

Before The
Federal Energy Regulatory Commission

APPLICATION FOR LICENSE
Minor Project
FERC Project No. 8158

LITTLEFIELD
HYDROELECTRIC PROJECT

March 1987

Littlefield Hydro Company
Greenwich, Connecticut

**Before The
Federal Energy Regulatory Commission**

**APPLICATION FOR LICENSE
Minor Project
FERC Project No. 8158**

**LITTLEFIELD
HYDROELECTRIC PROJECT**

March 1987

**Littlefield Hydro Company
Greenwich, Connecticut**

TABLE OF CONTENTS

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
INITIAL STATEMENT	1
VERIFICATION	7
EXHIBIT A PROJECT DESCRIPTION AND MODE OF OPERATION	8
EXHIBIT A-1 FLOW DURATION CURVE	A-1
EXHIBIT E ENVIRONMENTAL REPORT	13
E.1 Environmental Setting	13
E.1.1 Vegetative Cover	13
E.1.2 Fish and Wildlife	20
E.1.3 Water Quality	21
E.1.4 Water Quantity	26
E.1.5 Land Uses	26
E.1.6 Recreational Uses	27
E.1.7 Historical and Archaeological Resources	27
E.1.8 Scenic and Aesthetic Resources	28
E.2 Environmental Impacts	29
E.2.1 Impacts on Vegetative Cover	29
E.2.2 Impacts on Fish and Wildlife	32
E.2.3 Impacts on Water Quality	37
E.2.4 Impacts on Water Quantity	37
E.2.5 Impacts on Land Uses	38
E.2.6 Impacts on Recreational Uses	38
E.2.7 Impacts on Historical and Archaeological Resources	38
E.2.8 Impacts on Scenic and Aesthetic Resources	39
E.3 Agency Consultation	39
E.3.1 Agency Comments	40
E.3.2 Agencies Contacted to Date	43
APPENDIX E-1 HEP STUDY	E-1-1
APPENDIX E-2 LOWER LITTLE ANDROSCOGGIN WATER QUALITY DATA	E-2-1
APPENDIX E-3 MUNICIPAL WASTEWATER TREATMENT FACILITIES	E-3-1
APPENDIX E-4 SUMMARY OF REPORT OF SELF MONITORED PARAMETERS FOR MUNICIPAL LICENSES	E-3-1
APPENDIX E-5 LICENSED INDUSTRIAL DISCHARGES	E-5-1
APPENDIX E-6 SUMMARY REPORT OF SELF MONITORED PARAMETERS FOR INDUSTRIAL AND COMMERCIAL LICENSES	E-6-1
APPENDIX E-7 AGENCY CORRESPONDENCE	E-7-1
APPENDIX E-8 BACKWATER STUDIES	E-8-1
EXHIBIT F DRAWINGS OF PRINCIPAL PROJECT WORKS	F-1
EXHIBIT G PROJECT LOCATION	G-1
CERTIFICATE OF SERVICE	

INITIAL STATEMENT

BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION
APPLICATION FOR LICENSE FOR A
MINOR HYDROELECTRIC POWER PROJECT

1. Littlefield Hydro Company applies to the Federal Energy Regulatory Commission for a license for the Littlefield Hydroelectric Development Project, a small hydroelectric power project that is proposed to have an installed capacity of 5 megawatts or less. The Applicant was issued a Preliminary Permit on November 15, 1984 (FERC Project Number 8158), which expires on November 15, 1987.
2. The location of the project is:

State: Maine
County: Androscoggin
Township or nearby town: City of Auburn
Stream or body of water: Little Androscoggin River
3. The exact name and business address of the Applicant is:

Littlefield Hydro Company
c/o CONSOLIDATED HYDRO, INC.
Two Greenwich Plaza
Greenwich, CT 06830
Tel: 203/661-4203
4. The name and business address of the person authorized to act as agent for the Applicant in this application is:

Owner:
Littlefield Hydro Company
c/o CONSOLIDATED HYDRO, INC.
Two Greenwich Plaza
Greenwich, CT 06830

Attention: Jason D. James
Telephone: 203/661-4203
5. The applicant is a limited partnership organized under the laws of the State of Maine.
- 6.(i) The statutory and regulatory requirements for hydropower projects in the State of Maine are as follows:
 - I. Regulation by the Board and Department of Environmental Protection (BEP DEP)
 - A. Maine Waterway Development and Conservation Act 38 MRSA SS: 630-636.

In 1983, the State of Maine enacted a simplified permitting process which allows developers to file a single permit application with the State's Department of Environmental Protection. The application is circulated for comments among the following state agencies: Department of Conservation, Department of Inland Fisheries and Wildlife, Department of Marine Resources, Department of Transportation, Maine Historic Preservation Commission, Office of Energy Resources, Public Utility Commission and the municipal officials of the municipality in which the project is located. Information required by the DEP includes project size, location, environmental impact, service area, construction costs, etc.

The DEP evaluates the project and applicant on the basis of financial capability, safety, public benefits, traffic movements, and environmental and energy considerations.

B. Dam Inspection, Registration and Abandonment Act 38
MRSA Section 815-842

Inspection:

The statute authorizes the Board of Environmental Protection to inspect all dams in the state (except those licensed by FERC) for purposes of assuring public health, safety and welfare.

Registration:

The statute requires the registration of all dams in the state with the Department of Environmental Protection. The statute provides that failure to register after notice by the department will result in forfeiture of the dam to the state. Notice of transfer of the dam by sale, lease or gift must be provided to the department.

Abandonment:

The statute provides a procedure by which a dam site can be taken over by the state through eminent domain.

Water Levels:

The statute also provides procedures for establishing water levels at sites not licensed by FERC, authorized by the Federal Power Act, Section 23, or previously licensed under prior statutes.

II. Regulation by the Department of Conservation

A. Land Use Regulation Commission

LURC acts as a planning, and zoning board for unorganized townships and plantations in the state. No permanent structure may be erected, changed, converted, altered, or enlarged, other than normal maintenance, without first obtaining a permit from LURC. If a dam site is within LURC's jurisdiction the DEP application is submitted to LURC, who will evaluate the application based on the statutory criteria.

III. Regulation by the Department of Inland Fisheries and Wildlife

A. Notification of Intent to Build a Dam 12 MRSA Section 7702

Written notice must be filed with the Commissioner of the Department of Inland Fisheries and Wildlife prior to building a dam or otherwise obstructing a river, stream, or brook.

B. Fishways 12 MRSA Section 7701

The Commissioner of the Department of Inland Fisheries and Wildlife may require fish ladders to be provided, erected, maintained, repaired or altered by the owners or occupants of any dam in any inland waters frequented by salmon, shad alewives, or migratory fish. The Commissioner may be petitioned to hold a hearing to determine if there is a need for a fishway at an existing dam.

IV. Public Utility Regulation

The Public Utility Commission (PUC) oversees and regulates public utilities in the State of Maine. Regulatory functions of the PUC include authorizing projects through a Certificate of Public Convenience and Necessity, rate setting, and authorizing the issuance of stocks, bonds and notes by public utilities.

The Small Power Production Facilities Act encourages small power facilities which use renewable resources, by exempting qualifying small scale power producers which do not retail electricity from PUC regulation or control. A qualifying small scale power producer is any municipality, person or corporation owning or operating a facility which does not exceed 80 MW of installed capacity and which depends on renewable resources for its primary source of energy.

This Act also provides for power purchase contracts. In sales of electricity to a public utility, the rate paid by the public utility shall be determined by the small power producer and the public utility. If the two cannot agree on a price, the PUC shall order the utility to purchase the power and shall determine the price using such criteria as, term of contract, cost of energy to the availability and reliability of power. Standard rates are set for units under one megawatt that do not have a contract with the utility.

V. Maine Water Law

A. Riparian Rights

A riparian owner is one whose land abuts upon a stream of water. The privileges stemming from ownership of the shoreline and the normal bed include the right to use the flowing water. It must not be assumed that water rights were transferred with land rights. The rights of riparian owners are not absolute, but are defined by the reasonable use theory. Reasonable use theory is the right of enjoyment of the stream as it flows through the land, taking into consideration a like reasonable use by all other riparians above and below the user.

- 6.(ii) The steps which the applicant has taken or plans to take to comply with each of the laws cited above are:
- A. The applicant has requested a Water Quality Certificate from the Department of Environmental Protection pursuant to Section 401 of the Clean Water Act.
 - B. The applicant will file for approval with the Maine Department of Environmental Protection concurrently with its FERC filing.
 - C. The Town of Auburn is being consulted so they may comment on the proposed land use.
7. Brief project description: The applicant proposes to reactivate hydroelectric generation at this site by installing a double regulated double-tube turbine with a synchronous generator in a new powerhouse. The existing dam was breached in the 1936 flood. The dam will be repaired and recapped. Reconstruction of the dam has been designed to maintain the existing water surface profile under flood conditions. The 100 year flood level will remain about the same after the dam is reconstructed. The site will have a name plate rating of 1.35 megawatts.
8. There are no Federal lands of the United States that will be affected.

Riparian Rights

9. Construction of the project is planned to start within 24 months, and is planned to be completed within 48 months, from the date of issuance of license. It should be noted that in order to satisfy the requirements of a power purchase sales agreement between the Applicant and Central Maine Power, construction must be completed and the project must be on line by November 1, 1989 or the contract will be terminated. While this license application should have been filed prior to this date in order to conservatively meet this deadline, the Applicant also realized the importance of and value of agency consultation in expediting the licensing process. Filing was therefore delayed in order to conduct the studies requested by the Agencies. The Agencies have now requested additional consultation. The Applicant, however, believes that it has responded to Agency requests as best it can, and that filing of this license application can no longer be delayed without further jeopardizing the power purchase sales agreement and ultimately, the future of the project.

10. County, city, town or political subdivisions:

(i) Every county, city, town or similar local political subdivision, irrigation district, drainage district or similar special purpose political subdivision in which any part of the Project (or any Federal facilities that would be used by the Project) would be located:

County of Androscoggin
County Commissioners
2 Turner Street
Auburn, ME 04210

City of Auburn
John Cleveland
Auburn City Building
45 Spring Street
Auburn, ME 04210

(ii) Every city, town or similar local political subdivision that has a population of 5,000 or more people and is located within 15 miles of the Project dam:

City of Auburn, ME

City of Lewiston, ME

(iii) Every irrigation district, drainage district, or similar special purpose political subdivision that owns, operates, maintains, or uses any project facilities or any Federal facilities that would be used by the Project:

None Exist

- (iv) Every other political subdivision in the general area of the Project that the Applicant believes may be likely to be interested in, or affected by, the Application:

Town of Poland, ME

Town of Minot, ME

11. State Comprehensive Plan. In recent years, the Maine Legislature has passed two acts which are particularly significant to Maine's comprehensive planning for river resources. Recognizing the importance of its rivers as significant multiple use resources, they passed the Maine Rivers Act in 1983 which declared approximately 1100 miles of Maine rivers "off-limits" to hydropower development. At the same time, however, the Legislature recognized that the development of hydroelectric facilities on its other rivers should be encouraged and passed the Maine Waterway Development and Conservation Act. This act established a one-stop permitting process to simplify and clarify hydrolicensing procedures.

VERIFICATION

This application is executed in the

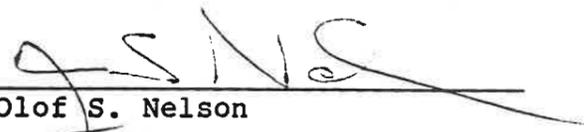
State of Connecticut

County of Fairfield

by: Olof S. Nelson, President
Littlefield Hydro Company
c/o Consolidated Hydro, Inc.
Two Greenwich Plaza
Greenwich, CT 06830

being duly sworn, deposes and says that the contents of
this application are true to the best of his knowledge or
belief. The undersigned applicant has signed this
application this
25th day of March 1987.

by:


Olof S. Nelson

Subscribed and sworn to before me, a Notary Public of the State of
Connecticut this 25th day of March, 1987.



My commission expires:

My Commission Expires March 31, 1991

EXHIBIT A

PROJECT DESCRIPTION AND
PROPOSED MODE OF OPERATION

EXHIBIT A - PROJECT DESCRIPTION AND MODE OF OPERATION

- A.1. The proposed development plan consists of the rehabilitation of the breached dam and spillway, reinstallation of flashboards, construction of a new powerhouse and installation of a new turbine, generator equipment, trashracks, control gates and all other auxiliary equipment.

Technical data for the Littlefield Project and pool as it pertains to the development plan herein are as follows:

Drainage area above dam:	331 sq. miles
Approximate dam height:	21 feet
Permanent spillway crest elevation:	213 msl
Spillway crest elevation with 3 foot high flashboards:	216 msl
Approximate pool area (216' msl):	101 acres
Approximate pool length (216' msl):	2.2 miles
Approximate pool volume (216' msl):	750 acre-ft
Number of generating units:	one
Type of hydraulic turbine:	Full Kaplan
Installed capacity:	1350 kW
Average net head:	22.5 feet
Maximum turbine discharge:	900 cfs
Minimum turbine discharge:	100 cfs
Mode of Operation:	Run-of-River
Type of operation:	fully automatic
Average annual output:	5,062 MWh

A.1.i Generating Units

The project will consist of a single turbine generator with an installed capacity of 1350kW. There is no plan for the installation of additional generating units.

A.1.ii Type of Hydraulic Turbines

The hydraulic turbine to be installed will be a Full Kaplan Turbine with a matched synchronous generator. The turbine will have a maximum rated discharge of 900 cfs and a minimum rated discharge of 100 cfs.

A.1.iii Plant Operation

The Littlefield Hydroelectric Project will operate in a strict run-of-river fashion. Instantaneous inflow will equal instantaneous outflow. When flows in the river are too low to run the turbine; water will pass over the dam spillway. The Plant will be fully equipped for automatic generation.

A.1.iv Average Annual Energy Generation

The total estimated net average annual energy generation of the Littlefield Hydroelectric Project is 5,062 MWh.

A.1.v Average Head

The estimated average net head on the plant is 22.5 feet.

A.1.vi Reservoirs

The reservoir surface area is approximately 101 acres at full pond level, and the reservoir volume is approximately 750 acre-feet. The net and gross storage capacity are estimated at 264 and 750 acre-feet, respectively.

A.1.vii Plant Capacity

The estimated hydraulic capacity of the plant is 900 cfs. The historical average flow of the Little Androscoggin River at the Project site is 570 cfs.

The Project flow duration curve is provided in Exhibit A-1. It was developed based on historic flows of the Little Androscoggin River. Data from United States Geological Survey Gaging Station #01058500 for the period 1941 to 1982 were used with no drainage area correction. The gauge is on the right bank of the Little Androscoggin River approximately one half mile upstream from the Littlefield Project. There are no tributaries between the gauge and the Project. The project drainage area is 331 square miles.

A.1.viii Project Works

The Littlefield Dam was originally built in the early 1900's and functioned as a hydroelectric generating facility. The March 1936 flood breached the left earthen embankment and a portion of the spillway. The breach was never repaired and no maintenance has been performed since that time. However, many of the civil structures remain including the powerhouse.

The dam is approximately 403 feet long with a height of about 21 feet. Its general composition from left bank to right bank before breaching included an earth-filled section with concrete core wall, powerhouse, spillway (at least partially built of stone masonry), a concrete dike, and an earthen dike. The 1936 flood washed away the left embankment and exposed the core wall at the northwest corner of the powerhouse. About half of the original spillway remains. The powerhouse is essentially intact; however, all equipment will require replacement.

Reactivation of the Littlefield Hydroelectric Development Project will require major rehabilitation of existing civil works prior to recommissioning the facility. The proposed redevelopment of the site includes the following:

1. Construct, in the left (northwest) abutment, a new concrete powerhouse approximately 60' x 35' in size.

2. Excavate a tailrace in the exposed ledge bottom to the downstream discharge channel of the existing spillway.
3. Build a new concrete ogee gravity emergency spillway between the new and the old powerhouse. This spillway will have a crest elevation 5 feet below the crest of the existing spillway, a length of approximately 100 feet, and a capacity of approximately 1100 cfs.
4. Install overflow gates on the ogee spillway to be tripped at elevation 218' msl.
5. Reconstruct the breached section of the principal spillway. Cap the entire principal spillway to the original elevation with a minimum of 6 inches of reinforced concrete. Fill up the old flood gate and powerhouse intake openings with concrete. Flashboard sockets that will accommodate three foot high wooden flashboards during normal operation, will be imbedded along the axis of the crest of the spillway and the top of the old powerhouse.
6. Repair the concrete and earthen dikes as required.
7. Clear and construct an access road on the left bank to the new powerhouse. An access road will be provided from the end of Merrow Road to the site. The road will be 20 feet wide with grades not greater than 5 percent. The powerhouse will be accessible from the parking area across the earth embankment dam. Sufficient laydown area will be provided for servicing the unit.
8. Install a Full Kaplan Turbine with a matched synchronous generator, transformer, switchgear equipment, and transmission line to connect to an existing Central Maine Power (CMP), 12.5 kV primary distribution circuit located at the end of Merrow Road. About 900 feet of new overhead transmission line will be required to connect the pad mounted transformer to the existing circuit. The new transmission line along with required station metering will be owned and maintained by CMP. The powerhouse will include trashracks, a headgate, a draft tube gate, and all necessary hoisting mechanisms.
9. The left and right sides of the dam will be earthfilled embankments. The composition of the embankment dam will consist of a clay with fine gravel and sandy gravel core covered with a layer of rip-rap type rock. The top elevation will be set so that 100 year flood will not overtop the embankment. A total of about 5,000 CY of material will be needed to construct this portion of the dam.

10. An earthfill embankment cofferdam will be used to isolate the construction area from the river on both the upstream and downstream side of the dam. The extensive dam repair requirements necessitate the use of a two phase cofferdam system.

During the first phase, an earthfill embankment will be constructed on the upstream side to isolate the left side of the dam. Powerhouse excavation and construction along with a portion of the dam repair can then be performed in the dry. During this phase, water will be diverted through a channel on the right bank. Some downstream cofferdamming may be required depending on the final location of the diversion channel.

After completion of the powerhouse and the left abutment embankment dam, the cofferdam will be moved to the right side where the remainder of the dam repair can be completed. Water will then be diverted through the powerhouse. For both phases, the cofferdam will be constructed from clean select clay and gravel fill. It will be protected by an upstream layer of rock and gravel. About 5500 CY of material will be required for each phase of cofferdamming work.

Cofferdam materials which cannot be used on the site will be removed and disposed of off site in accordance with state and local laws.

A.1.ix Estimated Cost

The estimated cost of the Project is \$3,406,000, broken down as follows:

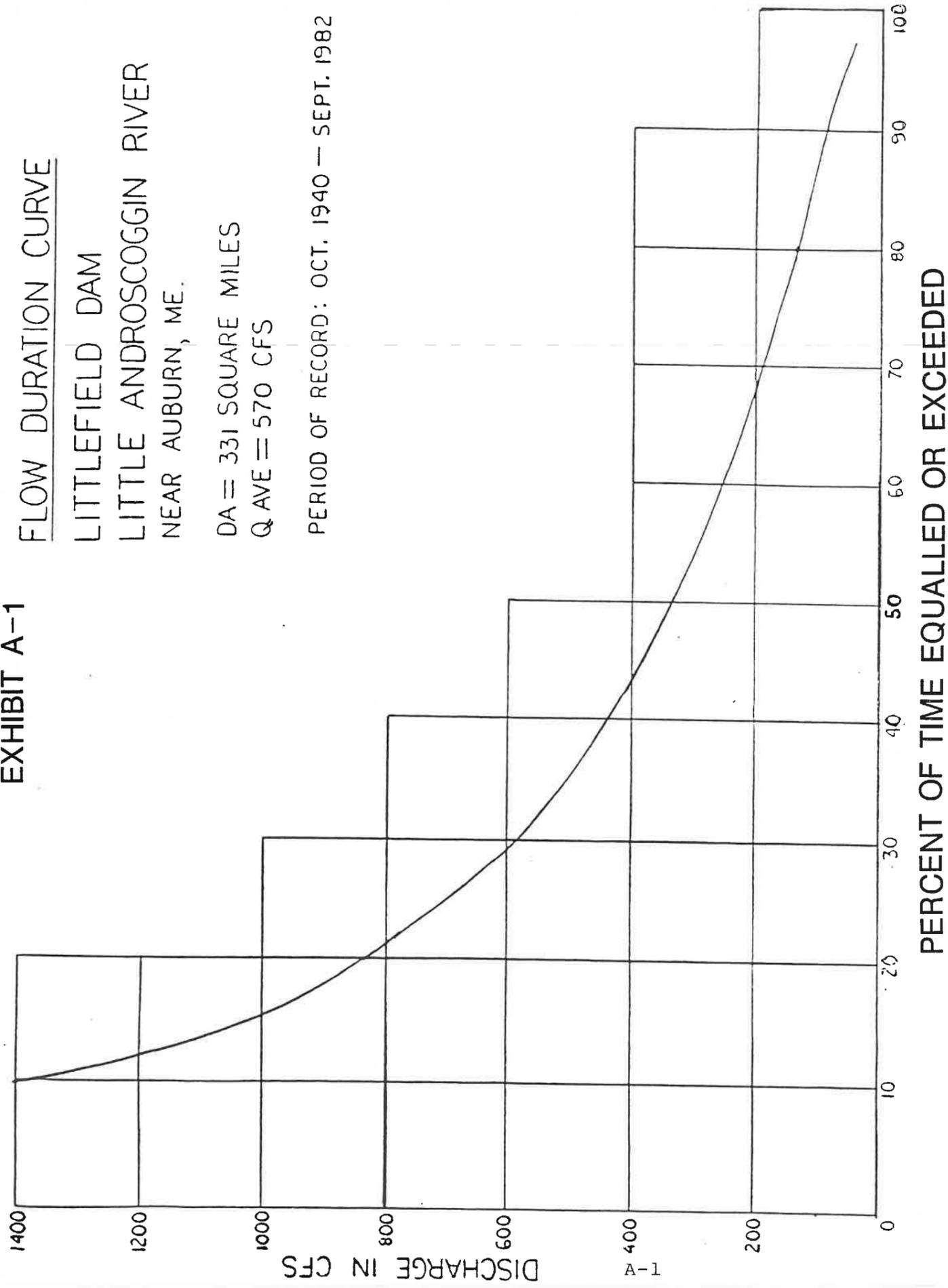
<u>FERC ACCT.</u> <u>NO.</u>	<u>DESCRIPTION</u>	<u>AMOUNT</u>
330	Land and Land Rights	\$ 312,500
331	Power Plant Structure & Improvements	600,000
332	Reservoirs, Dams & Waterways	500,000
333	Turbine, Generator & Associated Equipment	1,035,000
334	Accessory Electrical Equipment	75,000
335	Miscellaneous Power Plant Equipment	100,000
336	Access Roads	5,000
352	Substation Structures	5,000
353	Substation Equipment	75,000
354	Transmission Lines	10,000
	Construction Total:	2,717,500
	Contingency Allowance: Civil Works 15%	166,500
	Generating Equipment 7.5%	<u>77,625</u>
	Subtotal	<u>2,961,625</u>
	Engineering, Construction Supervision, Legal, Environmental, and Administration 15%	<u>444,244</u>
	Total Cost (1986 Dollars)	3,405,869
	Total Cost Rounded	\$3,406,000 =====

A.2. Purpose of Project

The proposed hydroelectric development plan for the Littlefield Project is designed to fully develop a renewable resource. The estimated net annual output of approximately 5,062 MWh will displace the need for about 8,473 barrels of crude oil, which would otherwise be required to provide an equivalent amount of annual energy. The total annual output will be sold to Central Maine Power Company (CMP), the local franchised utility. A twenty year power purchase contract has been executed with CMP, who has indicated a need for additional capacity.

EXHIBIT A-1

FLOW DURATION CURVE
LITTLEFIELD DAM
LITTLE ANDROSCOGGIN RIVER
NEAR AUBURN, ME.
DA = 331 SQUARE MILES
Q AVE = 570 CFS
PERIOD OF RECORD: OCT. 1940 - SEPT. 1982



A-1

EXHIBIT E
ENVIRONMENTAL REPORT

EXHIBIT E - ENVIRONMENTAL REPORT

E.1 Environmental Setting

The Littlefield Hydroelectric Project is located on the Little Androscoggin River, approximately 4.5 miles upstream from the confluence with the Androscoggin River, within the city of Auburn in the County of Androscoggin, Maine. The applicant proposes to reactivate the hydroelectric facility by installing a double regulated tube-type turbine with a synchronous generator in a new powerhouse. The existing dam, which was breached in the 1936 flood, will be repaired and recapped.

Soil associations in the Project area are Adams-Hinckley-Ninigret, which are characterized as nearly level to moderately steep, excessively drained to moderately well drained, sandy loam soils on varied topography that includes bottom lands and terraces, outwash plains, hills and ridges.

Plans of the present dam and proposed project are contained in Exhibits F and G, respectfully.

The proposed hydroelectric development plan for the Littlefield Project is designed to provide maximum benefit from a renewable resource. The estimated annual output of approximately 5,062 MWh will displace the need for about 8,473 barrels of crude oil, which would otherwise be required to provide an equivalent amount of annual energy. The total annual output will be sold to Central Maine Power Company (CMP), the local franchised utility. CMP has identified the need for additional capacity.

A detailed description of the major environmental considerations and the anticipated impacts of the proposed hydroelectric facility are presented in the following sections and sub-sections of this report.

E.1.1 Vegetative Cover

The pond created by reconstruction of the breached site to its historical maximum pool will result in a 101-acre pool extending upstream approximately 2.2 miles. Currently this 101-acre area consists of 66.8 acres of terrestrial areas and 34.2 acres within the affected 2.2 miles of the Little Androscoggin River.

Existing terrestrial cover types were identified by an on-site inspection conducted by the Applicant's biological consultant and a wildlife biologist from the Maine Department of Inland Fisheries and Wildlife (See Appendix E-1, p.8). Cover types include the following seven classification categories: Agricultural land, Deciduous Forest, Palustrine - Forested Wetland, Palustrine - Aquatic Vegetation, Palustrine - Emergent Wetland, and Scrub Shrub Wetland.

The locations of each cover type are shown in Figure E-1 which identifies each type by a number that corresponds to descriptive information provided in Table E-1. Included in Table E-1 is a breakdown of acreage by cover type and location.

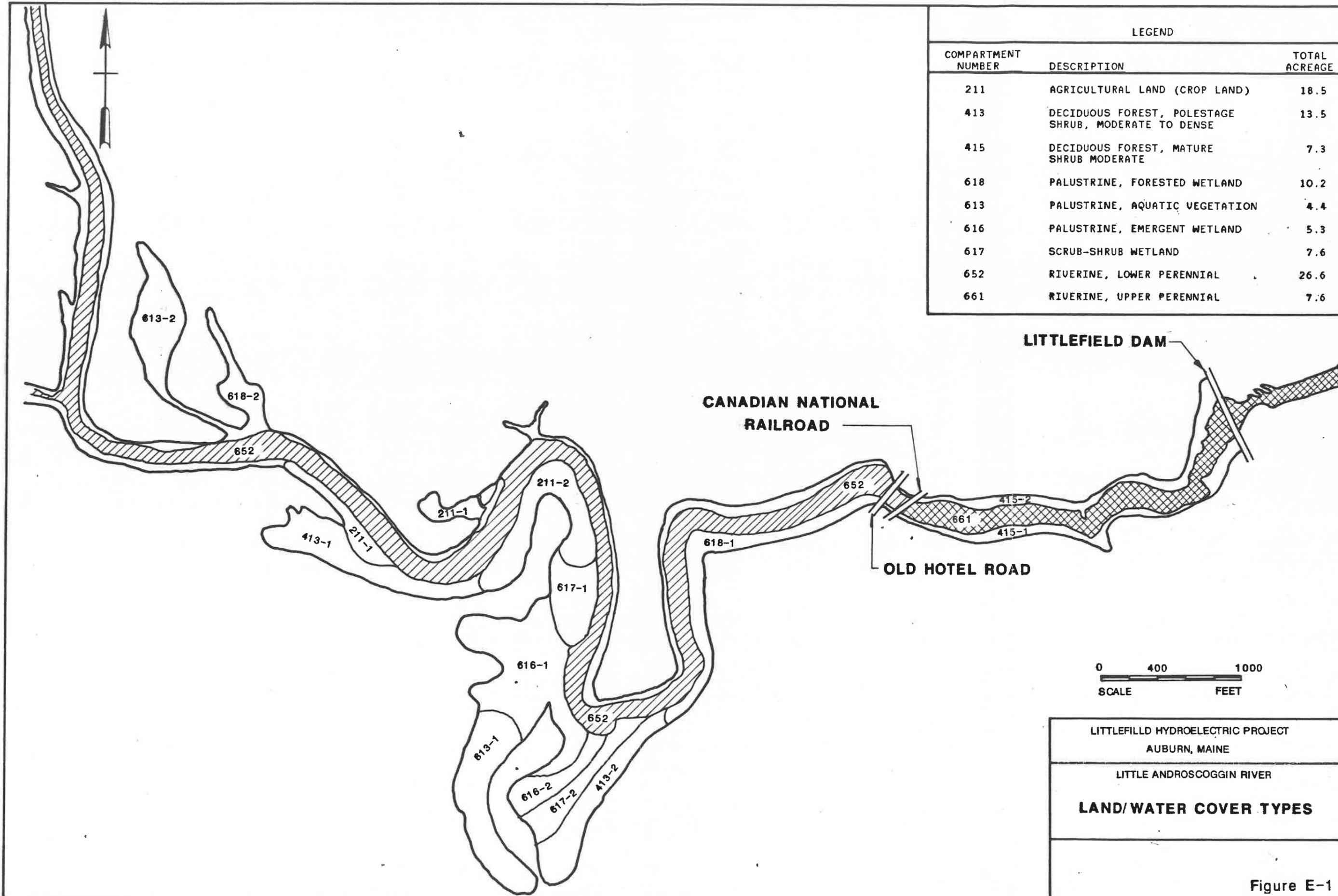
Vegetation on the bank adjacent to the easterly shoreline near the dam consists of sparse maple and beech trees, with ground cover of grasses and ferns. Major ledge outcrops are visible in much of the upstream and downstream channels. The floodplain on the right (south) bank near the dam extends about 100 to 150 yards inland before rising in a fairly steep slope upstream. The adjacent Martindale Golf Course is located both in the floodplain downstream and atop this steep slope upstream. The downstream channel, largely characterized by ledge outcrops, has some areas of cobbles.

The right (northeast) shoreline has been severely eroded by the river outward of the dam to form a fairly steep bank. Some rather recent clearing has been done near the dam and on this steep slope. Secondary growth of birch, maple, and oak trees remain as well as a few pines. This mixture of hard and soft-wood trees has an undergrowth of saplings interspersed with ferns. A list of the common plant species that may be found in the project area is provided in Table E-2.

The Canadian National Railroad, Old Trolley, and Old Hotel Road Bridges are located about a half mile upstream of the breached Littlefield Dam site. Since the dam breached during the 1936 flood these bridges have been a partial hydraulic control. This implies that they, in part, control the upstream water level, and above them, the water level was not significantly lowered by the breach. Reconstruction of the dam to its historic height should not greatly affect vegetative growth upstream of the pond that will be formed in an old oxbow immediately above the bridges.

No endangered or threatened species of vegetation are known to exist within the project area.

Construction access to the site will be provided by upgrading and reshaping an existing access road which leads to the dam on the left (north) side. Some of this access road has been eroded away by sloughing of the river bank when the earthen dike with core wall was breached.



LEGEND		
COMPARTMENT NUMBER	DESCRIPTION	TOTAL ACREAGE
211	AGRICULTURAL LAND (CROP LAND)	18.5
413	DECIDUOUS FOREST, POLESTAGE SHRUB, MODERATE TO DENSE	13.5
415	DECIDUOUS FOREST, MATURE SHRUB MODERATE	7.3
618	PALUSTRINE, FORESTED WETLAND	10.2
613	PALUSTRINE, AQUATIC VEGETATION	4.4
616	PALUSTRINE, EMERGENT WETLAND	5.3
617	SCRUB-SHRUB WETLAND	7.6
652	RIVERINE, LOWER PERENNIAL	26.6
661	RIVERINE, UPPER PERENNIAL	7.6

LITTLEFIELD DAM

CANADIAN NATIONAL RAILROAD

OLD HOTEL ROAD

0 400 1000
SCALE FEET

LITTLEFIELD HYDROELECTRIC PROJECT
AUBURN, MAINE
LITTLE ANDROSCOGGIN RIVER
LAND/WATER COVER TYPES

Figure E-1

Table E-1 LAND USE/COVER TYPE
CLASSIFICATION OF
PROJECT STUDY AREA

COMPARTMENT NUMBER	DESCRIPTION	ACRES	
		(SUBTOTAL)	(TOTAL)
211	Agriculture (cropland)		18.5
211-1	" "	7.2	
211-2*	" "	11.3	
413	Deciduous forest, polestage shrub, moderate to dense		13.5
413-1*	" " "	8.2	
413-2*	" " "	5.3	
415	Deciduous forest, mature, shrub moderate		7.3
415-1	" " "	6.0	
415-2*	" " "	1.3	
618	Palustrine-Forested Wetland		10.2
618-1*	" " "	7.2	
618-2*	" " "	3.0	
613	Palustrine-Aquatic Vegetation rooted vascular		4.4
613-1*	" " "	1.5	
613-2*	" " "	2.9	
616	Palustrine-Emergent Wetland		5.3
616-1*	" " "	4.7	
616-2*	" " "	.6	
617	Scrub-Shrub Wetland		7.6
617-1*	" " "	3.6	
617-2*	" " "	2.3	
617-3*	" " "	1.7	
	TOTAL TERRESTRIAL		66.8
652*	Riverine - Lower Perennial	26.6	
661*	Riverine - Upper Perennial	7.6	
	TOTAL RIVERINE		34.2
	TOTAL STUDY AREA		101.0

* AREAS FIELD SURVEYED.

TABLE E-2
COMMON PLANT SPECIES

<u>Family</u>	<u>Genus and/or Species</u>
Pine	Red Pine, Arbor Vitae, Juniper, Balsam Fir
Rose	Black Cherry
Olive	Red Ash
Beech	White Oak
Willow	Shining Willow, Balsam, Willow, Pussy Willow
Birch	Beaked Hazel, Hornbeam, Alder
Maple	Silver Maple
Dogwood	Round-leaved Dogwood, Blue Dogwood
<u>Family</u>	<u>Genus and/or Species</u>
Club-moss	Club-moss
Quillwort	Quillwort
Adder's Tongue	Adder's Tongue, Grape-fern
Flowering Fern	Cinnamon Fern
Fern	Wood-Fern, Holly Fern, Lady Fern, Chain-fern
Bur-Reed	Bur-Reed
Pondweed	Pondweed
Grass	Brome-grass, Fescue, Parl, Meadow-grass, Bluegrass, Hairgrass, Reed-Bentgrass, Bentgrass, Ticklegrass, Foxtail, Manna-Grass, Mountain-Rice, Crab Grass
Sedge	Callingale, Spike-Rush, Bullrush, Cotton grass, Beak-/rush, Sedges
Arum	Jack-in-the-Pulpit, Water, Arum
Duckweed	Duckweed
Lily	Bell Wort, Lily, False Solomon's Seal, Twisted-stalk, Trillium, Carrion-flower
Iris	Iris, Blue-eyed Grass

TABLE E-2
COMMON PLANT SPECIES (Continued)

<u>Family con't.</u>	<u>Genus and/or Species</u>
Orchid	Pink Lady's Slipper, Rein-Orchis, Pagonia, Grass Pink, Coral-root
Wax-Myrtle	Myrica, Sweet-fern
Amaranth	Amaranth
Carpet-weed	Indian Chickweed
Pink	Common Stitchwort, Catchfly, Crow foot, Buttercup, Meadow Rue, Anemone, Thimbleweed
Mustard	Yellow Cress
Saxifrage	Mitewort
Rose	Ninebark, Shadbush, Strawberry, Purple-flowering Raspberry, False Violet
Pulse	Sweet Clover, Alfalfa, Tick Trefoil, Vetch, Wild Lupine, Groundnut
Wood-Sorrel	Wood-Sorrel
Geranium	Starksbill
Milkwort	Millwort
Spurge	Spurge
Cashew	Poison Ivy
Holly	Gray Holly, Mountain Holly
Mallow	Mallow
St. John's Wort	Marsh St. John's-wort
Waterwort	Waterwort
Rockrose	Pinweed
Buckthorn	Buckthorn, Redroot
Vine	Woodbine, River-bank-Grape, New England Grape
Violet	Violet, Early Yellow Violet
Mezereum	Leatherwood

TABLE E-2

COMMON PLANT SPECIES (Continued)

<u>Family con't.</u>	<u>Genus and/or Species</u>
Evening-Primrose	Willow-herb
Water-Milfoil	Water-Milfoil
Parsley	Black Snakeroot, Sweet Cicely
Wintergreen	Pursh, One-flowered Pyrola, Shinleaf
Heath	Rhododendron, Pale Laurel, Bog-Rosemary, Lyonia, Leather-leaf, Trailing Arbutus, Sour-top Blueberry, Late Sweet Blueberry, Highbush Blueberry, American Cranberry
Primrose	Garden Loosetrife, Tufted loosetrife, Starflower
Gentian	Bartonia, Buckbean
Dogbane	Dogbane
Milkweed	Milkweed
Convolvulus	Bindweed
Mint	Dragonhead, False Dragonhead, Hemp-Nettle, Water-horehound
Nightshade	Ground-Cherry
Figwort	Verbascum, Toadflax, Dwarf Snapdragon, Hedge-Hyssop, False Pimpernel, Speedwell, Aureolaria
Bladderwort	Bladderwort
Madder	Bedstraw
Honeysuckle	Bush-Honeysuckle, Honeysuckle, Fly Honeysuckle, Twinflower, Wild Raisin, Arrow-wood
Bluebell	Lobelia
Composite	Goldenrod, Aster, Fleabane, Pussy's Toes, Cudweed, Cocklebur, Bur-Marigold, Coltsfoot, Ragwort, Thistle, Goats beard, Sow-Thistle, Lettuce, Rattlesnake-root, Hawkweed, Dandelion

E.1.2 Fish and Wildlife

Fishery resources of the Little Androscoggin River consist of both cold and warm water species. Excessive water temperatures (above 75 F) occur during hot summer months which restrict the cold water species (brook and brown trout) to a few areas where cold springs or seeps provide suitable temperatures. Warm water species include small and large mouth bass, chain pickerel, minnows, white suckers, yellow perch, bullheads and eels.

Although historically fisheries of the Little Androscoggin River have been severely reduced by pollution and blockage of fish migrations due to the introduction of dams, water quality is improving to the extent that restoration of historic fisheries appears feasible.

The State of Maine Department of Marine Resources (DMR) is presently involved in restoring anadromous fish runs to the lower Androscoggin and Little Androscoggin Rivers. Alewives and American shad are currently being stocked in the Little Androscoggin River in an attempt to establish sea-run populations of these species. This restoration project is associated with the Brunswick Hydroelectric Redevelopment Project (FERC 2284) on the Androscoggin River. Presently, adult fish are captured in the Androscoggin River at the head of tide in Brunswick and trucked to appropriate upriver spawning and nursery areas along the Little Androscoggin. Adult alewives have been stocked since 1983 into two lake systems, Marshall and Tripp Pond, which drain into the Little Androscoggin River above the Littlefield Dam. More recently, alewives have also been stocked in The Range Ponds, Whitney Pond, Hogan Pond, and Thompson Lake, all located above Littlefield Dam. American shad are being stocked in the riverine areas above Littlefield Dam. In addition, the Maine Department of Marine Resources, Department of Inland Fisheries and Wildlife, and the Atlantic Sea Run Salmon Commission are currently conducting studies and plans to establish anadromous populations of the Atlantic Salmon. These agencies are also studying inland species such as Brook Trout and Smallmouth bass in streams of the state where potentials for successful establishment of such fisheries are suitable. Finally, the U.S. Fish and Wildlife Service is currently conducting studies for an Environmental Impact Statement related to its Atlantic salmon restoration program for northeast coastal streams.

Wildlife expected to occur within the project site include the varieties of species found in the upland and wetland habitats of the surrounding area. White-tailed deer, squirrels, raccoon, woodchuck, beaver, mink, muskrat, wood-duck, black duck, mallard, mergansers, song-birds and amphibians are expected residents, while other water fowl such as woodcock and songbirds use the area during migrations. A list of the common animal species that may occur in the project area is provided in Table E-3.

TABLE E-3
COMMON ANIMAL SPECIES

Waterfowl

Canada Goose	*Wood Duck
*Mallard	*Ring-necked Duck
*Black Duck	Common Goldeneye
Green-winged Teal	Bufflehead
Blue-winged Teal	*Hooded Merganser
	*Common Merganser

Other Birds

Double-crested Cormorant	*Tree Swallow
*Great Blue Heron	*Bank Swallow
*Green Heron	Rough-winged Swallow
*Black-Crowned Night Heron	*Barn Swallow
*American Bittern	*Cliff Swallow
*Goshawk	*Purple Martin
*Sharp-shinned Hawk	*Blue Jay
*Cooper's Hawk	Common Raven
*Red-tailed Hawk	*Common Crow
*Kestrel	*Black-capped Chickadee
*Broad-winged Hawk	*White-breasted Nuthatch
Bald Eagle (Endangered)	Red-breasted Nuthatch
*Osprey	*Brown Creeper
Peregrine Falcon (Endangered)	*House Wren
*Ruffed Grouse	Winter Wren
American Coot	*Mockingbird
*Ring-necked Pheasant	*Catbird
*Virginian Rail	*Brown Thrasher
*Sora	*Robin
*Killdeer	*Wood Thrush
*American Woodcock	*Hermit Thrush
*Common Snipe	*Swainson's Thrush
*Spotted Sandpiper	Gray-cheeked Thrush
Solitary Sandpiper	*Veery
Great Black-backed Gull	*Eastern Bluebird
Herring Gull	Golden-crowned Kinglet
*Rock Dove	Ruby-crowned Kinglet
*Mourning Dove	*Cedar Waxwing
*Black-billed Cuckoo	Northern Shrike
*Great Horned Owl	*Starling
*Barred Owl	*Solitary Vireo
*Saw-whit Owl	*Red-eyed Vireo
*Whip-poor-will	*Black and White Warbler
*Common Nighthawk	Tennessee Warbler
*Chimney Swift	*Nashville Warbler
*Ruby-throated Hummingbird	Parula Warbler
*Belted Kingfisher	*Yellow Warbler
*Yellow-shafted Flicker	*Magnolia Warbler
*Pileated Woodpecker	Cape May Warbler
*Yellow-bellied Sapsucker	*Black-throated Green Warbler
*Hairy Woodpecker	*Black-throated Blue Warbler

* Birds commonly nesting in area.

TABLE E-3
COMMON ANIMAL SPECIES (Continued)

Other Birds

*Downy Woodpecker	*Chestnut-sided Warbler
*Eastern Kingbird	*Blackburnian Warbler
*Great Crested Flycatcher	*Yellow-rumped Warbler
Eastern Phoebe	*Bay-breasted Warbler
Adler Flycatcher	Blackpoll Warbler
*Olive-sided Flycatcher	Ovenbird
*Least Flycatcher	*Northern Waterthrush
Horned Lark	*Yellowthroat
*Wilson's Warbler	Pine Grosbeak
Canada Warbler	Common Redpoll
*American Redstart	*Pine Siskin
*House Sparrow	*American Goldfinch
*Boblink	*Rufous-sided Towhee
*Eastern Meadowlark	*Savannah Sparrow
*Redwinged Blackbird	*Slate-colored Junco
*Baltimore Oriole	Tree Sparrow
*Rusty Blackbird	*Chipping Sparrow
*Cowbird	*Field Sparrow
*Purple Grackle	White-crowned Sparrow
*Scarlet Tanager	*White-throated Sparrow
*Cardinal	Fox Sparrow
*Rose-breasted Grosbeak	*Song Sparrow
*Indigo Bunting	Snow Bunting
*Evening Grosbeak	*Vesper Sparrow
*Purple Finch	

Common Mammals

Hairy-tailed mole	Coyote
Star-nosed mole	Domestic Cat
Masked shrew	Bobcat
Smoky shrew	Woodchuck
Water shrew	Eastern chipmunk
Short-tail shrew	Red squirrel
Little Brown myotis	Northern flying squirrel
Small-footed myotis	Beaver
Silver-haired bat	Deer mouse
Eastern pipistrelle	White-footed mouse
Big brown bat	Southern bog lemming
Red bat	Northern bog lemming
Hoary bat	Red-backed vole
Black bear	Pine vole
Raccoon	Muskrat
Matren	Norway rat
Fisher	House mouse
Short-tailed weasel	Meadow jumping mouse
Long-tailed weasel	Woodland jumping mouse
Mink	Porcupine
River Otter	Snowshoe rabbit
Striped skunk	White-tailed deer
Red Fox	Moose
Gray Fox	
Domestic Dog	

* Birds commonly nesting in area.

TABLE E-3

COMMON ANIMAL SPECIES (Continued)

Common Amphibians and Reptiles

Spotted Salamander	Spring peeper
Red-spotted newt	Gray treefrog
Northern dusky salamander	Bullfrog
Red-backed salamander	Greenfrog
Spring salamander	Wood frog
Northern two-lined salamander	Northern leopard frog
Blue-spotted salamander	Eastern garter snake
Common American Toad	Northern ringneck snake
Snapping turtle	Northern black racer
Stinkpot	Smooth green racer
Spotted turtle	Eastern milk snake
Wood turtle	Northern brown snake
Eastern-painted turtle	Red-bellied snake
Pickerel frog	Kingsnake



FIGURE E-2.

SOURCE: New England River Basins Commission, Androscoggin River Basin Overview, September 1981.

E.1.4 Water Quantity

Streamflow data for the Little Androscoggin River near Auburn, Maine is available for the period of record 1941-1982. The U.S. Geological Survey installed this gauge and initiated readings at the beginning of Water Year 1941 on October 1, 1940. The gauge was taken over by Maine Hydro Development Corporation (MHDC) and Union Water Power, a Central Maine Power Company subsidiary, in 1982.

The gauge, formerly U.S.G.S. Gaging Station #01058500, is situated on the right bank 100 feet upstream from the highway bridge at Littlefield, Maine. Flows are monitored from a drainage area of 331 square miles. The peak discharge at the gauge occurred on March 28, 1953 and was recorded to be 16,500 cfs. The minimum flow at the gauge occurred on October 14, 1949 and was recorded to be 14 cfs. Also noted in the gauge records was a discharge of 16,800 cfs for the March 20, 1936 flood. However, this discharge was estimated at the mouth of the river (drainage area of 354 square miles) from river stage measurements.

The flow in this river is regulated by the Pennesseewassee and Thompson Lakes and several hydroelectric powerplants above the gauging station. The Flow Duration Curve at the gauge, based on all days for the 42-year record prior to MHDC operating it, is shown in Exhibit A-1. The Littlefield Project is located approximately one-half mile downstream of the gauging station. The drainage area at the dam is about 331 square miles with no intervening inflow streams. The flow duration curve for the period of record at the gauge is representative of available generating flows at the project. The dam was breached during the March, 1936 flood, prior to the installation of the gauge. /

E.1.5 Land Uses

The Littlefield Project is located on the Little Androscoggin River approximately 4.5 miles upstream of the river's mouth. The site is in the village of Littlefield Corner in the southwestern section of the City of Auburn.

The City of Auburn, Maine, encompassing approximately 65 square miles, is located in the southwestern part of the State approximately 30 miles southwest of Augusta and 30 miles north of Portland. Auburn is bordered by the Town of Turner to the north, the City of Lewiston to the east, the Towns of Durham and New Gloucester to the south, and the Towns of Poland and Minot to the West.

The lands surrounding the dam site and pool are generally undeveloped. The Martindale Golf Course is located on the easterly side of the project land. Three bridges span the Little Androscoggin River approximately one-half mile upstream of the dam: the Canadian National Railroad Bridge (downstream), the Old Trolley Bridge and the Old Hotel Road Bridge (upstream).

No residential structures are situated within the proposed project bounds. A few residential structures with small adjacent garden plots are located along Hardscrabble, Merrow, and Old Hotel Roads. These structures are about half a mile to a mile upstream of the dam site.

E.1.6 Recreational Uses

Congress, in 1965, passed the National Wild and Scenic Rivers Act to preserve selected, free-flowing rivers throughout the nation. An inventory, prepared by the Heritage Conservation and Recreation Service (HCRS), now administered by the National Park Service (NPS), designates potential river segments for inclusion on the National Wild and Scenic Rivers Inventory. The segment of the Little Androscoggin River, within or adjacent to the project bounds, is not included on, nor is it designated for inclusion in, the National Inventory.

The Class "C" water quality in the project area has historically restricted both the water contact recreational activities as well as angling opportunities. With the exception of the Martindale Golf Course, minimal recreational activity occurs in this area. Fishing and limited canoeing take place on the river now, with the reach between the railroad bridge and the dam preferable for fishing. There are no publicly maintained roads or trails that access the river in the project area. It is anticipated that as water quality conditions improve and fish abundance increases in the future, recreational fishing also will increase.

E.1.7 Historical and Archaeological Resources

The abandoned powerhouse at the site was built at the turn of the century and has physically deteriorated since the dam was breached. A prehistoric (Indian) archaeological site, (Maine Archaeological Survey No. 23.11), was discovered in either 1982 or 1983 within the Project boundary. This site will be reinundated by the rehabilitation of the Littlefield Dam.

The Applicant has conducted an archaeological survey (Phase I) of the Project area to identify any other existing or potential prehistoric archaeological sites. Those sites which were identified have been assigned the following Maine Archaeological Survey site numbers:

Site 1 assigned #23.15
Site 2 assigned #23.16
Site 3 assigned #23.17
Site 4 assigned #23.18
Site 5 assigned #23.19

"Informant reported" site was assigned site #23.20 in anticipation of its confirmation.

The Maine Historic Preservation Commission (MHPC) recommends the following excavation and testing areas for Phase II work:

- On site 1/23.15, a minimum of 20 meter square excavation to develop information sufficient to judge eligibility of the site to the National Register of Historic Places.
- On site 2/23.16, a minimum of 10 meter square in shovel testpitting to determine if any concentrations of cultural material can be identified and if any any unplowed deposits can be located.
- Site 3/23.17, a minimum of 20 meter square excavation to develop information leading to a determination of National Register eligibility.
- Possible sites 4/23.18 and /23.19, 10 shovel pits at each to develop further information of their cultural content.
- Excavation of 30 shovel testpits minimum in the area of the informant reported site (23.20) to confirm its presence and characterization.

The Phase II field survey, to be conducted in the spring of 1987, will incorporate the recommendations of the MHPC. It will be directed toward determining the eligibility of archaeological sites for the National Register of Historic Places.

E.1.8 Scenic and Aesthetic Resources

The Littlefield Project spans the Little Androscoggin River about 4.5 miles upstream of its mouth. The site is located in an undeveloped area in the village of Littlefield Corner, within the southwestern section of the City of Auburn, Maine. The lands surrounding the dam site and pool are generally undeveloped. The project site is not visible from the major roads or highways, however, the site can be seen from portions of the Martindale Golf Course.

The abandoned hydro facility at the site has been inoperative since the March 1936 flood breached the dam's stone masonry wall adjacent to the southwestern spillway abutment. The site, reflecting the lack of maintenance and repair, detracts from the aesthetic qualities of the area.

No significant visual resources including parks, monuments, scenic vistas, etc., are present in the project area.

The original configuration of the facility, characterized by the powerhouse being integral with the spillway structure, ensured that all inflows to the site were released in the downstream channel; i.e., no river diversions occurred. The breach returned the river more or less to its natural channel. The proposed structure will continue to contain flows within the channel and the site will operate run-of-river. Overall river aesthetics in the area should be enhanced by the presence of the impoundment created by the dam.

E.2 Environmental Impacts

The following subsections describe the expected environmental impacts from the proposed Littlefield Hydroelectric Redevelopment Project.

E.2.1 Impacts on Vegetative Cover

The impoundment above Littlefield Dam has not been in existence for over 50 years. Much of the area however that will once again be inundated is now flooded annually.

Backwater studies were conducted on the lower reach of the Little Androscoggin River to determine what effect the reconstruction of Littlefield Dam will have on the water surface profile (See Appendix E-8). The studies showed that the reconstruction of this site will create a 101-acre pool extending approximately 2.2 miles upstream of the dam. Figure E-3 shows the area that will be inundated by the reconstruction, assuming 3 foot flashboards are in place and a river flow of 600 cfs. The habitat types and corresponding acreages included in this area were identified previously in Figure E-1 and Table E-1. Approximately 59 percent of the 101 surface acre impoundment will cover areas which, except for higher elevation cropland, were previously inundated by annual river flooding. These areas will be relatively shallow, averaging three to four feet deep, and therefore characterized as Lacustrine - Littoral, which will support rooted aquatic vegetation and, in upper shallow fringe areas, emergent aquatic vegetation. The remaining 41 percent of the impoundment will be classified as Lacustrine - Limnetic, characterized as relatively deep and slower current velocity than riverine environment.

With respect to the effects of dam reconstruction on the 100 year flood conditions at Littlefield Dam, the water surface profile will increase 55 feet just upstream of the dam and decrease to 0.13 feet approximately 2500 feet upstream (See Figure E-4). The Applicant has submitted the necessary background technical data to The Federal Emergency Management Agency (FEMA) so that revised Flood Insurance Rate Maps and Flood Boundary and Floodway Maps for the affected area can be issued upon completion of the Project (See Appendix E-7, p.70). In addition to complying with the National floodplain regulations, the Applicant will also comply with the local shoreline regulations issued by the City of Auburn.

LEGEND



EXISTING POND LEVEL AT AVERAGE FLOW



NEW POND LEVEL AT AVERAGE FLOW



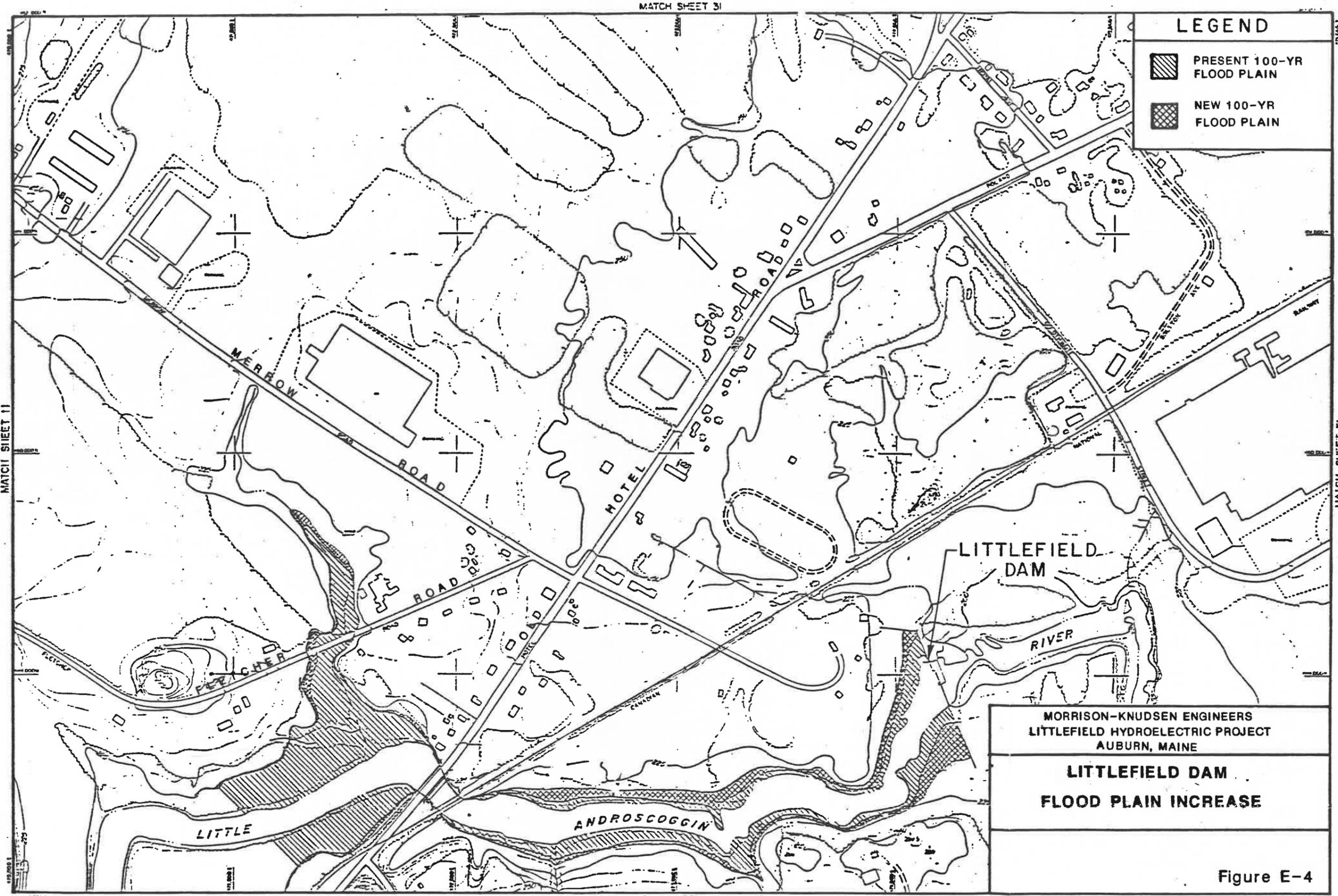
0 1000 2000
SCALE FEET

LITTLEFIELD
DAM

MORRISON KNUDSEN ENGINEERS
LITTLEFIELD HYDROELECTRIC PROJECT
AUBURN, MAINE

**LITTLE ANDROSCOGGIN RIVER
POND LEVEL INCREASE**

Figure E-3



LEGEND

-  PRESENT 100-YR FLOOD PLAIN
-  NEW 100-YR FLOOD PLAIN

MORRISON-KNUDSEN ENGINEERS
 LITTLEFIELD HYDROELECTRIC PROJECT
 AUBURN, MAINE

**LITTLEFIELD DAM
 FLOOD PLAIN INCREASE**

Figure E-4

MATCH SHEET 29

300 0 200 400 600 800
 FEET

DATUM: U.S.S. MEAN SEA LEVEL
 1000-FOOT GRID BASED UPON MAMC COORDINATE SYSTEM (WEST ZONE)
 5 FOOT CONTOUR INTERVAL

MATCH SHEET 11

MATCH SHEET 31

MATCH SHEET 51

Except for one area, just upstream of the dam, most of the area that will be permanently inundated consists of a narrow strip along the bank 20 to 40 feet wide. The banks are quite steep with much ledge at or near the surface. A few areas may extend back from the existing rivers edge as much as 200 feet. The area most acutely affected will be the old oxbow and low lands immediately above the Old Hotel Bridge. This area extends upstream about 4,200 feet with a maximum width of about 3,200 feet. Most of the 101 acres of total impoundment will be included in this area (approximately 80 acres with an average depth of water in the marsh of about 4 feet). This oxbow area will be converted from a shallow marsh to a deep marsh. Much of the aquatic plants in this area will be unaffected, as they would adapt themselves to live either partially or wholly submerged.

Because rivers can support a more limited flora than ponds, the vegetative cover displaced along the banks downstream of this pond should gradually be replaced by the more abundant aquatic plants.

Little change in the vegetative cover above the pond should be observed. Since no endangered species of flora have been identified in the area, the overall impact of the impoundment should prove beneficial.

One area in the immediate vicinity of the dam will require disturbance of the vegetative cover. This will be on the left bank where an access road, as an extension of Merrow Road, will be constructed to provide access to the powerhouse. The transmission line will be strung along this road terminating at the site of the old transformer station. Only the concrete slab floor of the latter will remain; however, its reuse is planned, thus no additional vegetative cover will be disturbed. Much of the tree cover has already been cut by others on the steep bank above the powerhouse. A considerable amount of toppings and limbings were left which will be removed. Only a few ferns and saplings are beginning to reappear through this brush. Thus only minimal disturbance of the vegetative cover for the construction of the project is anticipated. Upon completion of project construction, a more stabilized habitat should result.

E.2.2 Impacts on Fish & Wildlife

Consolidated Hydro, Inc., (CHI), the sole owner of the Littlefield Hydro Company, has considerable expertise in the development and operation of hydroelectric facilities. CHI is committed to the responsible use of renewable resources.

As a result of consultation with the U.S. Fish and Wildlife Service (FWS), Maine Departments of Inland Fisheries and Wildlife (MDIFW), Marine Resources (DMR), and the Atlantic Searun Salmon Commission (ASSC), CHI has made major changes to the proposed operation and design of the hydroelectric facility.

In response to Agency concerns that cycling (the originally proposed mode of operation) may cause an adverse impact on the downstream aquatic habitat during low flow, project operation was changed from a cycling mode to strict run-of-river, such that instantaneous inflow will equal instantaneous outflow.

In response to Agency concerns regarding fish impingement and entrainment, the equipment selection was changed from four Francis Turbines to one double regulated tube-type turbine.

It is recognized that significant impacts on existing and potential fishery resources could result from the rehabilitation of the Littlefield Dam and hydropower operation unless measures are included in the project plans, as necessary, to provide adequate fish passage, prevent degradation of water quality and compensate loss of instream riffle habitat. The applicant is committed to protecting these resources as discussed below.

The applicant has had several meetings and consultations with the state and federal agencies identified above to obtain their views and suggestions regarding potential impacts and possible solutions to potential problems related to the development of the Littlefield Project.

The agencies' concerns regarding these potential impacts are identified and interpreted as follows:

1. Elimination of freeflowing characteristics of the river due to impoundment.

The impoundment created by the project will result in a loss of 0.5 miles of existing riverine habitat comprising potential spawning area for the Atlantic salmon and American shad.

As a result of the Littlefield Dam breaching in 1936, riverine characteristics within the lower portion of the previous impoundment have returned. This is evidenced by exposure of a fast flowing riffle area extending approximately half a mile upstream from the Littlefield Dam to the railroad bridge. The river remains in a pool state upstream from the railroad bridge as the result of flow constriction by the bridge.

Riffle areas are essential for spawning of fish species such as American shad, Atlantic salmon, brook trout and other riverine fish. Riffles are also valuable fish food production areas and afford wading areas for angling. Losses of riffle areas would reduce the stream's capacity for spawning of anadromous and other riverine fish and limit the success of restoration for these species.

2. Cumulative Impacts

- a. Restoration of anadromous fish could be hampered through an increased number of dams and hydropower units which cumulatively result in decreased fish passage success and increased mortality of downstream migrants.
- b. Degradation of water quality could result from cumulative effects of increased impoundments due to reduction of natural stream aeration capacity and prolonged storage.

In addition, the fish and wildlife agencies recommended that the applicant perform assessments of fish and wildlife habitats that would be affected by the project, including a determination of mitigation measures needed to offset losses in habitat values and studies of angling opportunities. It was also recommended that the applicant provide conceptual level designs of facilities for downstream fish passage.

In response to recommendations by the federal and state fish and wildlife agencies, a study of potential project impacts on fish and wildlife habitats was conducted during the summer of 1986. The study was performed in accordance with specific assessment methods as prescribed by the U.S. Fish and Wildlife Services Habitat Evaluation Procedures (HEP). The complete study report is appended. (See Appendix E-1).

The HEP method requires evaluations of fish and wildlife habitat types in relation to models of life requirements (food, cover, breeding, etc.) of selected representative species. Fish and wildlife species selected by the fish and wildlife agencies and the Applicant's consultant for the HEP study were: Atlantic salmon, American shad, Alewife, Brook Trout and Smallmouth bass, Black duck and American Woodcock. Results of the study indicate that the project would provide a net increase of 199 percent in habitat for waterfowl and other aquatic-related wildlife, while woodcock habitat, in the forest and shrub areas of the flood plain, would be reduced by 12.2 acres. Some forested wetlands, suitable for Woodcock are expected to develop within the newly created annually flooded areas (above elevation 216' msl) which would compensate for some of the losses of existing habitat for this species. The Project would result in overall net increases in fishery habitat for Alewife (470 percent), Brook Trout (119 percent) and Smallmouth bass (246 percent). Spawning habitat for Atlantic salmon (2.3 acres) and American shad (2.2 acres), however, would be eliminated by this impoundment.

A mitigation plan to compensate for losses of stream habitats for Atlantic salmon and American shad has been developed by the Applicant which includes the creation of additional spawning and egg incubation areas at two new sites. Both sites are hydroelectric projects which are owned and operated by CHI. The mitigation areas include the Marcal Bypass Channel at the Mechanics Falls Dam and the Bypass Channel at the Barkers Mill Lower Dam (see Figures 3 and 4 in Appendix E-1). The mitigation plan provides for increased minimum instantaneous discharges of 20 cfs through the original stream channels from the Mechanics Falls site and from the Barkers Mill Lower Dam throughout the spawning and egg incubation periods of Atlantic salmon and American shad.

With respect to the proposed mitigation measures, the Agencies have expressed the following additional concerns:

1. The proposed flow durations at Mechanics Falls and Barkers Mill Lower Dam are too limited. Juvenile stages of Atlantic salmon and both juvenile and adult stages of brown trout will be expected to inhabit these sites year-round. (Atlantic-Sea Run Salmon Commission, Maine Department of Inland Fisheries and Wildlife).
2. Choice of Mechanic Falls and Barker Mill Lower sites as mitigation areas is not legitimate for shad habitat loss at the Littlefield site (Department of Marine Resources, U.S. Fish and Wildlife Service, Department of Inland Fisheries and Wildlife).

While the applicant recognizes that Atlantic salmon are different from other salmon and that Agency concerns pertaining to the proposed flow releases are valid, it is not economically feasible for the Applicant to provide continuous year-round flow at either site. Furthermore, the proposed flow releases were developed under the assumption that the fish, after hatching, will be able to move into pools immediately downstream from these areas. This assumption is believed to be valid, and the Applicant therefore believes that the proposed flow releases will indeed prove beneficial and provide compensation for the loss of riffle habitat. No mitigation measures providing compensation in full have been identified by the Agencies.

With respect to the appropriateness or legitimacy of the proposed mitigation measures, CHI is committed to providing the proposed flow durations and, as owner of the proposed mitigation sites, is willing to implement whatever procedures may be required by the fishery agencies and the FERC to make this proposal "legitimate".

Agency concerns pertaining to cumulative impacts and angling opportunities are addressed below and in Section E.2.3.

The Applicant recognizes that the numerous dams located along the Little Androscoggin River could impede the restoration of anadromous fish. The Littlefield Dam is the third dam upstream from the rivermouth and is one of eleven dams on the river. Barkers Mill Upper and Lower Dams are located approximately 3.1 and 3.6 miles downstream from the Littlefield Dam respectively (See Figure E-5). Immediately upstream from the Littlefield Dam are Hackett Mills and Mechanic Falls Dams, located approximately 5 and 9 miles upstream respectively. Of these four dams, two (Barkers Mill Lower and Mechanic Falls) do not have fish passage facilities. Hackett Mills and Barkers Mill Upper do provide downstream fish passage facilities.

Since present plans for fish restoration include trapping American shad and alewife at the downstream Brunswick Project and trucking them to upstream waters, a downstream passage facility at the proposed project is necessary. The Applicant is committed to providing the downstream fish passage facilities at Littlefield and has included their conceptual design in Exhibit F- 4. The Applicant does not believe that it is necessary to provide upstream fish passage at this time, however, for the following reasons:

1. Natural upstream migration of shad and alewives to the foot of the Littlefield dam is not possible since the Barker's Mill Upper and Lower dams, as well as dams at Lisbon Falls and above Brunswick, do not permit the natural upstream passage of these fish.
2. Whether fish were to be introduced above the Littlefield dam by natural migration or artificially by trucking, their further upstream migration will be blocked by the existing dams at Minot, Hackett Mills, Mechanic Falls and Welchville on the Little Androscoggin main thread and additionally, by the dams at the outlets of any of the lakes which will be their final destination. None of these dams have upstream fish passage facilities.

Should upstream fish passage facilities be required in the future by FERC, the Applicant is willing to consult with the appropriate Agencies to provide these facilities.

Finally, with respect to Agency concerns over the potential loss of angling opportunities from the Project, it is expected that angling opportunities for indigenous species should greatly increase as a result of expanded habitat areas provided by the project impoundment. Increases in habitat units related to these species are: alewife, 58.5; brook trout, 3.2; smallmouth bass, 26.0; amounting to a combined increase of approximately 173% over existing habitats for these species within the project site (See Appendix E-1). Equating habitat units with assumed species productivity translates to increased availability of fish for harvest and therefore significantly greater angling opportunities.

Construction Impacts

Construction impacts will be temporary and disturb only a minimum amount of wildlife habitat, primarily that of the smaller mammals, amphibians, and reptiles.

E.2.3 Impacts on Water Quality

The reactivation of the Littlefield Hydroelectric facility will change the 50 year regime of somewhat restricted flows through the breached dam to flows from a 101-acre impoundment with maximum depth of about 16 feet at the dam site. The impoundment will extend 2.2 miles upstream.

Water quality in the river has improved over the last several years because of the installation of upstream pollution abatement facilities; conditions are expected to continue improving since several other municipalities are planning to install pollution abatement facilities. As discussed in Section E.1.3, existing water quality conditions in the Littlefield Project are very good and the Project is not expected to significantly impact water quality. The proposed run-of-river operation, where inflow is equal to outflow, should provide a rapid pond flushing rate. The small size of the pond and rapid flushing rate should all but eliminate chemical and thermal stratification or sedimentation normally associated with larger and/or deeper impoundments. Potential eutrophication conditions should be minimal because of displacement of phosphorous and nitrogen concentrations required for algae blooms.

In addition, there will be no pollutant discharges from the Project facilities. No lavatory facilities are proposed for the powerhouse because the station will be automated. Trashrack debris will be removed and disposed of in a suitable off-site location.

There will be minor impacts on water quality resulting from construction activities at the Project site. Impacts during construction will be minimized as much as possible. Blasting of ledge will be necessary for the tailrace and some cofferdams will be required. Sitings will be carefully selected and the work will be accomplished during the lowest flow periods of the season. This should keep sedimentation to a minimum. River flows will be uninterrupted through the site during construction.

Accepted practices for sedimentation and erosion control will be incorporated into the project to minimize site runoff effects.

E.2.4 Impacts on Water Quantity

The Littlefield Hydroelectric Project will operate in a strict run-of-river fashion with instantaneous inflow equal to instantaneous outflow. There will be no impact on water quantity.

The City of Auburn draws its drinking water from a reservoir and is not likely to be affected by groundwater conditions in the project area. No change from current use, density, or legal classification will be made; therefore, there will be no impact on water use.

E.2.5 Impacts on Land Uses

The impoundment created by the project will eliminate forested and agricultural lands below elevation 216' msl. Approximately 59 percent of the 101 surface acre impoundment will permanently cover areas which, except for higher elevation cropland, were previously inundated only by annual river flooding. No residential or lands with potential for development will be affected by recommissioning the dam and restoration of the impoundment to its historic level. The bridge crossings that are a half mile upstream of the dam site will not be affected as they were constructed prior to 1936.

In addition, the Martindale Golf Course is not expected to be adversely affected by the Project impoundment.

E.2.6 Impacts on Recreational Uses

Short term recreational impacts will occur during construction and will be limited to the area where civil work is being done. Impacts will be confined to fishing, canoeing and hiking. These impacts could be mitigated somewhat through the use of detours. Excavation in the tailrace area will have a temporary, negative impact on fishing, but proper use of cofferdams will minimize excess sedimentation from entering the river.

Over the long term the project will significantly enhance the recreational opportunities in the area. Public access not presently available, will be provided at the site for both angling and canoeing purposes. A canoe portage around the site will be provided. The canoe launch will be far enough downstream of the turbine draft tube exit so that potential tailrace turbulence will not constitute a safety hazard. Access to the tailrace area, normally considered prime fishing locations at dam sites, will also benefit anglers.

Finally, in response to the Maine Bureau of Parks and Recreation's concerns pertaining to the potential use of boats by persons fishing in the area, the Applicant will provide a boat launching facility at the site.

E.2.7 Impacts on Historical and Archaeological Resources

The development of the site calls for the rehabilitation of the existing site. No previously undisturbed area will be affected. However, the reinundation of the Project area may cause erosion at existing archaeological sites. The Applicant has conducted a Phase I study of the Project area. During the study, existing and potential American Indian sites were identified.

This study is currently under review by the Maine Historic Preservation Commission (MHPC). The Applicant has begun conducting a literature review and will conduct the Phase II field survey immediately after the proposed workplan has been approved by the SHPO. The purpose of the Phase II survey is to determine the eligibility of any of these sites to the National Register of Historic Places.

E.2.8 Impacts on Scenic and Aesthetic Resources

The reactivation of the Littlefield Power facility will provide positive visual impacts within the project area. Rehabilitation of the site features, which are in disrepair from the lack of maintenance, and restoration of the pool to its historic operating level, will provide improved aesthetics at the dam site as well as along the periphery of the pool.

Construction of a new powerhouse, canal, trashracks, and headgates will enhance the visual appearance on the left bank. No significant visual impacts are anticipated by upgrading the trail which will be used as a construction and permanent access road to the site, or from the installation of the transmission line interconnection. The impoundment will undoubtedly have the most significant impact, complimenting the scenic beauty of the general area.

Short-term customary construction impacts will occur that are typical of a project of this nature. These disruptions are expected to last no more than 24 months, however, they will be kept to a reasonable minimum. Because of the site's isolated location, little personal inconvenience should result.

E.3 Agency Consultation

Consultation with Federal, State, and local agencies concerning the rehabilitation of the Littlefield Hydroelectric Project began in late 1984, prior to the effective date of Commission Rule 4.38. As a result of early consultation, the equipment selection and mode of operation were changed. Originally four Francis Turbines had been proposed to be installed at the site. Now the Applicant proposes to install one double regulated tube-type turbine. The operation of the Project was changed from a limited cycling mode to strict run-of-river to reduce the effect of the Project on downstream aquatic habitat.

In response to subsequent Agency consultation, the Applicant conducted studies and evaluations related to project impacts on the fish and wildlife habitats. The development of mitigation plans were also included in these studies (see Appendix E-1). A copy of the Draft License Application, which included the results of these studies, was submitted for Agency review in November, 1986.

The Fish and Wildlife Agencies are now requesting additional consultation. However, the Applicant believes that it has responded to Agency concerns to the best of it's ability and

can no longer delay in filing this license Application with the FERC. Realizing the importance of agency consultation in expediting the Licensing process, the Applicant delayed filing the license Application for over a year in order to conduct the studies requested by the Fish and Wildlife Agencies. This delay, however, has jeopardized the Applicant's power purchase sales agreement with Central Maine Power, which requires that project construction be completed and on-line by November, 1989. The Applicant believes it can no longer delay filing the license application without further jeopardizing the power sales agreement and ultimately the future of the Project.

Previous project correspondence is contained in Appendix E-7 of this report. The following section summarizes comments received.

E.3.1 Agency Comments

Maine Historic Preservation Commission

In their letter of September 24, 1984 (Shettleworth), the MHPC referenced that site #23.11, discovered by the Maine State Museum, was within the Project boundary.

Based on these comments a Phase I archaeological survey was performed and has recently been submitted to the MHPC. In their letters of July 31, 1986 and December 1, 1986 (Shettleworth), the MHPC requested a Phase II study based upon the preliminary findings of the Phase I study. MHPC also expressed concern that the geographic area surveyed in Phase I may have been inadequate. The Applicant acknowledges this inadequacy and has agreed to survey the area omitted from the Phase I survey during the Phase II survey. A contractor to do the Phase II study has already been selected. The study will commence as soon as the MHPC has reviewed and approved the workplan. Phase II is scheduled for completion by the spring of 1987.

Maine Department of Conservation

In their letters of September 24, 1984 (Baum) and December 10, 1986 (Anderson), the Department raised the issues of the need for boat access and a canoe portage trail around the dam. The Applicant feels that a canoe portage around the dam will be beneficial to canoeists and kayakers and will install one. The Applicant will also provide a boat launching facility.

United States Environmental Protection Agency

In their letter of October 15, 1984 (Higgins), the EPA expressed concern about downstream water quality during periods of cycling. The Applicant has changed its mode of operation to strict run-of-river in order to alleviate the concern of downstream water quality which was acknowledged in the EPA's December 13, 1985 (Higgins) letter. In both their letters the EPA expressed concern that the Applicant may need a general Section 404 permit from the U.S. Army Corp of Engineers. The Applicant has applied for the 404 permit.

United States Fish and Wildlife Service

In their letters of October 19, 1984 and December 31, 1986 (Beckett), the USFWS requested that HEP, IMIF, Cumulative Impact Assessment and Angling Opportunity Studies be done. Since the Applicant changed its mode of operation to run-of-river the USFWS stated that the Instream Flow Studies were no longer necessary (Beckett 11/27/85). The HEP Study has been conducted and is provided in Appendix E-1. It is also referred to in Exhibit E. The Applicant does not feel that Cumulative Impact Assessment and Angling Opportunities studies are necessary. A discussion of cumulative impacts and angling opportunities is included in Exhibit E, Section E.2.2.

National Marine Fisheries Service

The NMFS stated that the Applicant should supply adequate fish passage facilities in their October 19, 1984 letter (Bigford). The Applicant has incorporated a downstream migrant fish passage facility at the site into its design. The proposed passage facility has been approved by the fisheries for the Upper Barker Hydro Project (also owned by Consolidated Hydro, Inc.) on the Little Androscoggin River.

Maine Department of Environmental Protection

In their October 22, 1984 and January 29, 1987 letters (Murch) the DEP informed the Applicant of Statutory and Regulatory Requirements which the Applicant has noted. The DEP's other concerns and requests were: requested information regarding the impoundment, inundation maps, consultation with FEMA regarding flooding, flashboard information, concern of cycling mode, consultation with Maine Bureau of Parks and Recreation, description of site work and consultation with City of Auburn. The Applicant believes it has diligently pursued each item. Applicant will file concurrently with FERC and DEP for the final license.

Department of Inland Fisheries and Wildlife

In their December 19, 1984 letter (Trask), the DIFW stated that the application had not adequately addressed the effect of the Littlefield Project on fishery resources. As a result, the Applicant performed a HEP study which is referred to throughout this report and is contained in Appendix E-1. In their January 20, 1987 letter (Trask), the DIFW stated that the proposed mitigation was neither sufficient nor appropriate. They also recommended full mitigation in kind. The Applicant has responded to these concerns in Exhibit E, Section E.2.2.

Maine Department of Marine Resources

In their letters of January 30, 1985 and December 31, 1986 (Appollonio), the MDMR requested studies to assess:

1. The impacts of upstream and downstream losses on anadromous alewives and American shad by this project and other existing projects in the watershed.
2. How the applicant will mitigate for upstream and downstream losses caused by this project, and what provisions will be made for upstream and downstream passage of fish.
3. What will be the impact of inundation of riverine habitat in the project area on production of American shad and other riverine dependent species. How will there impacts be mitigated.
4. Identify potential fishing sites of American shad and address mitigation for lost angling sites.
5. Address how flows will be managed to maintain downstream aquatic resources.
6. Identify the cumulative impacts of Littlefield Dam, in conjunction with other existing dams upstream and downstream of the Project, on the anadromous fish runs in the basin. In addition the MDMR requested that the Applicant address responsibility for passing fish both upstream and downstream of the Project. They also questioned the legitimacy of the proposed mitigation measures.

The Applicant has addressed all of the above concerns in this report.

Department of the Army Corps of Engineers

In their November 26, 1985 letter (Ignazio) the Corps states that the operation change to run-of-river will have no impact on their responsibilities. The Applicant has requested a general Section 404 Permit from the Corps. In their letter of November 21, 1986, the Corps state that the proposed project will not affect their flood control activities, but that a Section 404 permit will be required. They also acknowledged the Applicant's request for the Section 404 permit.

Federal Emergency Management Agency

In their May 19, 1986 letter (Thomas) FEMA requested information about flood elevations with the reconstruction of the Littlefield Dam. That information has been gathered and recently submitted for FEMA's review.

Atlantic Sea Run Commission

In their December 10, 1986 letter, the ASSC requested a schematic map detailing the location of Atlantic salmon spawning and nursery substrate and commented that the proposed mitigation proposal was flawed with respect to its proposed release of mitigation flows. The Applicant does not feel that a schematic map detailing the location of spawning and nursery substrate is necessary. The Applicants response to the proposed flaws in the release of mitigation flows is addressed in Section E.2.2.

United States Geological Survey

In their December 19, 1986 letter, the USGS commented that the flow duration curve shown in Figure 1 of the HEP Study should have been based on the entire period of available record (1941-1982), rather than on the period 1941-1978. The calculated flow figures in Table 1 should also be revised. The Applicant has revised Figure 1 and Table 1 of the HEP Study, accordingly.

E.3.2 Agencies Contacted to Date:

The following agencies have been contacted to date. Correspondence with these agencies is included in Appendix E-7.

US Environmental Protection Agency
Region 1
JFK Federal Building
Boston, MA 02203

Contact: Donald Cooke (617) 223-1739

US Department of the Interior
Office of Environmental Project Review
1500 Custom House
165 State Street
Boston, MA 02109

Contact: William Patterson

US Department of the Interior
Fish and Wildlife Services
Ecological Services
P.O. Box 1518
Concord, NH 03301

Contact: Gordon Beckett (603) 224-2585

US Department of the Interior
Fish and Wildlife Services
Suite 700
One Gateway Center
Newton Corner, MA 02158

US Department of Commerce
National Marine Fisheries Service
Habitat Protection Branch
14 Elm Street
Gloucester, MA 01930

Contact: Thomas E. Bigford

US Department of the Interior
Geological Services
Water Resources Division
26 Ganneston Drive
Augusta, ME 04330

Contact: Bill Bartlett (207) 622-8209
Derrill J. Cowing

US Department of the Army
N.E. Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Contact: Harmon Guptill (617) 647-8513
Jay Clement (207) 622-8246
Joseph L. Ignazio

National Park Service
143 South Third Street
Philadelphia, PA 19106

State of Maine
Department of Environmental Protection
State House Station 17
Augusta, ME 04333

Contact: Dana Murch (207) 289-2111

State of Maine
Department of Inland Fisheries and Wildlife
284 State Street
State House Station 41
Augusta, ME 04333

Contact: Steve Timpano (207) 289-3286
Norman Trask
Phil Andrews

State of Maine
Department of Marine Resources
State House Station 21
Augusta, ME 04333

Contact: Lewis Flagg (207) 289-2291
Spencer Appolonio

State of Maine
Historic Preservation Commission
55 Capitol Street
State House Station 65
Augusta, ME 04333

Contact: Dr. Arthur Spiess (207) 289-2133
Earle G. Shettleworth

State of Maine
Department of Conservation
State House Station 22
Augusta, ME 04333

Contact: Ellen Baum (207) 289-2211
Richard Anderson (207) 289-2212

State of Maine
Office of Energy Resources
State House Station 53
Augusta, ME 04333

Contact: Betsy Elder (207) 289-3811

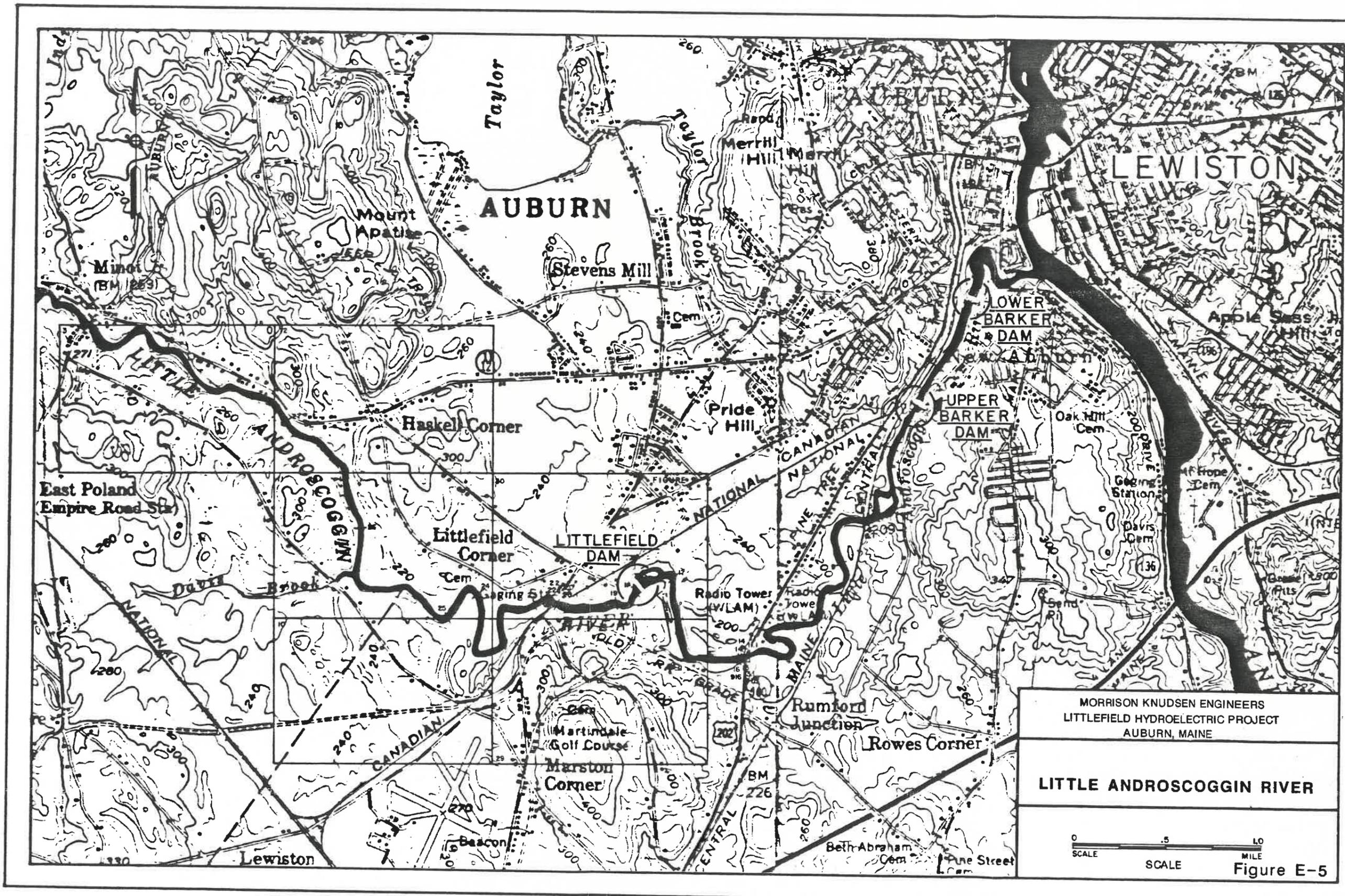
State of Maine
Public Utilities Commission
State House Station 18
Augusta, ME 04333

City of Auburn
Auburn City Building
45 Spring Street
Auburn, ME 04210

Contact: Roland Miller (207) 786-2421

Atlantic Sea Run Salmon Commission
P.O. Box 1298
Bangor, ME 04401

Contact: Kenneth Beland (207) 947-8627



MORRISON KNUDSEN ENGINEERS
 LITTLEFIELD HYDROELECTRIC PROJECT
 AUBURN, MAINE

LITTLE ANDROSCOGGIN RIVER

0 .5 1.0
 SCALE SCALE MILE

Figure E-5

APPENDIX E-1

HEP STUDY

EVALUATION OF POTENTIAL
IMPACTS ON FISH AND WILDLIFE
RELATED TO
THE LITTLEFIELD HYDROELECTRIC PROJECT
LITTLE ANDROSCOGGIN RIVER, MAINE.

BY GERALD G. TAYLOR
BIOLOGIST CONSULTANT

PREPARED FOR
CONSOLIDATED HYDRO, INC.

SEPTEMBER, 1986

TABLE OF CONTENTS

	<u>PAGES</u>
INTRODUCTION	1
Background	1
STUDY OBJECTIVES	1
DESCRIPTION OF PROJECT AREA	2
DESCRIPTION OF THE PROJECT	5
METHODS	
A. General Description of the Habitat Evaluation Procedure (HEP)	5
B. Specific HEP Study Procedures	
1. Formation and Operation of HEP Team	6
2. Selected Target Species and HSI Models	7
3. Preparation of Cover-Type Map	8
4. Measurements of Stream and Improvement Habitats	8
5. Development of Mitigation Plan	11
RESULTS OF HEP STUDY	
A. Without-the-Project	13
B. Project Impacts (with-the-Project)	14
MITIGATION PLAN	
Mitigation Site #1 - Mechanic Falls Marcal Bypass Channel	16
Mitigation Site #2 - Barkers Mill Lower Dam Bypass Channel	16
SUMMARY	19

LIST OF TABLES

- TABLE 1 Average monthly flows and durations which equal or exceed flows occurring 50 percent of the time at the U.S.G.S. Littlefield Guage.
- TABLE 2 Land use/Cover-type classification of Project Study Area.
- TABLE 3 Mitigation Category Classification Based on Fish and Wildlife Service Mitigation Policy for determining Mitigation Needs.

LIST OF FIGURES

- FIGURE I Flow Duration Curve, Years 1941 - 1978
Little Androscoggin River
Auburn, Maine
- FIGURE II Land and Water Cover Types
- FIGURE III Mitigation Site #1, Mechanic Falls Bypass Channel
- FIGURE IV Mitigation Site #2, Barker Mill Lower Dam
Bypass Channel

HEP EVALUATION FORMS

INTRODUCTION

This report is prepared for Littlefield Hydro, Co. (LHC). It presents procedures and results of studies and evaluations related to potential impacts on fish and wildlife with development and operation of the proposed hydroelectric project at the Littlefield Dam on the Little Androscoggin (L.A.) River, described in the Application for License, before the Federal Energy Regulatory Commission (FERC). The "project" herein refers to the proposed Littlefield Hydro project as described in the Application for License.

Background

The Maine Department of Inland Fisheries and Wildlife (MEDIFW), Maine Department of Marine Resources (MEDMR), Atlantic Sea Run Salmon Commission (ASRSC) and the U.S. Fish and Wildlife Service (FWS) have expressed concern that re-development of the Littlefield Project could adversely affect success of planned restoration of anadromous fish populations (Atlantic salmon, American shad and Alewife) to the L.A. River. LHC has responded by initiating several meetings with the agencies to address the issues raised and to obtain agencies' suggestions for specific requirements on part of the license applicant, deemed necessary to mitigate possible adverse project effects.

During a meeting on June 11, 1986 at Gray, Maine between representatives of the USFWS, MEDIFW and MEDMR and LHC, the agencies recommended studies to evaluate project impacts, to be performed in accordance with specific assessment methods as prescribed by the FWS's Habitat Evaluation Procedures (HEP). The procedures are described under "Methods". It was also decided that the studies would focus on those habitats related to fish and wildlife species selected by the MEDIFW and MEDMR and that these agencies would provide the LHC consultant with the habitat evaluation models for each species.

Following the June 11 meeting, LHC prepared a proposed plan for conduct of the recommended studies. The plan was reviewed by the agency's representatives and a meeting of study participants was held on July 20, 1986 at Gray, Maine and the project site, whereby specific study methods and site selections were finalized.

STUDY OBJECTIVES

The principal objectives of this study were: (1) to determine project effects on existing and potential habitats of Atlantic salmon (Salmo salar), American shad (Alosa sapidissima), Alewife (Alosa pseudoharengus), Brook Trout (Salvelinus fontinalis) and Smallmouth bass (Micropterus dolomieu); (2) to assess project impacts on upland and wetland areas; and (3) develop plans to mitigate project - occasioned losses of habitats for anadromous fish species.

DESCRIPTION OF THE PROJECT AREA

The Littlefield project site is located on the Little Androscoggin River, approximately 4.5 miles upstream from the river junction with the Androscoggin River, within the city of Auburn, Androscoggin County, Maine.

The Littlefield Dam is the third dam upstream from the rivermouth and is one of eleven dams on the river. Barkers Mill Upper Dam and Barkers Mill Lower Dam are located approximately 3.1 and 3.6 miles downstream.

Upstream from the Littlefield Dam are two dams located at Hackett Mills and Mechanic Falls, approximately five and nine miles respectively.

Total drainage area of the L.A. River is about 353 square miles, of which 331 square miles are above the project dam. The river has a total fall of 580 feet in its 46 miles of length.

The river, extending 1.7 miles upstream from the bridge crossing of the Canadian National Railroad and Old Hotel Road, is a slow moving pool with a gradient of approximately 1.6 feet per mile. This section is classified as Riverine - lower perennial as contrasted with the downstream 0.5 miles which has a gradient of approximately 12 feet per mile, is fast flowing over riffles and runs and is classified as Riverine - Upper perennial.

Stream flows average 570 cubic feet per second (cfs) based on U.S. Geological Survey (USGS) records for the period 1941 - 1982. Lowest flows usually occur during August, at a mean monthly flow of 180 cfs. The average seven day low flow, with occurrence frequency of once in 10 years (Q 7-10), is approximately 30 cfs. Figure I displays flow durations, for years 1941-1982. Table I shows the average and median monthly flows for the months April, May, June, July, August, September, October and November.

Upland vegetation at elevations above annual flood levels consists of mixed hardwoods and soft woods (maple, oak, beech, aspen, birch) and occasional pine. The annual river flood plain of which more than 90 percent is upstream from the bridge crossing, supports dominant vegetative types, associated with wetland (Palustrine) environments. Wetland, vegetation includes saplings of maple, birch, aspen and alder with ground cover of ferns and sedges. Permanently wet soils and water areas support cattails, rushes, arrowhead, waterlily and other aquatic types. Figure II delineates specific areas of the various cover types. Table 2 shows acreages and compartment numbers of each cover type.

Fishery resources of the L.A. River consist of both cold and warm water species. Excessive water temperatures (above 75 F) occurs during hot summer months which restrict the cold water species (brook and brown trout) to a few areas where cold springs or seeps provide suitable temperatures.

Warm water species include smallmouth and largemouth bass, chain pickerel, minnows, white suckers, yellow perch, bullheads and eels.

FIGURE I

FLOW DURATION CURVE

LITTLEFIELD DAM
LITTLE ANDROSCOGGIN RIVER
NEAR AUBURN, ME.

DA = 331 SQUARE MILES
Q. AVE = 570 CFS

PERIOD OF RECORD: OCT. 1940 - SEPT. 1982

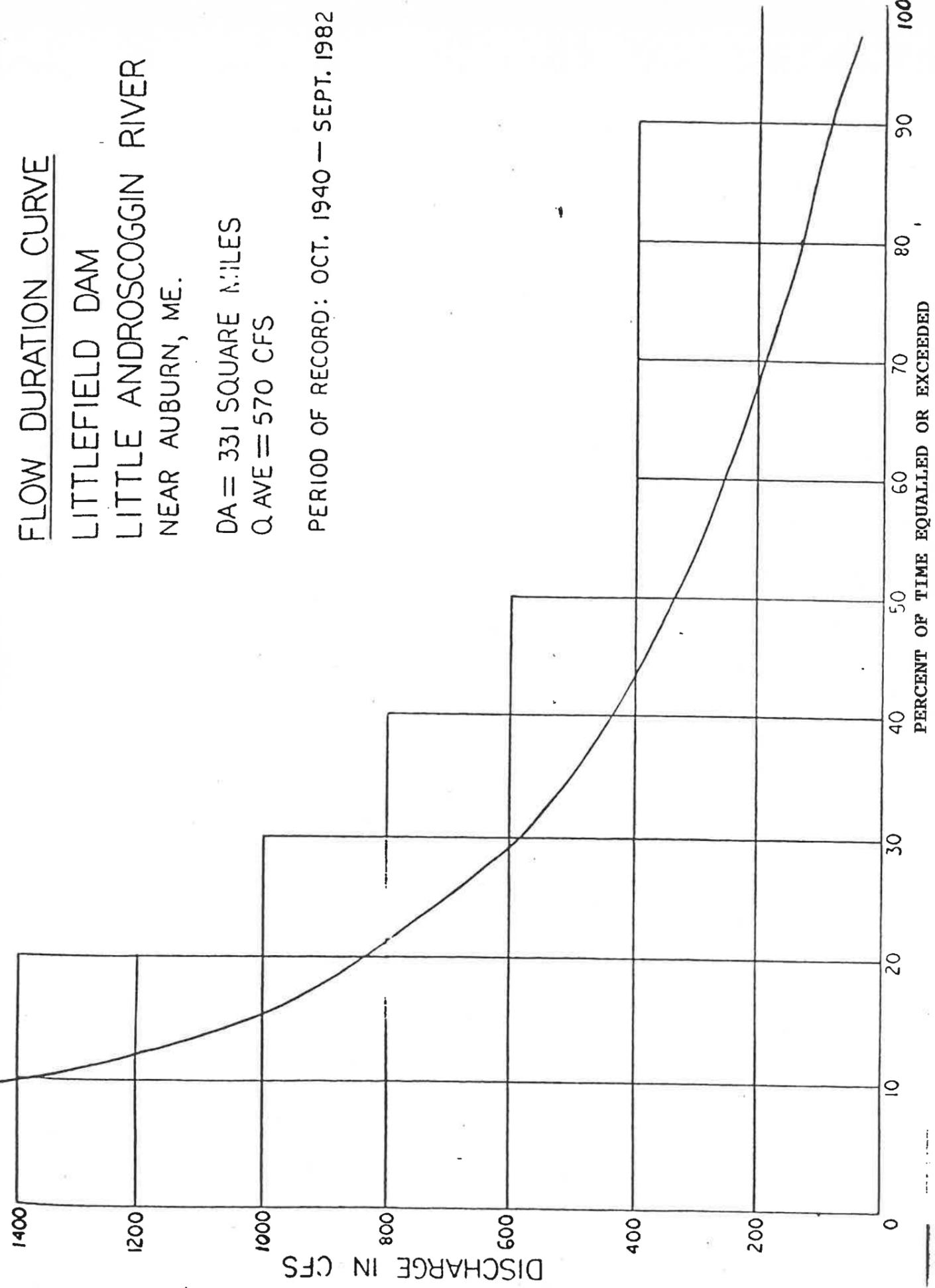


TABLE I
 AVERAGE MONTHLY FLOWS AND DURATIONS
 WHICH EQUAL OR EXCEED FLOWS OCCURRING
 50 PERCENT OF THE TIME AT THE U.S.G.S.
 LITTLEFIELD GAUGE

<u>Month</u>	<u>Average Flow (cfs)</u>	<u>Flow Equalled or Exceeded 50% of Time</u>
April	1710	1550
May	866	696
June	469	361
July	256	190
August	191	139
September	204	134
October	308	170
November	524	370

The MEDMR is presently involved in restoring anadromous fish runs to the lower Androscoggin and L.A. Rivers.

Atlantic salmon, Alewife and American shad are currently being stocked in the L.A. River headwaters in attempts to establish sea-run populations of these species.

Wildlife expected to occur within the project site includes the varieties of species found in the upland and wetland habitats of the surrounding area. White-tailed deer, squirrels, raccoons, woodchucks, beavers, mink, muskrats, wood ducks, black ducks, mallards, mergansers, song-birds and amphibians are expected residents while other waterfowl, woodcocks and songbirds utilize the area during migrations.

DESCRIPTION OF THE PROJECT

Technical data on project facilities and operations are in Exhibit A

Pertinent information for this report is as follows:

Approximate maximum pool elevation:	216' msl
Approximate pool area:	101 acres
Approximate pool length:	2.2 miles
Approximate pool volume:	750 ac-ft
Number of generating units:	One
Type of hydraulic turbine:	Full Kaplan
Net operating head:	22.5'
Maximum turbine discharge:	900cfs
Minimum turbine discharge:	100cfs

- The hydroelectric project will operate in strict run-of-river fashion.
- Instantaneous outflow will equal instantaneous inflow.
- When river flows are less than 100 cfs, the water will pass over the dam spillway.
- Turbine discharge will be directly into the tailwater on the left side base of the dam.

METHODS

A. General Description of the Habitat Evaluation Procedure (HEP)

The HEP methodology has been developed by the USFWS as a systematic process to measure quantity and values of terrestrial and aquatic fish and wildlife habitats related to impacts of land and water development projects. The procedure provides quantification of habitat that is based on: (1) The Habitat Suitability Index (HSI); and (2) the total area of available habitat. The HEP is based on the assumption that habitat for a selected fish or wildlife species can be described by this species' HSI which is a model of life requirements such as breeding, food, cover, water quality, etc.

The HSI is the average of summed life requirement variables (range 0.0 to 1.0) for each selected species. It (HSI) is multiplied by the area of available habitat to obtain Habitat Units (HU's) which are used to compare land and water-use changes in quantified terms.

The procedure requires (1) delineations of each habitat cover type within the study area (as determined from a published standard classification system); (2) selection of fish and/or wildlife target species which would represent other species associated with the cover types; (3) measurement of the life requisite variables provided by available habitat types; and (4) computation of species HSI's and related HU's.

The tabulated HU's computed without and with a proposed project would indicate habitats gained or lost as result of project impacts. Based upon results, plans for mitigation of losses would be included as part of the project, if necessary and feasible.

This study followed the foregoing HEP method except for the use of modified information recording forms developed by a team of fish and wildlife biologists, representing the USFWS, Pennsylvania Fish and Wildlife Commissions and a private consultant. The modified HEP is called Pennsylvania Modified Habitat Evaluation Procedures (PAM HEP).

B. Specific HEP Study Procedures

1. Formation and Operation of the HEP Team.

The team members were:

<u>Name</u>	<u>Agency</u>
Mr. Gordon Russell	USFWS, Concord, NH
Mr. Sonny Pierce	MEDIFW, Gray, ME
Mr. Phil Andrews	MEDFW, Auburn, ME
Mr. Warren Eldridge	MEDIFW, Gray, ME
Mr. Lewis N. Flagg	MEDMR, Augusta, ME
Mr. Steve Timpano	MEDFW, Augusta, ME
Mr. Gerald G. Taylor	LHC Consultant, West Chester, PA

The responsibility for the conduct of the study was by the LHC Consultant.

Responsibilities of the agencies' representatives were selection of target species for evaluation and provision of HSI models for the selected species to the LHC consultant. Their primary roles would be to advise and to supervise the study procedures.

2. Selected target species and HSI models were:

Atlantic salmon (Salmo salar)

HSI Variables:

- V5 - Dominant substrate types (according to code).
- V6 - Percent riffles at low water.
- V7 - Depths maximum of riffles, at low water.
- V8 - Velocity, average in riffles - low water.
- V9 - Percent substrate size class (10-40 cm).
- V10 - Percent fines (<3mm) in riffle - summer.

American shad (Alosa sapidissima)

HSI Variables:

- V1 - Mean surface water temp. (spawning)
- V2 - Mean velocity (spawning)
- V3 - Mean surface temp. (egg development)

Alewife (Alosa pseudoharengus)

HSI Variables:

- V1 - substrate
 - 1) $\geq 75\%$ mud or silt with soft material.
 - 2) $\geq 50\%$ mud or silt some sand & veg.
 - 3) $\geq 75\%$ sand or other hard material.
- V2 - Mean daily water temp. (spawn).
- V3 - Mean number zooplankton per liter.
- V4 - Mean surface water temp.

Brook Trout (Salvelinus fontinalis)

HSI Variables:

- V1 - Temperature
- V2 - Velocity
- V3 - Depth
- V4 - Substrate type (according to code).

Smallmouth bass (Micropterus dolomieu)

HSI Variables:

- V1 - Velocity
- V2 - Depth
- V3 - Substrate types (according to code).

Suitable Wildlife evaluation species were not available; therefore the HSI Consultant discussed the problem with the FW's team member and a decision was made to assess wildlife habitat in terms of HU's through selection of appropriate species and application of arbitrary HSI's, by the LHC Consultant, to derive a measure of habitat changes, particularly in the wetland areas. Accordingly, two wildlife species were selected:

Black duck to reflect areas with aquatic vegetation and

American Woodcock to reflect the drier but moist areas of flood plain habitat.

3. Preparation of Cover Type Map

Identification of vegetated areas within the project site was accomplished by on-site inspection by the LHC Consultant and a wildlife biologist of the MEDIFW. Areas identified were noted on a U.S.G.S. Topographic map, 7.5 minute series, 1981. Descriptions of the cover types were recorded in field notes after each site was identified. Each cover type was delineated on the Topo map and areas measured by dot-grid method. Classification of each cover type was in accordance with the FWS Wetland Classifications System (Cowardin, et.al., 1979). The data, consisting of an identification compartment number, descriptions of cover type, FWS mitigation category and acres related to each cover type are shown in Table 2. Figure II is a project base map with location of cover types shown by identification numbers corresponding to data recorded in Table 2.

4. Measurements of Stream and Impoundment Habitats

Collection of data to describe the steep gradient riffle-run habitat in the one-half mile section between the project dam and the upstream bridge crossings was accomplished on July 22 and 23 by measurements at three transects, across three riffle areas. Measurements of pool areas both downstream and upstream from the bridge crossings by the MEDIFW were also utilized. Locations of the transects are as follows (see Figure II).

TR #1 - Riffle, 255 feet downstream from the railroad bridge.

TR #2 - Riffle, 1,230 feet downstream of the railroad bridge.

TR #3 - Riffle, 1,695 feet downstream from the railroad bridge.

Table 2

LAND USE/COVER TYPE
CLASSIFICATION OF
PROJECT STUDY AREA

COMPARTMENT NUMBER	DESCRIPTION	MITIGATION CATEGORY	ACRES (SUBTOTALS)
211-2	Agriculture (cropland)	4	7.2
211-2*	" "	4	11.3
	SUBTOTAL		(18.5)
413-1*	Deciduous forest, polestage shrub, moderate to dense	3	8.2
413-2*	" " "	3	5.3
	SUBTOTAL		(13.5)
415-1	Deciduous forest, mature, shrub moderate		6.0
415-2*	Deciduous forest, mature shrub stage moderate to dense	3	1.3
	SUBTOTAL		(7.3)
618-1*	Palustrine-Forested Wetland	2	(10.2)
618-2*			
6133-1*	Palustrine-aquatic bed rooted vascular	2	1.5
6133-2*	" " "	2	2.9
	SUBTOTAL		(4.4)
616-1*	Palustrine-Emergent Wetland	2	4.7
616-2*	" " "	2	.6
	SUBTOTAL		(5.3)
6171-1*	Scrub-Shrub Wetland	2	3.6
6171-2*	" " "	2	2.3
6171-3*	" " "	2	1.7
	SUBTOTAL		(7.6)
6522*	Riverine - lower perennial	4	26.6
6612*	Riverine - upper perennial	2	7.6

* AREAS FIELD SURVEYED.

Measurements at each transect were accomplished by stretching a 1/4 inch rope (tagline) across the channel, perpendicular to the stream flow and recording depth, substrate types (in percentages of bedrock, boulder, cobble, rubble, sand and vegetation) at 12 - 14 measured intervals across the channel. Velocities at each transect were measured by timing three cork floats at 10' channelward of each bank and midchannel through a distance of 50 feet from upstream of the tagline. Additional data, included recording time of day, weather, air, pH, water temperatures, bank slopes to water edge and length of riffles. Lengths of all riffle areas within the one-half mile section were measured using a 100 foot steel tape. In addition, one-half liter sample of water for zooplankton analysis was taken at TR sites 1 and 3.

Metered stream flows for each day of transect measurements was also obtained from recordings at the Littlefield gauge (U.S.G.S. #01058500), located immediately upstream from the transect sites. Dissolved oxygen and temperature measurements during the study period were provided by the Maine Department of Environmental Protection (MEDEP).

Data for the upstream 1.7 miles of the river were taken from measurements made by the MEDIFW which indicated a continuous pool with sand and some cobble substrate. These data plus examination of elevation contours from topographic maps and a hydraulic backwater analysis by Morrison - Knudsen Engineers, corroborate the judgement that the upstream section is a continuous pool with average width at 129 feet and depth of 4.6 feet at average flow.

5. Development of Mitigation Plan

Two additional sites were measured for a mitigation plan to compensate losses of stream habitats for Atlantic salmon and American shad.

Mitigation Site #1 (Mechanics Falls - Marcal Bypass Channel, Figure III).

The dry, bypassed channel was measured by width and length at four sections between the dam and lower end of the bypass channel. Percentages of bottom types (bedrock, boulder, cobble, rubble, gravel) were estimated within each section. Areas of wet width, depths and velocities were computed at 10, 15, 20, 30, 35 and 40 cfs, based upon unpublished data from flow studies, provided by LHC.

HSI's and HU's for Atlantic salmon, American shad, Alewife, Brook Trout and Smallmouth bass were computed and recorded in form 5 b's, appended.

Mitigation Site #2 (Barkers Mill Lower Dam - Bypass Channel,
Figure IV.

Channel measurements of widths and lengths at 10 sections were made between the dam and the lower end of the bypass channel. Percentages of substrate types were estimated within each section. Areas, depths and velocities in relation to flows @ 20, 25, 30, 35 and 40 cfs were calculated based on channel morphology and related data from unpublished flow studies at the Marcal bypass channel (cited above). HSI's and HU's were computed as described for Mitigation Site #1 and recorded on form 5b, appended.

RESULTS OF HEP STUDY

A. Without-the-Project

The 101 acres within the project site (at elevation 216' MSL) is comprised of 66.8 acres of terrestrial areas and 34.2 acres within the 2.2 miles of Little Androscoggin River.

Terrestrial cover types (Figure II and Table 2), include seven classification categories: Agricultural land (211); Deciduous Forest (413, 415); Palustrine - Forrested Wetland (618); Palustrine - Aquatic Veg. (613); Palustrine - Emergent Wetland (616) and Scrub Shrub Wetland (617).

The river areas are classified by two types: the upper 1.7 miles (low gradient pool) is classified Riverine - Lower perennial Figure II, and the lower 0.5 miles is Riverine - Upper perennial.

The HEP also includes four categories with criteria for mitigation of various cover types. These are set forth in Table 3.

Table 3. Mitigation Category Classification Based On Fish and Wildlife Service Mitigation Policy for Determining Mitigation Needs.

<u>Category</u>	<u>Category Designation</u>	<u>Mitigation Planning Goal</u>
1	Habitat is of high value for evaluation species and is unique and irreplaceable.	No loss of existing habitat value.
2	Habitat is of high value for evaluation species and is scarce or becoming scarce.	No net loss of in-kind habitat value.
3	Habitat is of high to medium value for evaluation species and is abundant.	No net loss of habitat value, while minimizing the loss of in-kind habitat value.
4	Habitat is of medium to low value for evaluation species.	Minimize loss of habitat value.

NOTE: Material taken from Table 1, Federal Register, January 23, 1981, page 7646.

In accordance with the above criteria, cover types 618, 613, 616, 617 and 6612 are rated in mitigation category 2; Types 413, 415, are category #3; and Types 211 and 6522 are category #4.

Conversion of cover type acres (Form 2) to habitat units through multiplication of related Target species HSI's, results in 20.5 HU's in mitigation category #2 and 8.9 HU's in categories 3 and 4.

Habitats related to the selected target species are:

Atlantic salmon - Cover type: 661, (HU's = 2.3 acres).

American shad - Cover types: 661, 652, (HU's = 34.2 acres).

Alewife - Cover types: 661, 652, (HU's = 15.8 acres).

Brook Trout - Cover types: 661, 652, (HU's = 17.2 acres).

Smallmouth bass - Cover types: 661, 652, (HU's = 17.8 acres).

Black duck - Cover types: 211, 613, 616, 618,
(HU's = 12.2 acres).

Woodcock - Cover types: 413, 415, 616, 617, 618.
(HU's = 12.2 acres).

B. PROJECT IMPACTS (With the project).

The impoundment created by the project will remove 0.5 miles of existing riverine (6612) habitat comprising potential spawning area for Atlantic salmon and American shad. Forested and agricultural lands below elevation 216' msl will also be eliminated. The impoundment will cover 101 surface acres, of which 59 percent will permanently cover areas which, except for higher elevation cropland, were previously inundated only by annual river flooding. These impoundment areas will be relatively shallow, averaging three to four feet deep and are therefore characterized as Lacustrine - Littoral (no. 633), which would support rooted aquatic vegetation (613) and, in upper shallow fringe areas, emergent aquatic vegetation (616).

The remaining 41 percent of the impoundment is classified as Lacustrine - Limnetic (#622), characterized as relatively deep and slower current velocity than riverine environment.

Project effects on fish and wildlife habitats, as indicated by HU's of selected species, are summarized as follows:

<u>Species</u>	<u>Without the Project (HU's)</u>	<u>With the Project (HU's)</u>	<u>Difference w/o - with (HU's)</u>
Atlantic salmon	2.3	0	-2.3
American shad	34.2	32	-2.2
Alewife	15.8	74.3	+58.5
Brook Trout	17.2	20.4	+3.2
Smallmouth bass	17.8	43.8	+26.0
Black duck	14.9	29.7	+14.8
Woodcock	<u>12.2</u>	<u>0</u>	<u>-12.2</u>
Totals	114.4	200.2	+85.8

MITIGATION PLAN

The principal objective is to develop increased spawning habitats for Atlantic salmon and American shad to compensate losses related to the project. The only suitable spawning habitat available for these species within the project site are the riffle areas located in the 0.5 mile section of river upstream from the dam, which would be lost due to the recreated impoundment.

The proposed mitigation plan consists of two sites, located at Mechanic Falls Dam (site #1), approximately nine miles upstream and Barkers Mill Lower Dam (site #2), approximately 3.6 miles downstream from the Littlefield Dam (Figures III and IV). Both of these sites are owned by Consolidated Hydro, Inc. the sole owner of Littlefield Hydro Company.

Mitigation Site #1 - Mechanics Falls - Marcal Bypass Channel.

The Plan proposes provision of minimum instantaneous flow of 20 cfs through the original (presently bypassed) channel, which extends approximately 953 feet downstream from the Mechanics Falls Dam. The flow would be required throughout spawning and incubation periods of Atlantic salmon (November - March) and American shad (May - June). Since spawning varies with stream flow, temperatures, etc., precise times for the flow releases would require actual observations of fish activities, and therefore, cannot be determined at this time.

Provision of the recommended flows, would provide spawning habitat of approximately 1.22 acres which afford 1.22 and 0.94 habitat units (HU's) for Atlantic salmon and American shad, respectively. This would mitigate 53 percent of habitat losses of Atlantic salmon and 43 percent for American shad.

Mitigation Site #2 - Barkers Mill Lower Dam Bypass Channel.

The Mitigation Plan proposes a minimum instantaneous discharge of 40 cfs from the dam, through the original stream channel. This would increase the presently required minimum flow by 20 cfs within the 2,560 feet of stream channel. The present wet channel area is approximately 2.3 acres. Additional 20 cfs would increase the stream area by approximately one acre.

The 40 cfs would be required throughout the spawning and incubation periods of Atlantic salmon (November - March) and American shad (May - June).

Provision of the recommended flows would provide HU's of 1.0 and 0.77 for Atlantic salmon and American shad, respectively, which would mitigate 43 percent of the habitat losses of Atlantic salmon and 35 percent of American shad habitat losses.

MITIGATION SITE #1
MARCAL BYPASS CHANNEL
(DIAGRAMMATIC SKETCH)

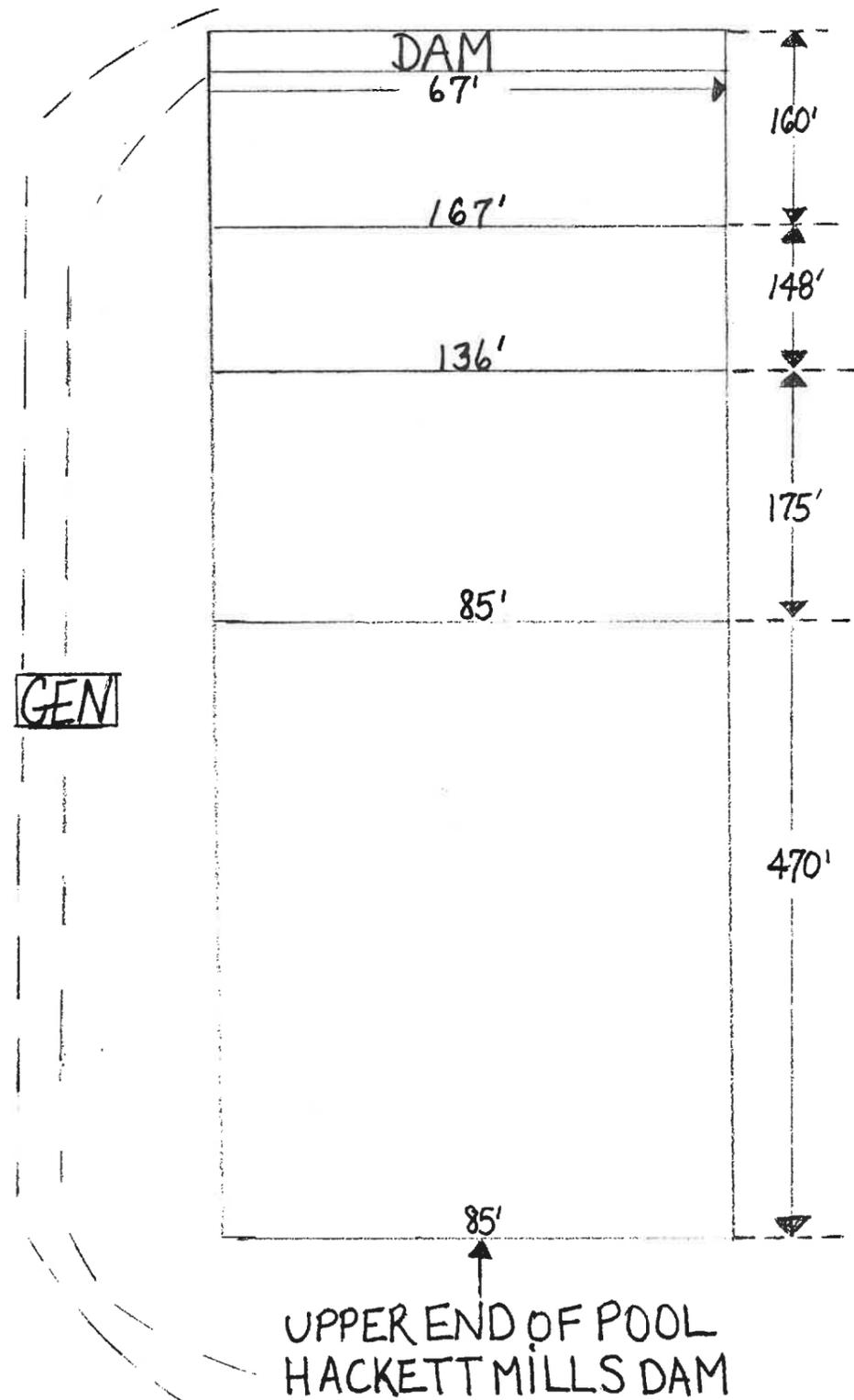


FIGURE III

SUMMARY

Development of the project would result in a net increase of 199 percent in habitat for waterfowl and other aquatic related wildlife, indicated by Habitat Units (HU's) for Black duck. Habitats of Palustrine - related forest and shrub areas would be reduced by 12.2 acres in HU's related to the HSI's for the American woodcock. A mitigation plan, requiring development of woodcock habitat does not appear feasible. Though not computed in this HEP analysis, some forested wetland types are expected to develop within the newly - created annual flood areas (above elevation 216 msl), which would compensate for some of the losses within the project site.

Overall net increases in fishery habitat for Alewife (470 percent), Brook Trout (119 percent) and Smallmouth bass (246 percent) would result from the project. Spawning habitats for Atlantic salmon (2.3 acres) and American shad (2.2 acres) would, however, be eliminated by the impoundment.

Incorporation of the mitigation plan described in the previous section, into the overall plan for the project would compensate for 96 percent and 78 percent of the habitat losses for Atlantic salmon and American shad, respectively. This would leave 0.1 and 0.5 acres of habitat units, for these species, unmitigated.

HEP FORMS

PENNSYLVANIA MODIFIED 1980 HEP - HEP TEAM COMPOSITION

Project LITTLEFIELD HYDRO PROJECT

Designated HEP Team Members

U.S. Fish & Wildlife Service

Name Gordon Russell
 Title Biologist
 Address _____

Concord, N.H.

Maine Dept. Inland Fisheries
 and Wildlife
~~PA Game Commission~~

Name Sonny Pierce and Warren Eldredge
 Title Fish and Wildlife Biologists
 Address _____
GRAY, ME.

Maine Dept. Marine Fisheries
~~PA Fish Commission~~

Name Phil Andrews
 Title Biologist
 Address _____
Fisheries Office, Box 125
 Bangor, ME 04401

Name Levi Flagg
 Title Marine Resource Scientist
 Address _____
State House, Station # 21
 Augusta, ME 04333

Action Agency/Applicant
Consolidated Hydro, Inc.

Name Gerald B. Taylor
 Title Biologist Consultant
 Address _____
310 Douglas Dr.
 West Scarborough, ME 04091

Additional Participating Personnel

Name	Agency	Address
<u>Steve Timmins</u>	<u>ME F&W</u>	<u>Augusta, ME.</u>
<u>Thomas Quinn</u>	<u>ME Dept Marine Fisheries</u>	<u>Augusta, ME.</u>
<u>John James</u>	<u>Consolidated Hydro, Inc.</u>	<u>Greenwood, ME.</u>

PENNSYLVANIA MODIFIED 1980 HEP - EVALUATION SPECIES SELECTION
TERRESTRIAL COVER TYPES

Project LITTLEFIELD HYDRO PROJECT Date AUGUST 1986

CANDIDATE EVALUATION SPECIES	FEEDING BEHAVIOR (Primary Adult)			FEEDING SITE (Primary Adult)				BREEDING SITE (Primary)				LAND USE/COVER TYPE								EVALUATION SUITABILITY RANKING						
	Herbivore	Insectivore	Omnivore	Carnivore	Water	Ground	Herbaceous Layer	Shrub Layer	Tree Layer	Water	Ground	Herbaceous Layer	Shrub Layer	Tree Layer	Urban Land	Agricultural Land	Herbaceous Rangeland	Shrub-Brush Rangeland	Mixed Rangeland		Deciduous Forest	Coniferous Forest	Mixed Forest	Barren Land		
X Selected Evaluation Species																										
X American Woodcock			X			X																				.7
X Black Duck										X																.3

22

PENNSYLVANIA MODIFIED 1980 HEP - EVALUATION SPECIES SELECTION
AQUATIC COVER TYPE

Project Littlefield Hydro Project Date August 1986
Type Fishery Cold (Cool) Warm

CANDIDATE EVALUATION SPECIES	FEEDING BEHAVIOR (Primary Adult)				SPAWNING SUBSTRATE				WATER USE/COVER TYPES												EVALUATION SUITABILITY RANKING	
	Herbivore	Insectivore	Omnivore	Carnivore	Aquatic Bed	Rock/Gravel/Sand	Debris/Structure	Mud	LEVEL II				LEVEL III									
Selected Evaluation Species									Lacustrine-littoral	Riverine-tidal	Riverine-lower perennial or 66' wide	Riverine-upper perennial or 66' wide	Aquatic bed-rooted/floating	Rock bottom-bedrock/rubble	Unconsolidated bottom-mud/sand/gravel	Rocky shore-rubble/bedrock	Epilimnion	Metolimnion	Hypolimnion	Profundal		
<i>Athalia E. imbr.</i>		X		X		X						X			X							.6
American Shad	X	X				X			X		X	X		X	X							.8
Alewife		X				X			X		X	X		X	X							.8
Brook Trout						X					X	X			X							.3
Smallmouth Bass						X			X		X	X		X	X							1.0

40

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
 TERRESTRIAL/WETLANDS TERRESTRIAL COVER TYPES

Project Littlefield Hydro Project Date 8/86
 Alternative Improvement Elevation 816' Target Year Base
 Land Use/Cover Type 413 Deciduous Forest - Poor Stage, Shrub moderate
 Compartment Number 3 Area 13.5 Mitigation Category 3
 Topography Hilly with sand and rocky soil.
 Tree Cover Mixed hardwoods with scattered conifers.
 Shrub Cover Typical mixed oak, red maple, aspen, black locust, Birch, Pine & hemlock.
 Herbaceous Cover _____

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PGC	AA/A	
<u>Woodcock</u>	<u>Breeding 1</u>	_____	_____	_____	<u>0</u>	<u>.15</u>
	<u>Roost 2</u>	_____	_____	_____	<u>.2</u>	
	<u>Food 3</u>	_____	_____	_____	<u>.1</u>	
<u>Limiting Factors</u> <u>Hilly terrain with sandy soil limits earth worms for food.</u>						

<u>Limiting Factors</u> _____						

<u>Limiting Factors</u> _____						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
 TERRESTRIAL/WETLANDS TERRESTRIAL COVER TYPES

Project LITTLEFIELD HYDRO PROJECT Date 8/86
 Alternative Impoundment Elevation 816' Target Year BASE
 Land Use/Cover Type 415 Deciduous Forest - Mature, Shrub mos.
 Compartment Number 4 Area 7.3 Mitigation Category 3
 Topography STEEP SLOPES IN narrow band (15-30 feet) bordering
 Tree Cover Oak, maple, aspen, pine. river.

Shrub Cover _____

Herbaceous Cover _____

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PGC	AA/A <u>X</u>	
<u>Woodcock</u>	<u>Breeding</u>	_____	_____	_____	<u>0</u>	<u>.15</u>
	<u>Cover</u>	_____	_____	<u>.2</u>	_____	
	<u>Food</u>	_____	_____	<u>.1</u>	_____	
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

Limiting Factors Sand and rocky soil limits food production

Limiting Factors _____

Limiting Factors _____

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
 TERRESTRIAL/WETLANDS TERRESTRIAL COVER TYPES

Project LITTLEFIELD HYDRO PROTECTION Date 8/86
 Alternative INFILTRATION ELEVATION 816' Target Year BASE
 Land Use/Cover Type 6133 Palustrine-aquatic rooted vascular vegetation
 Compartment Number 6 Area 4.4 Mitigation Category 2
 Topography LOW, FLAT, WATER COVERED SHALLOW (1"-12")
 Tree Cover NONE

Shrub Cover NONE

Herbaceous Cover Arrowhead, Lotus, Water lily, duck potato

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PGC	AA/A	
<u>Black Duck</u>	<u>Breeding 1</u>				<u>.5</u>	<u>0.6</u>
	<u>Cover 2</u>				<u>.3</u>	
	<u>Food 3</u>				<u>1.0</u>	
<u>Limiting Factors</u> <u>SPARSE SHRUB COVER FOR NESTING</u>						
<u>Limiting Factors</u>						
<u>Limiting Factors</u>						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
 TERRESTRIAL/WETLANDS TERRESTRIAL COVER TYPES

Project LITTLEfield Hydro Project Date 8/86
 Alternative Impoundment elevation 216' Target Year 13
 Land Use/Cover Type 616 Palustrine - Emergent Wetland
 Compartment Number 6 Area 5.3 Mitigation Category 2
 Topography FLAT, poorly drained, wet (1"-6")
 Tree Cover None

Shrub Cover Alder bordering spring drainage channel.

Herbaceous Cover Cattail, Three square, saw grass.

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PGC	AA/A	
<u>Black Duck</u>	<u>Breeding 1</u>				<u>.4</u>	<u>0.75</u>
	<u>Cover 2</u>				<u>.5</u>	
	<u>Food 3</u>				<u>.5</u>	

Limiting Factors LACK OF diversity, quality OF Food and Open Water.

<u>Wood Cock</u>	<u>Breeding 1</u>				<u>0</u>	<u>0.15</u>
	<u>Cover 2</u>				<u>.1</u>	
	<u>Food 3</u>				<u>.2</u>	

Limiting Factors No breeding population in area - ONLY migratory. Cover (alder) limited to < 5% OF area.

Limiting Factors _____

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
 TERRESTRIAL/WETLANDS TERRESTRIAL COVER TYPES

Project Littlefield Hydro Project Date 8/86
 Alternative Impoundment Elevation 816' Target Year Base
 Land Use/Cover Type 618" Palustrine-forested wetland, deciduous
 Compartment Number 8 Area 10.2 Mitigation Category 2
 Topography Low undulating swales between river and high ground
 Tree Cover mixed hardwoods (maple, oak, aspen) Primarily pole stage with occasional large trees.
 Shrub Cover Primarily alder bordering swales, interior flood drainage channels.
 Herbaceous Cover Primarily large ferns with sedge.

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PGC	AA/A <u>X</u>	
<u>Woodcock</u>	<u>Breeding 1</u>				<u>0</u>	<u>0.6</u>
	<u>Cover 2</u>				<u>.5</u>	
	<u>Food 3</u>				<u>.7</u>	
<u>Limiting Factors: Breeding: Area does not harbor breeding populations, only transitory migrants.</u>						
<u>Limiting Factors</u>						
<u>Limiting Factors</u>						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

9 '13
PI

PAM HEP Form 5b

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project LITTLE field Hydro Project Date 8/13
 Alternative Improvement of flow 9' x 2' Target Year B
 Water Use/Cover Type 6522 Riverine Lower Perennial
 Compartment Number 9 Area 26.6 Mitigation Category 3
 Site Description Upper 1.7 miles of river within project site.
Low gradient characterize riverine pool environment
Channelled vs Riverine - Lower Perennial

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A <u>X</u>	
<u>American SHAD</u>	<u>SPAWNING</u>					<u>1.0</u>
	<u>WAT. Temp. V₁</u>				<u>1.0</u>	
	<u>Velocity V₂</u>				<u>1.0</u>	
	<u>Egg - LARVAL</u>					
	<u>WAT. Temp. V₃</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>Alewife</u>	<u>SUBSTRATE V₁</u>				<u>.7</u>	<u>0.47</u>
	<u>WAT. Temp. V₂</u>				<u>1.0</u>	
	<u>ZOOPLANKTON V₃</u>				<u>.47</u>	
	<u>Temp. mean V₄</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>BROOK TROUT</u>	<u>SUBSTRATE V₁</u>				<u>.000</u>	<u>1.50</u>
	<u>DEPTH V₂</u>				<u>1.0</u>	
	<u>Velocity V₃</u>				<u>1.0</u>	
	<u>TEMPERATURE V₄</u>				<u>0</u>	
<u>Limiting Factors</u> <u>Temperature exceeds SI Limit (72°F)</u> <u>Lowest Trout species is 74°F (7.23°C)</u>						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project LITTLE field Hydro Project Date 8/86
 Alternative Improvement Flow: 81'6" Target Year B
 Water Use/Cover Type 6612 PINE/SHAD - Upper
 Compartment Number 10 Area 7.6 Mitigation Category 2
 Site Description Lower 0.5 miles downstream from RR. Bottom
Consist of riparian runs and pools.

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
ATLANTIC SALMON	SUBSTRATE V5					3.54
	PERCENT RICH V2					2.75
	DEPTH RICH V4					2.77
	VELOCITY V5					2.77
	TEMP. (Egg/Larvae) V2					1.0
	PERCENT PINES V10					1.0

Limiting Factors Habitat Limited to 2.6 Acres/Run only.

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
AMERICAN SHAD	SURFACE TEMP V1					1.0
	VELOCITY (SPRINGS) V2					1.0
	TEMP. (Egg/Larvae) V2					1.0

Limiting Factors

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
ALEWIG	SUBSTRATE V1					1.47
	TEMP. (Egg/Larvae) V2					1.0
	TEMP. (Egg/Larvae) V2					1.47

Limiting Factors

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "0A" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

H
F 5

PAM HEP Form 5b

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project LITTLE FIELD Hydro Project Date 8/86
 Alternative Impoundment Ele. 216' Target Year C
 Water Use/Cover Type 6333 LACUSTRINE LITTORAL
 Compartment Number 11 Area 59.4 Mitigation Category —
 Site Description Permanently inundated shallow areas
with mean depth @ 4', comprised of sand and mud
substrate and supporting rooted aquatic vegetation
Estimated Zooplankton @ 700+/LITER.

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings				Avg. HSI
			FWS	PFC	AA/A	X	
<u>BLACK DUCK</u>	<u>Breeding 1</u>					<u>.3</u>	<u>0.5</u>
	<u>Cover 2</u>					<u>.1</u>	
	<u>Food 3</u>					<u>1.0</u>	
<u>Limiting Factors</u> <u>Cover & nesting sites limited.</u>							
<u>Alewife</u>	<u>Substrate V1</u>					<u>.5</u>	<u>0.5</u> <u>Lowest SE Limit</u>
	<u>SPAWN-WATER TEMP V2</u>					<u>1.0</u>	
	<u>ZOOPLANKTON V3</u>					<u>1.0</u>	
	<u>MEAN TEMP V4</u>					<u>1.0</u>	
<u>Limiting Factors</u>							
<u>Smallmouth Bass</u>	<u>Substrate V1</u>					<u>0</u>	<u>.4</u>
	<u>Velocity V2</u>					<u>1.0</u>	
	<u>Depth V3 @ 2'</u>					<u>.15</u>	
<u>AMERICAN SHAD</u>	<u>SPAWN TEMP V1</u>					<u>1.0</u>	<u>.13</u> <u>Lowest SE Limit</u>
	<u>Velocity V2</u>					<u>.18</u>	
	<u>MEAN TEMP V3</u>					<u>1.0</u>	
<u>Limiting Factors</u>							

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

22 15
P26

PAM HEP Form 5b

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project LITTLEfield Hydro Project Date 8/86
 Alternative Impoundment Elevation 216' Target Year _____
 Water Use/Cover Type 622 LACUSTRINE LIMNETIC
 Compartment Number 12 Area 41.6 Mitigation Category _____
 Site Description Impounded area exclusive of back water (Littoral) areas. Characterized as deep (Av. depth 7.41) velocity @ 0.66 ft/sec during ap, may, June. Substrate

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
<u>American Shad</u>					<u>X</u>	<u>1.65</u>
	<u>SPAWN - Temperature V1</u>				<u>1.0</u>	
	<u>Velocity V2</u>				<u>.65</u>	
	<u>Egg Larval Temp. V3</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>Alewife</u>						<u>0.5</u>
	<u>Substrate V1</u>				<u>1.5</u>	
	<u>SPAWN TEMP. V2</u>				<u>1.0</u>	
	<u>ZOOPLANKTON V3</u>				<u>1.5</u>	
	<u>Mean Temp V4</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>Smallmouth bass</u>						<u>0.7</u>
	<u>Substrate V1</u>				<u>1.05</u>	
	<u>Velocity V2</u>				<u>1.4</u>	
	<u>DEPTH V3</u>				<u>1.0</u>	
<u>Limiting Factors</u> <u>Substrate 41.6 and not in 10' depth limit spawning areas.</u>						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PAM HEP Form 6

PENNSYLVANIA MODIFIED 1980 HEP - DETERMINING MEAN SPECIES HSI PER COVER TYPE

Project LITTLEFIELD Pond Date 8/1/81

Alternative Elevation 213' Target Year 2000

WATER/Land Use/Cover Type _____

COVER TYPE	Sample Sites	Area	Evaluation Species		Mean HSI	HU
			BLACK DUCK	W. WING TEAL		
1	211	18.5	0.3 5.5	-	0.3 5.5	HSI HU
2	2121	5.6				HSI HU
3	413	13.5	-	0.15 2.0	1.5 2.0	HSI HU
4	415	7.3	-	0.15 1.1	1.5 1.1	HSI HU
5	6133	4.4	0.6 2.6	-	1.5 2.6	HSI HU
6	616	5.3	0.7 3.7	0.15 0.5	1.5 4.5	HSI HU
7	617	7.6	-	0.35 4.1	1.65 4.1	HSI HU
8	618	10.2	.3 3.1	0.6 6.1	.9 9.5	HSI HU
9						HSI HU
Total Area		66.8				
Total HU						
Mean HSI						

PAM HEP Form 6

PENNSYLVANIA MODIFIED 1980 HEP - DETERMINING MEAN SPECIES HSI PER COVER TYPE

Project LITTLEFIELD Hydro Project Date 8/86

Alternative Elevation 216' Target Year Base

WATER/Land Use/Cover Type RIVERINE - Lower Perennial - Upper Perennial

Sample Sites	Evaluation Species					Mean HSI
	American Shad	Alewife	Brook Trout	Smallmouth Bass	Atlantic Salmon	
6522 1 Area 26.6 HSI HU	1.0 26.6	.47 12.5	.5 13.3	.58 15.4	- -	0.3 6.8
6612 2 Area 7.6 2.6 riffle HSI HU	1.0 7.6	.43 3.3	.52 3.9	.45 3.4	.9 2.3 riffle	0.3 20.5
3 Area HSI HU						
4 Area HSI HU						
5 Area HSI HU						
6 Area HSI HU						
7 Area HSI HU						
8 Area HSI HU						
9 Area HSI HU						
Total Area	34.2					
Total HU						
Mean HSI						

PAM HEP Form 6

PENNSYLVANIA MODIFIED 1980 HEP - DETERMINING MEAN SPECIES HSI PER COVER TYPE

Project LITTLEFIELD Hydro Project

Date 8/86

Alternative Elevation 216

Target Year C

Water/Land Use/Cover Type LACUSTRINE -

LIMNETIC 6222
LITTORAL 6333

Sample Sites

Evaluation Species

MEAN
HSI

American Shad	Alewife	BROOK/ TROUT	SMALLMOUTH Bass	BLK DUCK
------------------	---------	-----------------	--------------------	-------------

LIMNETIC 1
6222 Area 41.6 HSI
HU

<u>.65</u>	<u>.5</u>	<u>.49</u>	<u>.47</u>	<u>-</u>
<u>27</u>	<u>20.8</u>	<u>20.4</u>	<u>22</u>	<u>-</u>

1.6
35.2

LITTORAL 2
6333 Area 59.4 HSI
HU
AM. Shad = 29.2

<u>.17</u>	<u>.9</u>	<u>-</u>	<u>.4</u>	<u>.5</u>
<u>5.0</u>	<u>53.5</u>	<u>-</u>	<u>23.8</u>	<u>22.7</u>

0.6
112

3 Area HSI HU

4 Area HSI HU

5 Area HSI HU

6 Area HSI HU

7 Area HSI HU

8 Area HSI HU

9 Area HSI HU

Total Area

Total HU

Mean HSI

PENNSYLVANIA MODIFIED 1980 HEP - COMPARISON OF BASELINE (TYB) AND CONSTRUCTION (TYC) AREA, HSI AND HU BY LAND USE/COVER TYPE

Project LITTLE FIELD High Trail Alternative Elevation 216'

Land Use/Cover Type	Evaluation Species	Baseline Mean HSI	TYB HU	Constr. Mean HSI	TYC HU	HU Change
<u>Agriculture</u>	<u>Black Duck</u>	<u>.3</u>	<u>5.5</u>		<u>0</u>	<u>-5.5</u>
<u>CROPLAND</u>						
TYB Acres <u>18.5</u>						
TYC Acres <u>0</u>						
	<u>Sub-total HU</u>		<u>5.5</u>		<u>0</u>	<u>-5.5</u>
TYB Acres						
TYC Acres						
	<u>Sub-total HU</u>					
<u>Deciduous</u>						
<u>FOREST (pole stage)</u>	<u>Wood Cock</u>	<u>.15</u>	<u>2.3</u>		<u>0</u>	<u>-2.3</u>
TYB Acres <u>15.7</u>						
TYC Acres <u>0</u>						
	<u>Sub-total HU</u>		<u>2.3</u>		<u>0</u>	<u>-2.3</u>
<u>Deciduous Forest</u>						
<u>mature</u>	<u>Woodcock</u>	<u>.15</u>	<u>1.1</u>		<u>0</u>	<u>-1.1</u>
TYB Acres <u>7.3</u>						
TYC Acres <u>0</u>						
	<u>Sub-total HU</u>		<u>1.1</u>		<u>0</u>	<u>-1.1</u>
<u>Palustrine</u>						
<u>Aquatic Veg.</u>	<u>Black Duck</u>	<u>.6</u>	<u>2.6</u>		<u>0</u>	<u>-2.6</u>
TYB Acres <u>4.4</u>						
TYC Acres <u>0</u>						
	<u>Sub-total HU</u>		<u>2.6</u>		<u>0</u>	<u>-2.6</u>
<u>Palustrine</u>						
<u>Emergent Wetland</u>	<u>Black Duck</u>	<u>.7</u>	<u>3.7</u>		<u>0</u>	<u>-3.7</u>
TYB Acres <u>5.3</u>	<u>Wood Duck</u>	<u>.15</u>	<u>.8</u>		<u>0</u>	<u>-.8</u>
TYC Acres <u>0</u>						
	<u>Sub-total HU</u>		<u>4.5</u>		<u>0</u>	<u>-4.5</u>
	<u>Project Area Totals¹</u>					

¹Total at bottom of last page of form. Use additional sheets as necessary to accommodate all land use/cover types.

PENNSYLVANIA MODIFIED 1980 HEP - COMPARISON OF BASELINE (TYB) AND CONSTRUCTION (TYC) AREA, HSI AND HU BY LAND USE/COVER TYPE

Project LITTLEFIELD Hydro Proj. Alternative Elevation 216'

Land Use/Cover Type	Evaluation Species	Baseline Mean HSI	TYB HU	Constr. Mean HSI	TYC HU	HU Change
<u>Palustrine</u>						
Scrub-Shrub Wetland	Woodcock	.65	4.9		0	-4.9
TYB Acres			7.6			
TYC Acres			0			
Sub-total HU			4.9		0	-4.9
<u>Palustrine</u>						
Forested Wetland	Woodcock	.6	6.1		0	-6.1
TYB Acres			10.2			
TYC Acres			0			
	Black Duck	.3	3.1		0	-3.1
Sub-total HU			7.2		0	-7.2
<u>Riverine</u>						
Lower Perennial	American Shad	1.0	26.6		0	-26.6
TYB Acres			26.6			
TYC Acres			0			
	Alewife	.47	12.5		0	-12.5
	Brook Trout	.5	13.3		0	-13.3
	Smallmouth Bass	.58	15.4		0	-15.4
Sub-total HU			67.8		0	-67.8
<u>Riverine</u>						
Upper Perennial	American Shad	1.0	7.6		0	-7.6
TYB Acres			7.6			
TYC Acres			0			
	Alewife	.43	3.3		0	-3.3
	Brook Trout	.52	3.9		0	-3.9
	Smallmouth Bass	.45	3.4		0	-3.4
	American Shad	.90	2.3		0	-2.3
Sub-total HU			20.5		0	-20.5
<u>Lacustrine</u>						
Littoral	Alewife		0	.1	53.7	+53.7
TYB Acres			0	.4	23.7	+23.7
TYC Acres			57.4	.5	24.7	+24.7
	Smallmouth Bass		0	.17	5.0	+5.0
	Black Duck		0			
	American Shad		0			
Sub-total HU			0		112.4	+112.4
<u>Lacustrine</u>						
Littoral	American Shad		1	.65	27	+27
TYB Acres			0	.5	27.7	+27.7
TYC Acres			41.6	.47	20.4	+20.4
	Brook Trout		0			
	Smallmouth Bass		0	.48	20.4	+20.4
Sub-total HU			1		93.2	+93.2
Project Area Totals ¹			116.4		200.2	+73.8

¹Total at bottom of last page of form. Use additional sheets as necessary to accommodate all land use/cover types.

PENNSYLVANIA MODIFIED 1930 HEP - COMPARISON OF BASELINE (TYB) AND CONSTRUCTION (TYC) HU BY EVALUATION SPECIES

Project LITTLEFIELD HYDRO PROJECT
 Alternative Impoundment Elevation 216'

Evaluation Species	Land Use/Cover Type	TYB HU	TYC HU	HU Change
<u>BLACK DUCK</u>	<u>Ag. Cropland</u>	<u>5.5</u>	<u>0</u>	<u>- 5.5</u>
	<u>Palustrine/Ag. Veg.</u>	<u>2.6</u>	<u>0</u>	<u>- 2.6</u>
	<u>Palustrine - Emergent</u>	<u>3.7</u>	<u>0</u>	<u>- 3.7</u>
	<u>Palustrine - Forested</u>	<u>3.1</u>	<u>0</u>	<u>- 3.1</u>
	<u>LACUSTRINE - Littoral</u>	<u>0</u>	<u>29.7</u>	<u>+ 29.7</u>
	<u>Species HU Totals</u>	<u>14.9</u>	<u>29.7</u>	<u>+ 14.8</u>
<u>Woodcock</u>	<u>Deciduous Forest (Foli.)</u>	<u>2.3</u>	<u>0</u>	<u>- 2.3</u>
	<u>Deciduous For. (mature)</u>	<u>1.1</u>	<u>0</u>	<u>- 1.1</u>
	<u>Palustrine - Emergent</u>	<u>.8</u>	<u>0</u>	<u>- .8</u>
	<u>Palustrine - Scrub Shrub</u>	<u>4.9</u>	<u>0</u>	<u>- 4.9</u>
	<u>Palustrine - Forested</u>	<u>3.1</u>	<u>0</u>	<u>- 3.1</u>
	<u>Species HU Totals</u>	<u>12.2</u>	<u>0</u>	<u>- 12.2</u>
<u>ATLANTIC Salmon</u>	<u>Riverine - Upper Per.</u>	<u>2.3</u>	<u>0</u>	<u>- 2.3</u>
	<u>Species HU Totals</u>	<u>2.3</u>	<u>0</u>	<u>- 2.3</u>
<u>American Shad</u>	<u>Riverine - Upper Per.</u>	<u>7.6</u>	<u>0</u>	<u>- 7.6</u>
	<u>Riverine - Lower Per.</u>	<u>26.6</u>	<u>0</u>	<u>- 26.6</u>
	<u>Lacustrine - Littoral</u>	<u>0</u>	<u>5</u>	<u>+ 5.0</u>
	<u>Lacustrine - Littoral</u>	<u>0</u>	<u>27</u>	<u>+ 27.0</u>
	<u>Species HU Totals</u>	<u>34.2</u>	<u>32</u>	<u>- 2.2</u>
<u>Project Area Totals¹</u>		<u>-</u>	<u>-</u>	<u>-</u>

¹Total at bottom of last page of form. Use additional sheets as necessary to accommodate all evaluation species.

PENNSYLVANIA MODIFIED 1990 HEP - ANALYSIS OF HABITAT UNIT MITIGATION REQUIREMENTS

Project LITTLEFIELD HYDRO PROJECT
 Alternative TEMPORARY ELEV. 216'

FWS Mitigation Category	Land Use/Cover Types**	Compartment Numbers	Area		HU Lost Due to Project ¹	HU Gained Due to Project ¹	HU Mitigation Requirements ¹
			TYB	TYC			
<u>2</u>	<u>Palustrine-Aq. bed</u>	<u>6133-1, 6133-2</u>	<u>4.4</u>	<u>0</u>	<u>2.6</u>	<u>0</u>	<u>- 2.6</u>
	<u>Palustrine Emergent</u>	<u>616-1, 616-2</u>	<u>5.3</u>	<u>0</u>	<u>4.5</u>	<u>0</u>	<u>- 4.5</u>
	<u>Palustrine-Scrubsh</u>	<u>617-1, 617-2, 617.3</u>	<u>7.6</u>	<u>0</u>	<u>4.9</u>	<u>0</u>	<u>- 4.9</u>
	<u>Palustrine-Forest Wet.</u>	<u>618-1, 618-2</u>	<u>10.2</u>	<u>0</u>	<u>7.2</u>	<u>0</u>	<u>- 7.2</u>
	<u>Riverine-Upper Perennial</u>	<u>6618</u>	<u>7.6</u>	<u>0</u>	<u>20.5</u>	<u>0</u>	<u>+ 20.5</u>
	<u>LACUSTRINE Littoral</u>	<u>6333</u>	<u>0</u>	<u>59.4</u>	<u>0</u>	<u>11.2</u>	<u>+ 11.2</u>
			<u>Totals</u>	<u>35.1</u>	<u>59.4</u>	<u>- 39.7</u>	<u>+ 11.2</u>
<u>3</u>	<u>Deciduous Forest (Pole Stage)</u>	<u>413-1, 413-2</u>	<u>13.5</u>	<u>0</u>	<u>2.3</u>	<u>0</u>	<u>- 2.3</u>
	<u>Deciduous Forest (mature)</u>	<u>415-1, 415-2</u>	<u>7.3</u>	<u>0</u>	<u>1.1</u>	<u>0</u>	<u>- 1.1</u>
	<u>Riverine Lower Perennial</u>	<u>6532</u>	<u>26.6</u>	<u>0</u>	<u>67.8</u>	<u>0</u>	<u>- 67.8</u>
	<u>LACUSTRINE Littoral</u>	<u>6222</u>	<u>0</u>	<u>41.6</u>	<u>0</u>	<u>88.2</u>	<u>+ 88.2</u>
		<u>TOTALS</u>	<u>47.4</u>	<u>41.6</u>	<u>- 71.2</u>	<u>+ 88.2</u>	<u>+ 17</u>
<u>4</u>	<u>Aq. Openland</u>	<u>211-1, 211-2</u>	<u>18.5</u>	<u>0</u>	<u>- 5.5</u>	<u>0</u>	<u>- 5.5</u>
		<u>Project Area Totals²</u>	<u>101</u>	<u>101</u>	<u>- 5.5</u>	<u>0</u>	<u>- 5.5</u>
					<u>+ 116.4</u>	<u>+ 116.4</u>	<u>+ 83.8</u>

* See Table 2.
 ** Obtain data from PAI HEP Form 2
 1 Total of all HU's for included compartments
 2 Total at bottom of last page of form

PENNSYLVANIA MODIFIED 1930 HEP - MITIGATION PROCEDURE OUTLINE

Project LITTLEfield Hydro Project

Alternative Improvement Alternative

Mitigation Site No. I Location Mechanicsville hydro project, within Tulee
meadow bypass channel.

Description of Procedure(s) Provide 40 cfs into the existing bypassed channel
during spawning and hatching periods of Atlantic Salmon
and American Shad.

Mitigative Effect(s) Increase spawning habitats and population of these species

Evaluation Species	Affected Areas - Comp. No's. or Description	Resulting Requisite Rankings ¹
		Subst. Depth Vel Temp.
Atlantic Salmon	6612	1.0 1.0 - 1.0
American Shad	6612, 6522	- 1.0 1.0 1.0
Bronze Trout	6612, 6522	1.0 1.0 1.0
Alewife	6612, 6522	1.0 1.0 1.0
Smallmouth Bass	6612, 6522	1.0 1.0 1.0

¹Enter an appropriate PA1 HEP Form 5 for mitigation analysis. Attach PA1 HEP Form 5 and plan map of proposed mitigation to this form.

PENNSYLVANIA MODIFIED 1930 HEP - MITIGATION PROCEDURE OUTLINE

Project Lehigh Hydro Project

Alternative _____

Mitigation Site No. # 2 Location Lower Benning Mill bypass channel, approximately 7538 feet downstream from the dam.

Description of Procedure(s) Provide 40 cfs into the bypass channel. Throughput periods are 5 minutes with installation of 21 floats. Inflow from dam will be 100 cfs. Brook Trout, Alewife and Smallmouth Bass.

Mitigative Effect(s) Increased production of Willow, Submersed, Potamogeton, and Brook Trout. Through increased spawning → INCREASED HABITAT. Similar benefits will also accrue to Alewife and Smallmouth Bass.

Evaluation Species	Affected Areas - Comp. No.'s. or Description	Resulting Requisite Rankings ¹
		Subst. Depth Vel. Temp.
<u>WILLOW</u>	<u>6612 - Riverine - Upper Perennial.</u>	<u>1.0 1.0 1.0 - HST</u>
<u>POTAMOGETON</u>	<u>6612, 6522 - Riverine - Upper & Lower Perennial.</u>	<u>- 0.3 1.0 (.75)</u>
<u>BROOK TROUT</u>	<u>6612, 6522 - " " "</u>	<u>1.0 1.0 0 (.75)</u>
<u>ALEWIFE</u>	<u>6612, 6522 - " " "</u>	<u>1.0 1.0 1.0 (.15)</u>
<u>SMALLMOUTH BASS</u>	<u>6612, 6522 - " " "</u>	<u>1.0 1.0 1.75 - (60)</u>

¹Enter an appropriate PAT HEP Form 5 for mitigation analysis. Attach PAT HEP Form 5 and plan map of proposed mitigation to this form.

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project Little Falls Hydro Project Date 1/10/01
 Alternative MAINTENANCE Target Year 1
 Water Use/Cover Type Riverine Upper Perennial
 Compartment Number 612 Area 1.22 Mitigation Category 2

Site Description Original River Channel, extending 953 feet downstream from the MacArthur V. Dam. Substrate consists of Bedrock (55%), Fossils (14%), Cobble (25%), Rubble (4%) and Gravel (2%). Stream flows are diverted from the original channel through a bypass channel to hydroelectric facilities then reenter the original stream.

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
<u>Atlantic Salmon</u>	<u>Substrate V5</u>				<u>.83</u>	<u>1.0</u>
	<u>Percent Diss. O₂ V6</u>				<u>1.0</u>	
	<u>Depth V7</u>				<u>1.0</u>	
	<u>Velocity V8</u>				<u>1.0</u>	
	<u>Substrate Cover V9</u>				<u>1.0</u>	
	<u>Percent Diss. O₂ V10</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>American Shad</u>	<u>Surf. Temp V1</u>				<u>1.0</u>	<u>.75</u>
	<u>Velocity V2</u>				<u>1.0</u>	
	<u>Egg-Larvae Temp V3</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>Brook Trout</u>	<u>Substrate V1</u>				<u>.65</u>	<u>.65</u>
	<u>Depth V2</u>				<u>1.0</u>	
	<u>Vel. V3</u>				<u>1.0</u>	
	<u>Temp V4</u>				<u>0</u>	
<u>Limiting Factors Temp exceeds 70°F - Prohibited for Trout at Temp 74°F results in AV SE Computations.</u>						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "0A" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project Little Field Hydro Project Date 9/82
 Alternative Marcell Bypass Channel Target Year 0
 Water Use/Cover Type Riverine Upper Perennial
 Compartment Number 612 Area 1.22 Mitigation Category 2
 Site Description See Page 1 - Marcell Bypass

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings				Avg. HSI
			FWS	PFC	AA/A	X	
* <u>Aluminae</u>	<u>Substratum V1</u>					<u>.15</u>	<u>.15</u> Lowest SI
	<u>SP. Temp. V2</u>					<u>1.0</u>	
	<u>mean Temp V3</u>					<u>1.0</u>	
	<u>Zooplankton V4</u>					<u>.45</u>	
<u>Limiting Factors</u> <u>Zooplankton within Riverine</u>							
<u>Smallmouth Bass</u>	<u>Velocity V1</u>					<u>.44</u>	<u>.50</u>
	<u>Depth V2</u>					<u>.24</u>	
	<u>Substratum V3</u>					<u>1.0</u>	
<u>Limiting Factors</u>							
<u>Limiting Factors</u>							

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project LITTLE FIELD HYDRO PROJECT Date 3/86
 Alternative MITIGATION - LOWER BARKERS MILL Target Year 2
 Water Use/Cover Type RIVERINE - UPPER PERENNIAL
 Compartment Number 612 Area 1.0 Mitigation Category 2
 Site Description Original River channel extending 2535 feet
downstream from Lower Barkers Mill dam. Stream
flows EXCEPT a minimum of 20 cfs, are diverted through
a by pass channel to hydroelectric generating units
and returned to the stream at the lower end of the
bypass reach. Substrate consists of Bedrock (9%),
boulders (25%), Cobble (28%), Rubble (14%), Gravel (8%) and sand (16%).

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
<u>Atlantic Salmon</u>	<u>Substrate V5</u>				<u>1.0</u>	<u>1.0</u>
	<u>% ripple V6</u>				<u>1.0</u>	
	<u>DEPTH V7</u>				<u>1.0</u>	
	<u>Velocity V8</u>				<u>1.0</u>	
	<u>Juvenile Substrate V9</u>				<u>1.0</u>	
	<u>% fines V10</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>Am. Shad</u>	<u>SPAWN TEMP. V1</u>				<u>1.0</u>	<u>.75</u>
	<u>.. VELOCITY V2</u>				<u>.3</u>	
	<u>MAX TEMP. V3</u>				<u>1.0</u>	
<u>Limiting Factors</u>						
<u>BROOK TROUT</u>	<u>SUBSTRATE V1</u>				<u>1.0</u>	<u>.75</u>
	<u>DEPTH V2</u>				<u>1.0</u>	
	<u>VELOCITY V3</u>				<u>1.0</u>	
	<u>TEMP V4</u>				<u>0</u>	
<u>Limiting Factors</u> <u>Temp. exceeds rating level (55°F), maximum</u> <u>presence of trout, or other factors exceeding 74°F.</u>						

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

P.4
MITIGATION SITE 2
PAM HEP Form 5b

PENNSYLVANIA MODIFIED 1980 HEP - HABITAT COMPARTMENT HSI DETERMINATION
WETLAND AQUATIC COVER TYPES

Project LITTLEFIELD Hydro Project Date 8/86
Alternative MITIGATION Lower Barker Mill Target Year C
Water Use/Cover Type Riverine - Upper Potomac
Compartment Number 612 Area 1.0 Mitigation Category 2
Site Description See Page 7, Lower Barker Mitigation

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
<u>Algae</u>	<u>Substrate</u>				<u>.15</u>	<u>.15</u> <u>Good SI</u>
	<u>SP. Temp.</u>				<u>1.0</u>	
	<u>Mean Temp</u>				<u>1.0</u>	
	<u>Zooplankton</u>				<u>.45</u>	

Limiting Factors Rubble lacks mid-silt substrate required for good reproduction.

Smallmouth Bass	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	
	<u>Velocity V1</u>				<u>.75</u>	<u>.62</u>
	<u>Depth V2</u>				<u>.10</u>	
	<u>Substrate V3</u>				<u>1.0</u>	

Limiting Factors _____

Evaluation Species	Life Requisite	A.V. Site	Requisite Rankings			Avg. HSI
			FWS	PFC	AA/A	

Limiting Factors _____

Where applicable, record adjacent value (A.V.) site compartment number(s). Use "OA" to indicate sites outside of project study area. When A.V. is used, the compartment value shall be determined and recorded after it in parenthesis, such as: "0.7(0.2)".

PENNSYLVANIA MODIFIED 1980 HEP - MITIGATION PLAN DEVELOPMENT

Project Littlefield Hydro Project

Alternative Intermittent Channel 216' with Mitigation Plan No. 1

Mitigation Site No's. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Land Use/Cover Type	Evaluation Species	TYC HU Changes FWS Hit. Category			TYM HU Changes FWS Hit. Category			% Losses Mitigated/ % Enhancement
		1	2	3	1	2	3	
RIVERINE - Upper Potomac River	Atlantic Salmon	2.3		2.3	2.2		2.2	96 M
	American Sand	1.6		7.6	1.7		1.7	22 M
	BROOK TROUT	3.9		3.9	2.2		2.2	56 M
	Alewife	3.3		3.3	3.3		3.3	10 M
	Smallmouth Bass	3.4		3.4	1.3		1.3	38 M
	Cover Type Totals	20.5		20.5	7.7		7.7	
RIVERINE - Lower Potomac	American Sand			26.6			0	0
	Brook Trout			13.3			0	0
	Alewife							
	Smallmouth Bass							
	Cover Type Totals			39.9			0	0
LAKES - Littoral & Limnetic	American Sand			32			32	94 M
	Brook Trout			2.1			2.1	119 *
	Alewife							
	Smallmouth Bass							
	Cover Type Totals			34.1				
	Project Area Totals ¹	20.5		20.5	12.8		12.8	555 *

¹Total at bottom of last page of form. Use additional sheets as necessary to accommodate all land use/cover types.

²% Losses Mitigated with Impairment

LAND/WATER
COVER TYPES

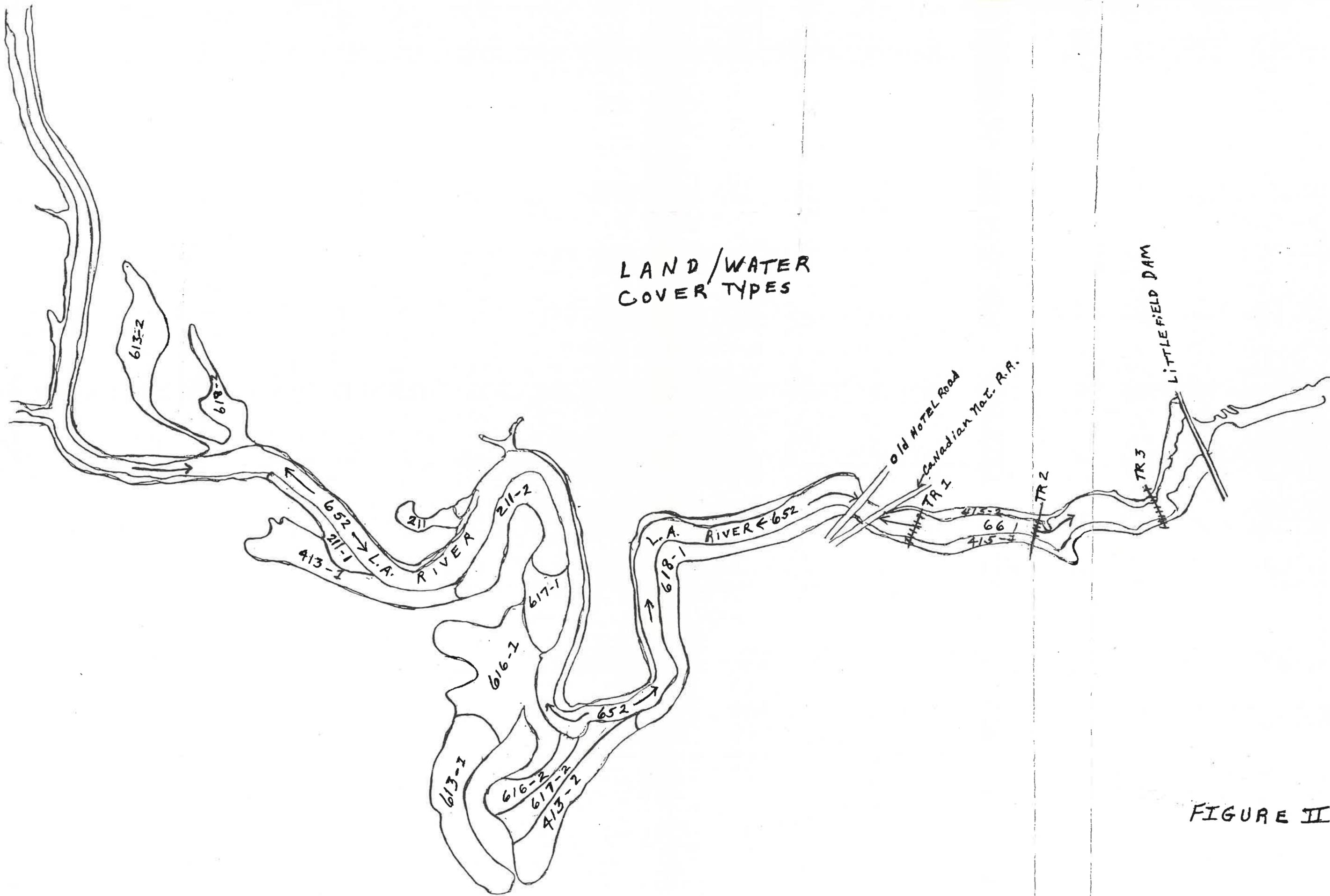


FIGURE II