQC stipulates that the elevation is to be maintained at or as close as possible to 2128.58 feet, msl, from May 1 to July 31 for loon nesting. From August 1 to November 1 the WQC stipulates that the reservoir can be drawn no lower than 2120 feet, msl. Therefore, the defacto period over which maximum drawdowns could occur, to the stipulated elevation of 2107 feet, msl, would be November 2 to April 30.

For Harriman Reservoir, elevation restrictions are documented at page 87 of the WQC. The WQC stipulates that the elevation is to be maintained as rising or stable from April 1 to June 15, shall not decrease by more than one foot per day from June 16 to July 15, and shall not go below elevation 1475 feet, msl, prior to November 1. Therefore, the defacto period over which maximum drawdowns could occur, to the stipulated elevation of 1440 feet, msl, would be November 2 to March 31.

NEP-7. Your clarification is appreciated.

Length of License Term - New License

The DEIS does not stipulate a license term for the new Deerfield River Project License. However, the DEIS at page 4-87 alludes to a license term of 30 years.

NEP assumes that this is a generic reference and not an indication of FERC's intent to act counter to the Offer of Settlement, which clearly anticipates that the new license for the Deerfield would have a term of 40 years. That a 40 year license term was an intrinsic component of the Offer of Settlement was discussed with FERC staff when they met with the parties to the Settlement in Boston, Massachusetts on August 24, 1994. NEP negotiated in good faith for this extended term and the parties to the Settlement agreed, in light of the enhancements proposed and their cost. As noted previously, NEP's economic analysis shows that the Deerfield Project has minimal benefits over alternative resources when operated under the restrictions agreed to in the Settlement (See *Executive Summary*, NEP January 1994). NEP recognizes that attempting to assign value to a production period between 30 and 40 years from the issuance of a new license is highly speculative. However, having a known set of license requirements during this period will allow NEP the opportunity to seek to make the Project beneficial, and this has value for NEP. NEP bargained for this opportunity with the other parties with the hope of making up for some of

NEP-8. We agree. Per the FPA, the Commission may issue licenses for periods ranging from 30 to 50 years. See revised text in Section 4.8.

the energy benefits lost in an extremely generous mitigation and enhancement package. FERC should respect the process that led to the Settlement, and the parties judgment, and issue a new license for the Deerfield with a 40 year term.

NEP appreciates the opportunity to provide these comments.

Sincerely,

Mark E. Slade
Attorney for
New England Power

cc:
Service List FERC No. 2323

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
Natural Resources Conservation Council

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April 19, 1996

COMMENTS
ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT

NEW ENGLAND POWER COMPANY
DEERFIELD RIVER HYDROELECTRIC PROJECT
BEAR SWAMP PUMPED STORAGE PROJECT

WESTERN MASSACHUSETTS ELECTRIC COMPANY
GARDNERS FALLS HYDROELECTRIC PROJECT

FERC PROJECT NOS. 2323, 2669, 2334 —001
012 000

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Dear Secretary Cashell:

The State of Vermont, through its Agency of Natural Resources (Agency), hereby files comments on the Draft Environmental Impact Statement (DEIS) for the above-referenced three hydroelectric projects. The Agency notes that the FERC staff generally endorses the conditions set forth in water quality certification issued by the Agency on January 30, 1995. Our comments are therefore brief and primarily focus on the technical accuracy of the DEIS.

Sincerely,

Jeffrey R. Cueto

Jeffrey R. Cueto, P.E.
Principal Hydrologist

encl. 8 copies; inc. res. water level tables, WRB rules for Somerset, loon raft info.
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VANR Comments on Deerfield River Project DEIS
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SECTION 1: PURPOSE AND NEED FOR ACTIONS

1.2 NEED FOR POWER

Table 1.1 lists generating facilities on the Deerfield River. The table includes Somerset, noted as located at river mile 66. Technically, Somerset is on the East Branch and not the mainstem and is not a generating facility.

VANR-1. We agree. See revised caption, Table 1-1.

Although the Agency does not dispute FERC's conclusion relative to the short and long term needs for power generated by the Deerfield Project, the supporting paragraph on Page 1-3 does not display a balanced perspective. The DEIS recognizes throughout that past generation has come at an substantial environmental cost, and this particular paragraph seems to ignore this fact.

SECTION 2: PROPOSED ACTIONS AND ALTERNATIVES

2.3 MODIFICATIONS TO THE PROPOSED PROJECTS

2.3.1.1 Water Quality Certificates

This section lists conditions set forth in the Vermont water quality certification. The specific water level management requirements contained in Condition B of the certification have been omitted, although they are considered in the DEIS.

VANR-2. No response required

In some cases the conditions of the certification are paraphrased in the DEIS and do not include the complete details of the condition. For example, #18 (ref. Condition Q of the certification) states only that NEP is required to construct and maintain recreation facilities consistent with its 1993 recreation plan. The certification condition also requires consultation with the Agency on final plan development and specific facility design details, as well as Agency review and approval of erosion control plans for the construction of facilities. The Agency looks forward to the enhancement of recreational use in this basin and wants to work closely with the licensee in this initiative; the final license article should reflect this, consistent with the certification condition.

During the public hearing FERC held on April 10, 1996, the Agency's representative was asked by FERC staff to provide the starting dates for the summer/fall operating restrictions on water levels for Somerset and Harriman reservoirs. In the case of Somerset Reservoir, a starting date was not specified because NEP is required to attain a reservoir level of 2128.58 feet msl by May 1 and hold that elevation through at least June 15 for the protection of loon nesting. Further, data from historic operation suggests that a starting date for the summer/fall

VANR-3. Your clarification is appreciated.

period is unnecessary. In each of the years 1974 - 1992, the spring high reservoir level reached at least 2126 feet msl.[1] The water quality certification requires that the summer/fall reservoir levels be maintained above elevation 2120 feet msl. Although it does not seem necessary to specify a starting date, we would recommend using June 21, which is the true start of summer.

For Harriman Reservoir, protection of spawning smelt and warmwater fish requires a stable or rising reservoir from April 1 through June 15. Historical operating records (1974 - 1992) show that the spring high level has consistently been well above the Agency's summer/fall low level restriction of 1475 feet msl. Again, we believe that technically there is no need to specify a starting date; however, we would suggest June 21 as an appropriate date to use for administrative purposes.

The eighteenth condition listed (ref. Condition S of the certification) relates to the telephone flow notification system to be installed to alert boaters to flows in boatable reaches in Vermont. The condition contains a mistake. The second sentence was supposed to pertain to Searsburg and not Somerset, which is addressed in the first sentence. Finding 326 of the certification cites the need for supporting boating in each of these three reaches.

VANR-4. We agree. See revised Section 4.1.1.6.

SECTION 3: AFFECTED ENVIRONMENT

3.2 CUMULATIVE EFFECTS ANALYSIS

3.2.1 Water quality and quantity

The text on page 3-2 indicates that certain former Class C waters in Vermont are under consideration for reclassification as Class B waste management zones. As indicated in Finding 62 of the Vermont water quality certification, there are presently two Class B waste management zones in the project area. One is on a tributary of Harriman Reservoir, and the other is on the mainstem below Readsboro. They were automatically reclassified to Class B waste management zones several years ago when the legislature eliminated Class C designations. The same mistake is made in the last paragraph on page 4-4.

VANR-5. See revised text in Sections 3.2.1 and 4.1.1.2.

[1]Attached are tables indicating the historical high spring water levels for the two reservoirs. These tables include estimates of what the high levels would have been with the Agency-proposed minimum flows and water level restrictions.

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3.2.2 Anadromous Fishery Resources

The third paragraph of this section should note the additional presence of sea lamprey, another indigenous anadromous fish species that can access the lower reach.

VANR-6. See revised text in Section 3.2.2.

3.2.3 Fisheries Habitat

The glacial characterization of the Deerfield River holds true for virtually every stream in northern New England; however, there is no foundation for concluding that fish [fisheries] habitat was never abundant on the Deerfield River and that hydropower development only "further aggravated" this natural system. The Deerfield River probably had as much fish habitat as other rivers of comparative size within the upper Connecticut River basin (e.g., the West, Ottauquechee and White rivers). Hydropower development has had a major impact on the fishery of this river.

VANR-7. See revised text in Section 3.2.3.

The discussion of the effects of reservoirs on bedload transport suggests that spawning habitat may be limited by substrate conditions, assuming adequate flows are provided. Although the Agency agrees with the physical process issue, we do not believe that any of NEP's studies have demonstrated that there is inadequate spawning habitat to support fish populations in the free-flowing reaches of river in Vermont.

The second paragraph of this section discusses natural reproduction of salmon in the watershed. The Agency believes that the impacts of hydropower, including direct habitat loss, inadequate flows, and fluctuating flows and water levels, have been most limiting with respect to maintenance of self-sustaining fish populations. Stocking programs have been necessary to maintain sport fishing opportunities. Even though wild populations do receive fishing pressure, much of the fishing activity is directed at stocked resources.

3.2.5 Recreation and Land Use Resources

On page 3-8, the second paragraph under Angling discusses the effects of dam construction on angling. Early dam construction for mills on the Connecticut River and its tributaries eliminated anadromous fish runs throughout the Connecticut River basin and the harvesting of these fish. In 1798, a dam was constructed on the mainstem Connecticut River just below the Millers River confluence (just above the Deerfield); this dam eliminated access to the majority of the Connecticut basin. The section notes the dams' impact on angling; however, the historical harvest of anadromous fishes was done mostly by means other than angling (e.g., nets and spearing). Angling did not become a prevalent activity until after these runs vanished from the system.

VANR-8. No response required.

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Historically, much of the Deerfield River supported self-sustaining brook trout populations. Alteration of riverine habitat and introduction of competing species has isolated wild brook trout populations to the relatively undisturbed higher elevation streams. The Agency's 1991 Vermont Angler Survey disclosed that brook trout is the most sought after species in Vermont (79% of the respondents indicated a preference for brook trout). Modifying hydropower operations on the Deerfield River, especially restoration of flows in flow-regulated reaches, will restore habitat for brook trout in Vermont and create additional sport fishing opportunities for this popular species.

3.3 SITE SPECIFIC RESOURCES

3.3.1.2 Water quality and quantity

In the sections on Somerset and Searsburg, the DEIS states on page 3-13 that these two facilities are presently operating in conformance with Vermont water quality standards. Until the measures required in the project water quality certification are implemented, the affected waters at these two facilities will not meet standards. Even dissolved oxygen and temperature standards are not met in the Searsburg bypass.

VANR-9. See revised text in Section 3.3.1.2.

On page 3-15, the DEIS states that Harriman Reservoir is eutrophying. Water quality data for determining the state of the reservoir is limited. Harriman Reservoir is either oligotrophic or mesotrophic, and there are no known algal problems.

The second paragraph on page 3-15 indicates that water temperatures above 20 deg C exceed state standards for cold water streams. Vermont does not have fixed numeric standards for temperature; as mentioned in the DEIS on page 4-3, Vermont's standard limits temperature increases to 1.0 deg F for cold water fish habitat streams (ref. Finding 65 of water quality certification). The first sentence of the same paragraph should read ". . . Harriman dam, <u>flow</u> from intervening tributaries, and <u>flow</u> from the West Branch . . ."

3.3.1.4 Vegetation and Wildlife Resources

On page 3-26, a discrepancy between loon data provided by the Agency and NEP is noted with respect to the number of years that loons have nested on Somerset Reservoir during the period 1978 - 1994. NEP's number of 13 years is correct. The number of surviving chicks, 11, is the same. One chick was also produced in 1995.

VANR-10. See revised text in Section 3.3.1.4.

3.3.1.3 Fishery Resources

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3.3.1.3.1 Somerset Development

Of the species listed in the first paragraph, brook and brown trout have the longest stocking histories. Rainbow trout were stocked over an eleven year period from 1970 to 1981. Landlocked salmon were stocked in only three years (1974, 1975 and 1978), and there were attempts to establish rainbow smelt by stocking adult fish (1972 and 1973) and eggs (1975-1977).

3.3.1.3.2 Searsburg

The language in the fifth paragraph is confusing. There are no plans to establish a smelt population in Searsburg Reservoir. We assume that "impoundment affected stream areas" refers to the Searsburg bypass and tailrace reaches.

3.3.1.3.3 Harriman

Commenting on the first paragraph, rainbow trout provide primarily a put-and-take fishery in Harriman Reservoir. However, stocked yearling brown trout do survive in the lake over multiple years and should be more correctly referred to as providing a fishery that is supported by maintenance stocking rather than put-and-take stocking. Good winter sport fisheries exist for smelt, brown trout and yellow perch, but not pickerel. Pickerel are taken very rarely indicating a low density population in Harriman Reservoir. Undoubtedly, pickerel production is suppressed as a result of there being inadequate aquatic vegetation in shallow water areas, a consequence of reservoir water level fluctuations.

The fifth paragraph on page 3-20 references "some" dewatering of the littoral zone. Reservoir management dewaters the entire littoral zone.

3.3.1.3.4 Sherman

Alternate year stocking was the practice until a couple years ago. The reservoir is now stocked annually by both states.

The current Vermont state record brown trout was taken from Sherman Reservoir in 1990. It weighed in at 22 lb. 3 oz. and measured 33¼ inches long.

While smelt are occasionally captured during fish population inventories, their abundance is not sufficient to support a sport fishery. There is no evidence of a self-sustaining smelt population in Sherman.

VANR-11. See revised text in Section 3.3.1.3.1.

VANR-12. See revised text in Section 3.3.1.3.2.

VANR-13. See revised text in Section 3.3.1.3.3.

VANR-14. See revised text in Section 3.3.1.3.4.

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3.3.1.6 Recreation and Land Use Resources

Figure 3-1 does not indicate fishing, hunting, and ice fishing in the list of recreational uses in the Somerset Zone.

It should be noted that NEP's management plan for Somerset Reservoir, as it related to boating use restrictions, conflicts with the Vermont Water Resources Board surface water rules promulgated for Somerset Reservoir on February 4, 1995 and amended January 2, 1996. A copy of the pertinent sections of *Vermont Use of Public Waters Rules Adopted October 5, 1994*, as amended effective January 2, 1996, is enclosed for FERC's information and use.

VANR-15. Comment noted. Figure 3-1 identifies the prominent recreational uses, not all the recreational uses in each zone. Also, see revised text in Section 3.3.1.6.

On page 3-30 in the section on the Harriman Use Zone, it should be indicated that, in addition to brown and rainbow trout, the Harriman Zone is stocked with brook trout (Searsburg powerhouse tailrace and Harriman Reservoir) and landlocked salmon and lake trout (Harriman Reservoir). Most recently salmon and lake trout stocking has occurred annually since 1992 and 1994, respectively.

SECTION 4: ENVIRONMENTAL CONSEQUENCES

4.1 PROJECTS AS PROPOSED

4.1.1.2 Water quality and quantity

4.1.1.2.1 Somerset Development

The second paragraph on page 4-3 references Massachusetts' water quality standards instead of Vermont standards.

VANR-16. See revised text in Section 4.1.1.2.1.

4.1.1.2.2 Searsburg

In the first paragraph on page 4-4, the DEIS states that it is unclear why Vermont considers the Searsburg bypass reach to be a non-support segment for the designated uses for which it is managed. The DEIS speculates that our finding of non-support may be attributed to water temperature violations and intermittent flows. This is correct. Lack of adequate flows for habitat and excessive temperatures limit the reach's capability to support fish. We call your attention to findings 91, 158, and 296 of the water quality certification.

VANR-17. See revised text in Section 4.1.1.2.2.

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4.1.1.3.1 Somerset development

This section indicates that there are no immediate plans to re-establish a landlocked salmon population in Harriman. As stated in Finding 181 of the water quality certification, the Agency intends to initiate fry stocking in the Searsburg bypass once flows are restored to this reach.

Stocking of landlocked salmon yearlings into Harriman Reservoir was resumed in 1992 with the availability of salmon from the new Grand Isle Fish Culture Station on Lake Champlain. This facility is capable of rearing salmon to a larger yearling size than other facilities within the Vermont fish culture system. With larger size salmon being stocked and an overall downward adjustment in the numbers of all salmonids released annually into the impoundment, salmon survival and growth is predicted to improve.

VANR-18. See revised text in Section 4-6.

4.1.1.3.3 Harriman development

Referencing the second paragraph, some stocked brown trout actually do holdover from year to year and may contribute, along with the resident wild population, to natural reproduction that occurs in several tributaries that drain into the reservoir. Rainbow trout holdover is less than that for brown trout, and no reproduction of this species has been observed in the Vermont portion of the Deerfield River drainage.

VANR-19. See revised text in Section 4.1.1.3.3.

In the summary on page 4-14, the DEIS states that reservoir management may affect the tubercled orchid and loon nesting. Loons do not use Harriman Reservoir for nesting.

VANR-20. See revised text in Section 4.1.1.3.3.

4.1.1.3.4 Sherman development

The section notes that enhanced conditions for smelt in Harriman Reservoir and upstream may result in increased numbers of smelt entering Sherman Reservoir. It should be clarified that most smelt passing through the Harriman development do not survive. The dead fish, however, do provide a forage base for brown trout in Sherman Reservoir. No mortality studies have been done for passage of fish through the penstock and turbines of Harriman Station.

VANR-21. See revised text in Section 4.1.1.3.4.

4.1.1.4 Vegetation and Wildlife Resources

Referencing the first paragraph on page 4-38, loons do not mate for life. They do display a territorial fidelity and a strong tie to a traditional nesting site, and the pair usually reunites at that site; however, they are not always monogamous.

VANR-22. We agree. See revised text in Section 4.1.1.4. Loon rafts were proposed by NEP as part of other wildlife enhancement measures. These wildlife enhancement measures are part of the Settlement (Paragraph IIIG). NEP proposed the loon rafts for reservoir fluctuations between 6 inches and a foot. If reservoir elevation fluctuations are held to ± 3 inches, loon rafts are not necessary.

The second paragraph on page 4-38 states that limiting fluctuations of Somerset Reservoir to ± 1.0 foot would "also" benefit several wildlife species aside from loons. The text in the prior paragraph concludes that the 1.0 foot limitation does not provide adequate protection for loons. This sentence should be reworded for consistency.

On page 4-39, FERC advocates use of loon rafts. Based on its experience, the Agency strongly discourages the use of rafts except in cases where extreme water level fluctuations are unavoidable or where non-island shoreline nesting sites are used and have a history of nest failure due to predation. We are confident that future improved water level management at Somerset Reservoir will be adequate to maximize productivity using natural nesting sites. Even under historic operation, a fair level of loon nesting success has been attained at Somerset. There is no reason to resort to the use of rafts. The DEIS's support for the use of rafts is inconsistent with the thrust of the discussion on this page, which seems to argue for protection of natural nesting sites using careful water level management. Even where rafts are provided, loons tend to select natural nesting sites on islands by preference.[3] An excerpt from the preliminary draft of the Agency publication *Vermont Loon Recovery Plan* is enclosed, providing information on the use of rafts in Vermont, including the reason for their use and the results.

Also on page 4-39, osprey nesting is discussed. The Agency is not aware of existing nesting by osprey at Somerset. Territorial bald eagles, Federally listed as threatened, have been sighted at Somerset each year since 1993, and have not been noted in Section 4.1.1.5, which states that only occasional transient Federally listed species use the project area. Careful site selection and design for nesting platforms is important. The Agency is unaware of the imprinting of osprey on power poles as a result of use of poles for nesting platforms and would appreciate a source citation. Prior to implementation, the Agency should be consulted in the development of specific management plans for enhancement of wildlife, including the several nesting measures discussed in this section of the DEIS, their appropriateness, siting, and design.

VANR-23. Comment noted. See revised text in Section 4.1.1.4. Information about ospreys imprinting on poles is from William Hansen, Biologist, Central Maine Power Company in NEP (1993). We agree with a consultation in developing specific management plans.

4.1.1.6 Recreation and Land Use Resources; 4.1.1.7 Aesthetic Resources

On pages 4-46 and 4-48, FERC staff acknowledges that drawdowns affect recreational use and aesthetics, but concludes that the project proposal for water level management is adequate. Historic water level management has resulted in a variation in water levels from year to year and through the recreational season. NEP's proposal does not limit drawdowns during the majority of the summer and fall. Drawdowns affect navigation safety, use of boat launches, access, swimming, angling, and aesthetics. The water quality certification has incorporated

VANR-24. In Section 4.2.1.3, we concluded that based on 53 years of recorded drawdowns at Somerset and Harriman, NEP's proposed project operations would typically meet VANR's maximum drawdown level requirements for the summer/fall season. We did conclude that the WQC drawdown requirements would result in recreation benefits; however, we believe the benefits would be minimal. Our recommended alternative includes VANR's drawdown level requirements.

[3]In Vermont, this has been the experience at Miles Pond in Concord and at Green River Reservoir, which is part of the Morrisville Project (FERC Project No. 2629)

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special conditions to reduce this variability, and these restrictions will enhance recreational use and reduce the impacts on aesthetics. We would ask that FERC staff support these water level management measures as reasonable and necessary to address these issues.

4.1.1.9 Socioeconomic Resources

On page 4-51, FERC staff notes that NEP does not intend to seek a reassessment of its property value as a result of the proposed conservation easements. NEP is to be commended for considering the impact a reappraisal may have on the local grand list and the distribution of the property tax burden. As a requirement of state law, reassessments are done periodically, however, in all towns as property values change over time. The EIS should address whether or not a reassessment will significantly impact any of the towns containing project features.

VANR-25. We concluded that NEP's conservation easement proposal could potentially decrease the valuation of their land holdings due to use restrictions. However, the value of these easements would offset any loss in municipal property tax revenues. Without conducting additional studies, we are unable to determine the impact significance of any property value reassessment on NEP's land holdings.

4.2 Modifications to the Proposed Projects Operation . . .

4.2.1.1.1 Somerset development

On page 4-67, maximum gate releases are discussed, and FERC staff concludes that there is no need to institute a maximum limit. The text indicates that the staff was unaware of the Agency's particular concern with respect to high flow releases. The issue of fluctuating flows is discussed in findings 313-316 of the water quality certification. The Agency recommends controlling both maximum and minimum artificial flows and ramping between flow changes. We agree that maximum gate releases above 300 cfs are unusual, but recommend setting a maximum in order to assure that the resource is protected, rather than leaving it to the discretion of the operator for the term of the license. High inflows to the reservoir are considered in the certification as the restriction is 312 cfs, <u>or instantaneous inflow if higher</u>.

VANR-26. See revised text in Section 4.2.1.1.1.

4.2.1.1.3 Harriman development

The three fish species cited in the second paragraph of this section are not mentioned in the first paragraph.

VANR-27. Section 4.2.1.1.3 has been revised.

4.2.1.3 Recreation and Land Use Resources

FERC staff notes on page 4-72 that NEP's typical operation of the reservoirs meets the Agency's summer/fall water level management requirements, and concludes, therefore, that those requirements would have minimal benefits over NEP's proposal. As discussed above, the Agency disagrees. The limitations will, to an extent, prevent the level of year-to-year variability that has occurred in the past and will stabilize the reservoirs during at least the early season.

VANR-28. Comment noted. Our recommended alternative includes VANR's drawdown level requirements.

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SECTION 1: STAFF'S CONCLUSIONS

5.1 CUMULATIVE EFFECTS SUMMARY

Recreation and Land Use

Under Sport Fishing, FERC staff concludes that the WQC's will provide no additional cumulative benefits over NEP's proposal. This is inconsistent with the section of the same table pertaining to Anadromous Fishery Resources and Fishery Habitat (page 5-3). If there are cumulative benefits to the fishery and habitat, including productivity and a more diverse fishery, then angling opportunities will be enhanced.

VANR-29. We disagree. In Table 5-1, we concluded that the WQC would generally provide the same cumulative benefits for resident fish habitat and anadromous fish passage as NEP's proposal. We do not believe the WQC offers any additional cumulative benefit for sport fishing over NEP's proposal.

5.2 COMPARISON OF ENVIRONMENTAL EFFECTS OF PROPOSED ACTIONS AND ALTERNATIVES

It is noted that VNRC's recommendations are, in certain cases, listed in the WQC's column. This is a bit confusing as VNRC's proposal deviates substantially with the Vermont certification, especially with respect to water level management.

VANR-30. See revised Table 5-2.

Vegetation and Wildlife Resources

The staff alternative with respect to birds and furbearing animals (page 5-10) is indicated to be the same as the NEP proposal. Our understanding is that the water level management recommendation by FERC staff would be the same as the Vermont water quality certification (±3 inches). Reference page 4-71, paragraph 4, which states that FERC staff agree[s] with the WQC's requirements to protect common loons."

VANR-31. See revised Table 5-2

Aesthetic Resources

Our understanding is that FERC staff endorses the WQC limitations on water level management, which is stated to have "some additional aesthetic benefits over NEP's proposal" as related to scenic views. If that is the case, the staff column should be corrected as it presently says that no additional benefits would accrue.

VANR-32. See revised Table 5-2.

MISCELLANEOUS TYPOS

Page xiii PHABSIM not PHASBIM

Page xiv Vermont Department of Environmental Conservation not Protection

Vermont Federation of Sportsmen's Clubs

VANR-33. See corrected and revised text.

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We would suggest adding CRMP (Cultural Resources Management Plan) to the list of acronyms.

Page 3-18 Kenneth Cox, referenced twice, is in the North Springfield Regional Office

Page 3-30 Jacksonville is a community in the town of Whitingham; Harriman is in Whitingham and Wilmington

Page 4-5 in line 8, "typically" is redundant

Page 5-1 reference to the East Fork should be the East Branch

Vermont Natural Resources Council

96 APR 22 PM 1:35

April 19, 1996

Lois Cashell, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, DC 20426

RE: **VNRC Comments on DEIS**
New England Power Co., Deerfield River Project
FERC Docket No. 2323 — 012

Dear Ms. Cashell:

The Vermont Natural Resources Council hereby provides comments on the Commission's Draft Environmental Impact Statement (DEIS) for the Deerfield River Hydroelectric Project (February 1996).

VNRC confines its comments to the impacts of the Project on the Deerfield River in Vermont and the effect of operational changes in Vermont on river resources and issues downstream. Specifically, VNRC asks the Commission to complete an in-depth, impartial review of the impacts of the project on the aquatic habitat and biota in the Somerset, Searsburg, Harriman and Sherman reservoirs (the Vermont Reservoirs). For several reasons, VNRC believes that the DEIS inadequately addresses the significant impacts of reservoir drawdowns on the habitat and biota in the Vermont Reservoirs.

The Commission's regulations implementing the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 et seq., note that "[t]hese regulations supplement the regulations of the Council on Environmental Quality, 40 CFR parts 1500 through 1508 (1986). The Commission will comply with the regulations of the Council on Environmental Quality except where those regulations are inconsistent with the statutory requirements of the Commission." 18 CFR §380.1. Thus, the Commission must turn to its own regulations as well as the Council on Environmental Quality (CEQ) regulations when fulfilling its NEPA obligations.

VNRC, 9 Bailey Avenue, Montpelier, Vermont 05602 (802) 223-2328 Facsimile: 223-0287

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VNRC provides several general comments outlined herein and provides detailed comments regarding the significant environmental impacts of reservoir drawdowns in the attached Memorandum of Jeffrey Parsons and Affidavit of C. Mead McCoy, III.

General Comments

The Commission is incorrect that the preferred alternative "represents a consensus in the basin." DEIS at 5-19. Consensus is normally defined as a lack of disagreement. VNRC has never agreed to the continuation of severe adverse environmental impacts in the Vermont reservoirs and has a live appeal of the Vermont Water Quality Certification before the Vermont Water Resources Board to address that very issue. While a number of entities have forfeited reservoir aquatic ecosystems in return for single species management and unrelated environmental enhancements elsewhere in the basin, a consensus has not been reached.

VNRC-1. See revised text in Section 5.4.

The Commission also relies heavily on a conclusion that the protection of the reservoirs will conflict with other non-developmental values such as whitewater boating. DEIS at 5-19 and 4-73. The Commission's conclusions in this regard are simply unsubstantiated. The Commission relies upon NEP's "Supporting Documentation for the Offer of Settlement" filed in December 1994. However, flow duration information provided by NEP does not appear to support a conclusion that there will be any conflict with whitewater boating. Indeed, the limited information provided by NEP cannot be used to reach any conclusion.

No Action Alternative and Baseline Conditions

The CEQ regulations require consideration of "the alternative of no action." 40 CFR § 1502.14(d). The DEIS defines the "No Action" alternative to mean that "the project would continue to operate as required by the original project licenses. If the projects are allowed to operate as in the past, there would be continued energy production at present levels and no additional protection or enhancement of existing environmental resources." DEIS at 2-18, § 2.4. This definition of the No Action alternative is incorrect for several reasons.

Relicensing is not the simple continuation of an on-going activity. As the U.S. Court of Appeals for the Ninth Circuit succinctly stated:

> [T]he Federal Power Act contemplates much more than a mere continuation of the status quo when the decision is made to relicense. Relicensing is substantially equivalent to issuing an original license and one would assume that the FERC regulations governing the preparation of an EIS generally apply.

VNRC-2 The "no action" alternative is the action, which if selected, results in no change to the existing environment. The Commission defined the existing environment at relicensed projects to be as it is today not up to 50 years ago (Commission Order 413, issued May 17, 1989, FERC Stats. & Regs., Reg. Preambles 1986-1990 ¶ 30,854, p. 31,401). This is reasonable because there is no practical way to get data about the environment as it existed before hydroelectric development. The same goes for obtaining data about the river as it existed in a free flowing unregulated state. The Deerfield River has been used for electric generation since the early 1900's (see Section 3.1.1). This does not mean that the effects of the projects on the river are ignored. Section 3 provides extensive discussion of the existing environment which includes project effects on environmental resources associated with the Deerfield River, both positive and negative.

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> Relicensing, then, is more akin to an irreversible and irretrievable commitment of a public resource than a mere continuation of the status quo. (citations omitted). Simply because the same resource had been committed in the past does not make relicensing a phase in a continuing activity. Relicensing involves a new commitment of the resource, which in this case lasts for a forty-year period.

Confederated Tribes and Bands v. FERC, 746 F.2d 466, 476-77 (9th Cir. 1984) (citations omitted). Based upon the Court's analysis, "no action" clearly does not mean simply continuing the status quo. Rather, when a license expires and relicensing is triggered, the "no action" alternative is simply not relicensing the project -- just as "no action" in an original licensing is to not issue a license. A determination not to relicense is final disposition of the case and would preclude further issuance of annual licenses.

Guidance issued by the CEQ on interpretation of the CEQ NEPA regulations further supports a determination that the "no action" alternative means not relicensing the project. The regulations provide that:

> The second interpretation of "no action" is illustrated in instances involving federal decisions on proposals for projects. "No action" in such cases would mean the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity to go forward.

"Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," Council on Environmental Quality, 46 Fed. Reg. 18026, 18027 (Question 3) (1981). Relicensing is a proposal for a project that is "substantially equivalent to issuing a new license. The CEQ definition above should be considered to be the basis for the "no action" alternative.

Similarly, the Commission's definition of "baseline" conditions for purposes of comparison of the economic and environmental impacts of various alternatives is incorrect. DEIS 2-19. Since the license for the project has expired and "no action" means not relicensing the project, the Commission should consider "baseline" conditions to be conditions in the absence of the project or the original condition of the Deerfield River.

Inadequate Consideration of Alternatives

VNRC proposed several alternatives for reservoir water level management which were intended to assure that the reservoir flood protection benefits were continued while providing mitigation for the adversely impacted reservoir environments in

VNRC-3. We disagree. Section 2.3.2.4 summarizes VNRC's recommendations in terms other than simply run-of-river. Section 2.6 shows the economics of VNRC's proposals, among others. The effects of eliminating peaking in the Deerfield projects' Vermont reservoirs, implementing ramping rates, and releasing various minimum flows on aquatic habitats are discussed in Section 4.2.1.1.1, Recommendation for fishways is also discussed in Section 4.2.1.1.1.

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Vermont and restoration of aquatic habitat in the impacted river sections. The DEIS generally alleges that VNRC simply requested consideration of "run-of-river" operation and apparently the Commission simply considered that alternative. DEIS at 4-66, 4-72 n. 7. The Commission has failed to adequately consider the alternative reservoir water level management regimes proposed by VNRC.

Inadequacy of Studies

The DEIS is based upon grossly insufficient information addressing impacts of reservoir level fluctuations. *See*, attached. Sections 1502.22 and 1502.24 of the CEQ regulations govern the content of EIS discussions of environmental impacts.

Section 1502.22 requires that the Commission analyze the severe environmental impacts of the reservoir drawdowns by stating that:

> If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.

The reservoir drawdown impacts of the project in Vermont are perhaps the most severe and significant environmental impacts of relicensing the project as proposed. Assessment of these impacts is fundamental to giving "equal consideration" to fish and wildlife and assessing the various alternatives. Certainly the cost of obtaining this information is not exorbitant. Indeed, the majority of costs that might be incurred by obtaining such information are primarily the result of the Commission's failure to require such studies to be conducted at an earlier stage in the proceedings.

Section 1502.24 of the CEQ regulations requires the Commission to "insure the professional integrity, including scientific integrity, of the discussions and analysis in environmental impact statements." The limited discussion of reservoir drawdowns included in the DEIS is completely devoid of any scientific basis because of the lack of site specific analysis conducted.

Thank you for this opportunity to comment.

Sincerely,

Christopher M. Kilian, Esq.

The effect of VNRC's recommended flows on tubercled orchids is addressed in Section 4.2.1.2. The effect of VNRC's recommendations on flat water and white water boating is addressed in Section 4.2.1.3. Effects of VNRC's recommendations on aesthetics and socioeconomics are addressed in Sections 4.2.1.4 and 4.2.1.6, respectively. Table 5.1 compares the effects of VNCR's recommendations to other major alternatives. Continued adverse effects of continuing fluctuation of the Deerfield project's Vermont reservoirs are acknowledged in Table 5.2.

VNRC-4. We disagree. As noted in response VNRC-3, adverse environmental effects of continued reservoir surface elevation fluctuation are recognized. NEP conducted numerous studies in the course of preparing its application and in response to additional information requests. Furthermore, NEP proposed a number of wildlife enhancement measures, e.g., beaver habitat improvements, waterfowl nesting structures, at Somerset. Agencies and staff are recommending other measures. As noted in Section 5.4, staff's preferred alternative consisting of the Settlement, Cultural Resources Management Plan, and the legally valid WQC conditions, is well balanced, and provides for the comprehensive development of the basin.

1

FEDERAL ENERGY REGULATORY COMMISSION

Re: Project No. 2323-012
Deerfield River Hydroelectric Project
New England Power Company

AFFIDAVIT OF MR. C. MEAD McCOY, III

I, C. Mead McCoy III, having been duly sworn, state:

1. My business address is Vermont Natural Resources Council, 9 Bailey Avenue, Montpelier, Vermont 05602.

2. I am the Water Program Staff Ecologist with the Vermont Natural Resources Council. I have more than ten years of combined technical and professional experience as a fish culturist and fish biologist. My background in aquatic sciences has addressed collection of data for use in Intream Flow Incremental Methodology (IFIM) studies, museum accession work, fish culture, creel census and angler interview analysis, instruction of students in fisheries and aquaculture methods, and primary scientific research. My MA in Biology is currently pending from the State University of New York at Oneonta. My BS in Biology was conferred in 1983 by the Pennsylvania State University, University Park, Pennsylvania.

3. The purpose of this affidavit is to provide comments on the Draft Environmental Impact Statement (DEIS) for Deerfield River Projects in Vermont (FERC Project Nos. 2334 - 001 & 2323 - 012), dated February, 1996. The focus of my analyses is on the four impoundments effected by the

project's operations in Vermont and more specifically on the affects of drawdown on fishery resources as a component of the aquatic biota found in all of the impoundments (i.e. Somerset, Searsburg, Harriman, and Sherman).

Summary of Important Issues to be Addressed:

4. The average extent of annual drawdown in Somerset Reservoir is approximately 15 feet and Harriman Reservoir is approximately 50 feet. Searsburg is a daily peaking facility with water level fluctuations of 8-10 fe... Sherman is also a daily peaking facility which fluctuates approximately 7 feet. The environmental effects of these drawdowns are significant and must be fully assessed prior to issuance of a Final EIS. The significance of the drawdowns is demonstrated by their extreme nature and potentially severe consequences on the aquatic biota and associated fisheries found in the reservoirs. The effects of these significant drawdowns on aquatic life must be more fully understood to enable one to assess the potential negative impacts of the Projects on aquatic organisms and their various life cycles (e.g. fall spawning and winter incubation of eggs).

5. The DEIS presents inadequate information to permit one to assess the potential negative environmental impacts to the aquatic biota and fisheries that are present in the impoundments affected by the Projects in Vermont. review of the application materials submitted by New England Power reveals that no studies have been required by the Commission (despite requests by State and Federal fish and wildlife agencies), nor provided by NEP to assess the ecology of the reservoirs or the impacts of drawdowns on fisheries and other biota. Simply put the studies have not been done to assess the impacts

VNRC-5. The four reservoirs have been operated under the same fluctuating water levels for around eight decades and that is the existing environment. Existing fish and wildlife populations reflect this environment. The Yakima decision (U.S. Dept. of Interior v. FERC, 952 F.2d 538, 546 (D.C. Cir. 1992) determined that FERC doesn't have to have perfect information before it acts on issuing a license, nor did it imply that all environmental concerns must be definitively resolved before a license is issued. The Settlement and staff recommendations will make improvements to the overall operation of the Deerfield Project. The EIS describes in detail many of the benefits that would accrue to fish and wildlife resources of the four reservoirs by implementing the measures in the Settlement, including maintaining water levels for loon nesting and promoting successful smelt and warmwater fish spawning. We believe the overall effects of relicensing the Deerfield Project will improve the fishery resources of the Deerfield River especially in the bypassed stream reaches. We weighed fishery benefits against fishery impacts, including fishery impacts in the four reservoirs in Vermont, and concluded the Deerfield Project should be relicensed by including the recommendations made in the EIS.

VNRC-6. Several studies were conducted in the reservoirs, including water quality, wetland assessments, fish access to tributaries, smelt spawning habitats, reconnaissance level habitat surveys for fish, and substrate studies. NEP worked closely with the resource agencies in identifying which studies were needed early in the licensing process and FERC requested additional information from NEP that led to other studies in addition to those identified by the state and federal resource agencies. Using the results from these studies, and data collected from other sources (e.g., fish collections made by VDFW), we were able to determine the potential impacts of the project development reservoir fluctuations on fish and wildlife resources. In any new license issued for the project, restrictions would be made on reservoir water level fluctuations to benefit fish and wildlife resources.

of reservoir drawdown on aquatic biota.

6. The reservoir drawdown effects caused by power generation and store and release operations on the aquatic biota and fisheries found in the reservoirs has not been determined. Somerset, Searsburg, Harriman, and Sherman Reservoirs are all lacking in studies to determine the effects of reservoir drawdown on aquatic life. All reservoirs of concern in Vermont must be investigated more fully before a FERC license should be issued.

7. The literature cited herein (Ploskey 1986, Wentworth and Gerardi 1990, Kim 1993) is unanimous that the negative impacts of reservoir drawdown/water level fluctuation are severe in contributing to the decline of fisheries and other aquatic biota found in reservoirs. The consequences of power generation on aquatic biota needs mitigation based on solid scientific evidence and well designed site specific studies.

Synthesis

8. In a section titled "Maximum and Minimum Reservoir Elevations" for Somerset reservoir, the DEIS candidly states that "staff doesn't have specific fisheries information about to what extent wintertime entrainment occurs, nor data from fish population studies to determine whether increased predation occurs during the winter drawdowns, nor whether the amount of increased wetted shoreline habitat under the drawdown limit of 2,107 feet would provide additional valuable fisheries habitat." FERC staff goes on to say that in fact the their decision to limit drawdown to 2,107 feet is "based on the limited fisheries information". The DEIS's candid recognition that it

VNRC-7. See response to VNRC-6

VNRC-8. We agree that water level drawdowns in reservoirs can adversely affect fisheries and aquatic biota. Our recommendations for mitigation of project effects on aquatic resources in the four reservoirs were made after considering the developmental and non-developmental benefits of the project. We must balance the environmental concerns with the power concerns when making final recommendations for the project. We believe the overall fishery resources of the Deerfield River will benefit from the alternative selected and not just the resources associated with the four upper reservoirs.

VNRC-9. Comment noted. See also response VNRC-5.

relies on "limited fisheries information" available for Somerset is representative of the general lack of fisheries information available concerning the other reservoirs in the project. The sections of the DEIS adressing the Searsburg, Harriman, and Sherman reservoirs lack the same kind of basic fisheries data on which to base any reasonable conclusions as to the effects of drawdown on prey and predator species of importance in reservoir ecosystems.

9. A review of the "Supporting Documentation for the Offer of Settlement" filed by NEP in December of 1994 reveals that no studies have been conducted nor provided to address the fisheries and overall ecology of the reservoirs either from a baseline (historic) or from a potential perspective. *See*, Table 1-4. It is apparent from Table 1 - 4 in this document that no studies of any kind were conducted on the fisheries and ecology of Somerset, Searsburg, and Sherman reservoirs, and with regard to Harriman only two studies were conducted: a wetlands assessment and a reservoir bank erosion investigation. These Tables do not list or provide refernce to any assessment or study to evaluate the environmental impacts of water level fluctuations on the fisheries and other aquatic biota present in these water bodies. I feel this is an egregious oversight on the part of the applicant which results in inadequate information to determine the effects the operation of these four impoundments on aquatic life. The DEIS insufficiently analyses these significant environmental impacts.

VNRC-10. Comment noted. See also responses VNRC-6 and 8.

10. The Vermont Department of Fish and Wildlife (VDFW) has also underscored the impacts of current operations on the reservoirs:

Seasonal water level fluctuations occur as a result of power

VNRC-11. Comment noted. NEP consulted VDFW throughout the licensing process.

> generation at Somerset, Searsburg, Harriman, and Sherman Reservoirs. Such fluctuations have historically, and continue, to impair fishery productivity in these impoundments. Fluctuating reservoir levels can have a broad range of adverse affects on fish populations and other aquatic biota: stranding, loss of spawning and nesting sites, abandonment of nests, desiccation and freezing of organisms and their eggs. The littoral region of water bodies characterized by having stabile water levels is generally a highly productive zone supporting the greatest diversity of aquatic biota. Many fish populations are closely associated with littoral habitats for cover, feeding and/or spawning. Due to the severity of water level drawdowns in all project reservoirs and seasonal exposure of the zone to prolonged periods of desiccation and freezing, productive littoral regions are lacking for these water bodies. Consequently, management objectives for some fish and wildlife species cannot be fully attained under current project operations.

Memorandum Re: Deerfield Hydropower Project from Roderick Wentworth, VDFW Impact Assessment Specialist, to Jeffrey R. Cueto, Principal Hydrologist, at p. 29 (June 27, 1994).

11. This lack of supporting information is particularly troubling in light of the available scientific literature discussing drawdowns. A review of the literature addressing the effects of drawdown on fisheries, with particular emphasis given to Vermont, shows that the negative environmental impacts on aquatic biota are severe and extreme in many impoundments that are similar to those being evaluated in the Deerfield River Projects DEIS.

VNRC-12. Comment noted. See also our response to VNRC-5.

An assessment of the impacts of drawdown on Lake Bomoseen, Vermont, states that "invertebrates are a major source of food for fish and their reduction or elimination is likely to adversely affect fish size and, perhaps numbers. According to Rod Wentworth of the Fisheries Division of the Department of Fish and Wildlife: Limitations of food supply are likely to affect fish growth. I'm not sure if this bothers the fish much, but it does matter to the anglers. The results can be a catch of both few and smaller fish. A good example is our management and evaluation of Waterbury Reservoir. One of our management goals there is to provide a trophy rainbow trout fishery. Toward that end, regulations call for a 2-fish daily creel limit, with a minimum size limit of 15 inches. We were surprised to find that the fast-growing strain of trout that we stocked didn't grow well at all. At least not initially. Further study revealed that fish growth was very slow until fish became large enough to eat other fish as a major part of their diet. A lack of invertebrate food organisms seemed to be the problem; fish were eating such things as hemlock needles which are not very nutritious to say the least. I suspect that the lack of adequate food organisms is a direct result of the annual winter drawdown of (30-40 feet) of the reservoir, for purposes of power generation.'" (Anonymous, 1990).

12. A recent Vermont Department of Environmental Conservation Memorandum to Agency of Natural Resources Secretary Barbara Ripley, discusses proposed drawdowns of Lake Bomoseen to control Eurasian watermilfoil of 72 inches. The memo states 'The ecology of the entire lake would be altered by drawdowns. Most significantly altered would be the littoral area of the lake which happens to be the region of the lake with the greatest productivity and biodiversity. Frequent drawdowns will result in the littoral area being less productive; thus it follows that the lake will be less productive, including fisheries.' (Attached).

VNRC-13. No response required.

13. A study conducted by Rich Kim (1993), District Fisheries Biologist, VDFW, to evaluate the growth and survival of rainbow trout in Waterbury Reservoir

VNRC-14. No response required.

discusses the limitations to reestablishing the fishery "Waterbury Reservoir annually undergoes an extreme winter drawdown of approximately 40-50 feet which results in surface acreage and pond volumes of approximately 38-49% and 20-30 % of normal reservoir levels, respectively (U.S Geological Survey 1988-1993, Figure 9) In addition to reducing the amount of physical habitat available to fish populations, winter drawdowns have a devastating effect on aquatic plants and invertebrates which normally inhabit the littoral zone of a lake (Ploskey, 1986) In Waterbury Reservoir, annual winter drawdowns have precluded the establishment of a true littoral zone, the area of primary food production in natural lakes and ponds."

14 Comparisons reveal important similarities between the Waterbury Reservoir referred to above and Harriman Reservoir: in particular, the magnitude of drawdowns and the desire by the VDFW to establish a sustainable coldwater fishery Harriman's 50 foot annual drawdown and that of Waterbury's 30-40 foot annual drawdown are comparable. It is logical to conclude that the greater drawdown in Harriman may have a more profound affect on the integrity of the reservoir's entire aquatic ecology.

15 Ploskey (1986) states that "after prolonged drawdown, growth of fish may decrease as concentrations of prey diminish and the production of most invertebrates and small fish declines." Ploskey (1986) cites a study done by another researcher in which it is suggested that food limitations experienced by benthophagous (bottom feeding) fishes (e g. rainbow trout) may account for their low abundance in widely fluctuating storage impoundments and high densities in stable mainstem reservoirs.

VNRC-15. We agree that reservoir drawdowns can adversely affect fish productivity and their food sources. We conclude that the overall fish and wildlife resources of the Deerfield River would improve because of better management of water levels in the reservoirs and because of minimum flows that will be provided in miles of stream reaches of the Deerfield River that for years have received little or no stream flows during various parts of the year.

VNRC-16. No response required.

16 Predator-prey relations may also be altered by changes in habitat complexity as water levels change. Not only are prey concentrated by large drawdowns, but they also may be forced to abandon refuge in littoral areas. Complex structure not only provides refuge for prey but also reduces the foraging efficiency of predators (Ploskey, 1986).

VNRC-17. No response required.

17 Adverse effects on fish reproduction are related to loss of habitat by drawdown or shoreline modification or to mortality of eggs of young-of-the-year (YOY) fish after exposure or suffocation by eroded sediments. Mortality of eggs or YOY fish stranded by drawdown has been documented for many species, including salmonids, sunfishes, walleyes, and black basses (Ploskey, 1986).

VNRC-18. Stabilization of several reservoirs during fish spawning and egg incubation should improve fish populations, particularly for warmwater species and for smelt in Harriman Reservoir.

Somerset Reservoir Comments

The Vermont Agency of Natural Resources primary fisheries management goal for Somerset Reservoir has been to create a viable coldwater fishery of brook, brown, and rainbow trout, landlocked Atlantic salmon, and rainbow trout. A license based upon the DEIS, would preclude attainment of this management goal by limiting managment options to a put-and-take brook trout fishery supported by annual plantings of legal sized fish (Anonymous, 1996). A put-and-take brook trout fishery is not a worthy substitute for a sustainable fishery based on a well functioning aquatic ecosystem.

NEP has recognized that drawdowns have adversely impacted the productivity and littoral zones of Somerset Reservoir stating that: "Regarding basic productivity and the potential to grow fish to attractive size, this

VNRC-19. Somerset Reservoir had been a put-and-take fishery for many years. It is an oligotrophic water body that has some seasonal disruptions in water quality that occurs naturally, irrespective of water level fluctuations caused by project operation. The proposed operation of the project under a new license should not alter any plans by the state to continue a put-and-take trout fishery in the reservoir. In addition, conditions for warmwater fish, such as bass and sunfish, should improve in the reservoir with stabilization of water levels during fish spawning. The finer tuning of all reservoir levels under the new license should improve the overall quality of fish habitat in the reservoirs.

[Somerset] impoundment certainly does not have a history of robust populations. The paucity of aquatic vegetation and fluctuating littoral zone no doubt reduce potential production, but there is a good population of white suckers which indicates that the pond certainly is not totally unproductive. There is reason, therefore, to assume that this reservoir might support a smelt population." Application, Vol. IV, Exhibit E-3, p. E3-9.

18. NEP has further Stated that at Somerset Reservoir: "Current level management has the potential to affect smallmouth bass reproduction during the May 15 to July 15 spawning / incubation / fry period (due to drawdown after spawning). The summer-fall drawdown has the potential to affect habitat suitability and production in the littoral area associated with maximum normal pond elevation." Id. at p. E3-3.

19. The Vermont Department of Fish and Wildlife (VDFW) has also underscored the impacts of current operations on Somerset Reservoir:

> NEPCO's proposal for the Somerset Reservoir does not address the broad issue of hydroelectric generation impacts on the littoral community. Regular and extreme dewatering of the littoral zone would continue and preclude establishment of what would otherwise be a diverse, productive and beneficial aquatic community under natural lake conditions. The abundance of many organisms (e.g. aquatic macrophytes, macroinvertebrates, forage and some predatory fishes) critical to reservoir food chains and the energy transfer system are depressed or altogether absent from the shallow water habitats subject to seasonal dewatering. Habitat for reproduction and cover is limited or inadequate for some species.
>
> Stabilization of the reservoir water level from May 15 to July 15 would provide an opportunity for aquatic macrophytes and macroinvertebrates to recolonize the littoral zone. However, whatever gains in biological diversity are made during this brief time period begin to be lost during the late summer drawdown

VNRC-20. NEP's statements quoted here and in comment VNRC-19 address their view of how the project affects fish and wildlife resources. An EIS should depict positive and negative effects of a project on the resources. NEP proposed several measures to reduce negative effects to fish and wildlife resources. Under a new license, water levels in Somerset Reservoir would fluctuate around ± 3 inches between May 1 and July 31. The tighter management of water levels in three of the four upper reservoirs under a new license should improve the overall quality of fish habitat.

VNRC-21. These issues were raised early in the licensing process and NEP consulted the VDFW during the licensing process. We believe the issues you mention here are adequately addressed in the EIS.

and entirely through the winter drawdown period.

Memorandum Re: Deerfield Hydropower Project from Roderick Wentworth, VDFW Impact Assessment Specialist, to Jeffrey R. Cueto, Principal Hydrologist, at p. 33 (June 27, 1994).

20. Based upon a review of the DEIS and the record, it is apparent that no studies have been completed to assess the impacts of the continuance of a store and release, seasonal operating mode of Somerset Reservoir on the salmonid fishery and other cool and warmwater fish species during the summer, fall and winter life stages. There are many unaddressed environmental impacts that are in need of study to assess the effects that continued drawdown on the average of 5 feet over the summer/fall period from typical spring water levels, and an additional 10 feet during the winter period (mid December through mid March) have on aquatic biota in the reservoir (Anonymous, 1996). The studies have not been done to determine impacts on aquatic biota.

Specifically, the following studies have not been, but must be, completed: An assessment of the impacts of fall and winter drawdown on salmonid spawning, incubation, and fry emergence, and also an associated study to evaluate recruitment into the salmonid population of young-of-the-year (YOY). This basic study is most urgently needed to assess the viability of managing for a sustainable salmonid fishery.

An updated fish survey assessing the Somerset Reservoir fish community. The survey conducted by VANR in 1983 has not been updated. The survey completed in 1983 indicated that the cool and warmwater fishery was not

VNRC-22. We disagree. We believe there is adequate information to make an informed decision about project impacts on the resources. See also our response to VNRC-5.

Water temperature and DO data collected for Somerset Reservoir are presented in the application and in responses to additional information filings by NEP. Temperature and DO currently don't limit trout success in the reservoir. Under new water level management proposed by NEP for Somerset Reservoir, stabilizing water levels from May through July might extend the depth of the thermocline and therefore the length of time it remains in place. However, these changes in water level management would not preclude trout management efforts in the reservoir as they likely would have minimal impacts on overall temperature or DO levels in the reservoir.

1

robust. The survey showed that fish were small in comparison to growth of the same species in other locations and in particular the yellow perch population was stunted (Anonymous, 1996).

A study of the affects of drawdown in the summer months on the availability of cover and forge base for fry and juvenile warmwater fishes due to the loss of water volume from the reservoir and associated losses to the littoral community, which produces significant primary productivity and nutrients that are then transported into the pelagic community of the reservoir ecosystem.

An assessment of salmonid spawning success and the potential adverse impacts due to fall/winter drawdown have not been assessed. Fish winter drawdown entrainment needs to be studied and evaluated.

An analysis of Somerset summer stratification occurrence to determine if decreased oxygen levels and elevated water temperatures preclude the development of a sustainable wild salmonid fishery and a healthy associated forage base of rainbow smelt. The DEIS states that the potential extension of the depth and duration of the stratified waters is not likely to cause significant decreases in DO or [increases] in water temperature. However, there the record does not include any information upon which such a statement can be based.

A study of fish population recruitment of YOY warmwater fish species into the population would also provide valuable information now lacking in the application.

23 Other studies requested by VANR are the impacts on fishery resources from excessive predation during the winter due to drawdown, and reservoir biomass loss due to excessive releases out of the reservoir (Anonymous, 1996). In view of the vacuum of avialable information to assess the impacts of drawdown on habitat and biota in the Somerset Reservoir it is impossible to even begin to assess the impacts of the proposed operating alternative on the reservoirs.

VNRC-23. Comment noted. See response to VNRC-5.

Searsburg Reservoir Comments

22. The DEIS recognizes that the management of Searsburg is for coldwater fish (i.e. brook and brown trout). Brook trout have been managed for since 1975 and browns were stocked in the reservoir between 1970 and 1975 (Anonymous, 1996).

VNRC-24. No response required.

23. The water level of Searsburg Reservoir can fluctuate up to 8 feet on a daily basis. In order to assess the impacts of this managment regime, a study must be conducted to assess the impacts of daily water level fluctuations on the fish community present in the impoundment. A review of the information filed with the Commission indicates that such study has not been conducted or recommended.

VNRC-25. We believe enough information about fishery resources and water level fluctuations in Searsburg Reservoir is available to make an informed recommendation about project effects on the fishery resources.

24. VDFW has underscored the impacts of the drawdowns on the littoral zone of the Searsburg Reservoir:

> The extreme nature and frequency of water level fluctuations at Searsburg Reservoir coupled with the impoundment's relatively

VNRC-26. See revised text. NEP has made concessions to benefit fishery resources at all the Deerfield Project developments. There was an overall look at fishery resources in the Deerfield River, not solely the fishery resources of the reservoirs. Many of the participants in the Settlement and state and federal resource agencies, during consultations with NEP, expressed concern about bypassed stream reaches of the Deerfield River that had been without minimum flows for many years. We're not saying

> narrow width and steep bottom contours has a significant impact on aquatic habitat and biota. The littoral zone is regularly dewatered (daily form late spring through fall) and consequently is not conducive to invertebrate production and other biota.
>
> . In order to make any measurable improvements in the fisheries of this impoundment, water level fluctuations would need to be greatly reduced in terms of magnitude and frequency.

Memorandum Re: Deerfield Hydropower Project from Roderick Wentworth, VDFW Impact Assessment Specialist, to Jeffrey R. Cueto, Principal Hydrologist, at pp. 33-34 (June 27, 1994).

25 The VANR conducted a fish survey in 1989 that collected large numbers of yellow perch and white sucker, small numbers of brown bullhead, and one brook trout and longnose sucker (Anonymous, 1996). The survey of the fish community in Searsburg is in need of reassessment, simply because of the low number (1) of brook trout collected in the last survey conducted seven years ago. The results of the study conducted in 1989 indicate that Searsburg does not support a viable brook trout fishery which is the stated primarily goal set by VANR.

26 The impacts of drawdowns on the littoral community in Searsburg has not been studied to assess the impacts on the entire aquatic community and future fishery development, maintenance, and enhancement. The effects of drawdown on the success rate of spawning of brook trout in the reservoir and in the upstream reach of the river that flows into the impoundment also have not been studied.

Harriman Reservoir Comments

27 The DEIS proposes to require the reservoir level to be stable or rising during

there was a direct tradeoff whereby the parties saw a greater gain in habitat for fishery resources by putting minimum flows into the 3.5-mile long Searsburg bypassed reach, but these benefits to the fishery resources of the Deerfield River were considered in evaluating what action should be taken concerning water level fluctuations in the Searsburg Reservoir. The VDFW wants to establish minimum stream flows in the bypassed reach that would provide quality habitat for a self-sustaining population of brown trout.

VNRC-27. Comment noted. We suspect that because brook trout stocked in the Searsburg Reservoir are for a put-and-take fishery, holdovers of these trout are limited by fishing pressure and by marginal summer water temperatures.

VNRC-28. We believe the information contained in the Deerfield Project license application and supplemental filings provided by NEP provide adequate information to analyze project impacts on the aquatic resources.

VNRC-29. See revised Section 4.2.1.1.3.

the period from May 1 to June 15 each year, and that from June 16 to July 15, the reservoir elevation would fluctuate no more than one foot per day (Anonymous, 1996). No other water level fluctuation restrictions are stated in the DEIS proposed mode of operation.

28. This reservoir more than any other in the system offers the greatest potential for future fisheries development (Anonymous, 1996). The gamefish and foragefish species of interest in Harriman are brown and rainbow trout, yellow perch, smallmouth bass, landlocked Atlantic salmon, lake and brook trout and rainbow smelt. It has been stated by the VANR that management objectives for Harriman Reservoir are: to establish and maintain landlocked [Atlantic] salmon and lake trout fisheries and sustain and enhance the rainbow smelt population; and sustain and enhance the smallmouth bass population.

VNRC-30. No response required.

29. NEP has stated that the Harriman Reservoir "has a long history of management for several coldwater species and the present trout population is supported by stocking. There are also several warmwater populations and smelt provide forage. The existing fisheries are popular but production is low for coldwater species. Application, Vol. IV, Exhibit E3, p. E3-14. The Applicant has admitted that drawdowns have adversely impacted the productivity and littoral zones of Harriman Reservoir stating that:

> Current water level management has the potential to affect reproduction of several important fish species as well as habitat suitability and production of the littoral zone associated with a normal full pond elevation. It is clear that current operation provides little chance of reproduction by lake trout, which spawn in mid-October over coarse substrates in shallow water within the reservoir. Since eggs do not hatch until May, most likely they are dewatered by the large drop in winter

VNRC-31. No response required.

> impoundment elevation. Similarly, there are fluctuations during the smallmouth bass spawning/ incubation/ fry season that could affect reproduction of the species. In 1990 and 1991 dewatering of shore-spawned smelt eggs was observed, apparently from short-term drops in water level (during the normal filling cycle in late April) that coincided with smelt spawning.

Application, Vol. IV, Exhibit E-3, p. E3-15.

30 VDFW has underscored the importance of Harriman Reservoir for fisheries management:

> Establishment and maintenance of salmonid fisheries in Harriman Reservoir is a high priority of this Department. Harriman Reservoir is the largest lake in the southern tier of the State providing habitat suitable for the management of lake fisheries for landlocked salmon, brown trout and lake trout.

Memorandum Re: Deerfield Hydropower Project from Roderick Wentworth, VDFW Impact Assessment Specialist, to Jeffrey R. Cueto, Principal Hydrologist, at p. 34 (June 27, 1994).

VNRC-32. No response required.

31. VDFW has detailed the impacts of fluctuations of the levels of the Harriman Reservoir on littoral zones:

> Past years of drastic annual water level drawdowns at Harriman Reservoir have resulted in a barren, largely unproductive littoral zone. Aquatic macrophytes, such as emergent, floating leaved and submergent plants, are sparse or absent from shallow water habitats that otherwise under long term pool stabilization would define the littoral community.
>
> Macrophytes are important for food production and feeding areas, spawning and nursery habitats, and protective cover for a variety of invertebrates, fishes, waterfowl, and wading birds, and riparian mammals. In the absence [of] these plants, invertebrate production is depressed and diversity is low. A high species diversity gives great stability to ecosystems. Macrophytes in moderate abundance increase reservoir ecosystem stability by

VNRC-33. No response required.

providing a wider variety of food materials and habitats that cannot be compensated for by a plant community consisting entirely of phytoplankton.

Invertebrate populations are additionally impacted by the severity and duration of the overwinter drawdown period which subjects these organisms to desiccation and freezing. Low invertebrate productivity reduces food available for consumption by aquatic animals further up on the food chain. Most fish species of particular interest to anglers (e.g. bass, salmonids, pickerel, yellow perch, and other assorted panfish) feed on macroinvertebrates and small forage fishes inhabiting the littoral community.

Id. at p. 37 (citations omitted).

32. VDFW has further Stated:

The availability of an abundant and stabile forage fish base is critical to managing reservoirs for large salmonids. Smelt are a prerequisite for undertaking landlocked salmon and lake trout management. . . . While NEPCO's proposal to stabilize water levels during a large part of the smelt spawning season may have some beneficial results for this forage base, no improvements in littoral food production can be expected under this plan.

Natural lake trout reproduction in Harriman Reservoir is also desirable but not attainable under NEPCO's current and proposed reservoir operations. Lake trout are fall spawners. In Vermont, spawning generally occurs from early October - late November. Spawning depth ranges from about half a foot down to 180 feet. Lake trout spawning in Vermont waters has been frequently observed to occur in shallow areas as well as in the 30 -55 foot depth range. For successful lake trout spawning to occur in [Harriman Reservoir] reservoir drawdowns must be limited so as not to expose spawning substrate and eggs. Due to the magnitude of the overwinter drawdown of Harriman reservoir (41 feet) shoal and shoreline areas offering suitable spawning habitat would be dewatered and exposed to freezing and desiccation.

Id. at p. 38

VNRC-34. We believe there is a potential for improvements in littoral food production in Harriman Reservoir based on reservoir water levels that would be stabilized between April 1 and July 15 during a good portion of the growing season.

33 In Vermont's Lake Trout Management Plan for Inland Waters (Wentworth and Gerardi, 1990), the importance of establishing a lake trout sustainable fishery is discussed, and water level stabilization is necessary in achieving that fishery management objective is stated. "it appeared that all the lakes capable of sustaining reasonable numbers of lake trout were already being stocked , with just one exception. We felt that Harriman Reservoir may be able to sustain lake trout if water level fluctuations caused by hydropower generation were reduced. Since the hydropower projects that affect Harriman Reservoir are currently going through relicensing, we suggest that the department re-examine the potential for lake trout management once the water level issues have been resolved." The report further states that: "The production of fish from spawning should be encouraged, both for its intrinsic value and its contribution to the fishery. Spawning habitat should be protected and where possible, enhanced."

The Draft Lake Trout Management Plan for Vermont's Inland Waters Proposed Action Plan (submitted as part of Wentworth and Gerardi, 1990) states in Recommendation 2: "Expand the list of waters managed for lake trout to include Harriman Reservoir (Whitingham)." and then goes on to apply an Action to the Recommendation sought: "The Department will seek to require water level stabilization at Harriman Reservoir as a condition for federal relicensing of the Deerfield River Hydropower Project in 1993 Following a favorable outcome of the relicensing process that results in habitat improvements for lake trout, Harriman will be included in the lake trout stocking program to establish a population and viable fishery." It is further stated in the same document that "New England Power Company (NEP) will be undertaking various studies to consider environmental and

VNRC-35. A resumption of lake trout stocking in Harriman Reservoir is a state natural resource agency decision. We believe the better management of water level in the reservoir, as proposed in the EIS, could improve the situation for lake trout reintroduction, however, water level fluctuation is only one of several concerns to be considered before lake trout reintroduction occurs.

fisheries impacts associated with continued operation of the project and potential mitigation strategies."

34. Lake trout and landlocked Atlantic salmon require cold, well oxygenated water through out the year. In the late summer and early fall a hypolimnetic zone with adequate levels of available oxygen must be maintained if a population of salmonids is to be sustained through these difficult months of thermal stress. Fall and winter water level stabilization needs to be assessed if a sustainable salmonid population is to be managed for in Harriman Reservoir (i.e. critical spawning/incubation habitat areas must be protected). Drawdown in the fall/winter my also be affecting not only in-basin salmonid spawning activities but also tributary spawning activities and survival of eggs that may perish as a result of dewatering (causing desiccation) and freezing of spawning areas during the fall and winter months, respectively. The emergence/survival of wild brown and brook trout fry in the late winter/early spring may also be impacted severely by reservoir drawdown and needs to be assessed.

VNRC-36. The trout fishery in Harriman Reservoir is a put-and-take fishery while the lake trout and landlocked Atlantic salmon fishery are an experiment. We considered effects of project operation in our analysis of project impacts on the trout fishery. We believe no additional studies are needed to determine reservoir drawdown impacts on these trout resources.

35. No comprehensive studies have been conducted and submitted by NEP to address the extensive environmental and fisheries impacts to Harriman Reservoir resulting from the drawdowns. There are serious issues of lake ecosystem management that appear to be unaddressed in the DEIS. The need for more study of lake ecosystem dynamics and how they effect the reservoir fishery and associated biota must be conducted to be able to adequately determine the consequences of continuing to operate the Harriman Reservoir with as much as a 50 foot annual drawdown from spring storage levels.

VNRC-37. We disagree with your request to conduct more comprehensive studies in Harriman Reservoir. We believe the information provided by NEP in the application and supplemental filings is sufficient to make an informed decision (see also response to VNRC-5). Our analysis of project effects went beyond lake ecosystem dynamics and included an evaluation of project effects on the fishery resources of the Deerfield River.

Sherman Reservoir Comments

Sherman Reservoir is operated as a daily peaking project and fluctuates the water level in the impoundment 4 to 7 feet on a weekly basis. The affects of impoundment fluctuation on the aquatic biota have not been evaluated in the DEIS

VNRC-38. Section 4.1.1.3.4 indicates that water level changes in the Sherman Reservoir can adversely affect fishery resources.

The record and DEIS include little information regarding the Sherman fishery. However, it is apparentaly currently being managed by both Vermont and Massachusetts as a coldwater fishery of brown and brook trout. Both states have management plans which continue to favor the stocking of yearling brown trout to create a salmonid fishery. The fish species present are chain pickerel, yellow perch, rainbow smelt, rock bass, brown bullhead, bluegill, pumpkinseed, longnose sucker, golden shiner, fallfish and creek chub (Anonymous, 1996)

VNRC-39. No response required.

36. VDFW has detailed the impacts of fluctuations of the levels of the Sherman Reservoir on littoral zones:

> Water level drawdowns in the range of four to seven feet do have an effect on the littoral community in many of the ways discussed under previous sections [Somerset, Searsburg, Harriman]. Resident populations of smallmouth bass, chain pickerel, yellow perch, sunfish, and several minnow species may be affected during their spawning seasons and juvenile life stages as a result of dewatered eggs and loss of cover. The release of cold water from Harriman appears to benefit trout management in Sherman Reservoir. Smelt entrained in the Harriman Bypass intake structure is believed to contribute forage for fish predators and perhaps has in part been responsible for the occasional record size brown trout taken by anglers.

Memorandum Re Deerfield Hydropower Project from Roderick Wentworth, VDFW Impact Assessment Specialist, to Jeffrey R. Cueto, Principal

VNRC-40. No response required.

Hydrologist, at p. 34 (June 27, 1994).

Conclusion

37. In conclusion, drawdowns of water levels are, in general, detrimental to lake environments, and in particular, to fisheries. Littoral communities provide cover from predation and forage for fry, juvenile, and adult warm, cool and coldwater fishes. The productivity of littoral communities is transported out into the pelagic lake community and is fundamental in establishing an intact sustainable pelagic community. Without stabilization, the reservoirs will be severely limited in productivity and will continue to be limited from a fisheries perspective.

VNRC-41. Comment noted. We believe that better overall control of the Deerfield Project reservoir fluctuations under the proposals analyzed in the EIS will improve the aquatic habitat for fishery resources in the reservoirs over existing reservoir conditions.

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MEMORANDUM

TO: Christopher Kilian, Vermont Natural Resources Council

FROM: Jeffrey Parsons, Consulting Ecologist Jeffrey Parsons

DATE: April 16, 1996

SUBJECT: Comments on the Draft Environmental Impact Statement for Deerfield River Projects (FERC Nos. 2334-001 & 2323-012)

The Vermont Natural Resources Council (VNRC) has requested that I review the available information regarding the ecological effects of reservoir drawdown at the Harriman, Somerset, Searsburg, and Sherman Reservoirs on the Deerfield River. This report is a result of that investigation. Please see the attached Resume for my qualifications.

Summary of Main Points

1. Littoral zone ecological communities play an important, often critical role, in lake and reservoir productivity and food web stability.

2. Littoral zone communities in the Deerfield Reservoirs are very limited in extent, diversity, and structural and functional integrity.

3. Structurally and functionally diverse littoral zone communities are limited in the Deerfield Reservoirs by the overriding environmental disturbance-extensive winter drawdowns. Limiting summer drawdowns will not eliminate or compensate for littoral zone community-wide impacts and losses associated with winter drawdown.

4. New England Power Company has provided insufficient information (amount of appropriate substrate, slopes etc. available for colonization

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by littoral zone species) to accurately assess the potential for additional littoral zone community development in the event of water level stabilization.

5. Given the limited information available, littoral zone ecological communities would become established in the bays and along some shoreline regions of the Deerfield River Reservoirs. While, the exact areal extent of littoral zone development is uncertain, the critical nature of the littoral zone resource warrants their development to whatever extent feasible.

6. A detailed analysis of the environmental benefits from water level stabilization and littoral zone community development is impossible due to a lack of detailed information.

I. Background-Reservoirs

The Harriman, Somerset, Searsburg, and Sherman Reservoirs on the Deerfield River are located in Southern Vermont. The reservoirs are managed for hydroelectric generation resulting in extensive drawdown of water levels through the winter months. These drawdowns on a yearly basis may be as much as 60-80 feet in the Harriman Reservoir (with a yearly average of approximately 41 feet). Drawdowns in the Somerset Reservoir average approximately 15 feet and the Searsburg drawdowns are on the order of 10 feet. Sherman Reservoir drawdowns are approximately 7 feet.

VNRC-42. Comment noted. Under any new license issued for the project, we are recommending that maximum drawdown levels be established for Somerset and Harriman Reservoirs as discussed in Section 4.2.1.1.

II. Littoral Zone Ecology

In ecological terms, lakes and reservoirs are divided into different life zones, i.e. littoral, photic, pelagic, and benthic life zones (Moore and Thornton, 1988). The boundaries of these zones are delineated by factors such as depth of light penetration, and the presence or absence of rooted plants. Littoral zones are defined as the region of a lake or reservoir that extends outward from the shoreline to the maximum depth occupied by rooted plants. Littoral areas are life zones typically dominated by a diversity of plant and animal life and the highest primary productivity (and thus plant biomass) of all lake/reservoir life zones (Wetzel, 1979). This high productivity is due, in large part, to the presence of sufficient available oxygen and carbon dioxide, and often elevated nutrient concentrations (e.g phosphorus and nitrogen) as well.

VNRC-43. No response required.

Littoral zones can be divided into 3 zones: (1) the emergent zone (0-1 meter in depth); (2) the floating-leaved aquatic plant zone; and, (3) the submerged aquatics zone. Thus many littoral communities have a multi-

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layer plant canopy. It is this mixing of vegetative layers, with emergents above and floating and submerged plant strata below, that produces a structural habitat diversity that is of such great importance to a wide-variety of attached algae, fungi, invertebrates, and fish (Hammer, 1992). It is this structural habitat diversity that is missing in most of the Deerfield River Reservoirs.

The multi-layer plant canopies typical of stable littoral life zones provide a very large surface area for colonization of macrophytes by microflora (periphyton and fungi) (Baker *et al.* 1993). Periphyton of littoral zones consists of a mix of diatoms, blue-green algae and flagellates and is bathed in oxygen, carbon dioxide, and nutrients, and is thus very photosynthetically productive (Wetzel, 1975). Highly productivity algal communities are even common on inorganic littoral zone substrates such as coarse sands (that is, in lakes with stable water levels). Other common littoral plant types (especially in softwater lakes and reservoirs) include the water ferns and mosses. Periphyton can also coat rock surfaces and can be found in high concentrations on this substrate. Other groups of organisms such as bacteria are also found on macrophyte leaf surfaces and this combined biological stew called "aufwachs" provides a productive and rich food source for the many species that live in well-developed littoral zones (Wetzel, 1979).

Many species of macroinvertebrates, and fish inhabit littoral regions with well-established submerged and floating-leaved vegetation. Invertebrates take advantage of the rich structural diversity and vegetative surface area found in littoral zones with stable water levels. The microflora associated with larger plants is an important food source for many macroinvertebrates-often more important than the macrophytes themselves. The multi-layer canopy of the typical littoral zone also provides protective cover essential to the survival of many species of juvenile fish (DesMeules and Park, 1988).

III. Lake and Reservoir Trophic Energy and Food Webs

An important energy source in many freshwater lakes and some reservoirs (those where littoral zones develop) is the production of plant and animal biomass in the littoral zone. The production of plant biomass, its decomposition and the eventual exchange of these materials with deeper lake regions plays a critical role in lake metabolism throughout temperate regions (Thorton, *et al.* 1990; Wetzel, 1990a). The detrital (i.e. dead and dying organic matter that is undergoing decomposition) food web functionally controls lake metabolism in the vast majority of temperate lake systems and the littoral zone flora is the energetic driving force behind this cycle.

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VNRC-44. No response required.

In temperate lakes and reservoirs, dissolved and particulate nutrients and organic matter are seasonally exchanged between deep water pelagic and littoral zone life zones. The carbon and energy sources from benthic (bottom) decomposition in littoral zones of lakes represents the dominant energy and carbon flux in most lakes. Much of the organic compounds resulting from the decomposition of littoral zone macrophytes is refractory (slow to decompose) and represents a long-term stable source of energy for the lake food web, including pelagic life zones (Wetzel, 1990b). The energy turnover in functional littoral zones (vegetation and other biota) is measured in yearly or multi-year cycles. Conversely, the turnover of energy in the planktonic (free-floating algae) portion of the food web is measured in days and weeks. Planktonic populations are, of course, subject to great fluctuation (such as algal blooms) and boom and bust cycles. The energy produced in littoral zones of healthy lakes thus becomes that part of the energy base (i.e. food web) that flattens out fluctuations in the planktonic food web and thus stabilizes energy relationships in lakes and reservoirs (Wetzel, 1990b).

IV. Impacts of Drawdown at the Deerfield River Reservoirs

The large drawdowns of the reservoirs on the Deerfield River have substantial impacts upon the establishment, density, and diversity of littoral zone plants and animals, food web and energy dynamics of these water bodies, and the overall structural and functional ecology of the reservoirs. In addition, these drawdowns impact use and productivity of these areas by juvenile fish, spawning fish, birdlife and some mammals.

VNRC-45. We agree that reservoir water level fluctuation adversely affects biotic resources (See Sections 4.1.1.3 and 4.1.1.4).

Fauna and Flora

Plants that are dependent upon a fairly consistent water level can not become established in areas with widely fluctuating water levels. Floating-leaved and submerged aquatic plants in particular do not become established in most areas with extensive fluctuations in water levels. Simple wetland communities dominated by annual aquatic plants that can overwinter as seeds become established at the expense of a diverse community of littoral zone plants. In the Deerfield Reservoirs, even these communities are scarce. Annual plants become established because they can wait out drawdowns as seeds and re-emerge the following year (Rorslett, 1989; Jenkins, 1989).

VNRC-46. No response required.

Diverse, functional, multi-canopied littoral zone communities are prevented from becoming established due to winter drawdowns. Many perennial plants are prevented from becoming established in shoreline areas subject to extreme fluctuations in water level. Winter drawdowns expose aquatic plants to drying (desiccation) and freezing (Jenkins, 1989) and ice-scour

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(Roy *et al.* 1986). Jenkins' (1989) work detailing the effects of winter drawdown on wetland/littoral zone plant communities in Lake Bomoseen demonstrated quite clearly that submerged and floating-leaved aquatic plants were devastated by a single winter drawdown. Plants in the 1-3 foot deep littoral zone were nearly completely destroyed.

At Lake Bomoseen, a single winter drawdown decreased the abundance of aquatic vegetation by 50%, decreased its diversity by 40%, decreased the overall extent of floating-leaved aquatic vegetation by 99%, and caused decreases (in abundance) of 45% - 99% or more in 9 of the 13 commonest species. Jenkins (1989) went on to state that the biological integrity of the deepwater wetland had been severely compromised by the drawdown. In Norwegian hyrdroelectric reservoirs with winter drawdowns, shorelines were barren and devoid of perennial macrophytes (Rorslett, 1989). Only "weedy" annual plants became established where water levels fluctuated in winter. The structural diversity of multi-canopy littoral communities are missing throughout most of the Deerfield River Reservoirs.

Floating-leaved and submerged aquatic plants typically provide the greatest surface area for colonization by attached algae and bacteria. Without these communities, primary productivity can drop substantially. In a Michigan lake, littoral zone communities comprised only 15% of the lake area-but the epiphytic algae (on macrophytes) accounted for between 70% and 85% of the lake primary productivity (Wetzel, 1990a). Invertebrates, invertebrate feeders, fish, and fish-eaters decrease when this vital portion of the food web is missing or greatly limited in extent, as is the case in the Deerfield River Reservoirs.

Research results consistently show that large-scale drawdowns in reservoirs decrease the diversity, density and biomass of macroinvertebrates (Wilcox and Meeker, 1992). Most of this is in response to a lack of plant food and cover in reservoirs where drawdowns inhibit the development of littoral plant communities (Wilcox and Meeker, 1992). Some mayfly and isopod groups have been reported to suffer from freezing and desiccation associated with drawdown as well.

Certain mammals are negatively impacted by winter drawdowns in reservoirs. Muskrats inhabiting waterbodies with extensive water level management suffer high predation, decreased availability of food resources, and the loss of shoreline denning sites. In Minnesota, populations of muskrat in reservoirs with extensive water level fluctuations were about half as high as nearby lakes with stable water levels (Wilcox and Meeker, 1992). River otter, mink, and beaver that use bank dens can also be forced to abandon these sites.

Impacts of Drawdown on Deerfield River Reservoir Productivity, Food Webs, and Trophic Stability

Although only minimal research has been completed at the Deerfield River Reservoirs, all of the available information suggests that diverse, functional littoral zones, and the food web dependent upon it are largely absent. The productivity associated with littoral zones is absent in the reservoirs. Primary productivity in the form of aquatic macrophytes, microflora (such as attached algae), and periphyton associated with stable shoreline substrates (rocks etc) are greatly diminished. Secondary productivity in the form of insects, mulluscs and other invertebrates, fish, birds, and certain mammals (and probably amphibians and reptiles as well) is diminished as a result of water level fluctuations, and, in particular, winter drawdown.

The littoral zone export of dissolved and particulate organic matter and nutrients to pelagic regions of the reservoir is greatly diminished. In reservoirs without functional littoral zone communities, overall reservoir productivity is dependent upon a volatile energy cycle derived from planktonic sources.

VNRC-47. Comment noted.

V. Potential for Littoral Zone Community Development at the Somerset, Harriman, Searsburg and Sherman Reservoirs

Based on the limited amount of information available, the potential for littoral zone vegetative development at the three reservoirs cannot be determined. Currently, the overriding impact of extensive water level fluctuations greatly restricts the development of a functional littoral life zone. In the event that water levels were stabilized in winter, some other factors that would influence the degree and extent of littoral zone vegetation establishment include: soil suitability, slope, water clarity (and to a lesser extent nutrients), and the proximity of seed sources for wetland vegetation.

The DEIS refers to the Applicant's claim that non-nutritive sandy and gravelly soils and soft, clear waters play an important role in limiting littoral zone development in the Deerfield Reservoirs. No evaluation of the nutritive value of the soils was conducted by the applicant. Nutritive values of the soils could potentially impact the primary productivity of aquatic plants-but the waters of the Deerfield reservoirs are not so limiting in nutrients as to prevent the establishment of most littoral zone plants. The water quality of the reservoirs show no signs of being non-nutritive and soils would be in equilibrium with overlying waters. The Harriman and Somerset Reservoirs have water quality characteristics (phosphorus and chlorophyll levels) indicative of mesotrophic waterbodies (NEPCO, 1991).

VNRC-48. Comment noted. See response to VNRC-5.

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These waterbodies are of mid-productivity, not low productivity. Information for the Searsburg and Sherman Reservoirs is lacking on this question.

The Applicant states that clear waters are a factor in limiting littoral zone community development. In fact, clear waters favor the establishment of submerged and floating-leaved aquatic plant communities by allowing light to penetrate and plants to photosynthesize (Hammer, 1992). In Hammer's evaluation of the necessary considerations when designing new wetlands, turbidity, salinity, and low pH (e.g. 4.0) are the only water quality limitations for macrophyte establishment. Neither low pH, salinity, or turbidity are concerns at the Deerfield Reservoirs.

I concur with the Vermont Agency of Natural Resources that littoral zone development is limited mainly by extensive winter reservoir drawdowns (VANR,1995). Water level stabilization in summer will not eliminate or compensate for community losses suffered by biota from winter drawdowns.

Soils

In general, soils in the region are glacial till soils, generally loamy soils, often with a fine sand as the dominant inorganic constituent. Loamy soils are the most common wetland soil in Vermont (USDA, 1989). The only limitation that these soils have are that they are currently not wet enough to support hydrophytic (wetland) plants. Upon wetting, these soils would provide an adequate anchor and substrate for wetland plant development.

Many species of submerged, floating-leaved and emergent plants are found in submerged loamy mineral soils (Thunhurst, 1993). For example, the common waterweed, pond plants (Potamogeton sp.), and wild celery grow in a wide variety of soils including sandy and silt loams. Emergents such as water plantain, blue joint grass, bulrushes (Scirpus sp.), and cattails are commonly found in hydric loamy mineral soils (Thunhurst, 1993).

Muck soils appropriate for the development of littoral zone communities already exist at the reservoirs. Volume XVII, Appendix 13 documents extensive areas of wetland soils where NEPCO has proposed to build water-retaining diked impoundments to hold back water and create functional littoral zones. Up to 53 acres of appropriate soils at the Somerset Reservoir were considered for this type of mitigation. Generally these areas are on shallow slopes and are silt or muck soils.

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VNRC-49. Comments noted. There is no proposal at this time to build water-retaining diked sub-impoundments at Somerset.

It is my opinion that constructing dikes would create disfunctional sub-basins with altered nutrient dynamics, altered hydrological exchanges with the main reservoir, potential warming in summer and freezing in winter, and the dikes would present barriers to movement of fish and wildlife in certain seasons.

Worden soils (poorly drained/wetland soils) typically have shallow slopes and are found along over 9 miles of Harriman's shoreline (Stetson-Harza, Figures 1 & 2). This is greater than one-third the length of the entire shoreline. Some of the these soils are found in relatively protected reservoir regions (less fetch and not a N-S orientation) and wetland communities, including a diverse perennial flora would be expected to establish in these areas.

There are extensive shoreline areas that consist of rock/cobble substrate. These shoreline reaches originally consisted of loamy and sandy soils that have been subject to extensive water fluctuation, and, overtime, erosion of fine soil materials. Under conditions of a stabilized water regime, fine material would, over time, become stranded and accumulate in some of these areas. Hardy emergents such as cattails would become established. Organic matter would accumulate (from internal [cattail litter] and external sources [such as leaf fall]) and soil development would proceed over time (Carpenter and Lodge, 1986). As additional organic material accumulates with time, a wider-variety of aquatic macrophytes able to live on a broader range of substrates would colonize these areas adding further organic matter to the substrate. Eventually a less stressful environment would favor a diversity of aquatic plants. This process of soil modification and development and subsequent plant succession is a naturally occurring process in lake ecology as well as terrestrial ecology.

Slopes

The slopes at the three (no information for Sherman was reviewed) reservoirs range from moderately flat to steep. Upon examining the limited topographic information and soils mapping for the nearshore environments for the three reservoirs, it is clear that extensive areas with slopes shallow enough for littoral zone wetland establishment are present. Wetland restoration guides recommend that reconstructed wetland slopes (this would be primarily for emergent vegetation) be approximately 1:5 to 1:15 or 6-20% or less (D'Avanzo, 1987). This roughly corresponds to soil survey mapping units designated A-C (C slopes in Windham County have slopes of 8-15%).

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VNRC-50. No response required.

A quick review of the Shoreline Soil Delineation Maps provided by Stetson-Harza (Figures 1 & 2) or the Windham County Soil Survey (maps # 59, 60, 70, 71, 100, 101, 108, 109, 117, 118) reveals extensive shoreline areas with C slopes or less on both the Somerset and Harriman Reservoirs. (U.S.D.A., 1987) At the Somerset Reservoir there are considerable low slope areas at the northern end of the reservoir associated with bays, inlets, and islands. Scattered throughout the remainder of the reservoir are areas of worden (bays throughout), mundal (especially the east shore), and markey soils all of which have relatively shallow slopes (<15%) and consist of soil materials conducive to wetland plant development. The worden and markey soils are loams and are only limiting to the development of hydrophytic plant growth by a lack of water. A stabilized water regime with inundation would address this limitation.

At elevations between 1470-1480 Somerset Reservoir has extensive flat shelves in more than one area that could provide appropriate areas for the establishment of littoral zone communities.

The Searsburg Reservoir soils maps are not available and the extent of shallow-mild slopes is not known. However, a site visit to the reservoir (July 1995 at very low water) revealed extensive shallow slopes (10%), loamy soils with considerable organic material, and several small protected bays where littoral vegetation could become established. Bathymetric maps also show some shoreline areas and islands with relatively shallow slopes surrounding them.

The Harriman Reservoir has shallow slopes and appropriate wetland substrate at its north end, south end, and in protected bays throughout the reservoir. These areas would develop more diverse, productive littoral zone communities if water levels were stabilized and winter drawdowns were limited. Fringe littoral zone communities would develop along shoreline areas of the main reservoir body where wave action is not limiting. Worden soils (poorly drained/wetland soils) typically have shallow slopes and are found along over 9 miles of Harriman's shoreline. This is greater than one-third the length of the entire shoreline. Some of the these soils are found in relatively protected reservoir regions.

Light Levels/Turbidity

Information on water clarity at Harriman and Somerset Reservoir's indicate that these are not highly turbid waterbodies. Secchi disc readings are generally in the 10 ft. depth area for Harriman indicating a possible photic zone depth of 20 ft. This strongly suggests that photosynthetic plant

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VNRC-51. No response required.

life could develop down to considerable depths where conditions are appropriate. Somerset secchi readings average about 13 ft. indicating a potential photic zone depth of 26 ft. The development of shoreline littoral zones consisting of a diverse and multi-storied canopy is not limited by light in these reservoirs. Information concerning the Searsburg and Sherman Reservoirs is not available.

Wetland communities already present at these reservoirs (Countryman, 1991) would provide seed sources for the establishment of new littoral zone/wetland plant communities. Other plants not currently found in the reservoirs would colonize from other nearby water bodies with plant/seed sources. Boaters, birds (shorebirds, waterfowl), fish, and other aquatic animals (as well as stream flow from the Deerfield River) are all known to disperse aquatic plant seeds, rootstock, and vegetative material.

The other biological components of a lake/reservoir littoral zone are likely already present in the reservoirs as well. Microbial populations, macroinvertebrates, fish, avian, amphibians and reptiles, and mammalian communities would, of course, take some time to become established in newly available littoral habitats. The relative proximity and mobility of colonizing populations of these groups would play an important role in determining the length of time required for full life zone development.

Summary

A review of the record and the DEIS shows that insufficient study has been devoted to assessment of reservoir stabilization alternatives to mitigate the impacts of project operations on the ecology and productivity of the project reservoirs. As a result, the DEIS and the application lack important information necessary to assess reservoir productivity and littoral zone development. Based upon the limited available information and a review of the literature, it is my opinion that water level stabilization in the Deerfield River reservoirs would allow establishment of littoral life zone vegetation in appropriate locations along reservoir shorelines. The extent of littoral zone establishment would differ between the four reservoirs. The amount of littoral zone vegetative development at each reservoir would be highly dependent upon what range of water levels the reservoirs were managed at under a water stabilization program. Given the information provided by the applicant, a determination of the extent of littoral zone development or its overall importance to reservoir ecology and fish and wildlife is impossible to conclude. This is especially the case

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VNRC-52. We agree with the conclusion that water level stabilization in the Deerfield project's reservoirs would likely allow the establishment of littoral zone communities in appropriate locations along the reservoir shorelines. Existing littoral communities would likely become more productive and diverse. Nevertheless, as noted in Section 5.4, staff's preferred alternative consisting of the Settlement, Cultural Resources Management Plan, and the legally valid WQC conditions, is well balanced and provides for the comprehensive development of the basin.

for the Sherman Reservoir for which very little information was made available.

Productive littoral zones with a diverse multi-canopy structure would not likely become established in the most wind exposed, steep sloped and rocky regions of the reservoirs. However, littoral zones would become established in narrow fringes along less exposed rocky shorelines. These communities would build and diversify over time and would help stabilize shorelines. More extensive littoral zone communities would develop where slopes are shallow, where soils already have some finer material, and where communities are protected. The addition of these littoral zones would greatly enhance the fish and wildlife value, as well as recreational value of the reservoirs.

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COPY

Mona M. Janopaul
Conservation Counsel

96 APR 22 PM 3:00

April 22, 1996

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: Draft Environmental Impact Statement No. 0185
Deerfield River and Gardners Falls, Project Nos. 2323 and 2334 -012 -001

Dear Ms. Cashell:

Attached, please find the original and eight copies of comments written by members of the Trout Unlimited ("TU") Deerfield/Millers Chapter on the above-referenced Draft Environmental Impact Statement.

A copy of these comments will be provided to each person designated on the service list for this proceeding. If any party has questions about the attached comments, please contact either Charles Olchowski at (413) 773-5352 or Donald Pugh at (413) 545-3734.

Thank you very much for the opportunity to provide these comments.

Sincerely,

Mona M. Janopaul by KHC

Mona M. Janopaul

cc: John Clements, Director, Division of Project Review, OHL
Service list

Trout Unlimited: America's Leading Coldwater Fisheries Conservation Organization
Washington, D.C. Headquarters: 1500 Wilson Boulevard, Suite 310, Arlington, VA 22209-2310
(703) 522-0200 • FAX (703) 284-9400 • CompuServe: 70534,3234 • America Online: TroutU@aol.com

DEERFIELD RIVER PROJECT (NEPCO) FERC No. 2323

A review of the DEIS would indicate that FERC staff incorporated most of the terms of the Offer of Settlement into their findings and conclusions. We find this quite encouraging in light of the numerous studies conducted, data analysis and the long negotiation sessions that the signatories endured to reach accord.

TU-1. See revised Sections 4.1.1.6 and 5.6.

TU was disappointed that FERC did not adopt the provision of the Enhancement Fund into the license. The Enhancement Fund concept was first discussed in creating the Deerfield River Comprehensive Management Plan (DRCMP) where it was envisioned that such a source of funds would allow more relevant and timely expenditure of funds for projects that manifested themselves over the course of a thirty or forty year license. We believe that NEPCO will live up to providing all of the recreational enhancements in the settlement, but there simply is no way to anticipate future needs or new conditions that require a source of funds to assure recreational opportunities remain completely viable and utilized. Certainly if an issue arose where NEPCO refused to fund a project with moneys from the Enhancement Fund and a party sought relief through FERC, at that time FERC could refuse to intervene due to lack of jurisdiction. We do not anticipate such an issue reaching that level, but if the scope of the Enhancement Fund was more focused, it could be incorporated into the license and become a valuable tool in assuring recreational enhancements are maintained.

GARDNER FALLS PROJECT (WMECO) FERC No. 2334

We do have some serious problems with the conclusions made by staff relative to the Gardner Falls Project.

Bypass Reach Flows

After carefully examining the IFIM data and other available information and understanding this project's relation to the flows from and to the projects above and below Gardner Falls, TU and both the Federal and state fishery agencies were in agreement that the bypass reach should be prioritized for brown trout. This species was the focus in that a constant and continuous flow of 150 CFS was possible to maintain yearround. Such a flow was well suited for all life stages of this species and allowed a holdover capability. While TU believes that some Atlantic salmon will utilize this reach, the Massachusetts Division of Fisheries and Wildlife (MADFW) has no present plans to stock this section. So at best, this section will possibly have "drop-downs" from stocking upstream of this project. FERC staff itself indicates that utilization of this section of river by juvenile Atlantic salmon would only be of a transient nature. Therefore, TU concludes that management for Atlantic salmon in the bypass reach would be imprudent and that brown trout should be the species managed for in these waters. TU believes that 150 CFS is a flow that balances brown trout and rainbow trout utilizing the bypass reach while also considering the potential use of this section by some juvenile Atlantic salmon.

TU-2. See response to DI-7.

The water temperature issue initially raised by the utility is specious at best and should be recognized as such by FERC staff. One can only believe that under normal water flow conditions at 150 CFS, that the potential to maintain water temperatures conducive to maintaining and holding over brown trout is entirely plausible. Studies done under the current license reflect temperatures of mere trickles as opposed to the proposed regime. Further, the shutdown of the Yankee Atomic Plant in Rowe will only improve (decrease) the flow temperature. Water temperatures with those flows would be similar in both the bypass and powerhouse reaches.

This reach will also provide a unique angling opportunity as a controlled flow of 150 CFS would be maintained even under high flow or storm event conditions of up to 1500 CFS or more. Thus, it will provide waters suitable for fishing while the main flows remain too high and too dangerous for such activity. The bypass reach is also quite accessible to the fishing public.

At a flow of 150 CFS, the bypass reach will be ideal for wading, the fishing technique of preference in this type of water. Furthermore, this reach is the only actual section suitable for this approach to fishing in the project area. The section below the powerhouse is too channeled without any shallows, and therefore is not wadeable. As such, this wading angling opportunity should be considered as a significant benefit to the fishing public.

TU maintains a position of requiring a constant minimum flow of 150 CFS for the bypass reach. If staff is still considering inflow, at least a minimum of 100 CFS should be maintained at all times into this stretch. In conducting this evaluation, staff should consider the Gardner Falls Project's ability to supplement a 100 CFS flow to reach and maintain a 150 CFS flow from storage capacity and the minimum flows provided from No. 3 of the Deerfield River Project. This is especially critical during the low flow months of July, August and September.

Wilcox Hollow

A considerable amount of time was spent by various committees in drafting language for the Deerfield River Comprehensive Management Plan that best reflected what would be the ideal use and atmosphere for the Wilcox Hollow area. This river stretch was the subject of a lot of discussion due to the fact that it is a beautiful, pristine riverscape, known and utilized only by a small percentage of the population, notwithstanding its proximity over a rough and inconspicuous access road from Route 2. The general sentiment was to keep this area primitive as possible and to only improve in harmony with this perspective. This is reflected in Goal VI of the DRCMP under its objective where it states, "Develop and upgrade appropriate facilities for recreation while maintaining aesthetics and protecting [the] environment."

What the Committee members envisioned was seasonal restroom facilities, as permanent structures would interfere with the primitive nature of the setting. Although the choices for such facilities may be limited, it was intended that they harmonize as best as possible with the surroundings. With either choice, there is always the specter of vandalism as the area is remote enough to shelter such destructive activity from detection.

The Committee also recommended that the road remain unimproved and only a fifty or sixty foot section near Route 2 be paved to increase safe ingress and egress. It was felt that the road was adequate and that there was no history of accidents on the road or at the access point on Route 2

Disabled person access was a sensitive and delicate issue to discuss. No one certainly wants to deprive a disabled person from enjoying the same natural beauty of this area that others could experience. The main problem was that any aide for disabled boaters, whether it be a rail, ramp, dock or similar structure or device or a combination thereof, could conflict with maintaining the

TU-3 While we agree that excessive development at the Wilcox Hollow area would detract from its natural character, we concluded that recreational enhancements were needed to accommodate access opportunities in the Gardners Falls tailwaters. Current use at this site is minimal, yet, because this area is stocked with rainbow and brown trout by the MA DFW to support a put-and-take fishery, we conclude that access improvements would attract more angling use to this area. We also conclude that WMEC's proposed access enhancement measures to improve angling opportunities in this area would not compromise the area's natural character.

We agree that providing seasonal, rather than permanent, restroom facilities at the Wilcox Hollow area are consistent with the undeveloped character of this site, and we recommend that WMEC provide seasonal restroom facilities at this site in consultation with the National Park Service, the MA DEM, and the MA DFW.

We agree with WMEC's proposal to pave the Wilcox Hollow area access primitive nature of this reach. The Committee reasoned that such areas as the section above NEPCO No. 4 should be more thoroughly explored because the access is excellent along Route 2 and the impoundment area was also less prone to dangerous flows and pool level fluctuations. It is urged that this approach be adopted and that FERC evaluate all the project areas being considered for a new license and not limit themselves to each project to provide barrier-free access. There are not many remote sections on the Deerfield River. Therefore it would make sense to balance this fact with the need for disability access prudently and common sensically.

road entrance and further improve the gravel access road. Paving the access road entrance is needed to improve safety conditions for vehicles entering and existing this area.

While we recommend WMEC's proposed boat launch at Wilcox Hollow to improve access for individuals with disabilities, we also recommend that WMEC finalize their planned improvements with the MA DEM to minimize any adverse effects to the site's undeveloped character

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OFFICE OF THE SECRETARY
96 APR 22 AM 9:31
FEDERAL ENERGY REGULATORY COMMISSION

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

New England Power Company	)	Project No. 2323-12
	)	
Western Massachusetts Electric Company	)	Project No. 2334-001

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE DEERFIELD RIVER PROJECTS BY AMERICAN RIVERS, AMERICAN WHITEWATER AFFILIATION, APPALACHIAN MOUNTAIN CLUB, CONSERVATION LAW FOUNDATION, DEERFIELD RIVER COMPACT, DEERFIELD RIVER WATERSHED ASSOCIATION AND NEW ENGLAND FLOW

American Rivers, American Whitewater Affiliation, Appalachian Mountain Club, Conservation Law Foundation, Deerfield River Compact, Deerfield River Watershed Association and New England FLOW jointly submit the following comments on the Draft Environmental Impact Statement for Deerfield River Projects, Vermont and Massachusetts, February, 1996 (DEIS). Our organizations represent over 100,000 members of the public with a direct interest in the improved management of the Deerfield River. We seek the relicensing of the above-captioned projects in full compliance with the Federal Power Act, the National Environmental Policy Act, and applicable state water quality standards. Many of our members use the Deerfield River for recreation, including fishing and boating.

Since as early as 1989, our organizations have been involved in collaborative negotiations with New England Power Company (NEP). These negotiations resulted in a comprehensive, basin-wide agreement, signed in 1994, that assures improved management of the watershed consistent with state and federal law. The Offer of Settlement (Settlement) calls for significant enhancement of the Deerfield River's fish, wildlife, forestry and recreational resources as a condition of relicensing the dams. The Settlement was submitted to the Commission in October, 1994 by NEP as an application amendment.

Our organizations are pleased that the Commission's staff has recommended the issuance of new licenses that contain operational conditions consistent with the Settlement. The DEIS states unequivocally that,

> Based on our independent review and evaluation, Staff recommends relicensing the Deerfield River Project as proposed by NEP in the Settlement ... Staff also recommends approving almost all aspects of the

settlement and amending the license to Bear Swamp Pumped Storage Project, upon receipt and notices of an amendment application.

DEIS at xvi.

Our organizations request that the Commission now act in a timely fashion to issue a Final EIS and licenses that implement staff's DEIS recommendations and the Settlement's terms -- with only minor modifications recommended herein.

I. General Comments on DEIS

AR-1. Comment noted. See also our response to comment VNRC-2.

We commend FERC for preparing a basin-wide environmental impact statement for the hydroelectric projects on the Deerfield River rather than examining individual dams in isolation and deferring most mitigation of cumulative impacts.

As the Commission is aware, the Deerfield River watershed is an outstanding resource, providing important energy production, recreation, and ecological values. However, the ecological health of the Deerfield River has been adversely and cumulatively affected by a series of ten dams in addition to related water diversions and hydroelectric generating facilities.

Under the Federal Power Act, FERC must accurately assess these cumulative impacts from a comprehensive, watershed basis before relicensing any hydropower project. NEPA further requires the Commission to evaluate the cumulative impacts of proposed relicensing actions so that the combined environmental impacts of all related actions are considered.

Our organizations have long insisted that FERC's cumulative impact analyses should be conducted on a river basin or watershed basis to include all hydropower projects and other facilities in the basin whose environmental impacts are cumulative with the projects under review. Cumulative impact analyses are essential because, as opposed to single-project assessments, they capture the full range of environmenal impacts. Single project assessments fail to account for the complex interactions among the physical, chemical, and biological components of a system. Cumulative impacts analyses, on the other hand, account for these interactions by using an ecosystem-based approach and collecting scientifically sound baseline data.

Cumulative impact analyses are also consistent with national policy. For example, President Clinton, EPA, the Department of Interior, and the U.S. Forest Service each have established initiatives that adopt an ecosystem-wide approach to solving longstanding environmental problems.

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Unfortunately, in the past, FERC has rejected an ecosystem approach and limited its cumulative impacts assessment both spatially and temporally. The Commission has refused to analyze the impacts of all projects and activities in a watershed that interact cumulatively with the projects being relicensed.

However, with issuance of the Deerfield DEIS, FERC appears to be taking a new approach to relicensing that addresses the cumulative impacts of multiple hydroelectric projects on all non-power values from a comprehensive, basin-wide perspective. We strongly endorse and applaud this new direction.

The Deerfield DEIS is truly a comprehensive environmental review. It considers the combined, cumulative impacts of all of the hydroelectric projects in the Deerfield River Basin. It ignores individual project boundaries and treats the river as an ecosystem, not as a series of isolated dams. It recognizes the importance of analyzing the cumulative impacts of multiple projects in the same river basin. It properly identifies the ecosystem boundaries to include the entire affected watershed -- from the East Branch of the Deerfield to the mainstem river to its confluence with the Connecticut River. It also considers the cumulative impacts of land use practices occurring on adjacent watershed lands.

For example, the DEIS states,

> For recreation, land use, and aesthetic resources, the geographic scope of anlaysis will encompass the East Branch and mainstem Deerfield River from the headwaters of the Somerset impoundment downstream to the confluence with the Connecticut River, including all impoundments and riverine reaches.

DEIS, 1-6.

The Commission also correctly notes that a proper cumulative impact analysis must encompass all past, present, and reasonably foreseeable future projects in the basin, regardless of license status, and their effects on water quality and quantity, fishery resources, wetlands, recreation, land use, aesthetics and hydropower generation. DEIS, 1-7.

Furthermore, the Commission's treatment of NEP's Bear Swamp project illustrates that the Commission intends to use information generated by its cumulative impact analysis to improve management throughout the watershed. The DEIS properly

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considers the impacts and needed enhancements at NEP's Bear Swamp project, even though its license does not expire for many years. Based on the cumulative impact analysis, FERC correctly directs NEP to file an amendment application for the existing Bear Swamp license in order to mitigate all cumulative impacts at all projects in the basin. Rather than wait for a reopener petition or for the Bear Swamp license to expire, FERC correctly uses the information generated in its cumulative impact analysis to require immediate implementation of year-round fishery flows and recreational whitewater releases at Bear Swamp. This is the right approach and, again, we applaud FERC's new direction.

Our organizations do have one concern regarding the DEIS analysis. As we have stressed consistently to FERC, the Commission continues to use the wrong "baseline" in its environmental analyses. Relicensing an existing hydroelectric project is not a "mere continuation of the status quo," but instead a new "irreversible and irretrievable commitment of a public resource," requiring new federal authorization. Confederated Tribes and Bands of Yakima Indian Nation v. FERC, 746 F.2d 466, 476 (9th Cir. 1984). "The decision to relicense requires the same inquiry as original licensing..." Id. Therefore, the proper baseline to determine ecological degradation and corresponding mitigation is watershed conditions without the dams, not current degraded conditions.

However, the Deerfield DEIS defines baseline conditions improperly by assuming that "current hydro power operations in the Deerfield River Basin (including all projects and developments) remain in effect." DEIS, 2-19. In other environmental reviews in which FERC has improperly defined the NEPA baseline as the "status quo", the entire NEPA analysis has been skewed because the Commission has ignored the past effects of existing hydropower developments and then subordinated environmental resources to power production.

Fortunately, in the Deerfield DEIS, despite the improper definition of baseline, FERC has made a reasonable effort to describe past cumulative impacts caused by existing dam operations. Further, FERC staff has recommended significant mitigation and operational changes to NEP's dams that address these past cumulative impacts. Therefore, the use of an inappropriate baseline does not appear to have affected FERC's obligation to give equal consideration to power and non-power values of the Deerfield River. However, we again urge the Commission to reconsider its approach to the baseline issue in the final EIS and in subsequent relicensing proceedings.

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II. New England Power Company's Projects

In recent years, the Commission has moved more aggressively to assist settlement processes and collaborative relicensing efforts. In the case of NEP's Deerfield River projects, we commend the Commission for working with our organizations, federal and state agencies, and NEP to approve and implement the Settlement agreement.[1]

The Commission's endorsement of the Settlement's terms in new licenses is a prerequisite to the agreement's implementation and the resulting improvements in watershed management. Under the Settlement's terms, the agreement does not become effective unless the Commission's licenses and the state 401 certifications are issued with conditions consistent with the agreement.

We are pleased that the text of the DEIS indicates that the Commission intends to issue licenses consistent with the agreement and with the state 401 certifications.

In Massachusetts -- as the DEIS notes -- the state 401 certification is consistent with the Settlement and FERC's DEIS recommendations.

As for Vermont, the DEIS accepts the Vermont 401 certification's terms. We note that there are some minor discrepancies between the Settlement's terms and the Vermont 401 certification conditions-DEIS recommendations.[2] However, in each such case, the DEIS/401 conditions are more protective of non-power values, and, therefore, not inconsistent with the agreement from our perspective.

In summary, the DEIS endorsement of the Vermont 401 certification causes no concern to our organizations. However, if NEP has concerns, we suggest that any differences between the

[1] For example, the Commission (1) held a public meeting in 1994 to review the draft Settlement and provide guidance to our organizations and NEP in our negotiations, (2) publicly noticed the final Settlement agreement for public comment, and (3) included the Settlement agreement's terms as the proposed action in the DEIS.

[2] For example, under the 401 certification and DEIS recommendation, the elevation of Somerset reservoir must be maintained within +/- 3 inches from May 1 to July 31. The Settlement sets the limit at +/- 1 foot during this period.

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AR-2. No response required.

settlement and the 401 certification be worked out between the Commission, the State of Vermont, and NEP.

We now wish to comment on specific provisions of the DEIS relative to the Settlement.

<u>Land Protection</u>

In the DEIS, FERC correctly concludes that substantial watershed land protection around NEP's projects, as called for by the Settlement, is consistent with FERC regulations and necessary to protect the river's non-power values. DEIS at 4-46. The DEIS also endorses license conditions that require implementation of a progressive forest and wildlife management plan negotiated in the settlement. DEIS, 4-37, 5-26.

Throughout the DEIS, FERC properly notes the direct relationship between watershed land management and the river's fishery, aesthetic, and recreational values.

As the DEIS states,

> Protecting these properties provides a buffer zone around project waters that is consistent with the Commission's Regulations... We conclude that NEP's conservation easements along the Deerfield River ensure long-term public benefits, protecting aesthetic resources and access to project waters and surrounding land...

<u>Id</u>.

The DEIS also notes that NEP's land management practices cumulatively affect the river and that continued protection of these lands through license conditions would prevent adverse cumulative impacts on the river basin's resources.

The DEIS states,

> Today, NEP owns a significant portion of the shore land along the Deerfield River and their land management practices cumulatively affects land use and development along the river.
>
> * * *
>
> While the lands surrounding the Deerfield River are primarily rural and residential,

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AR-3. No response required.

> the current local zoning laws in Massachusetts offer little protection against future develoment along this stretch.
>
> * * *
>
> NEP's Deerfield Project boundary provides an extensive buffer zone along most of the river corridor in Vermont and significan portions of the river corridor in Massachusetts. NEP owns significant segments of the Deerfield River shore land that has potential development value, and these properties are likely to increase in value due to the river basin's growing tourism industry. Continued protection of these properties from future subdivision, shore land development, inappropriate forestry practices, and agricultural activities would help prevent adverse cumulative effects on the river basin's fisheries, wildlife, aesthetic, and recreation resources.

DEIS, 3-9, 3-10.

Finally, the DEIS emphasizes that shoreland protection is a key element to implementing a comprehensive, basin-wide approach to relicensing. For example, the DEIS notes the importance of NEP's implementing a specific forest management plan as a condition of relicensing in order to protect watershed resources and the river's overall water quality. The DEIS states,

> The Forest Management Plan in conjunction with conservation easements on lands along the Deerfield River is important to the protection of terrestrial species. ... This enhancement measure ... minimiz[es] adverse effects to the water quality of the river basin through sedimentation... In addition, the proposal is consistent with both Vermont and Massachusetts' Deerfield River Comprehensive Plan.

DEIS, 4-37.

Many of our organizations have argued consistently that the Commission has both the authority and responsibility to protect significant amounts of watershed lands surrounding projects and to require good land use management practices in order to

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safeguard river values. We also have stressed the inadequacy of FERC's past reliance on zoning regulations to protect shorelands from inappropriate development. In this DEIS, the Commission demonstrates its strong acceptance of these principles.

We commend FERC for recognizing in the Deerfield EIS that shoreland protection and proper land use management is an important consideration in relicensing and an appropriate condition of new licenses. We hope FERC's approach on the Deerfield will guide FERC's review of other projects throughout the country.

Decommissioning

Our organizations are disappointed with the Commission's failure to discuss decommissioning in the DEIS. We expect this was an oversight and we request that FERC correct this deficiency in the final EIS.

Under the Federal Power Act, denial of a license is a reasonable option that must seriously be considered as part of every licensing evaluation. Each of these dams has a finite life and FERC must plan for the possibility of decommissioning such that the public does not get saddled with the fiscal responsibility for dam closure and removal.

The Settlement agreement specifically addresses decommissioning. In the agreement, NEP acknowledges its responsibility to plan for decommissioning and to collect funds for eventual project retirement. Unfortunately, the DEIS never mentions decommissioning or the commitments made by NEP in the settlement agreement.

There is substantial evidence and strong policy reasons for the Commission to endorse the Settlement's provision for decommissioning. NEP is one of the first federal license holders to acknowledge its responsibility for future retirement of its dams. FERC should applaud NEP's willingness to address the decommissioning issue with a precise commitment to plan and fund project retirement.

Furthermore, the Settlement's decommissioning provision is fully consistent with the Commission's Policy Statement on Project Decommissioning at Relicensing issued December 14, 1994. This new policy concludes that FERC has authority to order decommissioning. The policy also states that FERC will address funding obligations of licensees on a case-by-case basis. The policy goes on to state that, where supported by the record, the Commission will impose license conditions to assure that funds

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AR-4. The Settlement specifically addresses decommissioning as a potential future action not as an alternative to licensing the project now. This is a procedural measure that relates indirectly to the environmental enhancements described elsewhere in the Settlement. The Commission's order on relicensing will address this measure.

are available to do to job when the time for decommissioning comes. Finally, the policy confirms that "the Commission will be receptive to proposals, concerning pre-planning and pre-funding of decommissioning costs, reached by mutual agreement during the course of individual licensing proceedings or during the term of a license."

Here, the Deerfield Settlement's decommissioning provision clearly reflects FERC's policy guidance on decommissioning. The provision was reached by mutual agreement of NEP and our organizations. The agreement creates clear record support for the decommissioning provision that the Commission must not ignore.

We urge the Commission to endorse the Settlement's decommissioning terms in the Final EIS and in its licensing decision.

Enhancement Fund

AR-5

The DEIS rejected the provision in the Settlement that establishes an enhancement fund. The Commission does find that the enhancement fund "will provide a benefit to the public and for that reason commends NEP for its agreement to provide funds." DEIS, 4-47. However, having made this finding, inexplicably, the Commission then states that it does "not recommend that the provisions of the Settlement establishing the Deerfield River Enhancement Fund be included in the license."

The Commission's primary reason for rejecting the fund is that the use of the fund "may or may not relate to the project and, therefore, may or may not be within the Commission's jurisdiction." DEIS, 4-47 (emphasis added). This project-specific rationale conflicts with the Commission's treatment of the hydropower system from a basin-wide perspective and ignores the express language of the Agreement that requires funds to be used only if related to the river.

First, the DEIS considers the Deerfield dam projects and the river as an integrated system, not as a series of isolated projects. FERC does not restrict its analysis to the individual project boundaries but considers power and non-power benefits for their basinwide contribution. Similarly, FERC must not reject an enhancement fund because it is not specific to an individual project. The Fund is designed to address basinwide recreational needs that are not specific to one project.

Second, the Settlement makes it clear that use of the funds must be related to the river and consistent with FERC-approved

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AR-5. See revised Sections 4.1.1.6 and 5.6.

comprehensive plans. The agreement states that the funds must be used for environmental protection, education, and recreation activities "directly related to the Deerfield River watershed." Section IV.C. Projects must also "be consistent with those plans accepted by FERC as Comprehensive Plans for the Deerfield River." Id. Under the Federal Power Act, FERC must issue license conditions that will ensure projects "will be best adapted to a comprehensive plan for improving or developing a waterway" and must ensure projects are continually consistent with comprehensive plans. 16 U.S.C. § 803. Therefore, the Commission clearly has jurisdiction to authorize an enhancement fund specifically designed to implement state comprehensive plans and to improve the river's non-power values during the terms of new licenses.

Finally, the Commission is charged under NEPA with the responsibility to determine how resources may be cumulatively affected by all projects in the past, present, and future. It is wholly consistent with NEPA, if not required, that the Commission consider and implement an enhancement fund designed to address basinwide cumulative impacts, both those recognized today and those that may not be foreseen today.

We urge the Commission to reconsider its rejection of the enhancement fund. At a minimum, the Commission should provide us with some guidance on under what conditions such an enhancement fund would be acceptable.

III. The Western Massachusetts Electric Company Project

AR-6 The DEIS treatment of the Western Massachusetts Electric Company (WMEC) Project is not consistent with its treatment of NEP's projects in requiring significant environmental enhancements as a condition of relicensing. The State of Massachusetts, the Department of Interior, and our organizations strongly recommended that the Commission condition the WMEC relicensing on establishment of conservation easements along the project impoundment and creation of an enhancement fund. Without adequate explanation, the Commission staff rejects these recommendations.

Conservation Easements

All the reasons the Commission cites in the DEIS to support establishment of substantial conservation easements at NEP's projects apply directly to WMEC's project. There is no explanation for the Commission's disparate treatment of the shoreland buffer issue at Gardners Falls.

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AR-6. We disagree. We conclude that the current Gardners Falls Project boundary adequately protects aesthetic resources and public access opportunities in the project area. We also believe that our treatment of Gardners Falls is consistent with our treatment of NEP's project in requiring environmental enhancements as a condition of relicensing based on the size and impact of each respective project. Our recommendations were based on the particulars of each project and based on the nondevelopmental and developmental resources they affect. the Commission may require buffer zones around project waters to preserve aesthetic and recreational resources when such measures are warranted.

FERC previously has determined that there is a need for license applicants to acquire sizeable buffer zones to protect project lands. Alabama Power Co., 3 FERC ¶ 65,246 (1978), aff'd 12 FERC ¶ 61,059 (1980). As the Commission notes in the DEIS, its regulations require establishment of buffer zones around project waters to preserve aesthetic qualities and public access.

The lands along the Gardners Falls project's impoundment, bypassed reach, and power canal are already owned by WMEC. Therefore, the recommended easements will entail no expense to the company. The Commission argues that since these lands are steep, there is no development potential and no need for land protection. This argument actually supports imposition of easements because if the land is truly not developable, as the Commission speculates, easements will entail no diminution in value of the lands to WMEC and impose no hardships on the company.

We again recommend that the Commission treat WMEC's project consistent with the Commission's recent approach to shoreland protection at NEP's projects and at projects on the Kennebec River. For example, at Kennebec Water Power's Moosehead project on the Kennebec, the Commission has determined that sizeable shoreland buffer zones should be provided in order to protect nonpower values. The Commission decided that a practical and cost-effective way to establish the necessary shoreland protection zones is to require the licensees to obtain necessary property rights and submit a shoreland management plan to help ensure that areas around projects remain undeveloped over the term of new licenses. DEIS for Kennebec River Basin, November, 1995. The Commission should follow the same approach at Gardners Falls.

Enhancement Fund

The Commission also rejected our recommendations for establishment of an enhancement fund. The DEIS states that the agencies and AMC provided no basis for the fund amount. The Commission also repeats the arguments it made for rejecting the NEP enhancement fund. Again, the Commission's arguments for dismissing creation of an enhancement fund are not reasonable and ignore the specific wording of the proposed funding mechanisms. AR-7

As stated above, expenditure of funds is conditioned specifically on direct relationship to the river and must be consistent with river comprehensive plans approved by FERC. In addition, the fund proposal expressly provides for FERC oversight to guarantee that any funded actions are used within

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AR-7. We conclude, that WMEC's proposed recreation plan would significantly improve recreation opportunities within the project area, providing recreation facilities that would meet foreseeable recreation demands. Their plan also includes O&M costs over the license term, ensuring the continual maintenance of the existing and proposed recreation facilities. While we cannot completely anticipate future needs at the project, we conclude that NEP's proposed recreation plan would satisfy existing and future recreation demands at the project. The Commission's Form 80 monitoring process would provide periodical review to determine needs unforeseen at the time of licensing. Depending on the outcome of the monitoring analysis, the Commission would have the option to request additional facilities it deems necessary.

The Commission considers and evaluates the recommendation for an enhancement fund under Section 10(a) of the FPA; that is, we must consider all aspects of the public interest in the use of the waterway by weighing, or giving value to, the resources the recommendation would affect. The environmental measures we recommend to the Commission are those measures where the benefit to the nondevelopmental resource balances or justifies the developmental costs. Without information to support the dollar value requested in the enhancement fun, we have no basis for recommending it to the Commission. See also revised discussion in Section 4.1.1.6.

We conclude that the recommended enhancement fund is not accompanied by supporting documentation showing specific public benefits related to project purposes gained by implementing the measure. Further, the enhancement fund recommendation lacks evidence to support the proposed dollar value, the recommendation identify projects, and distributed revenues from the fund may not specifically enhance opportunities related to project purposes.

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any jurisdictional constraints that the Commissions deems necessary.

Furthermore, the Commission is wrong to state that the amount of the recommended fund has no basis. The $50,000 figure was suggested by and represents the professional judgment of professional natural resource personel from the State of Massachusetts and the Department of Interior. See Letter from Margaret Van Deusen, State of Mass. to FERC, Dec. 8, 1994; Letter from Marie Rust, NPS to FERC, Dec. 1, 1994).

Again, we urge the Commission to reconsider its rejection of the enhancement for the Deerfield projects.

Flows

Finally, we strongly support the recommendations of the resource agencies that support a flow release of 150 cfs continuous minimum or inflow from NEP's No. 3 dam if such inflow is less than 150 cfs. This flow recommendation was justified by Massachusetts Department of Fish & Wildlife and DOI and included in the Massachusetts 401 certification. NMEC's 50 cfs proposal is inadequate to protect and enhance fishery resources as demonstrated by the federal and state resource agencies. The DEIS further confirms that the 150 cfs would "be best for all fishery resources." DEIS at 4-76.

AR-8. No response required.

Conclusion

Subject to the objections made herein, our organizations strongly support the Commission staff's DEIS recommendations for mitigation and enhancement of the Deerfield River hydropower projects. The Commission's endorsement of the Settlement ensures that the power and non-power values of the Deerfield watershed are given equal consideration and treatment. We again commend the cooperative efforts of NEP and the Commission to work with our organizations and state and federal agencies to improve the operation of these facilities to the benefit of all the river's values. We now urge the Commission to issue new licenses as soon as possible that implement all the terms of the Settlement, including license amendment of the Bear Swamp project, so that the river can be restored and improved in the public interest.

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Dated: April 18, 1996

Respectfully submitted,

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Appalachian Mountain Club
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ORIGINAL

CONNECTICUT RIVER
Watershed Council, Inc.

One Ferry Street, Easthampton, Massachusetts 01027
Headquarters: (413)529-9500 • Upper Valley: (603) 675-2518 • Lower Valley: (860) 528-3588
Facsimile: (413) 529-9501 • E-Mail: crwc@k12.oit.umass.edu

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96 APR 24 AM 10:01
FEDERAL ENERGY
REGULATORY
COMMISSION

April 17, 1996

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

RE: Deerfield River Projects, Vermont - Massachusetts
FERC Project Nos. 2334 - 001 & 2323 - 012

Dear Secretary Cashell:

I am pleased submit the following comments of the Connecticut River Watershed Council (CRWC) on the draft environmental impact statement (DEIS) for the above-referenced projects.

The Watershed Council is a nonprofit citizens group that was established in 1952 to promote the restoration, conservation, wise development and use of the natural resources of the Connecticut River watershed, of which region the Deerfield River watershed is an important part. We are a member of the Deerfield River Compact, which group developed the Deerfield River Management Plan that provided the basis from which the Settlement Offer ("the Settlement") was developed and the framework for its implementation.

CRWC endorses the Settlement without reservation and urges the FERC to adopt it as the basis for the Deerfield River Projects license. We wish to commend both the Commission for encouraging this cooperative approach to resolving conflicts that could have made this relicensing an adversarial proceeding, and New England Power for embracing it and for providing the resources that made it possible for the Deerfield River Compact to develop its comprehensive management plan.

We believe the Settlement, as presented, is important for several reasons. Foremost, it is a comprehensive approach to the dams affecting an entire watershed. This has resulted in a compromise agreement between competing interests that enhances the natural characteristics of the Deerfield River and provides for the economic needs of the license-holders. For this reason alone, the Settlement should be adopted by the Commission. It would have been difficult, if not impossible to achieve either of those purposes if the dams had been considered one by one. We are especially pleased at the inclusion of the Bear Swamp Project, FERC Project No. 2669, which would normally have been on a future licensing cycle.

The second reason why we consider the Settlement to be so important is that it provides a model for the relicensing proceedings for major hydroelectric facilities on the Connecticut River that are just getting underway, the Holyoke Dam (FERC Project No. 2006) and the 15-Mile Falls Project (FERC Project No. 2077). CRWC is already involved in both of these projects, as are most of the NGO signatories to the Settlement.

Protecting the Connecticut River since 1952

CRWC-1. No response required.

Re: Deerfield River Project -2- April 17, 1996

The Commission will be receiving detailed comments on the Deerfield River Projects DEIS from the consortium of NGO's that are signatories to the Settlement. I have had an opportunity to review those comments, and CRWC endorses them. I will therefore refrain from detailed comment on the DEIS.

To increase the effectiveness of the Deerfield River Projects and the Settlement as a model, I have a specific request. Most of the NGOs and local groups that have begun to work cooperatively on FERC Project No. 2006 (Holyoke Dam) are not parties to the Deerfield River Projects and have no direct knowledge of the Settlement. It would be extremely beneficial if these interests could receive copies of the final environmental impact statement for the Deerfield River Projects. CRWC can either provide the Commission with a mailing list, or we would be pleased to distribute copies (we would need 24 copies of the FEIS).

In conclusion, I wish to restate the Connecticut River Watershed Council's unreserved support for the Settlement Offer and urge the Federal Energy Regulatory Commission to adopt it as presented.

Sincerely,

Tom Miner
Executive Director

tm
cc: Distribution List

CRWC-2. We are providing 24 copies of the FEIS, as requested.

Erik Olsen
63 Bradford Street
Northampton, MA 01060

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96 APR 23 PM 1:07
FEDERAL ENERGY
REGULATORY
COMMISSION

April 19, 1996

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

RE: Comments on DEIS for: **Deerfield River Project** (FERC Proj. No. 2323) — 012
Bear Swamp Pumped Storage Project (FERC Proj. No. 2669)
Gardners Falls Project (FERC Proj. No. 2334) — 001

Secretary Cashell:

The following are my comments on the DEIS recently produced by FERC for the above noted projects. Prior to commenting I would like to note that my review and analysis of this document has been severely limited by the failure of your agency to provide me with a copy of the document in a timely manner. Despite the fact that I had earlier (12/7/95) requested that my name be added to the mailing list for these projects, I did not receive a copy of the DEIS until I called Mr. R. Feller (on 3/25/96) and requested one. Because of this I did not receive this document until the first week of April.

Owing to the extremely short time that I have had to review this DEIS, the following comments are limited to a few specific issues, and are somewhat general in nature. My comments are as follows:

(1) **Section 1.3.1.2 Temporal Scope.** This introductory discussion correctly recognizes the obligation of this document, as mandated by the National Environmental Policy Act (NEPA), to analyze past, present, and future actions and their effects on the environmental resources impacted. However, this document fails to adequately incorporate this temporal scope into its analysis and conclusions. Specifically, the existing Deerfield, Gardners Falls, and Bear Swamp projects are themselves past actions. Therefore, their existing effects should be considered as the consequences of past actions, and thus as pre-existing effects on the environment. They should not be used as baseline conditions, as is done throughout this document.

For example, to conclude that modifications included in the proposed projects pursuant to "the Settlement" would result in

EO-1. See our response to comment VNRC-2.

Lois D. Cashell, Secretary
April, 19, 1996
Page 2

"beneficial effects" or "improvements" is incorrect. The net effect of these actions may represent a reduction in the pre-existing adverse impact of these projects, but they in no way represent improvements to the environmental resources impacted by the continued operation of these projects.

In its present state this DEIS fails to fulfill the mandate of NEPA to adequately analyze the proposed project with respect to past, present, and future actions.

(2) **Section 2.5 Alternatives Considered But Eliminated From Further Consideration.** Pages 2-18,19 states "We don't regard this alternative as reasonable because it would result in the loss of substantial electric power generation in exchange for possible significant environmental impacts. For example, dam removal could result in sediments accumulated behind the dams to be washed downstream, lacustrine habitats could be converted to riverine habitats, and wetlands could be lost."

There is no logical basis for this conclusion based on the evidence presented in this DEIS. There are several readily available ways to mitigate for the sediment-related water quality effects resulting from dam removal. Such a mitigation might include controlled dredging in combination with water quality control measures. Furthermore, in the absence of federal or state-listed threatened or endangered species there is no logical basis for giving preference to one type of habitat--lacustrine--over another--riverine. A rigorous analysis would recognize that in the project area the former is a constructed environment, while the latter is naturally occurring.

EO-2. Comment noted.

(3) **Future Studies.** Throughout this document the analysis and conclusions rely on references to future studies to conclude that a proposed action would not pose a significant adverse effect. For example, p. 5-59, paragraph 4, states, "A monitoring plan would likely include studies that would be required to determine if the downstream passage facilities are operating effectively."

The reliance on future studies which may or may not indicate successful achievement of the assumed mitigation is logically inconsistent. Recent case law has consistently found that reliance on future studies is not an acceptable basis on which to conclude that an environmental effect will not be significant or adverse. One cannot presume that a future study will find ways to adequately mitigate for adverse environmental effects, and thus to conclude that no such adverse effect will result is specious and patently misleading. Furthermore, given the current political climate

EO-3. We disagree. Downstream fish passage facilities have been shown to enhance riverine fisheries. Monitoring is needed to verify that the facilities function as intended. If they do not, they must be modified so that they do function properly.

Lois D. Cashell, Secretary
April, 19, 1996
Page 3

in the United States, there is no basis for assuming that FERC will continue to exist as a government entity for the full-term of the license period being sought. Therefore, any future actions contingent on FERC's continued existence and participation are groundless.

The numerous cases throughout this DEIS where the conclusions about project impacts are based on agreements contained in the Settlement to undertake future studies is a major flaw in this document, and renders it legally inadequate under NEPA.

(4) **Trap and Truck Upstream Fish Passage.** The use of trap and truck methods to support anadramous fish migration should not be viewed as anything other than a short-term ameliorative measure. The problems associated with this method of fish passage are as various as they are well known. For this reason trap and truck is being rapidly phased-out in the western United States, where it has been employed more intensively than in the east, in favor of more permanent and efficacious structural methods. Among the problems associated with trap and truck are: (a) decreased success in spawning due to stress and injury; (b) predation at trapping sites; (c) the necessity for concerted and sustained effort indefinitely by public or private agencies who may or may not sustain this activity.

Unless evidence can be provided to the contrary, the DEIS should recognize that the reliance on trap and truck methods will severely impact the re-establishment of anadramous fish runs in the project area, and decrease the probability of ever achieving self-sustaining populations within the project area. The indefinite reliance on human intervention to achieve the re-establishment of anadramous species in the project area is an unacceptable consequence of this project and past actions. The historical extirpation of these species in this area should be recognized as an existing significant impact, and structural measures should be implemented to insure their permanent re-establishment.

(5) **Section 4.7, Irreversible and Irretrievable Commitment of Resources.** The discussion provided under this section is negligently inadequate, and is indicative of the degree to which this document is lacking in content and analysis. One example of discussion that should be included here but is not, is that this project area represents a significant portion (13% according to p. 3-3) of all the Atlantic salmon nursery habitat in one of the largest and most significant watersheds in New England--the Connecticut River Basin. The commitment of this large a portion of New England's Atlantic salmon nursery to any use warrants a comprehensive and thorough

EO-4. Any trap and truck facilities used to capture Atlantic salmon immediately below the No. 2 development dam would be interim fish passage measures employed seasonally until the permanent upstream passage facility is built at the No. 2 development dam.

EO-5. We disagree. The conclusion that 13 percent of Atlantic salmon nursery habitat in the Connecticut River watershed exists in the Deerfield River takes into account the current status of the East Branch of the Deerfield River and the mainstem of the Deerfield River, i.e., with hydroprojects. Atlantic salmon access to the spawning habitat within the watershed is the crux of the problem. Under conditions described in the EIS, upstream and downstream fish passage facilities would be constructed. These fish passage structures will contribute to the success of Atlantic salmon in the Connecticut River Basin. It is difficult to place a

Lois D. Cashell, Secretary
April, 19, 1996
Page 4

evaluation. This evaluation should include a cost-benefit analysis which considers the economic effects of maintaining this area in its current altered state against the commercial value of this area as a productive and self-sustaining Atlantic salmon fishery.

(6) **Section 4.8, Relationship Between Short-Term Uses and Long-Term Productivity. Same as comment 5.** EO-6

For these reasons I believe that this document fails to adequately address the environmental effects of the proposed projects, and fails to satisfy the mandates of NEPA. Therefore, I believe that this project must be re-analyzed, and a new DEIS should be produced and circulated for public comment.

Thank you for the opportunity to comment on this document. I look forward to receiving further notification as to the status of this project.

Sincerely,

Erik Olsen

dollar amount on the value of these Atlantic salmon restoration efforts in the Deerfield River watershed, however, licensees would spend millions of dollars to support the restoration effort. Without project relicensing, there is no indication when there would be restoration efforts of this magnitude, as Atlantic salmon fry, parr, and smolts have been stocked in the Deerfield River Basin annually since 1983 without assistance from NEP.

In addition, our recommended alternative would improve water quality, resident fish habitat, downstream anadromous fish passage, Atlantic salmon nursery habitat, smelt spawning habitat, loon nesting habitat, beaver habitat, whitewater boating flows, recreational facilities, sport fishing while enhancing aesthetics, protecting cultural resources, and providing hydroelectric power.

EO-6. See response to EO-5.

WINDHAM REGIONAL COMMISSION

ORIGINAL

OFFICE OF THE SECRETARY
96 APR 22 PM 1:20
FEDERAL ENERGY REGULATORY COMMISSION

April 17, 1996

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, NE
Washington, DC 20426

RE: LP No. 2323-012--Deerfield River Relicensing Comments

Dear Secretary Cashell,

The Windham Regional Commission (WRC) has reviewed both the Settlement agreement and the Vermont 401 Water Quality Certification (WQC). The WRC supports the Vermont WQC and believes that any license should incorporate the terms of the final Section 401 Certification into the Settlement Agreement if the Settlement is to stand as the mode of operation for the project. The FERC staff comments have, for the most part, incorporated the terms of the Vermont WQC into their recommendations.

WRC-1. No response is necessary.

The FERC staff does not seem to propose to accept the Vermont WQC's recommendation regarding level fluctuations of ± 3 inches to accommodate loon nesting on Somerset Reservoir (p. 5-10). The DEIS analysis on page 4-71 would seem to support the WQC recommendation. The Windham Regional Plan contains policies that protect critical wildlife habitat and the Somerset Town Plan contains policies that support Vermont State efforts to protect the common loon (see attached). The Windham Regional Commission supports the Vermont WQC recommendation regarding level fluctuations of ± 3 inches to accommodate loon nesting.

WRC-2. See revised Table 5-2, to clarify that staff accepts the ± 3 inch reservoir surface elevation fluctuation limitation to benefit loon nesting.

In our October 5, 1994 letter to FERC, the WRC stated that the license needs to:

> Incorporate the ruling of the Water Resources Board on the Use of Public Waters at Somerset Reservoir into the final relicensing conditions. The application for relicensing is in conflict with the recent petition to the Water Resources Board requesting a change in the Rules for the Use of Public Waters at Somerset Reservoir. In a letter to the Water Resources Board, the WRC supported even more restrictive rules than the petition. The final relicensing document should reflect the fact that the Water Resources Board has jurisdiction over the Rules for the Use of Public Waters.

The DEIS does not address this issue and the WRC believes that it is important for the license to recognize the Vermont Water Resources Board's jurisdiction in this matter.

WRC-3. This is a procedural issue that relates indirectly to environmental matters. The Commission's order on relicensing will address this measure.

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ATTACHMENT/RIMS

FERC DOCKETED
APR 22 1996

139 Main Street, Suite 505 / Brattleboro, Vermont 05301 / 802 257-4547 / Fax: 802 254-6383

The WRC supports the relicensing of the Deerfield River Hydroelectric project under the terms of the proposed Settlement and the Vermont WQC. The FERC staff recommendations, with the exception of the one noted above, do not seem to differ significantly from these terms and could be supported by the WRC, if accepted by NEPCO and VANR.

Sincerely,

Melissa M. Reichert

Melissa M. Reichert
Senior Planner

cc: Service List

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
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April 19, 1996

OFFICE OF THE REGIONAL ADMINISTRATOR

Lois D. Cashell, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington DC 20426

Re: Deerfield River Projects - New England Power FERC Docket Nos. 2323-012 and 2334-001 -- Draft Environmental Impact Statement

Dear Ms. Cashell:

The U.S. Environmental Protection Agency - New England Region, in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and §309 of the Clean Air Act has reviewed the draft Environmental Impact Statement (DEIS) prepared by the Federal Energy Regulatory Commission (FERC) for the above referenced project.

As you are aware, EPA is the federal agency principally responsible for protection and enhancement of the Nation's environment. EPA's broad responsibility includes administering the Clean Water Act (CWA), 33 U.S.C. §1251 et seq., which establishes a national goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters in a manner that provides for the protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water. The CWA also preserves the rights of states to plan the development and use (including restoration, preservation, and enhancement) of its land and water resources.

GENERAL COMMENTS

This proposed project is comprised of eight hydropower developments with a combined generating capacity of 85 MW along the Deerfield River in southern Vermont and western Massachusetts. EPA-New England filed a motion (November 10, 1992) with FERC to intervene in the relicensing process for these facilities.

EPA-1. No response required.

New England Power (NEP) and several non-governmental organizations and resource agencies have pursued a negotiated settlement of unresolved issues associated with the final application for relicensing of this project. Efforts to develop a negotiated agreement resulted in an agreement being signed on October 5, 1994. Signatories are NEP, a coalition of recreation and resource preservation non-governmental organizations, the Department of Interior's Fish

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and Wildlife and National Park Services, the Massachusetts Division of Fish and Wildlife and EPA-New England.[1,2] One of the projects analyzed in the DEIS, the Gardners Fall Project, is not part of the Settlement agreement.

Based on our knowledge and understanding of the facts at the time of the agreement's execution, EPA supported the environmental commitments and conditions established in the agreement and believed that they provided many benefits for the environment. In addition to signing the agreement, EPA recommended FERC consider the conditions of the agreement to constitute the proposed action to be evaluated, along with appropriate other alternatives, in the NEPA process.

WATER QUALITY STANDARDS

The Settlement sets forth a preferred alternative for the NEPA analysis. This alternative includes flow release patterns intended to provide a reasonable balance of aquatic life protection, recreational uses and power generation in both the free flowing and impounded sections of the Deerfield River in Vermont and Massachusetts. Under this alternative, fluctuating impoundment levels will continue to affect the littoral zone areas.

EPA has provided comments to the states during their water quality certification (§401) processes for this project. In particular, our concerns have been focused on standards issues associated with a fluctuating reservoir.[3] In comments (November 4, 1994) to Vermont Agency of Natural Resources (VANR) on its draft §401 certificate EPA recommended that "the state acknowledge that project operations do, and will continue to have impacts on aquatic life that are inconsistent with its water quality standards and propose a plan to resolve the conflict between the continuing

[1] Non-governmental organization signatories: New England Flow, American Whitewater Affiliation, American Rivers, Appalachian Mountain Club, Conservation Law Foundation, Deerfield River Watershed Association, Deerfield River Compact, Trout Unlimited.

[2] Although EPA is a signatory to the agreement, the Settlement contains language preserving EPA's authority to fully and objectively consider all public comments received in any regulatory process related to this project, to conduct an independent review of the project under applicable federal statutes, and to provide comments to FERC (Settlement Agreement, General Provision J).

[3] The problem of storage reservoirs experiencing significant water level fluctuations, with resulting adverse impacts on the aquatic resources of the littoral zone, can be found at impoundments throughout New England.

EPA-2. No response required.

impact of project and the water quality standards." To accomplish this, EPA identified two acceptable approaches: (1) the state would acknowledge that substandard water quality conditions will continue to exist in the impoundments due to water level fluctuations and complete a use attainability analysis (UAA) to resolve the issue; or, (2) the state would demonstrate that standards will be met.

In its final §401 certification for the Deerfield project, Vermont attempted to balance competing uses in reaching the determination that the project would be consistent with standards; this type of balancing of uses is typically accomplished through a UAA.[4] Vermont also concluded that it has the authority to make case specific judgements on the standards. While EPA chose not to appeal Vermont's determination, we are concerned that such a case specific approach could affect other water quality standard cases in Vermont.

The Vermont §401 certificate differs in some aspects from the conditions of the settlement agreement. For example, the Vermont §401 conditions require less fluctuation of reservoir water levels during the period of May 1 to July 31 than does the settlement agreement. Vermont's water quality certification is currently under appeal.[5]

<u>Gardners Falls</u>

Both the U.S. Fish and Wildlife Service and the §401 water quality certificate prepared by the Massachusetts Department of Environmental Protection (MDEP) recommend a release from the dam of 150 cfs continuous minimum or inflow from NEP's No. 3 Development if inflow is lower than 150 cubic feet per second (cfs). FERC staff position on this issue is unclear. The DEIS (page 4-76) states FERC staff recommends "... WMEC [Western Massachusetts Electric Company] should be required to release 150 cfs or inflow, if less, to the bypassed reach. This recommendation complies with the requirements of the WQC (water quality certificate)." However, the DEIS (page 4-56, and Tables 5-3 and 5-6) also states that "Staff agrees with WMEC's recommendation to release a minimum of 50 cfs and 100 cfs below the powerhouse from April through June, but the 150 cfs required in the WQC is mandatory."

[4] Deerfield River Hydroelectric Project Water Quality Certification Public Responsiveness Summary (page 2).

[5] State of Vermont, Water Quality Certification, Deerfield River Hydroelectric Project, January 30, 1995.

EPA-3. See revised text, Table 5-5 and Table 5-6, and responses [illegible] DI-3, and DI-5.

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EPA recommends that the final EIS clearly state that the conditions imposed by the MDEP water quality certificate shall become conditions of the license to be issued for this project.

NEPA COMPLIANCE

NEPA requires, and EPA has commented accordingly on this project since 1992, that all reasonable alternatives be examined in an impact statement. The EIS should, at a minimum, include a thorough analysis of alternatives to the proposed action (as set forth in the Settlement), including an assessment of the environmental impacts of such alternatives and possible mitigation measures. The alternatives analysis should include an evaluation of various operating regimes for the facilities.

The DEIS provides an analysis of several alternatives including the "Vermont Natural Resources Council (VNRC) recommendations" alternative. The VNRC alternative recommends, among other things, run of river operation throughout the system. The DEIS (Table 5-1) states that water quality under the VNRC alternative would likely improve throughout a greater portion of the Deerfield River than under conditions provided by the Settlement or the §401 water quality certificate. The DEIS reports estimates that the VNRC alternative would result in a decrease of 90,126 MWh for the basin versus a loss of 73,700 for the staff selected (modified Settlement) alternative. With existing total generation of 724,735 MWh, the percentage reduction is 12.4% for the VNRC alternative versus 10.2 % for the staff alternative.

EPA believes that information presented in the DEIS on the impacts of this alternative is unclear and incomplete. For example, it is not clear from the DEIS whether economic comparisons of the alternatives includes a quantification of the ecological benefit, particularly from water quality improvements, of a run of river alternative. EPA recommends that the final EIS include a more comprehensive evaluation of the VNRC alternative, specifically with regards to balancing economic and environmental benefits.

Based on the comments set forth in this letter EPA has rated this project "Environmental Concerns - Insufficient Information" (EC-2). Please refer to the attached Summary of Rating Definitions for a full explanation of this rating.

EPA-4. The economic comparison of the alternatives in Table 5-4 does not include quantification of the ecological benefits. We address ecological effects of VNRC's recommended alternatives qualitatively in several sections of the EIS. See our response to VNRC-2. While economic estimates of power generation is fairly straight forward, assigning dollar values to nondevelopmental resources, e.g., water quality is not. We believe the qualitative information presented in the EIS is sufficient to make an informed decision regarding alternatives for these projects. Consequently, we have not attempted to assign dollar values to the various nondevelopmental resources affected by the projects.

EPA-5. Comment noted.

1

Thank you for the opportunity to comment on the Deerfield River Projects draft EIS. If you have any questions regarding our comments, please contact Steven John (617/565-3426) of my Office of Environmental Review or Ralph Abele, Hydropower Coordinator (617/565-3548).

Sincerely,

John P. DeVillars
Regional Administrator

cc: service list